HYDROACOUSTIC EVALUATION OF HAMMER EFFECTIVENESS AT INDIAN POINT UNIT 3

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by:

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1.0 INTRODUCTION

The New York Power Authority (NYPA) is evaluating the use of underwater steel drums, or "hammers," as a means of deterring fish from entering cooling water intakes at the Indian Point Nuclear Power Plants on the Hudson River near Peekskill, NY. The hammers were supplied through contract by Ontario Hydro Inc., Toronto, ON.

In 1985 and again in 1988, BioSonics, Inc. was contracted to study fish behavior in response to underwater sound sources near Indian Point Power Plants. The 1985 feasibility study was a contract with Consolidated Edison Co. of New York, to evaluate the effectiveness of underwater compressed-air "poppers" in keeping fish away from Unit 2, Intake 26. The 1988 feasibility study was contracted to BioSonics, Inc. by New York Power Authority. The primary objective was to determine the effectiveness of hammers as a means of deterring fish from approaching Intakes 34, 35 and 36 at Unit 3. Hydroacoustics were selected as a tool for monitoring fish behavior and patterns of movement near the intakes.

BioSonics employed fixed-location hydroacoustic techniques for both the 1985 and 1988 studies. Fixed-location hydroacoustic techniques are especially well-suited to investigations of this type because they can obtain meaningful information on behavioral activity, particularly short term changes in both activity and distribution. Additionally, by monitoring 24 hours/day, hydroacoustics could provide fish presence/absence and abundance information, which was critical for determining the timing of hammer tests.

Initial equipment installation took place from January 9 to January 22, 1988. Deployment configurations were changed several times during the study, however, in efforts to provide optimal behavioral data for this feasibility study. Hydroacoustic data collection occurred continuously from January 16 to February 22, 1988. Additional blocks of data were collected between February 23 and March 4, 1988.

2.0 METHODS

2.1 Instrumentation

Two types of hydroacoustic data collection systems were used at Indian Point Power Plant Unit 3 in 1988. The primary type was a single-beam system (Figure 1), operated 24 hours/day. Data from the single-beam system were used to evaluate fish behavior during hammer tests and to estimate fish abundance at the test site 24 hours/day. The single-beam system uses transducers which transmit and receive on the same electronic element. The detected fish data are recorded on paper charts or "echograms." In the echo counting technique which can be used with single-beam systems, echograms provide the basis for data interpretation, behavioral observations, and abundance estimates.

The secondary data collection technique used a dual-beam hydroacoustic system to estimate fish sizes or "target strengths" at the study site. In this system, a dual-beam echo sounder transmits on the narrow-beam element of a dual-beam transducer, and receives echoes on both the narrow- and wide-beams of the transducer. The difference between the return voltages on the narrow and wide elements provides information which can be used to calculate target strengths.

Equipment used for this study included a dual-beam echo sounder (also used as a single-beam sounder), two chart recorders, a multiplexer/equalizer, an oscilloscope, and seven transducers. Four single-beam transducers and one dual-beam transducer were deployed. Single-beam transducers included three with circular cross sections, and one with an elliptical cross section. Two of the circular-beam transducers had beam angles of 15° , and the other had a 6° beam angle. The 6° X 12° elliptical-beam transducer had a 12° beam angle on the x axis and a 6-degree beam angle on the y axis. The narrow and wide beam angles of the dual-beam transducer were 6° and 15° , respectively. With a wide variety of beam angles, it was possible to sample in confined areas while maximizing sampling volume at areas of interest. The elliptical-beam transducer allowed horizontal sampling 40 meters out into the river.

One of the 15° circular-beam transducers was principal in data collection during this study. It was rigidly mounted about 0.5 m below mean low water level (MLW), at the bottom of a relatively short, 25 ft vertical aluminum pole which was positioned immediately in front of the trashrack in a 40-cm slot at Intake 35 (Figure 2). The transducer was aimed obliquely down and out into the river, with the axis of the beam about 35° from vertical.

This transducer monitored fish close to the intake, providing data on fish movement, vertical distribution and abundance.

Another 15° circular-beam transducer was mounted at the same depth on a longer 30 ft aluminum pole, with an oblique aiming angle of 30° rather than 35°. The 6° X 12° elliptical-beam and 6° circular-beam transducers were suspended in mid-water from the long pole mount (Figures 2 and 3). Both transducers were aimed horizontally into the river. The 6° circular-beam transducer was attached to a rotator, which allowed adjustments of aiming angle in the horizontal plane while the transducer was deployed. To minimize interference from the river bottom and water surface, the elliptical transducer was orientated with the narrow (6°) axis in the vertical plane, and the wide (12°) axis in the horizontal plane. The primary purposes of these transducers were to monitor for any patterns in fish abundance with respect to distance from the intake, and to collect directional movement data in the inshore-offshore dimension.

Another mount configuration using the dual-beam transducer and the 6° X 12° elliptical-beam transducer is illustrated in Figure 4. This configuration was employed toward the end of the study period, after 24-hour/day monitoring had ended. To be able to compare target-strength data with length frequency tables, a dorsal aspect view of the target fish is required. The dual-beam transducer was mounted at the catwalk 0.5 m below MLW, and aimed vertically down in front of Intake 35. This transducer was later relocated in front of Intake 36 with a similar orientation. Hammer tests were conducted during target-strength data collection.

The 6° X 12° elliptical-beam transducer was mounted near the intake floor and aimed horizontally into the river in front of Intake 36 with a range of 40 m (Figure 4). Bottom interference was minimized by orientating the narrow axis of the transducer in the vertical plane and the wide axis in the horizontal plane. This transducer's purpose was to observe inshore and offshore fish movement near the river bottom.

All single- and dual-beam transducer mount configurations were evaluated during and after the study. Data from four of these configurations were selected for analysis to address the study objectives. Criteria used for selecting transducer mount configurations and data for analysis are discussed in Sections 2.2 and 2.3, respectively.

2.2 Data Collection

With the exception of several brief interruptions for maintenance or transducer redeployment, data were collected continuously from January 16, 0000 h to February 22, 1600 h. Most of these data were collected using two transducers: the 15°, obliquely aimed circular-beam transducer mounted on the short pole; and the 6° X 12°, horizontally aimed elliptical-beam transducer. Because of excessive noise and solid target interference, the 15°, obliquely aimed transducer mounted on the long pole was rarely sampled. Also, minimal data were collected using the 6°, circular-beam horizontal transducer with rotator because of limited sample volume and ambiguous data interpretation. Additional blocks of data were collected using the dual-beam transducer and the bottom-mounted 6° X 12° transducer from February 23 to March 4.

During continuous data collection, technicians monitored chart recorders for realtime fish abundance information. When fish abundance reached an approximate threshold level of 45-60 raw¹ fish detections in 15 consecutive minutes, hammer tests were initiated. This level of fish abundance was regarded as sufficient for evaluating fish avoidance response to the hammers.

Generally, a testing period began with a control period lasting 10-15 minutes, followed by a hammer test lasting several minutes, then another control period, another hammer test, and so on. The hammer tests continued as long as fish abundance was sufficient to warrant testing. Hammer testing periods lasted from about 20 minutes to several hours.

During the individual hammer tests within a testing period, the frequency of hammer firing was varied. For example, hammers were sometimes turned on and off in 1-minute intervals, or they may have been turned on for 10 seconds, and off for 20 seconds. The patterns of hammer on/off times, referred to as "treatments," were recorded directly on the echograms, and in a logbook.

Preliminary observations were made from the echograms during and after data collection. These observations allowed evaluation of various transducer deployments, and provided information for the selection of subsets for further data analysis.

¹ "Raw" fish detections are those that appear on the echograms and oscilloscope. They have not yet been adjusted or "weighted" for transducer beam spread according to the fish's distance from the transducer.

2.3 Data Analysis

Several periods of hammer test data were selected for analysis. The criteria for this selection included: high or moderate fish densities; continuous data collection throughout the hammer test period; and periods when hammer treatments were long enough to allow at least 2 consecutive beats of one hammer while hammers were on.

There were two periods when very high fish densities occurred: the night of January 26-27 from 2100 h to 0000 h; and the night of January 13 from 2000 h to 2300 h. Both these periods were included in the hammer test analysis. Moderate and consistent fish densities occurred during hammer testing on these dates: February 4 from 0100 h to 0400 h; February 18 from 0100 h to 2300 h; February 19 from 0000 to 1400 h; and February 20 from 0000 h to 2200 h. These periods were also selected for hammer test data analysis.

For all the hammer tests listed above, data were collected using the 15° circularbeam transducer aimed obliquely from the short pole, and the mid-water 6° X 12° ellipticalbeam transducer aimed horizontally out into the river.

Additional hammer test data from periods of moderate fish density were selected for analysis. These data were collected using the surface-mounted 6° element of the dual-beam transducer aimed vertically downward and the bottom-mounted 6° X 12° elliptical transducer aimed horizontally out across the bottom. These data analysis periods included: February 23 from 1800 h to 2000 h, February 24 from 1300 h to 2200 h; February 25 from 0900 h to 2000 h; February 26 from 0800 h to 2300 h; February 27 from 0000 h to 1800 h; March 3 from 0300 h to 1800 h; and March 4 from 0300 h to 0500 h.

As mentioned above in Section 2.1, data were recorded by a chart recorder on echograms. Traces on the echogram were visually interpreted for fish, and the traces grouped into four categories corresponding to distinct fish behaviors, illustrated in Figure 5. The trace type categories were defined as follows:

- LS: Long-to-Short range movement; a fish moving generally toward the transducer.
- SL: Short-to-Long range movement; a fish moving generally away from the transducer.

NC: No Change in range; a fish moving across the transducer beam perpendicular to its axis, moving neither toward nor away from the transducer.

WW: Wallower, a relatively stationary fish spending many seconds in the beam without distinct directional movement. This often indicates a resident fish which is not migrating through the study area.

The behavioral meaning of the trace depends on the specific deployment of the transducer. For example, with the mid-water 6° X 12° elliptical-beam transducer aimed horizontally into the river, LS traces describe fish moving inshore (toward the intake), while SL traces are fish moving offshore. NC traces indicate movement in upstream or downstream directions, across the transducer beam. When the 15° circular-beam transducer aimed obliquely down into the intake was sampled, virtually all traces were LS. This could indicate two types of movement; either inshore (toward the intake) or vertically upward.

The interpretation of fish traces from the surface-mounted 6° element of the dual-beam transducer aimed vertically downward is different than that for the two transducers described above. At this transducer, which sampled immediately in front of the intake, LS traces indicated movement toward the surface, while SL traces would indicate fish moving toward the bottom. Traces with no change-in-range (NC) indicated no vertical movement, but could be moving horizontally in any direction.

To account for the spreading sampling volume at increasing ranges from the transducer, fish numbers were weighted according to distance (range) from the transducer. A transducer's maximum range was divided into range bins or strata, with numbers and sizes of strata specific to each transducer. For the 15° obliquely aimed transducer, there were four strata of 2 m each; for the 6° X 12° elliptical-beam horizontal transducer, there were five to eight strata of 5 m each; and for the surface-mounted 6° circular-beam transducer aimed vertically downward, there were seven strata of 1 m each. The number of raw fish detections within each stratum was multiplied by a constant stratum "weighting factor," unique to that particular stratum. This weighting factor represented the proportion of the width of the intake to the width of the beam at the stratum being analyzed, with stratum width measured at the stratum's midpoint range. Thus, as the sampling volume increased with range from the transducer, the numerator of the weighting factor became larger and the weighting decreased.

Fish detections in the first 1.3 m from the transducer were not processed due to over amplification of detections in this range. Ranges listed in the tables begin from this "blanking" range (1.3 m from the transducers).

To evaluate the effectiveness of the hammers, each hammer test was divided into a "before", "during", and "after" phase. Each test was normally from five to ten minutes in duration. When hammer tests were contiguous, only the during and after phases were analyzed. To evaluate each hammer test a chi-square test was performed. The chi-square distribution is a probability density function in which the null-hypothesis would assume an even distribution throughout a hammer test. That is, in evaluating a relatively short time period consisting of 15–30 minutes, the fish densities would be expected to be evenly distributed between the before, during and after phases of a hammer test if hammer operations had no effect on fish behavior. When there were three phases for a particular hammer test, an expected frequency of 33.33% was assumed for each phase and range bin. When only two phases occurred, a 50.00% expected frequency was assumed.

3.0 RESULTS

During the first part of the study, hammer tests were monitored by only one transducer at a time. The 6° X 12° transducer was selected as the main monitoring transducer to observe inshore movement of fish schools. The 15° circular-beam transducer aimed obliquely downward monitored fish movement close to the intakes.

During the high fish densities observed on the night of January 26-27, a total of seven hammer tests were performed. Six of these tests were monitored by the 6° X 12° horizontally-aimed elliptical-beam transducer, and only one test by the 15° circular-beam transducer aimed obliquely downward (Table 1, Appendices C and D). Echogram traces from the 6° X 12° transducer showed a dense band of fish within the first three range bins (0-15 m, see Figure 6). The trace type analysis (Section 2.3) for the 6° X 12° transducer showed that these fish schools maintained a constant distance approximately 5-15 m from the intake. The 15° transducer, however, showed an overall movement toward the intake (Figure 7). The trace types observed from both monitoring locations failed to show any noticeable effect from hammer operations.

In six of the seven tests, fish densities were significantly different from the expected frequencies, with three of these tests having the highest fish densities in the after phase. These results may have been due to natural fluctuations in fish densities during hammer testing periods rather than any effect by hammer operations. Evaluating the hammer tests by range bins did not show any apparent effect on fish densities with respect to the hammers being on or off (Figures 8-14).

Similar results were observed when high fish densities occurred again on the night of February 13, when a total of ten tests were conducted (Table 2, Appendices C and D). These hammer tests were monitored by both the 15° circular-beam transducer aimed obliquely downward, and by the 6° X 12° elliptical-beam transducer aimed horizontally into the river. For the 15° transducer, five of the ten tests showed fish densities which were significantly different from expected frequencies. Highest fish densities were present in four of the five tests in the "after" phase, and only one in the "during" phase. For the 6° X 12° transducer, five of the ten tests were significant with three of the five tests having the highest densities in the "during" phase, one in the "before" phase, and one in the "after" phase. Again, no apparent effect of hammer operation on fish densities by range bin was observed (Figures 15-34).

Other periods during the season when fish densities were high enough to warrant hammer testing occurred on February 4, 18, 19, and 20 (Tables 3-6, Appendices C and D). These tests were monitored by both the 15° oblique transducer and the 6° X 12° elliptical transducer. A total of 50 hammer tests were conducted during these days.

For the 15° oblique transducer, 23 of the 50 tests showed fish densities which were significantly different from the expected frequencies. The highest densities were present in 17 of the 23 tests in the "during" phase, 5 were highest in the "after" phase, and only 1 showed highest densities in the "before" phase. Eight of the 17 tests in which the highest densities were observed in the "during" phases occurred on February 18.

For the 6° X 12° horizontal transducer, only 7 of the 50 tests showed fish densities which were significantly different from the expected frequencies. Of those seven tests, six showed highest densities in the "during" phase, and only one in the "after" phase.

Directional data (i.e. from the fish trace type analysis) for all 50 tests indicated that inshore movement predominated during all test phases. Of the 50 hammer tests, there were only 5 when the 15° oblique and the 6° X 12° horizontal transducers had significantly different test phase numbers for the same hammer test. It is not surprising that the results from the two transducers would be different for the same test, since they effectively sampled different zones near the intake. The maximum sampling volume of the 15° obliquely-aimed transducer was located at the river bottom, very close to the intake. In contrast, the 6° X 12° elliptical-beam transducer was mounted at mid-water depth and aimed horizontally into the river. Its maximum sampling zone was mid-water, at ranges of up to 40 m from the intake. If the effect of the hammers was only at close range (see Appendix G), it is unlikely that the 6° X 12° elliptical-beam transducer would have been able to monitor this response.

Any observed increase in fish density for the "during" phase of the hammer tests might be explained if there was a response from bottom-oriented fish located directly in front of the intakes. With the 15° oblique transducer aimed 35° off the vertical face of the intake, a 3.5-m area directly in front of the intake was not within the transducer's sampling volume. An increase in fish numbers in the "during" phase of a hammer test would occur if a reaction by bottom-oriented fish resulted in an upward swimming movement. Fish would then enter the beam of the transducer. This type of behavior was observed using a 6° narrow element of a dual-beam transducer aimed vertically downward. This transducer configuration was only in effect during the latter part of the study season, during collection

of target strength data at Intakes 35 and 36. See Appendix B for a discussion of target strength analysis and results.

Table 7, Appendix E shows data from the hammer tests at Intake 35, which occurred from February 23 to February 27. These data were collected using the 6° element of the 6° X 15° dual-beam transducer aimed vertically downward in front of Intake 35. A total of 36 hammer tests were conducted. Of these, 21 showed significant differences between test phases, with 16 tests showing the highest fish densities for the "during" phase, 2 were highest in the "after" phase, and 2 highest in the "before" phase. Of the 16 tests with highest densities for the "during" phase, 13 had a significant increase in LS fish traces. At this transducer configuration, a LS trace type would indicate the fish swimming upward toward the surface.

On March 3 and 4, Intake 36 was sampled using the same 6° element of the dual-beam transducer mounted at the surface and aimed vertically downward. The 6° X 12° elliptical-beam transducer was also deployed at Intake 36, mounted near the bottom and aimed horizontally out across the river bottom. These two transducers simultaneously monitored all hammer tests conducted at Intake 36.

On these two days, a total of 23 hammer tests were conducted (Tables 8 and 9, Appendices E and F). For data collected using the 6° vertical transducer, a total of seven tests showed fish densities which were significantly different from expected frequencies. Six of these tests showed an increase in fish density for the "during" phase and one showed an increase in the "before" phase. The 6° X 12° horizontal elliptical-beam transducer showed a total of ten hammer tests with fish densities significantly different from expected. Of the ten tests, nine showed an increase for the "during" phase and one for the "after" phase.

Of the 23 hammer tests conducted on March 3 and 4, there were only 4 tests when the surface-mounted 6° vertical and the bottom-mounted 6° X 12° horizontal transducers showed significantly different fish densities between test phases for the same hammer tests. All four of these tests had higher fish densities in the "during" phase.

Results obtained from the hammer tests conducted on March 3 and 4 show that there may be less of a response to hammer operations at Intake 36 compared to Intake 35. An explanation for this may be that of the three intakes (34, 35, and 36), Intake 36 was furthest upstream and flow rates into this intake appeared to be greater than at Intake 35.

Fish located in front of this intake would be in the faster moving water and may not be able to maintain a stationary position for any long period of time. This behavior was evidenced by a majority of LS traces observed at Intake 36. Hammer operations at this location did not seem to have an effect on fish entrained within this faster flow.

Fish located in front of Intake 35 would be in the quieter water zone and would be able to maintain relatively stationary positions. This is supported by a majority of NC traces observed at this location. When hammers were operating at Intake 35, the observed trace types changed from the noted NC traces to LS traces, indicating an upward movement response to the hammers.

4.0 CONCLUSIONS AND RECOMMENDATIONS

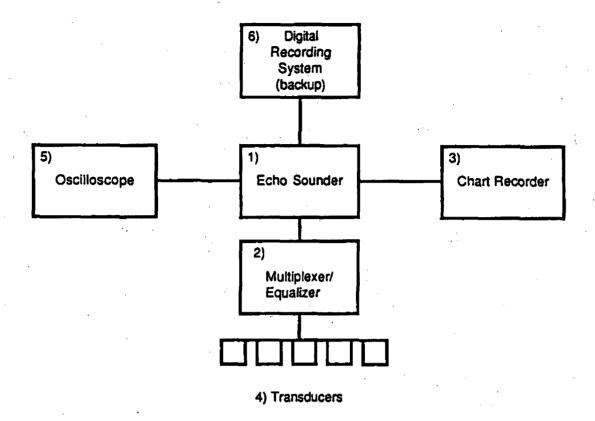
- 1. The hammers used in this study did not appear to be an effective means of influencing fish movement at distances of 2 m or more from the intakes during heavy and moderate fish densities.
- 2. Hammer effectiveness may be dependent on intake flow patterns and velocities.
- 3. Bottom-oriented fish close to the intakes may respond to hammer operation by swimming upward several feet off the bottom.
- 4. The underwater hammers used in this study were tested in the lab previous to the field season. However, in-season sound spectra testing indicated that the hammers emitted different sound frequencies in situ than in the lab. We recommend extensive in situ testing of alternative underwater sound sources before selecting equipment for permanent installation at Indian Point Unit 3.
- 5. Studies of fish abundance and distribution at Indian Point Power Plants must take into consideration the variability of fish densities over 24-h periods and with tidal fluctuations (see Appendix A).

5.0 ACKNOWLEDGMENTS

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- 2. BioSonics, Inc. Model 151 Multiplexer/Equalizer
- 3. BioSonics, Inc. Model 115 Chart Recorder
- 4. BioSonics, Inc. 420 kHz transducers
- 5. Hitachi, Inc. Model V-422 oscilloscope
- 5. Finachi, inc. Model V-422 oscillosco
- 6. Recording system included: Sony Betamax recorder SL-2000 Sony Digitizer PCM-F1

BioSonics, Inc. Model 171 Recorder Interface

Figure 1. A block diagram of the data collection system used at Indian Point Power Plant Unit 3, Intakes 35 and 36, from January 16 to March 4, 1988. The specifications of this equipment can be obtained from BioSonics, Inc.

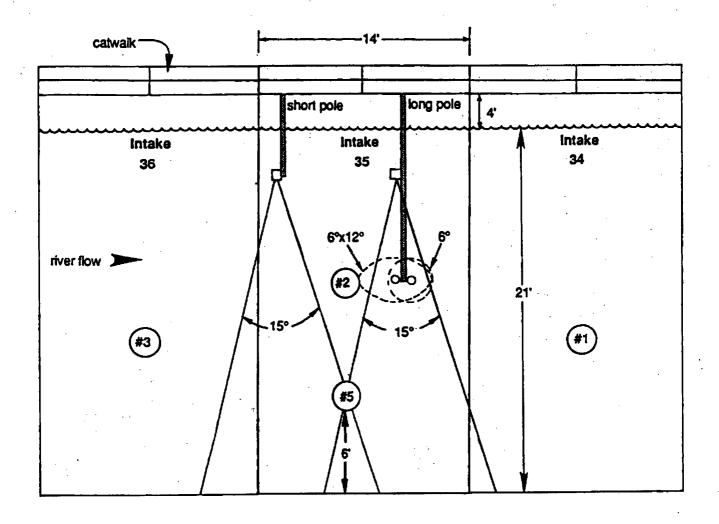


Figure 2. A front view of the short and long pole mounts deployed in front of the trash rack at Unit 3, Intake 35. The solid-line cones are the 15° oblique transducers, the dashed lines indicate the horizontal mid-water 6°x12° elliptical transducer and the 6° transducer with rotator, with the area sampled at a range of 15 m. Small circles indicate approximate location of hammers, for Intakes 34, 35, and 36. Hammer numbers are designated by the respective channel number on the hammer control box.

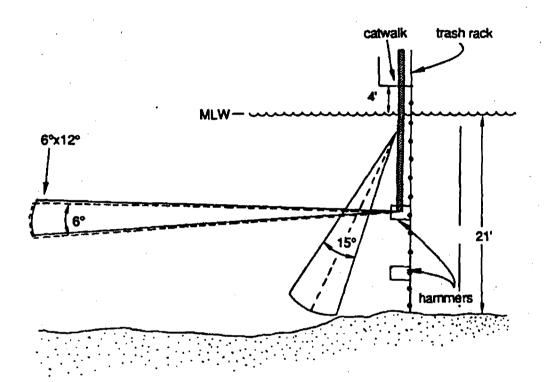


Figure 3. This side-view diagram shows the deployment of the long pole mounted transducers. The cones represent the "acoustic beams" of the transducers. The solid-line cone is the 15° oblique transducer, the dashed lines are the horizontal mid-water 6°x12° elliptical transducer and the 6° transducer connected to a rotator. Squares indicate approximate location of hammers, at -9 ft and -15 ft. MLW.

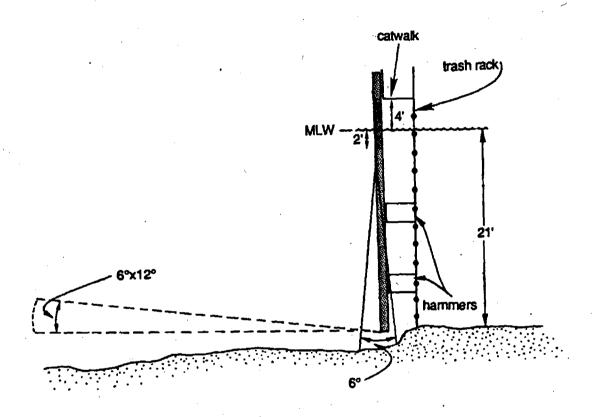


Figure 4. This side-view diagram shows the post-season deployment of the transducers used at Intakes 35 and 36. The solid cone represents the 6° vertical transducer, and the dashed line is the horizontal bottom 6°x12° elliptical transducer. Squares indicate the approximate location of hammers.

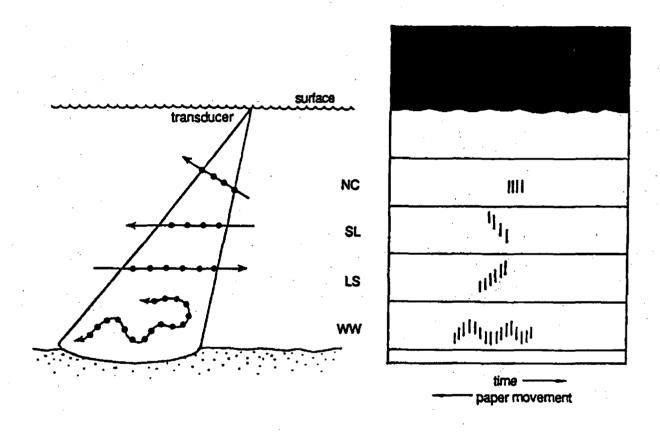


Figure 5. Fish behavior in the acoustic beam of a transducer (left) results in distinct traces on the chart recorder, or echogram (right). The change in range on the echogram traces indicates changing distance of the fish from the transducer. Arrows indicate the path of a fish through the acoustic beam. Dots along the arrows indicate successive ensonifications, or "pings", each leaving a mark on the echogram.

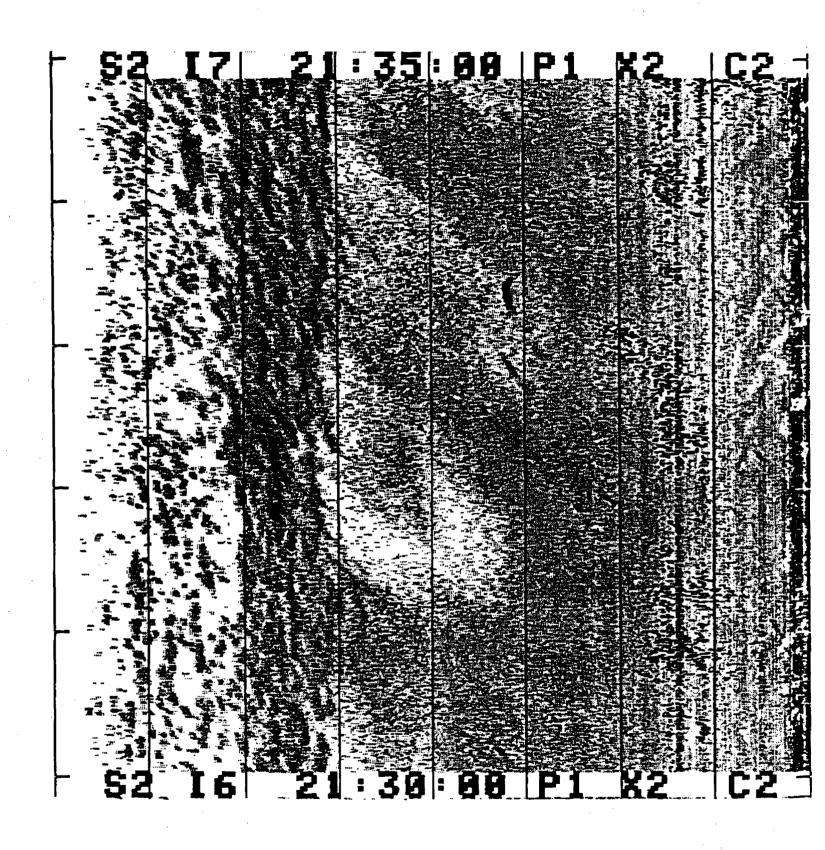


Figure 6a. Photocopy of an echogram showing fish traces during high fish densities sampled with the 6°x12° elliptical horizontal transducer at 2135 h on January 26, 1988. The grid lines are set at 5 m intervals.

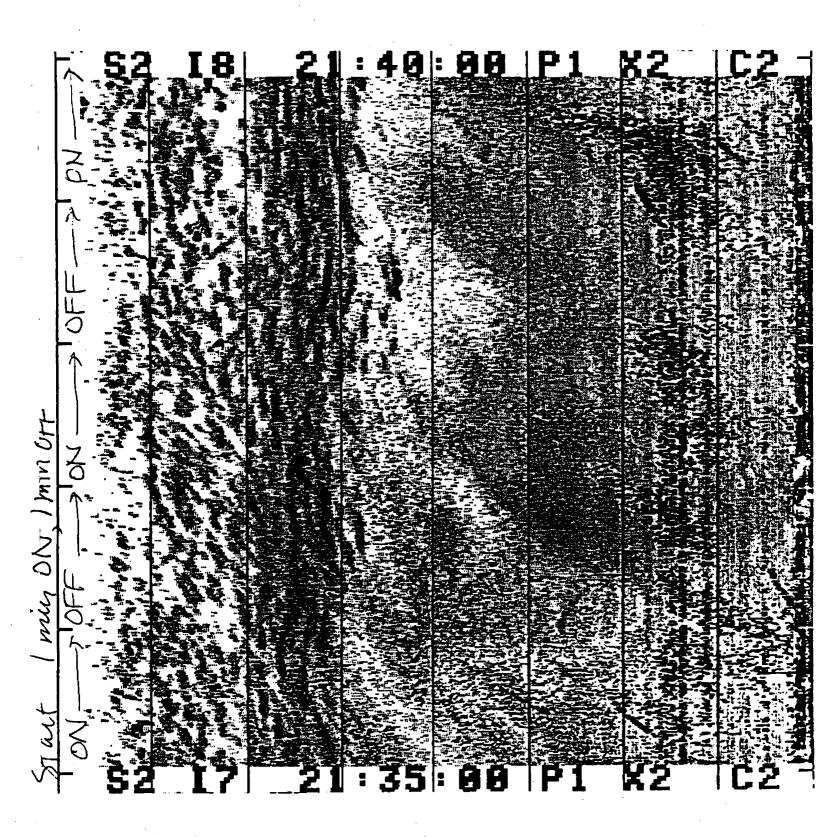


Figure 6b. Photocopy of an echogram showing fish traces during high fish densities sampled with the 6°x12° elliptical horizontal transducer at 2140 h on January 26, 1988. The grid lines are set at 5 m intervals.

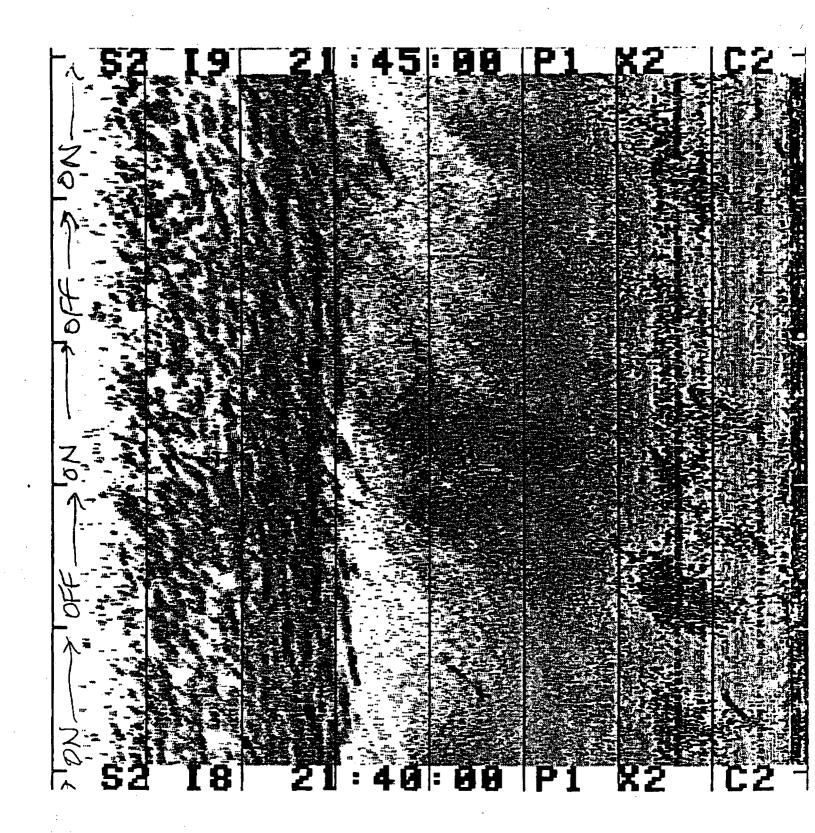


Figure 6c. Photocopy of an echogram showing fish traces during high fish densities sampled with the 6°x12° elliptical horizontal transducer at 2145 h on January 26, 1988. The grid lines are set at 5 m intervals.

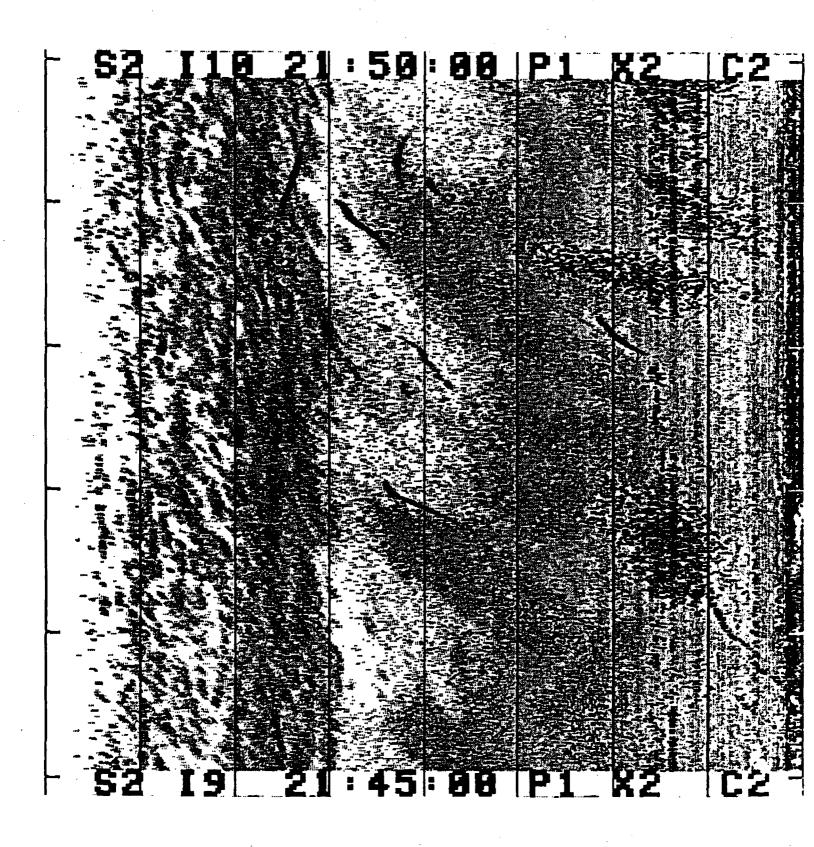


Figure 6d. Photocopy of an echogram showing fish traces during high fish densities sampled with the 6°x12° elliptical horizontal transducer at 2150 h on January 26, 1988. The grid lines are set at 5 m intervals.

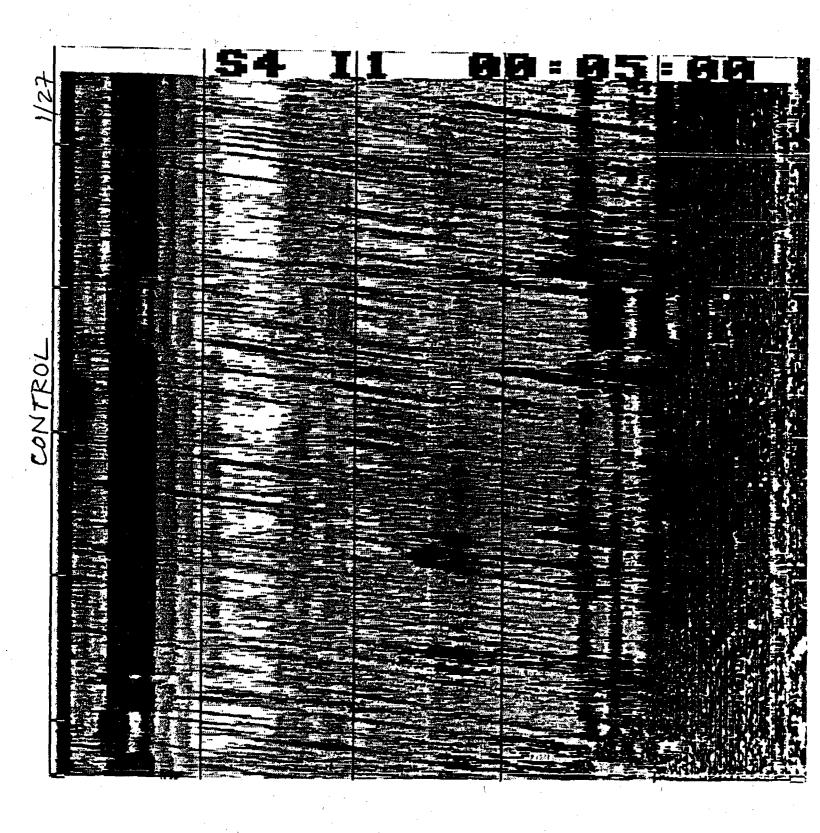


Figure 7a. Photocopy of echogram showing fish traces during high fish densities with the 15° conical oblique transducer at 0005 h on January 27, 1988. The grid lines are set at 2 m intervals.

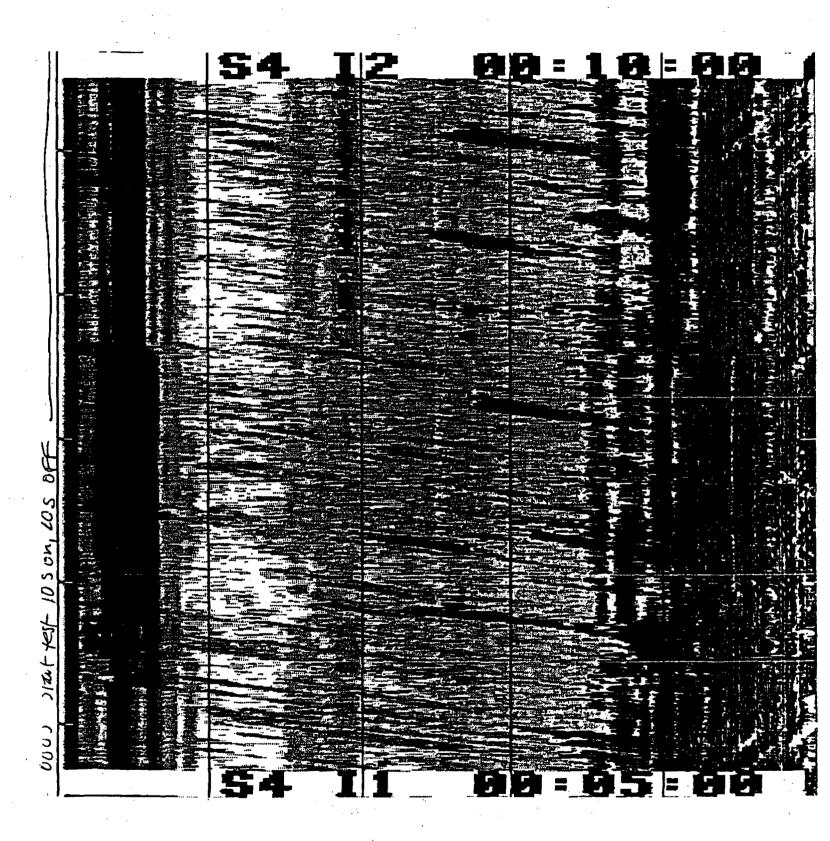


Figure 7b. Photocopy of echogram showing fish traces during high fish densities with the 15° conical oblique transducer at 0010 h on January 27, 1988. The grid lines are set at 2 m intervals.

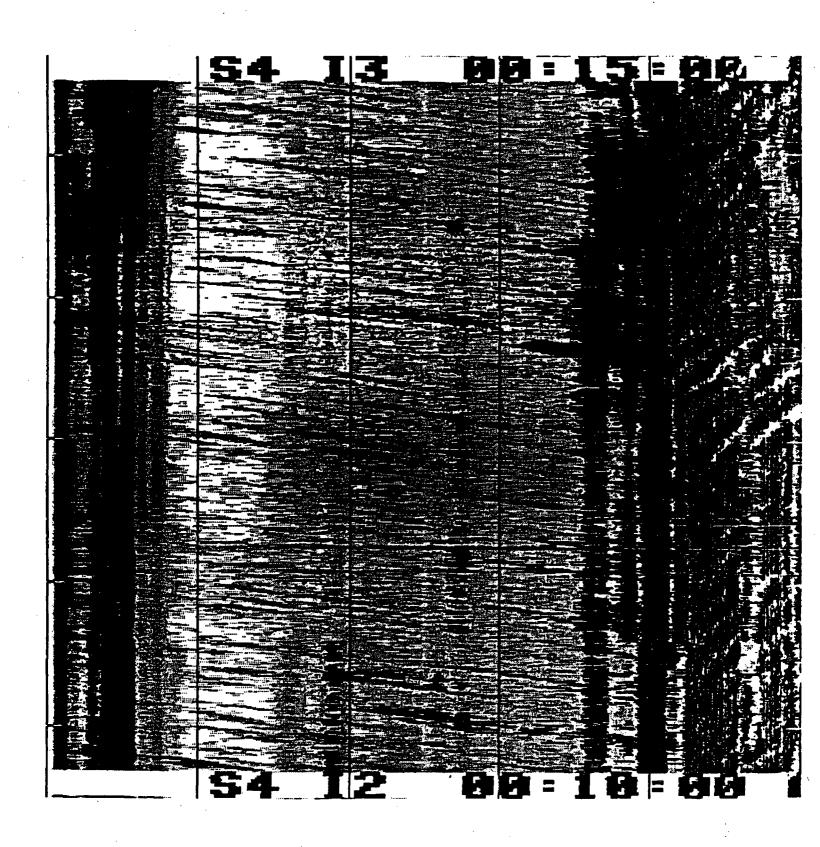


Figure 7c. Photocopy of echogram showing fish traces during high fish densities with the 15° conical oblique transducer at 0015 h on January 27, 1988. The grid lines are set at 2 m intervals.

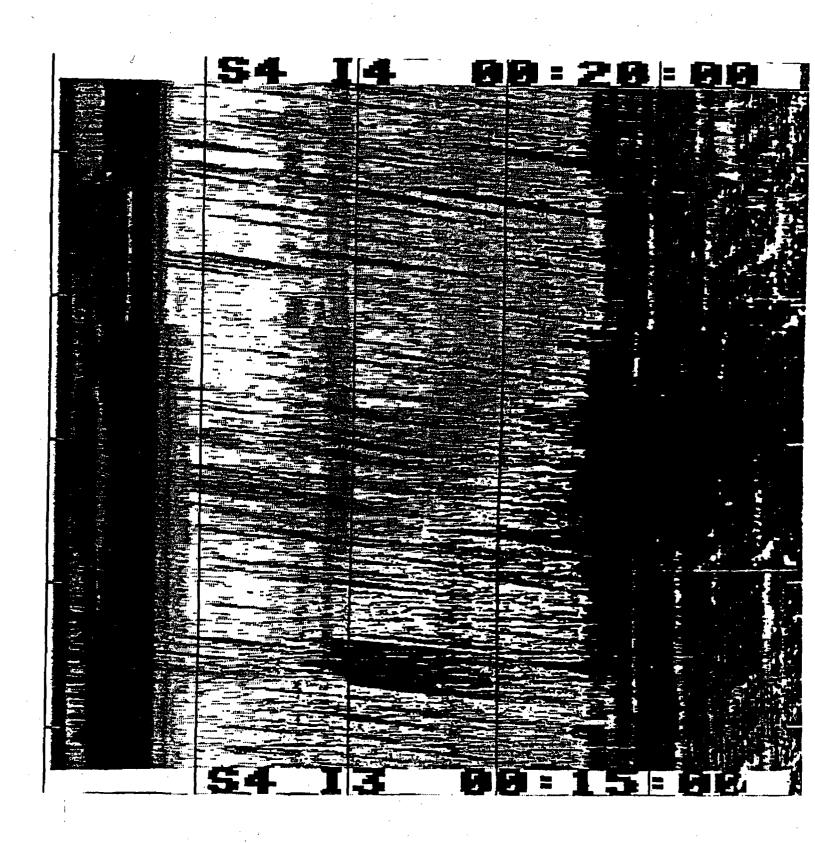


Figure 7d. Photocopy of echogram showing fish traces during high fish densities with the 15° conical oblique transducer at 0020 h on January 27, 1988. The grid lines are set at 2 m intervals.

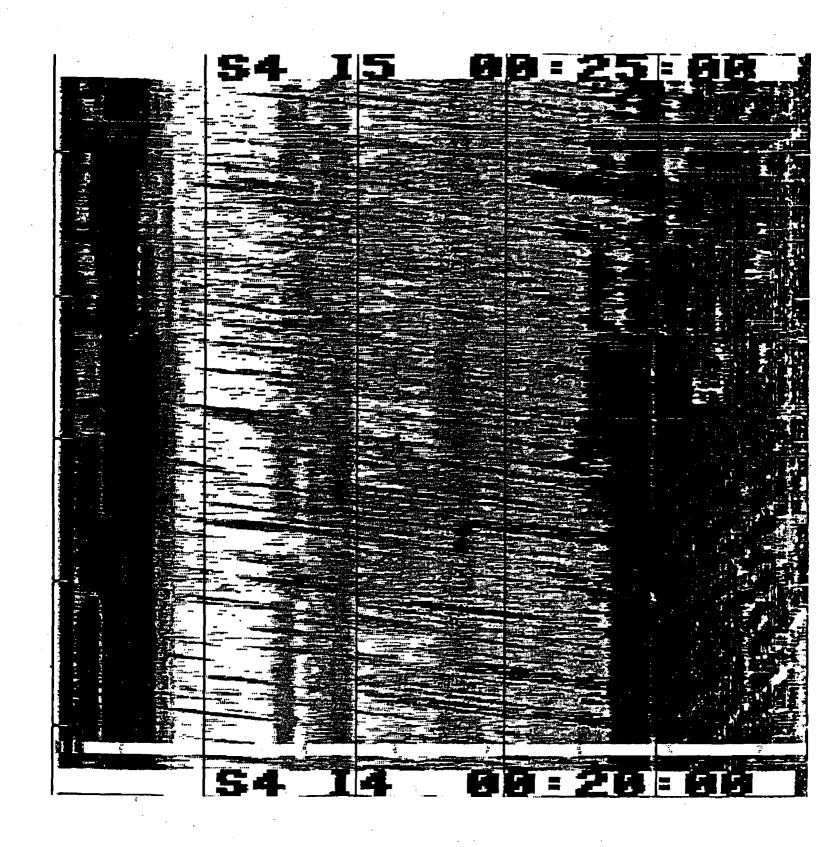


Figure 7e. Photocopy of echogram showing fish traces during high fish densities with the 15° conical oblique transducer at 0025 h on January 27, 1988. The grid lines are set at 2 m intervals.

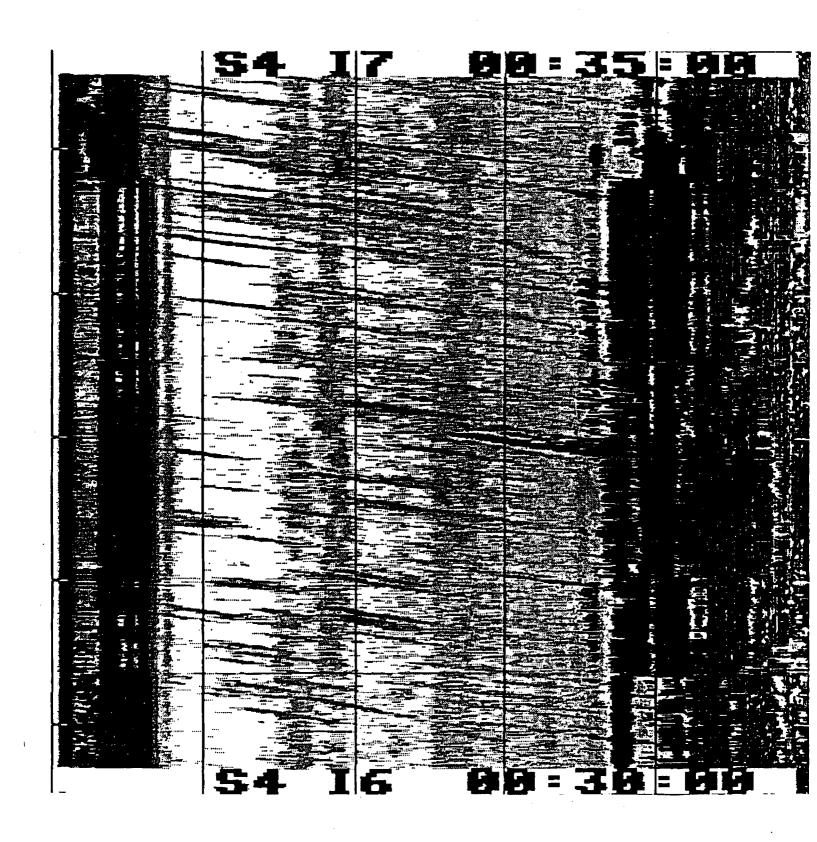
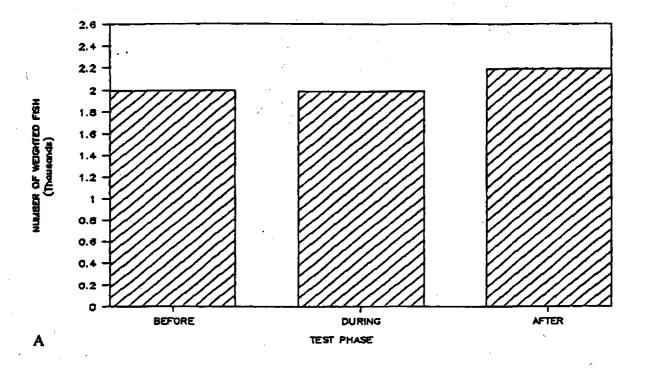


Figure 7f. Photocopy of echogram showing fish traces during high fish densities with the 15° conical oblique transducer at 0035 h on January 27, 1988. The grid lines are set at 2 m intervals.



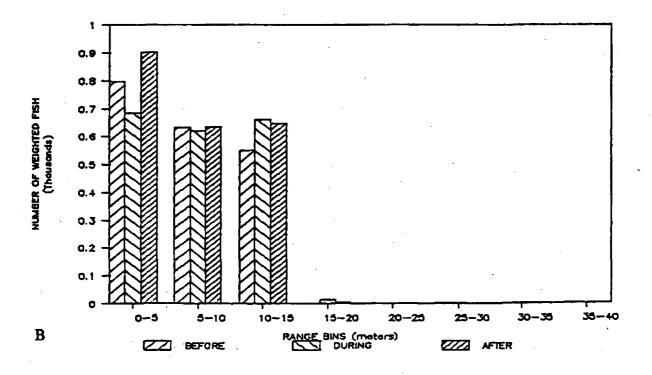
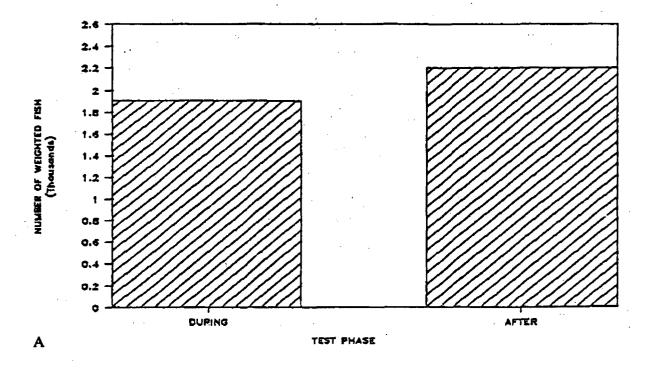


Figure 8. Fish density data from the mid-water 6°x12° horizontal transducer at Intake 35 for the January 26, 2135 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



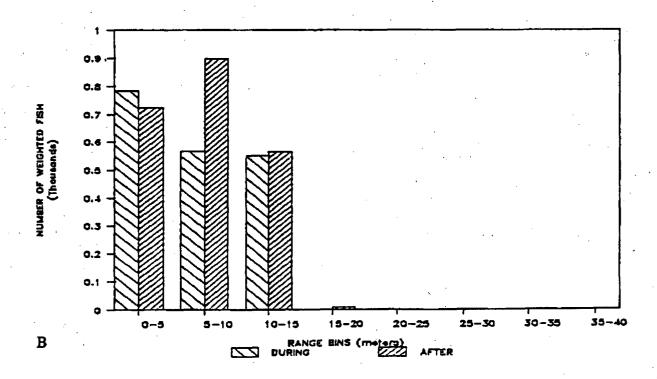
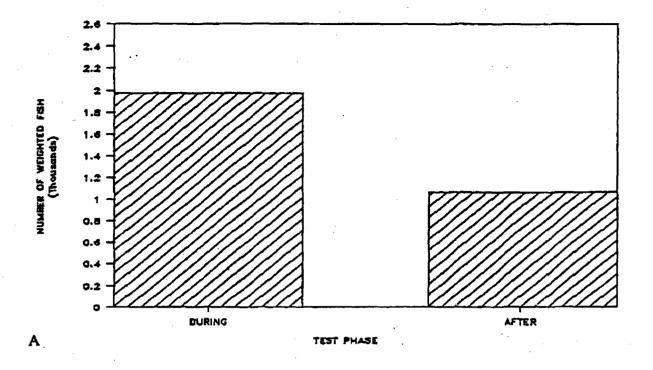


Figure 9. Fish density data from the mid-water 6°x12° horizontal transducer at Intake 35 for the January 26, 2155 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



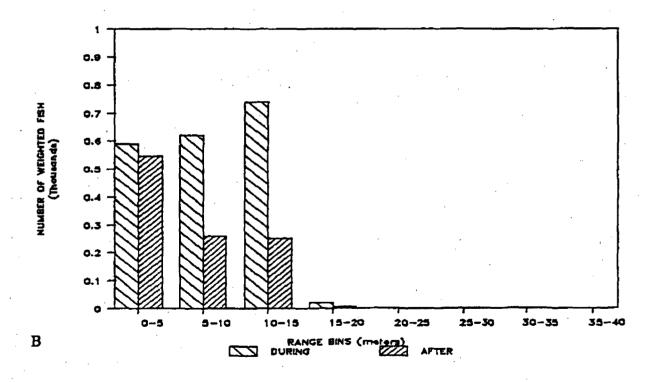
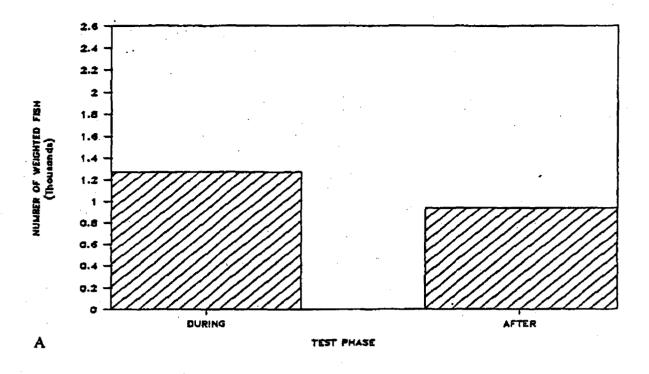


Figure 10. Fish density data from the mid-water 6°x12° horizontal transducer at Intake 35 for the January 26, 2220 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



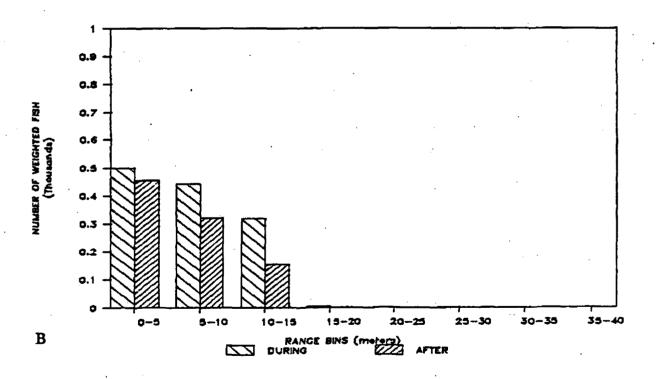
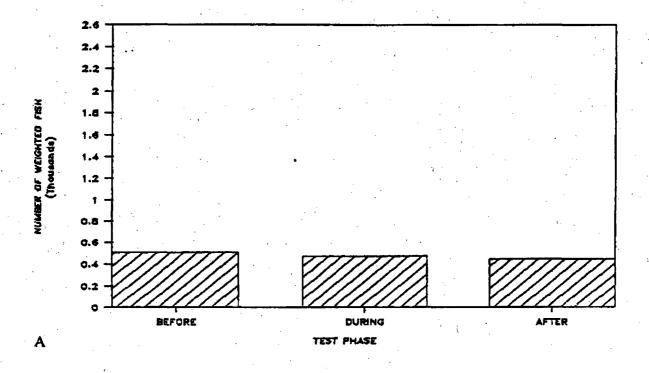


Figure 11. Fish density data from the mid-water 6°x12° horizontal transducer at Intake 35 for the January 26, 2245 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



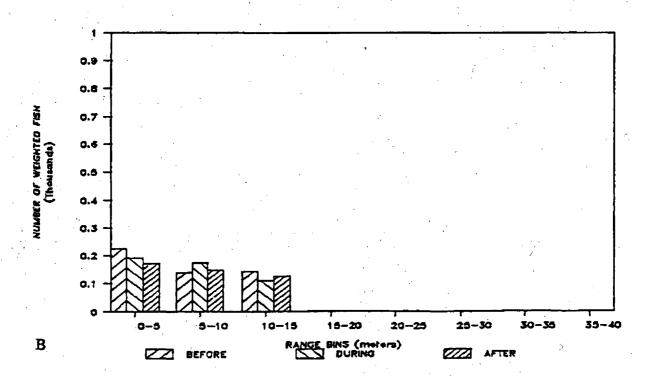
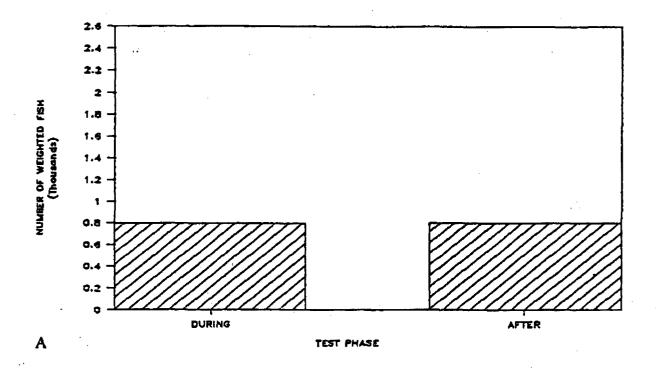


Figure 12. Fish density data from the mid-water 6°x12° horizontal transducer at Intake 35 for the January 26, 2305 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



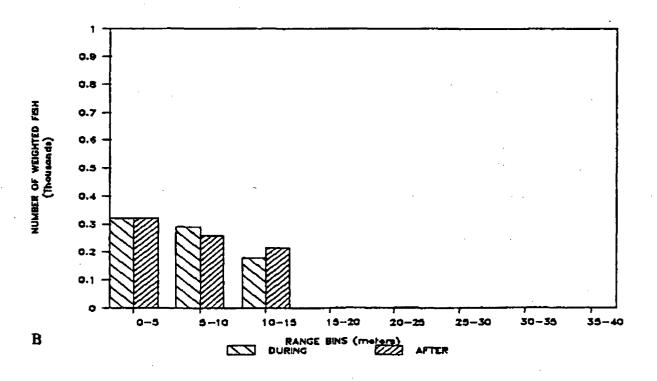
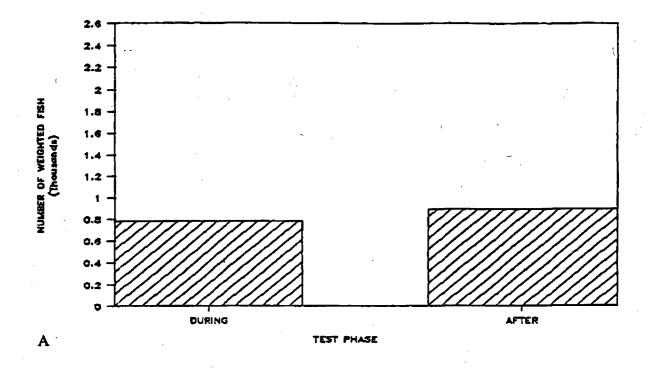


Figure 13. Fish density data from the mid-water 6°x12° horizontal transducer at Intake 35 for the January 26, 2320 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



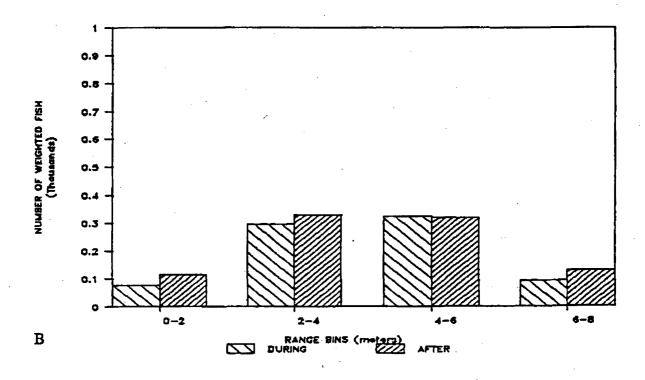
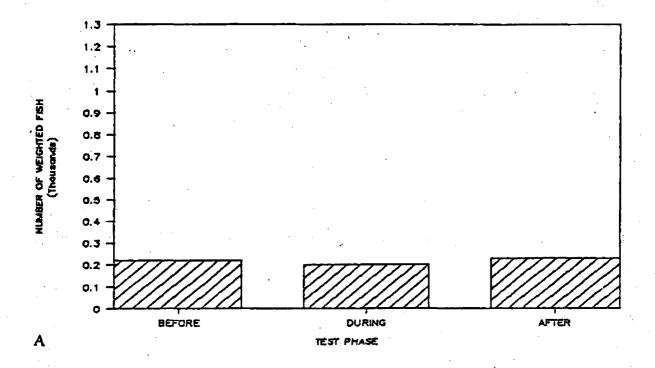


Figure 14. Fish density data from the 15° oblique transducer at Intake 35 for the January 26, 0005 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



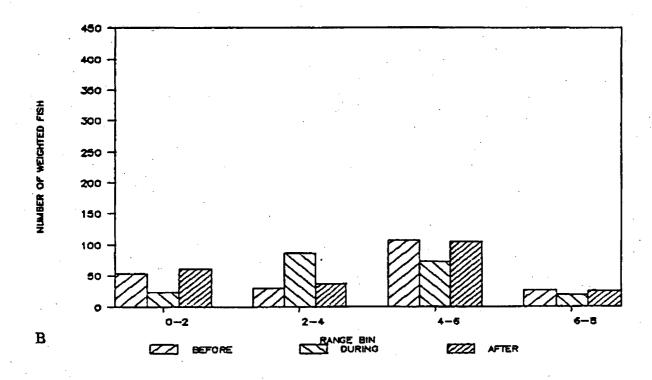
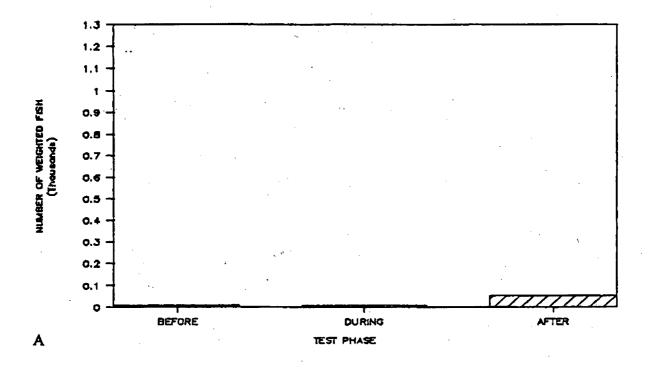


Figure 15. Fish density data from the 15° oblique transducer at Intake 35 for the February 13, 1047 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



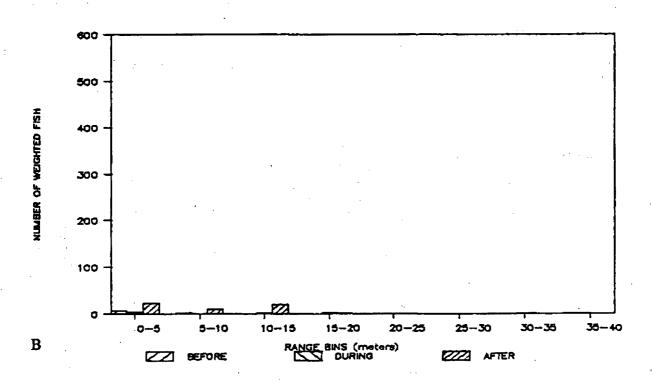
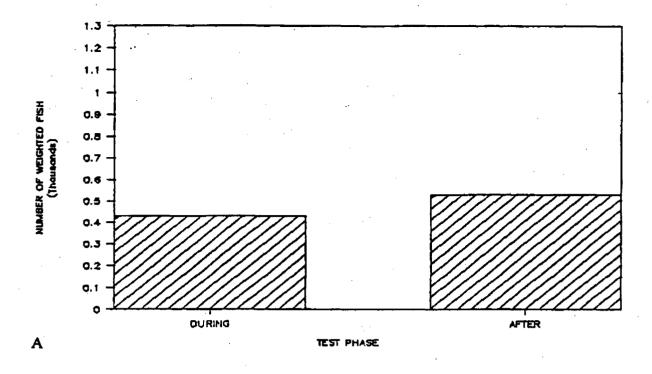


Figure 16. Fish density data from the mid-water 6°x12° horizontal transducer at Intake 35 for the February 13, 1047 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



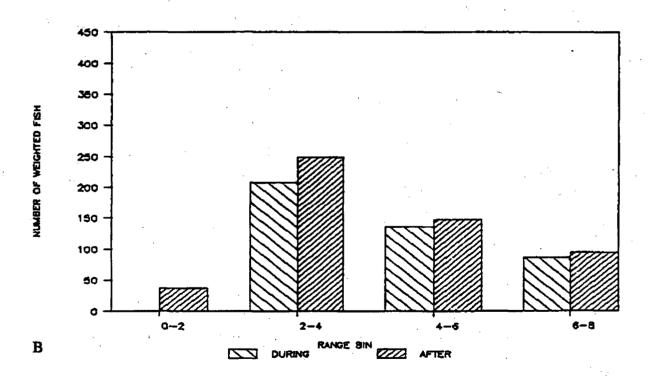
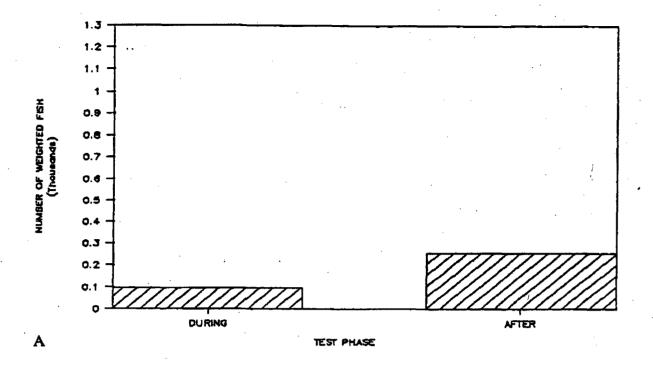


Figure 17. Fish density data from the 15° oblique transducer at Intake 35 for the February 13 1107 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



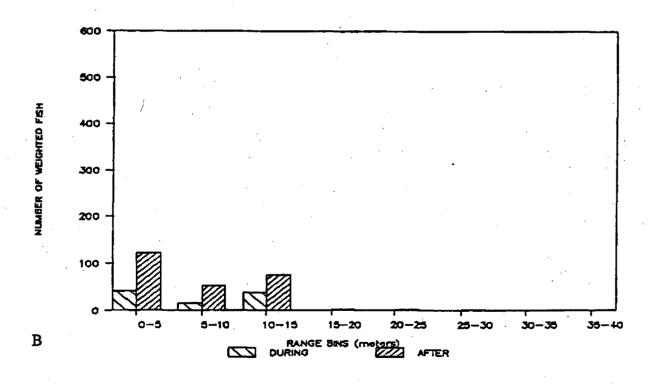
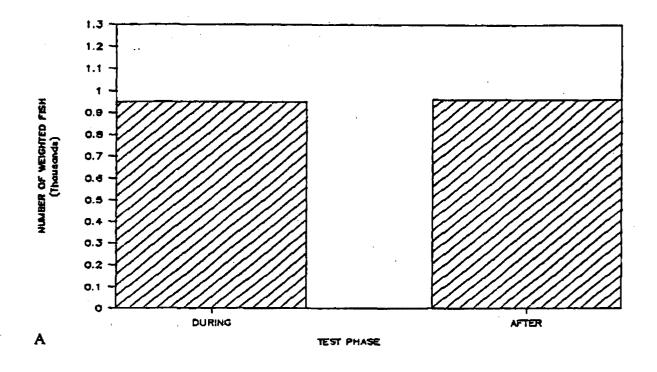


Figure 18. Fish density data from the mid-water 6°x12° horizontal transducer at Intake 35 for the February 13, 1107 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



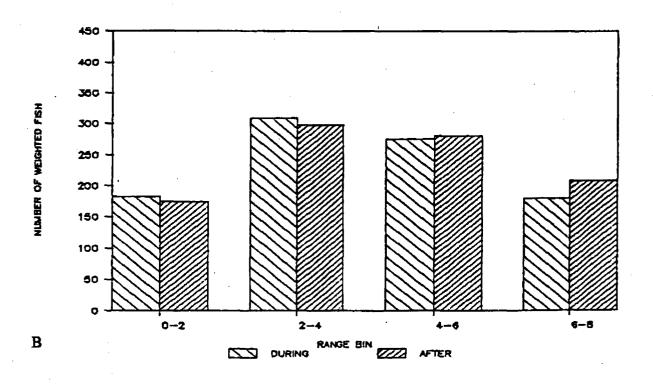
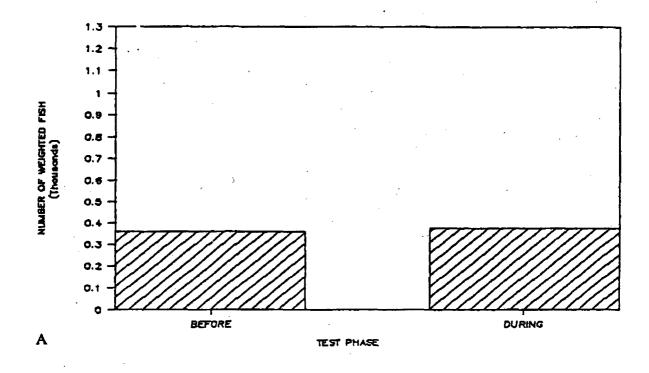


Figure 19. Fish density data from the 15° oblique transducer at Intake 35 for the February 13, 1127 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



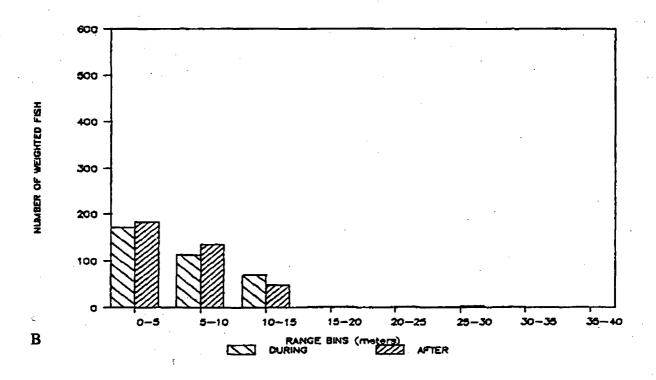
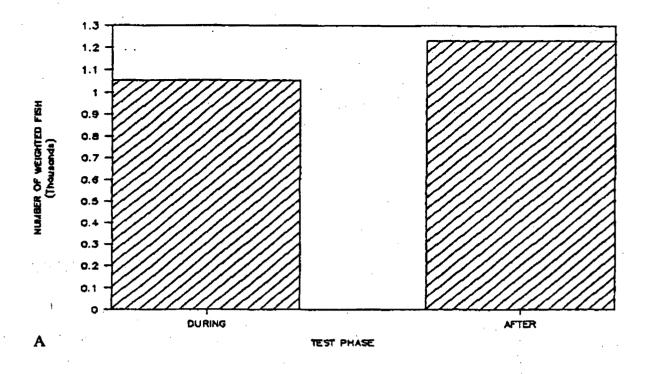


Figure 20. Fish density data from the mid-water 6°x12° horizontal transducer at Intake 35 for the February 13, 1127 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



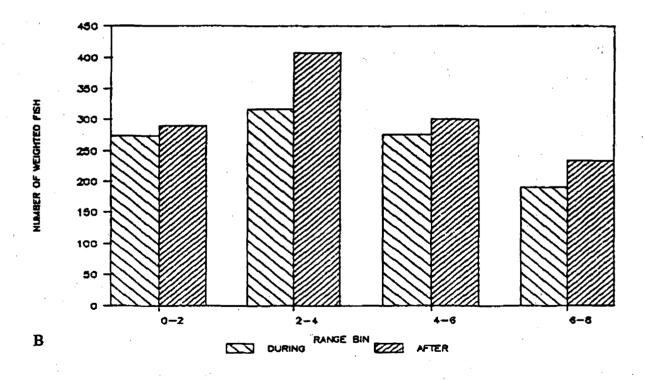
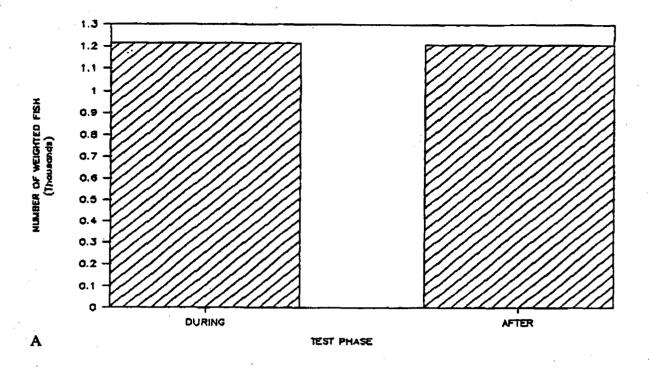


Figure 21. Fish density data from the 15° oblique transducer at Intake 35 for the February 13, 1147 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



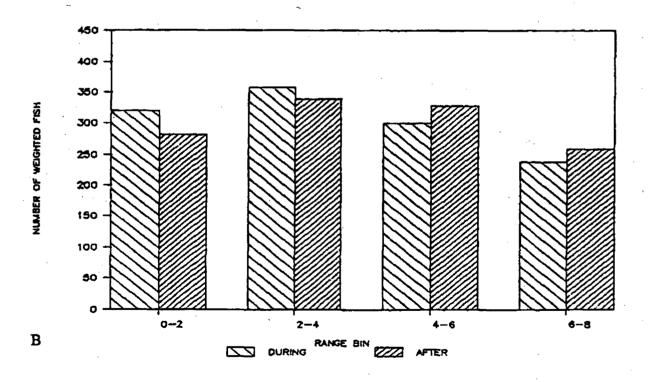
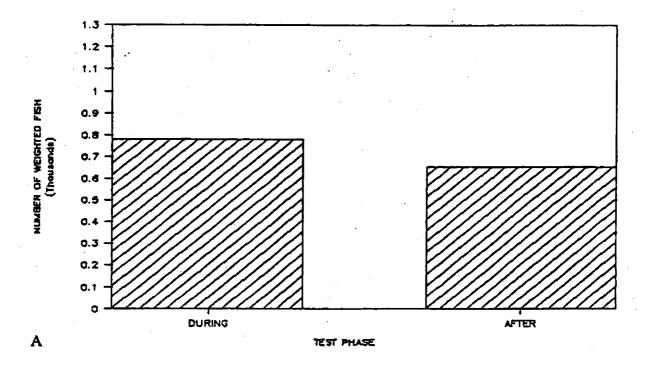


Figure 23. Fish density data from the 15° oblique transducer at Intake 35 for the February 13, 1207 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



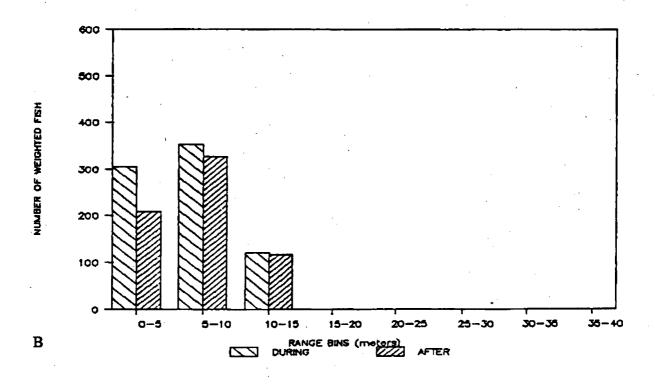
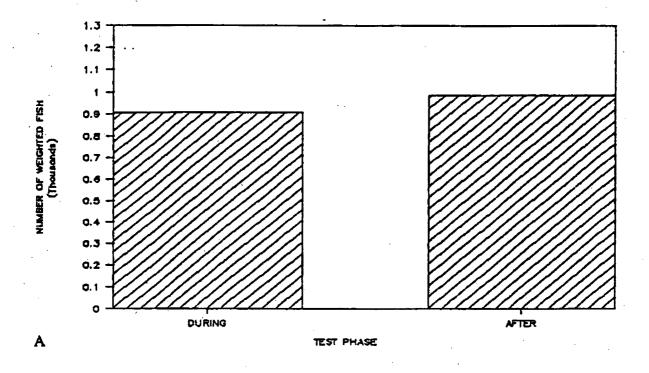


Figure 22. Fish density data from the mid-water 6°x12° horizontal transducer at Intake 35 for the February 13, 1147 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



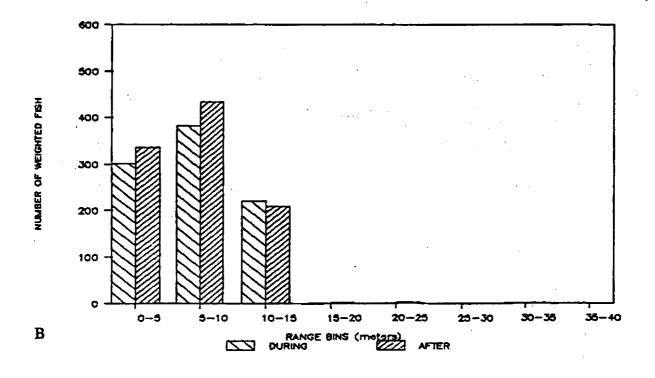
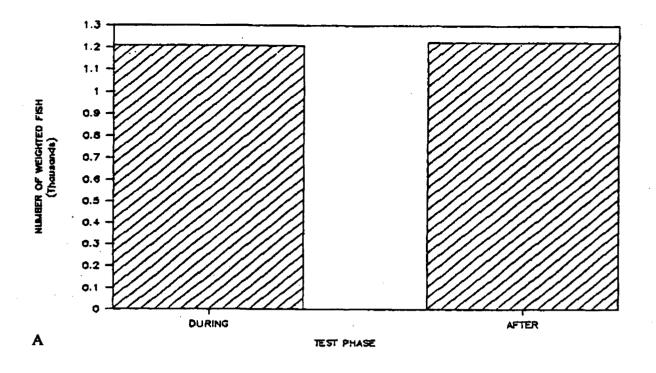


Figure 24. Fish density data from the mid-water 6°x12° horizontal transducer at Intake 35 for the February 13, 1207 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



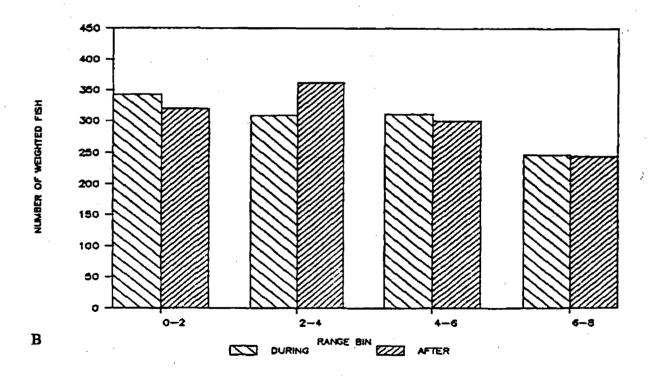
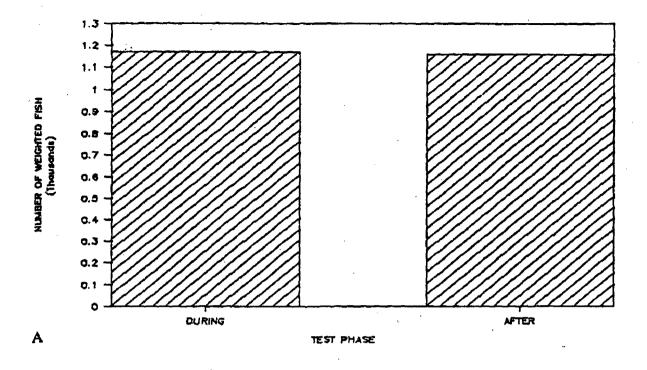


Figure 25. Fish density data from the 15° oblique transducer at Intake 35 for the February 13, 1227 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



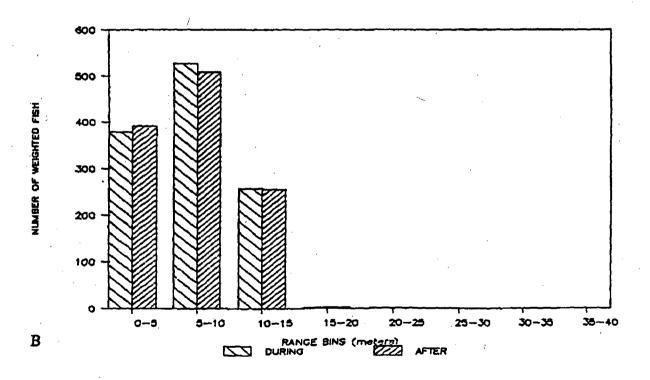
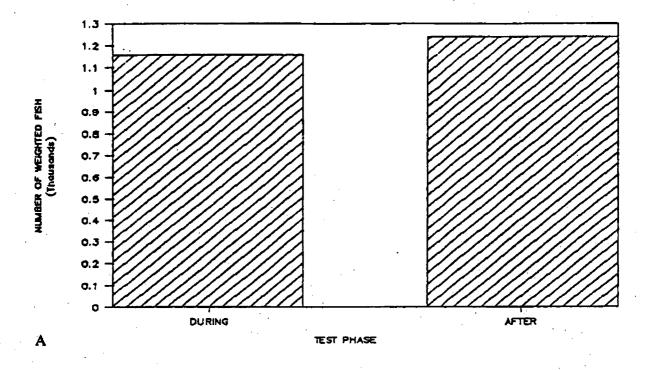


Figure 26. Fish density data from the mid-water 6°x12° horizontal transducer at Intake 35 for the February 13, 1227 h harmmer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



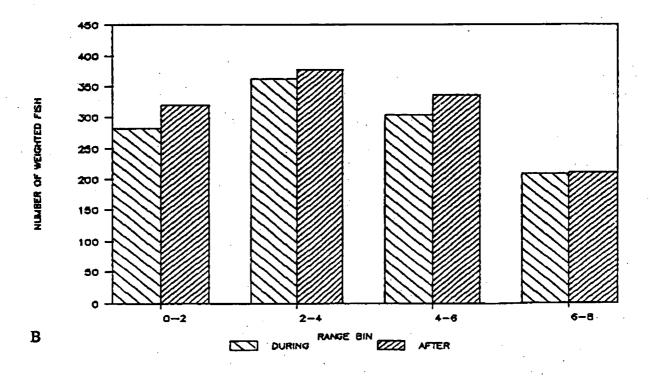
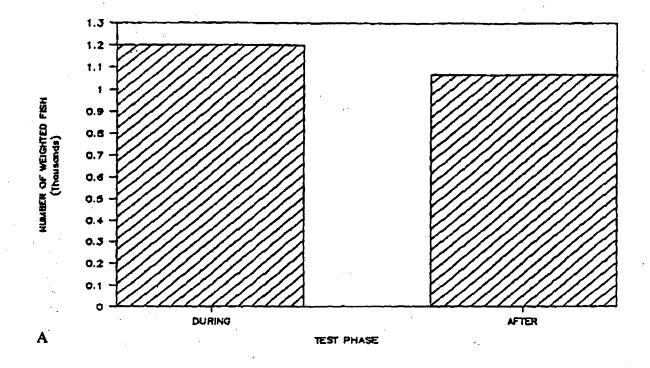


Figure 27. Fish density data from the 15° oblique transducer at Intake 35 for the February 13, 1247 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



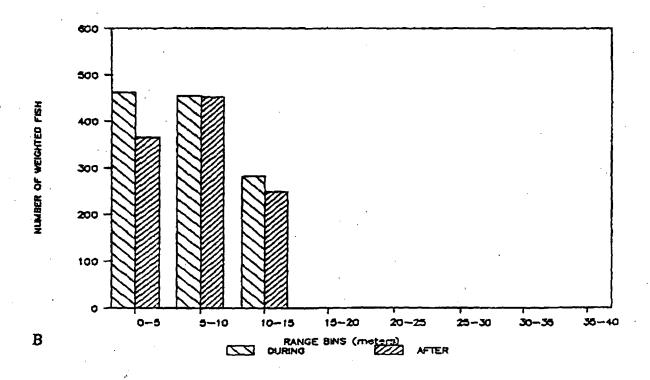
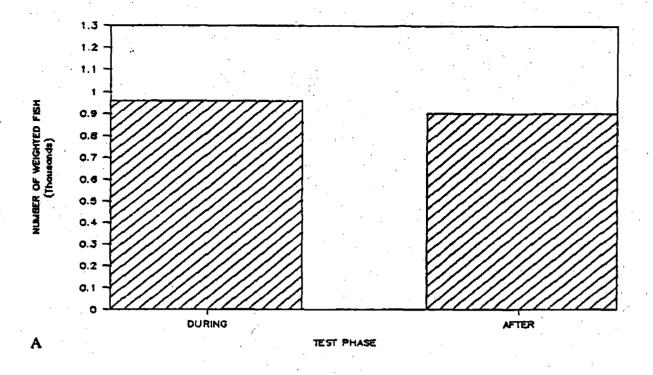


Figure 28. Fish density data from the mid-water 6°x12° horizontal transducer at Intake 35 for the February 13, 1247 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



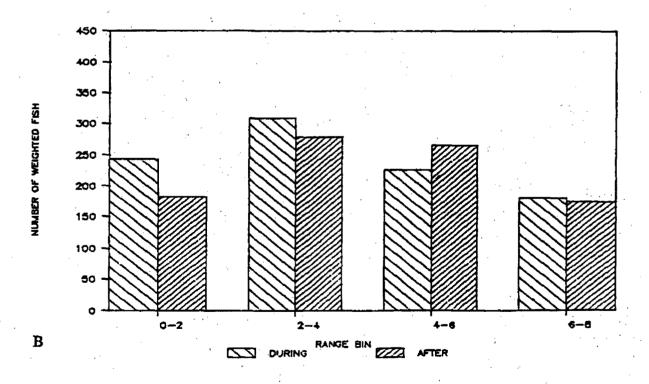
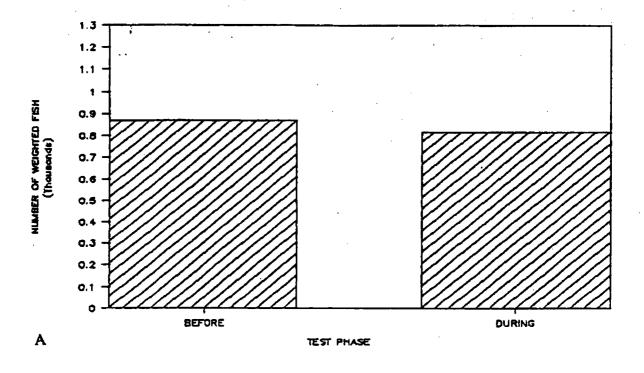


Figure 29. Fish density data from the 15° oblique transducer at Intake 35 for the February 13 1307 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



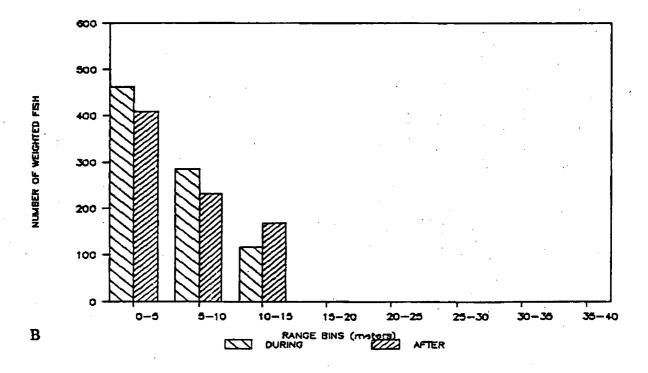
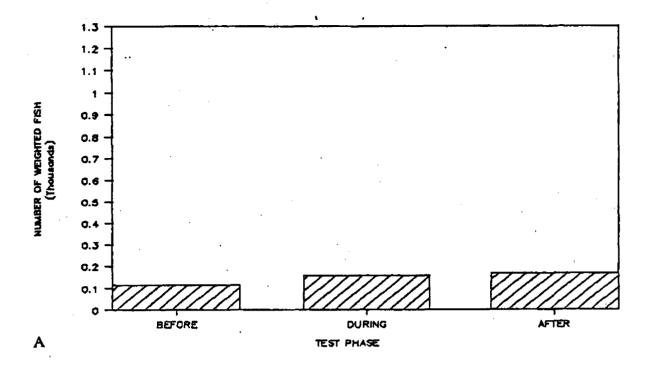


Figure 30. Fish density data from the mid-water 6°x12° horizontal transducer at Intake 35 for the February 13, 1307 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



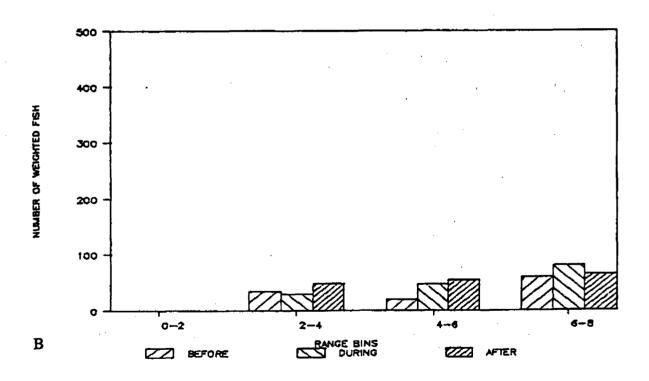
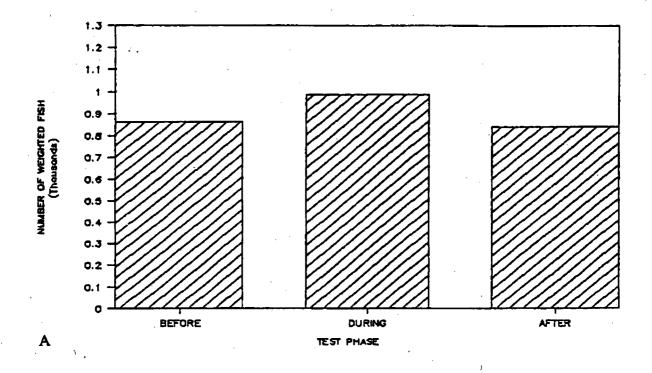


Figure 31. Fish density data from the 15° oblique transducer at Intake 35 for the February 13, 2330 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



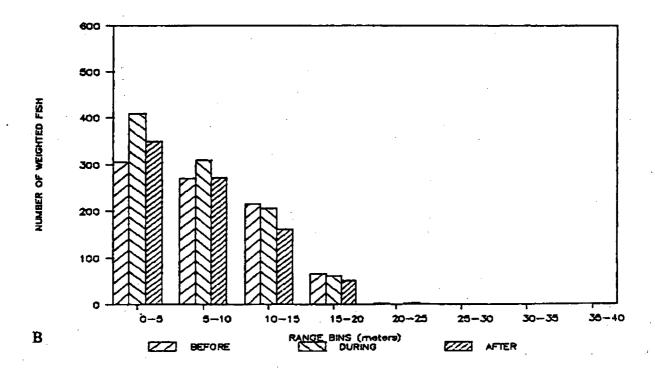
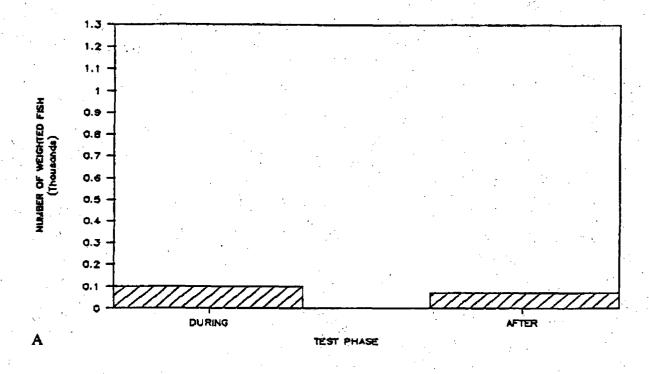


Figure 32. Fish density data from the mid-water 6°x12° horizontal transducer at Intake 35 for the February 13, 2330 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



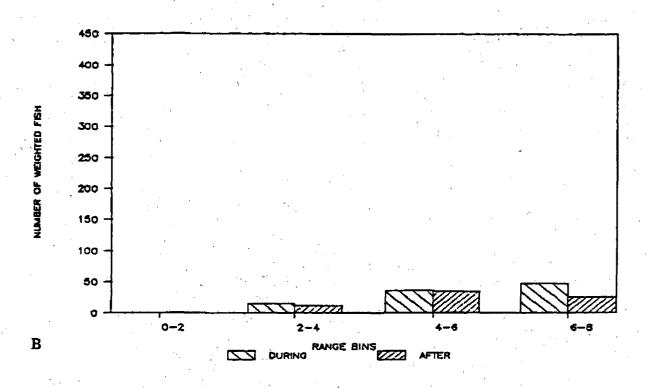
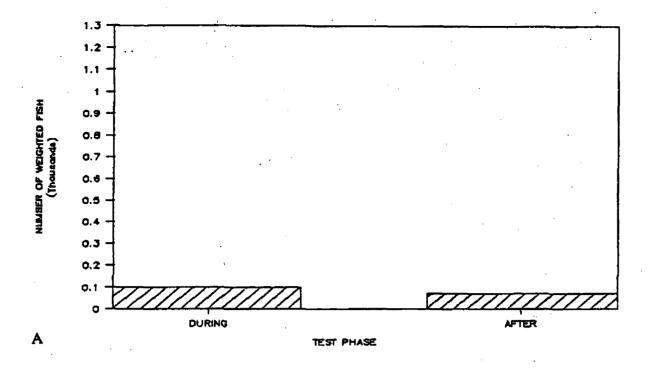


Figure 33. Fish density data from the 15° oblique transducer at Intake 35 for the February 13, 2350 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



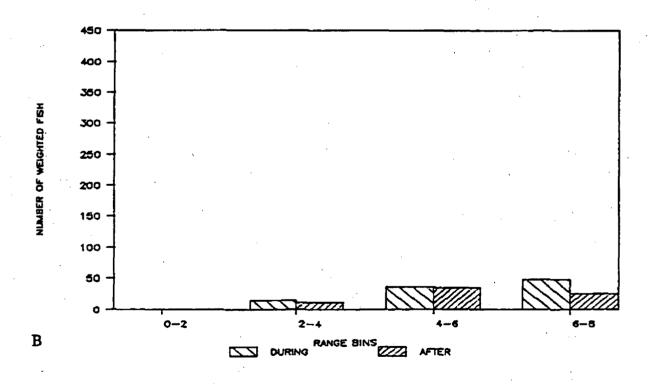
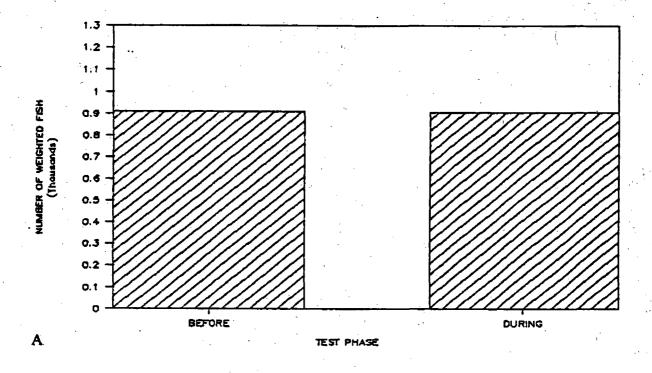


Figure 33. Fish density data from the 15° oblique transducer at Intake 35 for the February 13, 2350 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.



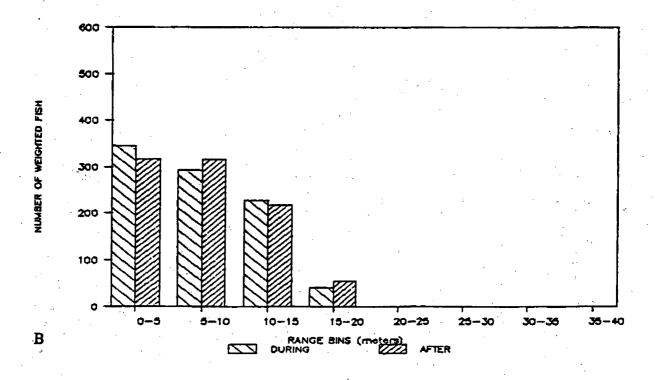


Figure 34. Fish density data from the mid-water 6°x12° horizontal transducer at Intake 35 for the February 13, 2350 h hammer test. Figure A shows the number of weighted fish for each test phase, and figure B shows the number of weighted fish for each range bin.

Table 1. Hammer test monitoring in front of Unit 3, Intake 35, using a 15° oblique transducer and a 6° x 12° horizontal transducer on January 26 and 27. Indian Point, 1988.

| , | | | | Range Bins ³ (meters) | | | | | | | | | | | | |
|---------|----------------------|------------------------|-------------------------|----------------------------------|-----|-----|------------|-------------|------------|-------|-------|-------|-------|-------|--------------|--|
| Time of | • | _ | Test Phase ³ | | | 15° | | | | | | x 12° | | | | |
| _Test_ | Hammers ¹ | Treatment ² | 15° 6°x12° | 0-2 | 2-4 | 4-6 | <u>6-8</u> | Q <u>-5</u> | 5–10 | 10-15 | 15-20 | 20–25 | 25–30 | 30-35 | <u>35-40</u> | |
| 2135 | 1, 2, 3 | 1':1' | A | | | | | , A | N | D | D | Ń | N | N | N | |
| 2155 | 1, 2, 3 | 10": 20" | A ' | | | | | N | A | N | N | N | N | N | N | |
| 2220 | 2 | 10": 20" | D . | | , | | | N | D | D. | D | N | N | N | N | |
| 2245 | 2 | 10": 20" | D | | | | | N | , D | D | N | N | N | N | N | |
| 2305 | 2 | 5": 10" | В | | | | | В | N | В | N | N | _ | N | _ | |
| 2320 | 1, 2, 3 | 10": 20" | N | | | | | | | | | | | | | |
| 0005 | 1, 2, 3 | 10": 20" | A | A | N | N | A | | | | | | | | | |

¹Hammers that were on for test, referred to by control box channel number.

²Amount of time that hammers were on and off during the test. Ex 1':1' = 1 minute on, 1 minute off; 10'': 20'' = 10 seconds on, 20 seconds off; cont. = continuously on.

³Hammer tests and range bins with statistically significant differences (α=.05) in weighted fish numbers between test phases from expected frequencies. Phase with highest numbers noted as: B=Before, D=During, A=After, N=No significant difference between phases. Dashed line indicates no traces.

Table 2. Hammer test monitoring in front of Unit 3, Intake 35, using a 15° oblique transducer and a 6° x 12° horizontal transducer on February 13. Indian Point, 1988.

| Time of Test Phase ³ | | | | | | Range Bins ³ (meters) | | | | | | | | | | | | | |
|---------------------------------|----------------------|------------------------|---|-----|------------|----------------------------------|------------------|-----|-----|------|-------|---|----------------|-------|-------|-------|--|--|--|
| Time of Test | Hammers ¹ | Treatment ² | | | 0-2 | | <u>5°</u> 4–6 | 6-8 | 0-5 | 5-10 | 10–15 | | x 12° 20–25 | 25–30 | 30–35 | 35-40 | | | |
| 1047 | 3, 5 | 10": 20" | N | A | A | D | В | N | A | A | A | N | _ | | _ | | | | |
| 1107 | 3, 5 | 10": 30" | A | D . | , A | N | N | N | A | A | A | N | N | N | N | N | | | |
| 1127 | 3, 5 | 10": 40" | N | N | | | | | | | | | | | | | | | |
| 1147 | 3, 5 | 20": 20" | A | В | N | A | N | A | D | N | N | N | | _ | | • | | | |
| 1207 | 3, 5 | 20": 30" | N | N | • | | | | | | | | | | | | | | |
| 1227 | 3, 5 | 20": 40" | N | N | | | | | | | | | | | | | | | |
| 1247 | 3, 5 | 30": 20" | N | В | | | | | D | N | N | N | | N | | | | | |
| 1307 | 3, 5 | 30": 20" | N | N , | | | | | | | | | | | | | | | |
| 2330 | 3, 5 | 10": 20" | A | D | | N | A | N | D | N | В | N | N | _ | · — | _ | | | |
| 2350 | 3, 5 | 10": 30" | D | N | _ | N | N | D | | | | | | | | • | | | |

¹Hammers that were on for test, referred to by control box channel number.

²Amount of time that hammers were on and off during the test. Ex 1':1' = 1 minute on, 1 minute off; 10": 20" = 10 seconds on, 20 seconds off; cont. = continously on.

³Hammer tests and range bins with statistically significant differences (α=.05) in weighted fish numbers between test phases from expected frequencies. Phase with highest numbers noted as: B=Before, D=During, A=After, N=No significant difference between phases. Dashed line indicates no traces.

Table 3. Hammer test monitoring in front of Unit 3, Intake 35, using a 15° oblique transducer and a 6° x 12° horizontal transducer on February 4. Indian Point, 1988.

| , | ٠ | • | | | Range Bins ³ (meters) | | | | | | | | | | | | | |
|---------|----------------------|------------------------|------------|----------------------|----------------------------------|------------|-----|------------|-----|------|-------|-------|-------|-------|-------|--------------|--|--|
| Time of | | | Tes | t Phase ³ | | | 15° | | | | | | x 12° | | | | | |
| _Test_ | Hammers ¹ | Treatment ² | <u>15°</u> | 6°x12° | 0_2 | 2-4 | 4-6 | 6_8 | 0_5 | 5-10 | 10-15 | 15-20 | 20-25 | 25–30 | 30–35 | <u>35–40</u> | | |
| 0100 | 5 | 10": 20" | D | A | A | D | D | N | A | A | N | N | D | N | N | N | | |
| 0140 | 5 | 10": 20" | N | D | | | | | D | A | N | N | N | N | N | . N | | |
| 0200 | . 5 | 10": 30" | N | N | | | | | | | | | | | | | | |
| 0220 | 5 | 10": 40" | N | N · | | | | | • | | | | | | | 1 | | |
| 0240 | . 5 | 20": 20" | N | N | | | | | | | | • | | | | | | |
| 0300 | 5 | 20": 30" | N | N | | | | | | | | | | | | | | |
| 0320 | 5 | 20": 40" | N | N | | | | | | | | | | | | • | | |
| 0340 | 5 | 30": 20" | D | N | _ | D | D | N | | | | | - | | | | | |
| 0400 | 5 | 30": 30" | A | N | A | . A | N | A _ | | | | 4 | | | | | | |
| 0420 | -5 | 30": 40 " | N | N | | | | | | | | | | | | - | | |

¹Hammers that were on for test, referred to by control box channel number.

²Amount of time that hammers were on and off during the test. Ex 1':1' = 1 minute on, 1 minute off; 10": 20" = 10 seconds on, 20 seconds off; cont. = continously on.

³Hammer tests and range bins with statistically significant differences (α =.05) in weighted fish numbers between test phases from expected frequencies. Phase with highest numbers noted as: B=Before, D=During, A=After, N=No significant difference between phases. Dashed line indicates no traces.

Table 4. Hammer test monitoring in front of Unit 3, Intake 35, using a 15° oblique transducer and a 6° x 12° horizontal transducer on February 18. Indian Point, 1988.

| Time of | ime of Test Phase ³ 15° | | | | | | | Range Bins ³ (meters) 15° 6° x 12° | | | | | | | | | | | |
|---------|------------------------------------|------------------------|------------|--------|-----|-------------|------------|---|-------------|------|-------|-------------|---|-------|-------|-------|--|--|--|
| Test_ | _ | Treatment ² | | 6°x12° | 0-2 | | | 6-8 | 0-5 | 5–10 | 10–15 | | | 25-30 | 30–35 | 35-40 | | | |
| 0153 | 1, 2, 3 | 10": 20" | В | N | _ | D | В | В | | ٠ | | | | | | • | | | |
| 0215 | 1, 2, 3 | 10": 10" | N | N , | | | | | | | | | | | | | | | |
| 0235 | 1, 2, 3 | 10": 40" | A | N | _ | A | A | A | | | | | | | | | | | |
| 0255 | 1, 2, 3 | 20": 20" | N | D | | | | | N | N | D | N | N | N | N | N | | | |
| 0315 | 1, 2, 3 | 20": 30" | N | N | | | | , | | | | | | | | , | | | |
| 1155 | 1, 2, 3 | 20": 40" | A | N | _ | A | , A | N | | | | | | | | | | | |
| 1215 | 1, 2, 3 | 30": 20" | N | N | • | | | • | | | | | | | | | | | |
| 1235 | 1, 2, 3 | 30": 30" | D | N | _ | D | | N | | | | • | | | | | | | |
| 1620 | 3,5 | 10": 30" | D | N | D=A | | B | N | | | | | | | | | | | |
| 1640 | 3, 5 | 10": 30" | N | N | | | | | | | | | | | | | | | |
| 1700 | 3, 5 | 10": 40" | D | N | _ | D | _ | N | | | | | | | | | | | |
| 2045 | 3, 5 | 10": 20" | N | N | | | | | | | | | | | | | | | |
| 2115 | 3, 5 | 10": 30" | N | N | | | | | | | | ٠ | | | • | | | | |
| 2225 | 3, 5 | 10": 20" | D | N | В | D | N | A | | | | | | | | | | | |
| 2245 | 3, 5 | 10": 30" | N | N | | | | | • | | | | | | | | | | |
| 2305 | 3, 5 | 10": 40" | : A | D | A | A | N | N | | D | N | | N | N | _ | | | | |
| 2345 | 3, 5 | 20": 20" | N | N | | | | | | | | | | | | | | | |

¹Hammers that were on for test, referred to by control box channel number.

²Amount of time that hammers were on and off during the test. Ex 1':1' = 1 minute on, 1 minute off; 10": 20" = 10 seconds on, 20 seconds off; cont. = continously on.

³Hammer tests and range bins with statistically significant differences (α =.05) in weighted fish numbers between test phases from expected frequencies. Phase with highest numbers noted as: B=Before, D=During, A=After, N=No significant difference between phases. Dashed line indicates no traces.

Table 5. Hammer test monitoring in front of Unit 3, Intake 35, using a 15° oblique transducer and a 6° x 12° horizontal transducer on February 19. Indian Point, 1988.

Range Bins³ (meters) Test Phase³ Time of 15° Test Hammers Treatment 15° 6°x12° 0035 1, 2, 3 20": 30" D N N N D N N N N 0125 1, 2, 3 30": 20" N N D N B=D 0335 1, 2, 3 30": 30" N N 0355 1, 2, 3 30": 40" D N D D 0415 1, 2, 3 30": 20" N N 0435 1, 2, 3 30": 30" D N N 1235 1, 2, 3 10": 20" N N N 1255 1, 2, 3 10": 30" N N 1315 1, 2, 3 10": 40" D N D N 1335 1, 2, 3 20": 20" D D D N N N N N D D D 1355 1, 2, 3 20": 30" D N N 1415 1, 2, 3 20": 40" N N

¹Hammers that were on for test, referred to by control box channel number.

²Amount of time that hammers were on and off during the test. Ex 1':1' = 1 minute on, 1 minute off; 10'': $20'' \approx 10$ seconds on, 20 seconds off; cont. = continuously on.

³Hammer tests and range bins with statistically significant differences (α =.05) in weighted fish numbers between test phases from expected frequencies. Phase with highest numbers noted as: B=Before, D=During, A=After, N=No significant difference between phases. Dashed line indicates no traces.

Table 6. Hammer test monitoring in front of Unit 3, Intake 35, using a 15° oblique transducer and a 6° x 12° horizontal transducer on February 20. Indian Point, 1988.

| | | | _ | | Range Bins ³ (meters) 6° x 12° | | | | | | | | | | | | | |
|-----------------|---|------------------------|---|------------------------------|--|---|------------|-----|-----|------|-------|-------|---|-------|-------|-------|--|--|
| Time of Test | | Treatment ² | | it Phase ³ 6°x12° | 0-2 | | | 6-8 | 0-5 | 5-10 | 10–15 | 15-20 | | 25-30 | 30–35 | 35-40 | | |
| 0015 | 3 | 20": 30" | N | N | | | | | | | | | | | | | | |
| 0035 | 3 | 20": 40" | D | N | _ | D | . N | D | | | | | | | | - | | |
| 0055 | 3 | 20": 20" | N | N | | | | | | • | | | | | | | | |
| .0445 | 3 | 30": 30" | A | D | _ | A | A | Α | N | A | D | N | N | N | N | N | | |
| 0505 | 3 | 30": 40" | N | N | • | | | | | | | | | | | | | |
| 0525 | 3 | 40": 20" | N | N | | | | | | | | | | | | | | |
| 0545 | 3 | 40": 30" | D | N | D | N | N | N | | | | | | | | | | |
| 0605 | 3 | 40": 40" | N | N | | | | | | | | | | | • | | | |
| 2155 | 3 | 10": 20" | N | N | | | ٠. | | | | | | | | | | | |
| 2235 | 3 | 10": 40" | N | N | | | | | | | | | | | | | | |
| 2255 | 3 | 10": 20" | D | N | . — | D | N | N | | | | • | | | | | | |

¹Hammers that were on for test, referred to by control box channel number.

²Amount of time that hammers were on and off during the test. Ex 1':1' = 1 minute on, 1 minute off; 10": 20" = 10 seconds on, 20 seconds off; cont. = continously on.

³Hammer tests and range bins with statistically significant differences (α=.05) in weighted fish numbers between test phases from expected frequencies. Phase with highest numbers noted as: B=Before, D=During, A=After, N=No significant difference between phases. Dashed line indicates no traces.

Table 7. Hammer test monitoring in front of Unit 3, Intake 35, using a 6° vertical transducer on February 23, 24, 25, 26, and 27. Indian Point, 1988.

| | 1 | | | | | | · · · | Range | ` | 6 67 | | |
|------|------|----------------------|------------------------|-------------------------|-----------------|---------------|----------------|--------------|----------------|-------------|------------|------------------|
| Date | Time | Hammers ¹ | Treatment ² | Test Phase ³ | LS ⁴ | 0-1 | 1-2 | 2-3 | 3_4 | 4-5 | _5-6_ | <u>6-7</u> |
| 2/23 | 1822 | 1, 3 | CONT. | N | | | | | | | | |
| 2/23 | 1941 | 1, 3 | CONT. | N | | • | | | , | 1 20 | | |
| 2/23 | 2015 | 1, 3 | CONT. | N | | | | , | · ; | | | |
| 2/24 | 1330 | 1, 3 | CONT. | N. | | • | | | 4 - 4 | | | |
| 2/24 | 1358 | 1, 3 | CONT. | D | D 4 | _ | .— · | • | N | N | D. | N |
| 2/24 | 1419 | 1, 3 | CONT. | D | N | | | | N | D | N | N |
| 2/24 | 1957 | 1, 3, 5 | CONT. | N. | | | • | | , | | | .* |
| 2/24 | 2244 | 1, 3, 5 | CONT. | D | D | | | - | D | D | _ | |
| 2/25 | 0954 | 1, 3, 5 | CONT. | N | | . , | | | | | | |
| 2/25 | 1215 | 1, 3, 5 | CONT. | D | D | . | , <u> </u> | _ | N | D | N | N |
| 2/25 | 2026 | 1, 3, 5 | CONT. | D | D. | _ | _ | Ņ | _ | | D | _ |
| 2/26 | 0806 | 1, 3, 5 | CONT. | D | D | _ | _ | , D | N | N | N | \mathbf{n}^{A} |
| 2/26 | 0814 | 1, 3, 5 | CONT. | N | | | • | | | | | |
| 2/26 | 0828 | 1, 3 | CONT. | D | Ď | _ | _ | | _ | · · | D. | N |
| 2/26 | 0849 | 1, 3, 5 | CONT. | N | | | | | | | | |
| 2/26 | 0924 | 1, 3, 5 | CONT. | N | | | | . : | | | | |
| 2/26 | 1007 | 5 | CONT. | В | В | · | A | . — | ; - | D | . B | B=D |
| 2/26 | 1027 | 1, 3 | CONT. | D | D | | - ; | | Ď | N | N | N |

¹Hammers that were on for test, referred to by control box channel number.

²Amount of time that hammers were on and off during the test. Ex 1':1' = 1 minute on, 1 minute off; 10": 20" = 10 seconds on, 20 seconds off; cont. = continously on.

³Hammer tests and range bins with statistically significant differences (α=.05) in weighted fish numbers between test phases from expected frequencies. Phase with highest numbers noted as: B=Before, D=During, A=After, N=No significant difference between phases. Dashed line indicates no traces.

⁴Test phase with statistically significant difference in weighted Long to Short trace types between test phases from expected frequencies. Test phase with highest LS trace types noted as in foomote 3.

Table 7, cont.

| | | • | | | | | | Range | Bins ³ (| meters) | | |
|------|---------------|----------------------|------------------------|-------------------------|-----------------|------------|-----|-------|---------------------|---------|-----|---------|
| Date | Time | Hammers ¹ | Treatment ² | Test Phase ³ | LS ⁴ | 0-1 | 1–2 | 2-3 | 3_4 | 4-5 | 5-6 | 6-7 |
| 2/26 | 1047 | 1, 3, 5 | CONT. | N | | | | | | | | |
| 2/26 | 1348 | 1, 3, 5 | CONT. | B=D | D | _ | _ | D | N | N | В | В |
| 2/26 | 1800 | 1, 3, 5 | CONT. | B=A | N | | | B=A | N | N | N | atrian. |
| 2/26 | 2040 | 5 | CONT. | N | | | | | | | | |
| 2/26 | 2100 | 1, 3, 5 | CONT. | N | | | | | | | | |
| 2/26 | 2123 | 1, 3 | CONT. | N | | | | | | | | |
| 2/26 | 2140 | 5 | CONT. | D | D | | D | - | D | D | N | N |
| 2/26 | 2200 | 1, 3, 5 | CONT. | D | D | | Ď | N | N | N | N | N |
| 2/26 | 2220 | 1, 3 | CONT. | A | N | | A | | N | N | Α | N |
| 2/26 | 2240 | 5 | CONT. | A | N | _ | | _ | | N | N | N |
| 2/26 | 2300 . | 1, 3, 5 | CONT. | D | D | _ | _ | | D | D | N | N |
| 2/26 | 2320 | 1, 3, 5 | CONT. | D | D | | _ | | N | D | N | N |
| 2/26 | 2342 | 1, 3, 5 | CONT. | D | N | — . | | _ | N | D | N | N |
| 2/27 | 0002 | 1, 3, 5 | CONT. | D | D | D | _ | N | N | D | N | N |
| 2/27 | 1750 | 1, 3, 5 | CONT. | D | N | . — | _ | N | D | D | В | N |
| 2/27 | 1810 | 1, 3, 5 | CONT. | N | | | | | | | | |
| 2/27 | 1830 | 1, 3, 5 | CONT. | D, | D | Ď | _ | N | D | D | N | N |
| 2/27 | 1850 | 1, 3 | CONT. | N | | | | | | | | |

¹Hammers that were on for test, referred to by control box channel number.

²Amount of time that hammers were on and off during the test. Ex 1':1' = 1 minute on, 1 minute off; 10": 20" = 10 seconds on, 20 seconds off; cont. = continously on.

³Hammer tests and range bins with statistically significant differences (α =.05) in weighted fish numbers between test phases from expected frequencies. Phase with highest numbers noted as: B=Before, D=During, A=After, N=No significant difference between phases. Dashed line indicates no traces.

⁴Test phase with statistically significant difference is weighted Long to Short trace types between test phases from expected frequencies. Test phase with highest LS trace types noted as in footnote 3.

Table 8. Hammer test monitoring in front of Unit 3, Intake 36, using a 6° oblique transducer and the bottom oriented 6° x 12° horizontal transducer on March 3. Indian Point, 1988.

| | | | | | Range Bins ³ (meters) | | | | | | | | | | | | |
|-------------|----------------------|------------------------|-----|--------------------|----------------------------------|----------------|-----|-----|------|----|--------------|-----|-----|------|---------|------|---------------|
| Time of | _ | _ 2 | | Phase ³ | | | | | 6° | | | | · | | _ | 12° | |
| <u>Test</u> | Hammers ¹ | Treatment ² | 6 | 6°x12° | LS4 | 0_1 | 1-2 | 2-3 | _3_4 | 4. | <u>5_5_6</u> | 6_7 | 0-5 | 5_10 | 10-15 1 | 5-20 | <u> 20–25</u> |
| 0320 | 1, 3 | 10": 20" | N | D | | | | | | | | | N | D | N | N | N |
| 0340 | 1, 3 | CONT. | N | N . | | | | | | | | | | • | | | |
| 0350 | 1, 3 | CONT. | N | N | | | | | | | | • | | | | | |
| 0400 | 1, 3 | 10": 20" | D | N | D | D | D | D | D | N | N | N | | i | | | |
| 0410 | 1, 3 | 10": 20" | D | N | D | . . | D | N | D | N | A | N | | | | | |
| 0420 | 1, 3 | CONT. | N | D . | | | | | | | | | D | D | N | N | N |
| 0440 | 1, 3, 5 | 10": 20" | D | N | D | D | D | N | N | N | N | N | | | | | |
| 0450 | 1, 3, 5 | 10": 20" | N | N | | | | | | • | | | · · | | | | |
| 1600 | 1, 3, 5 | CONT. | B=D | D | D | D | D | B | B | Ň | D | _ | D | D | D=A | D | N |
| 1620 | 1, 3, 5 | CONT. | N | N | | | | | | | | | | | | | |
| 1643 | 1, 3, 5 | CONT. | N | D | | | | | ٠ | | | ٠ | D | N | N | N | |
| 1700 | 1, 3, 5 | CONT. | N | N | | | | | | | | | | | | | |
| 1720 | 1, 3, 5 | 10": 20" | N | N | | | | • | | | | | | | | | |
| 1740 | 1, 3, 5 | 10": 20" | N | N | | | | • | | ٠ | | | | | | . , | |
| 1800 - | 1, 3, 5 | CONT. | Ŋ | , N | , | | | | | | | | | | | | |

¹Hammers that were on for test, referred to by control box channel number.

²Amount of time that hammers were on and off during the test. Ex 1':1' = 1 minute on, 1 minute off; 10": 20" = 10 seconds on, 20 seconds off; cont. = continuously on.

³Hammer tests and range bins with statistically significant differences (α=.05) in weighted fish numbers between test phases from expected frequencies. Phase with highest numbers noted as: B=Before, D=During, A=After, N=No significant difference between phases. Dashed line indicates no traces.

⁴Test phase with statistically significant difference in weighted Long to Short trace types between test phases from expected frequencies. Test phase with highest LS trace types noted as in footnote 3.

Table 9. Hammer test monitoring in front of Unit 3, Intake 36, using a 6° vertical transducer and the bottom oriented 6° x 12° horizontal transducer on March 4. Indian Point, 1988.

| | | | | | | | | | | P | lange | Bins ³ | (meters |) | | | |
|---------|----------------------|------------------------|---|----------------------|-----|-----|-----|-----|-----|-----|-------|-------------------|------------|------|-------|-------|--------------|
| Time of | | | | t Phase ³ | | | | | 6° | | | | | | 6° x | 12° | |
| _Test_ | Hammers ¹ | Treatment ² | € | 6°x12° | LS4 | 0-1 | 1-2 | 2-3 | 3_4 | 4_5 | 5-6 | 6-7 | 0-5 | 5_10 | 10–15 | 15-20 | <u>20–25</u> |
| 0330 | 1, 3 | 20": 20" | N | D | | | | | , | | | | · A | A | N | N | N |
| 0350 | 1, 3 | CONT. | N | D, | | | | | | | | | N | D | N | N | N |
| 0410 | 1, 3 | 20": 20" | N | N | | | | | | ٠ | | | | | | | |
| 0430 | 3 . | CONT. | D | D | N | _ | A | _ | D | N | N | N. | N | N | D | N | · N |
| 0450 | 3 | CONT. | N | D | | | | | | | | | N | N | D | N | N |
| 0510 | 3 | CONT. | D | A | D | D | | _ | N | N | D | _ | A | N | N | N | N |
| 0530 | 3 | CONT. | N | N | | | | | | | | | | | | | |
| 0550 | 3 | CONT. | D | D . | D | D | D | N | N | N | D | N | D | N | N | N | N |

¹Hammers that were on for test, referred to by control box channel number.

²Amount of time that hammers were on and off during the test. Ex 1':1' = 1 minute on, 1 minute off; 10": 20" = 10 seconds on, 20 seconds off; cont. = continously on.

³Hammer tests and range bins with statistically significant differences (α=.05) in weighted fish numbers between test phases from expected frequencies. Phase with highest numbers noted as: B=Before, D=During, A=After, N=No significant difference between phases. Dashed line indicates no traces.

⁴Test phase with statistically significant difference in weighted Long to Short trace types between test phases from expected frequencies. Test phase with highest LS trace types noted as in footnote 3.

APPENDIX A:

Fish Abundance Data

APPENDIX A: Fish Abundance Data

Fish abundance estimates were calculated for the period of January 16 to February 22, with only several brief periods when monitoring was interrupted. The midwater 6° X 12° horizontal transducer was used to gather the hourly estimates of fish density in front of Unit 3, Intake 35. Fish traces were enumerated from the echograms, weighted by range bin and extrapolated if sample time was less than an hour.

Tidal information was obtained during the project with high and low tide values used for New York (The Battery), N.Y. Correction factors used to adjust tide times for Peekskill, N.Y. were high = +2:28 h and low = +3:03 h.

During the first week of the study (January 16 to January 23), high peak fish densities were generally associated with mid-tide levels, and low fish densities occurred at low tide. This trend continued on through the second week and the beginning of the third week (January 24 to February 2). Towards the end of the third week fish densities decreased dramatically, remaining at low densities on into the fifth week (February 4 to February 12). Toward the middle of the fifth week of the study until the end of the 24 h monitoring (February 14 to February 22), overall fish densities began to increase gradually with the same trend for high and low peak fish densities as was observed in the beginning of the project.

The two time periods when the highest fish densities of the project were observed (January 26–27, and January 13), both occurred just before or during low tides.

A possible explanation for the trends observed in fish densities in front of the intakes may be related to the behavior of fish following the freshwater zones of the river influenced by tidal variations. As the saltwater wedge recedes downriver during an ebb tide, fish upriver within the freshwater zone may move downstream. The river channels in front of the power plant may then funnel these fish toward the plant's intakes.

Fish density increases prior to high tide could be related to fish milling near the power plant's outflow. During the onset of high tide, a freshwater plume, caused by the outflow of the power plant, may be pushed upriver and directed by the river channels into the power plant's intakes. Fish within this plume would then be directed toward the intakes.

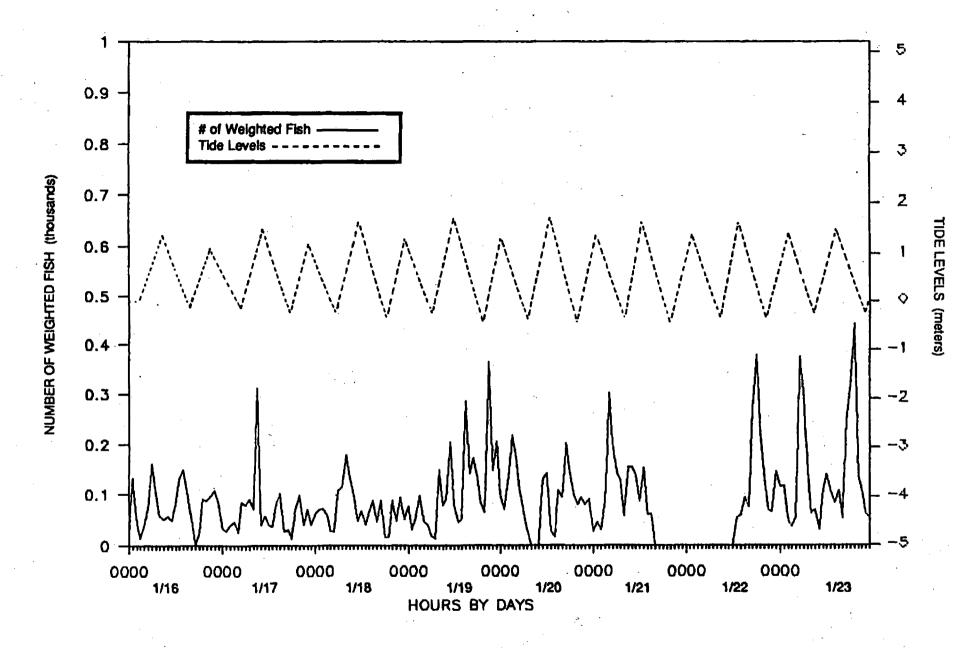


Figure A1. Hourly estimates of fish abundance with high and low tide levels in front of Unit 3, Intake 35 for January 16 to 23, Indian Point, 1988.

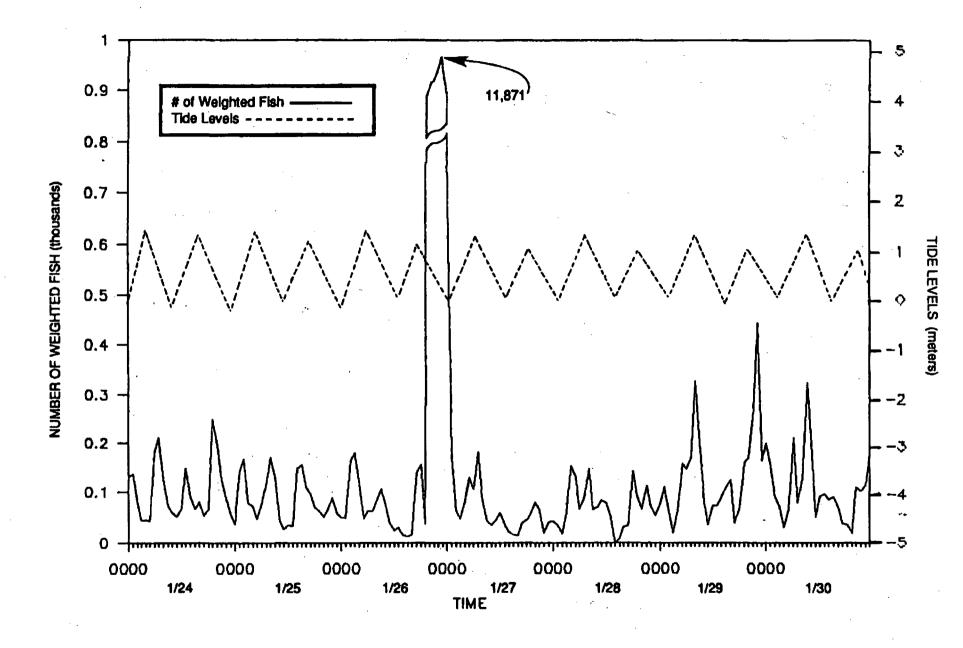


Figure A2. Hourly estimates of fish abundance with high and low tide levels in front of Unit 3, Intake 35 for January 24 to 30, Indian Point, 1988.

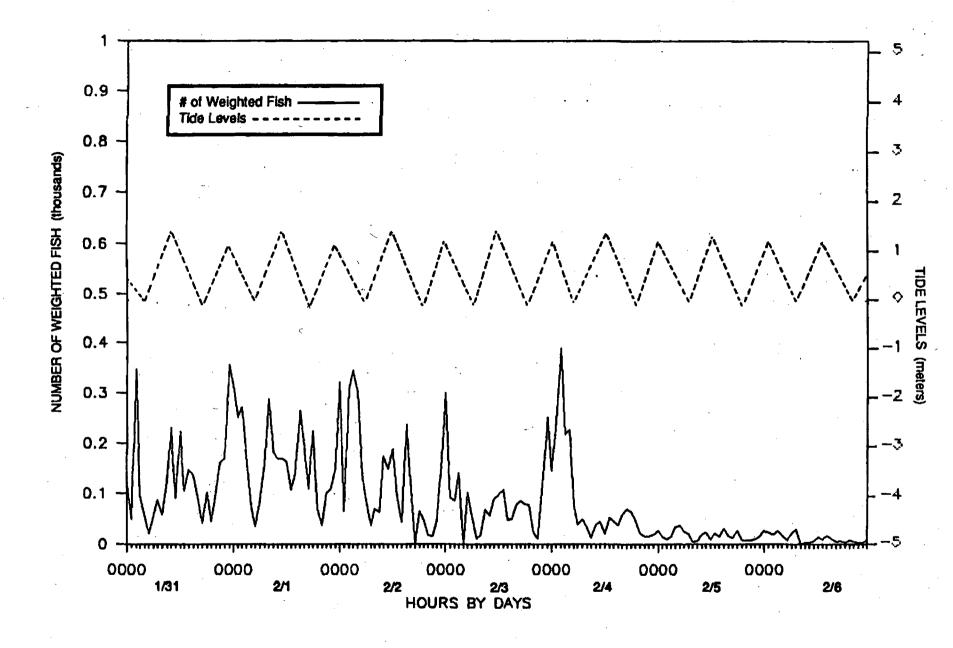


Figure A3. Hourly estimates of fish abundance with high and low tide levels in front of Unit 3, Intake 35 for January 31 to February 6, Indian Point, 1988.

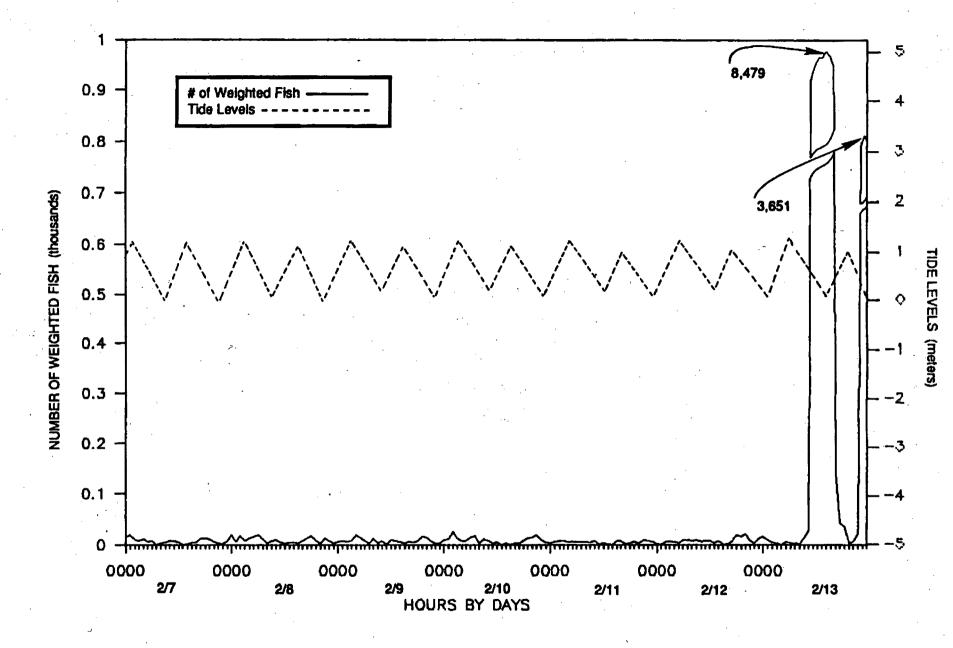


Figure A4. Hourly estimates of fish abundance with high and low tide levels in front of Unit 3, Intake 35 for February 7 to 13, Indian Point, 1988.

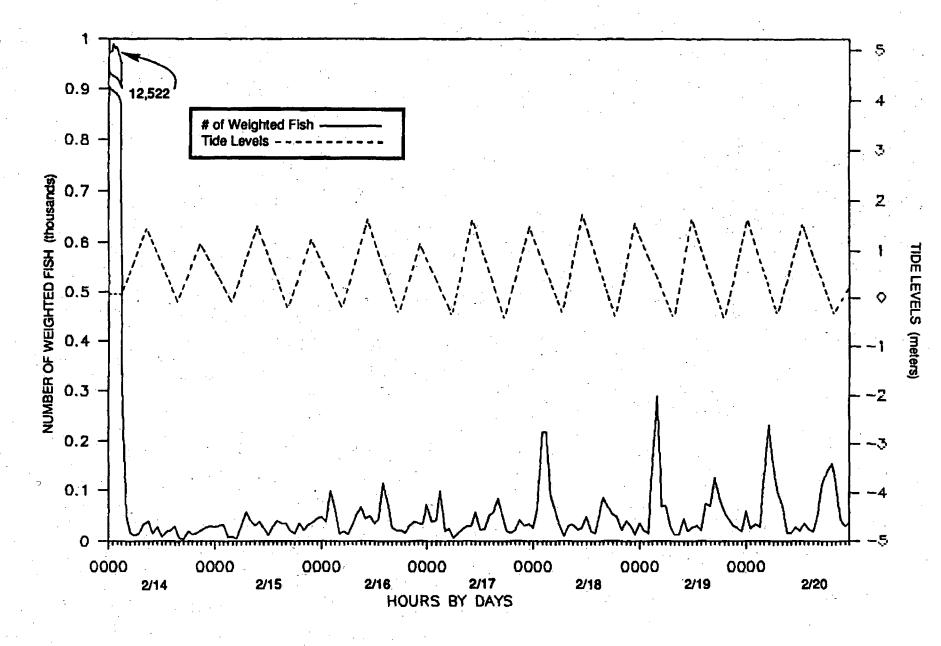


Figure A5. Hourly estimates of fish abundance with high and low tide levels in front of Unit 3, Intake 35 for February 14 to 20, Indian Point, 1988.

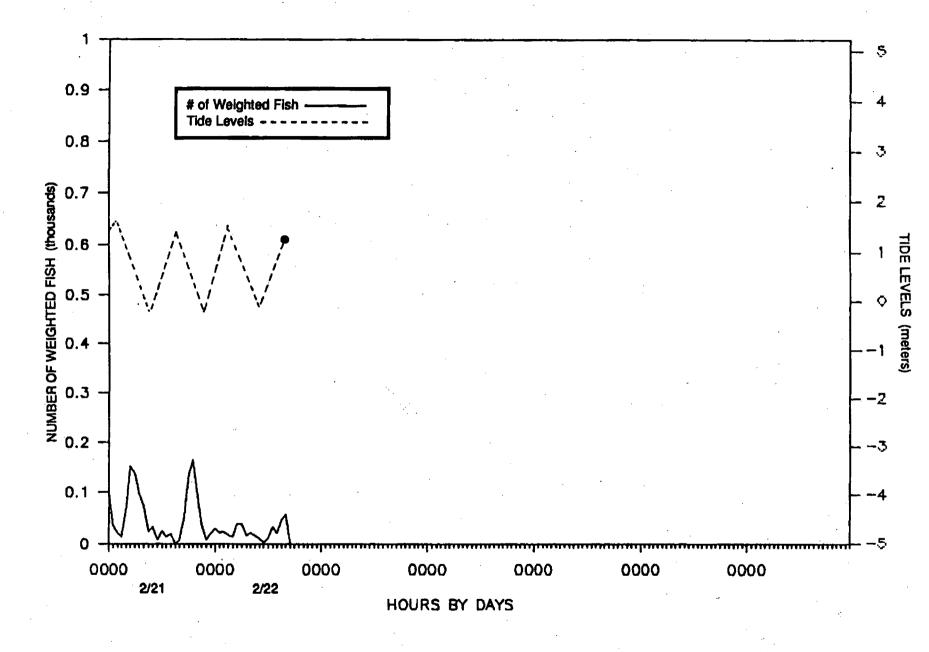


Figure A6. Hourly estimates of fish abundance with high and low tide levels in front of Unit 3, Intake 35 for February 21 to 22, Indian Point, 1988.

Table R1. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 % 12 degree horizontal transducer, for January 16. Indian Point, 1988.

| Hour | 0-5 P.au | NF | P. | 5-10 | WF | 10-1 Rau | 15 HF | 15-20 Rau | WF | 20-25 Rau | HF | 25~3 Rau | 30 . WF | 30-: Raw | 35 WF | 35-40 Rau | WF | HOURLY Ray | TOTAL HF |
|--------------|-------------|-----|-----|------|-----|-------------|----------|--------------|-----|--------------|-----|-------------|------------|-------------|----------|--------------|----|---------------|-------------|
| 0000 | 0 | 0 | 1 | 0 | 0 | 1 1 | 1 | 1 1 | 1 | 1 2 | 2 | l 1 | 1 | 1 2 | 1 | ı 0 | 0 | 1 21 | 18 |
| 0100 | 1 | 4 | 1 | 6 | 11 | 1 8 | 10 | 1 11 | 10 | 1 2 | 2 | iā | ž | 1 9 | ร์ | iŏ | ō | 1 120 | 132 |
| 0200 | 0 | 0 | ŧ | 3 | 6 | 1 2 | 2 | i 1 | 1 | i 5 | 4 | i ī | ī | i Ď | ŏ | iŏ | ŏ | 36 | 42 |
| 0300 | 1 | 4 | ŧ | 0 | 0 | i õ | 0 | 1 0 | ā | 1 0 | Ó | iò | · ō | i õ | ă | | ő | 1 3 | 12 |
| 0400 | 1 | 4 | ŧ | ī | Ž | i 5 | 6 | 1 0 | ō | ii | 1 | iŏ | ŏ | i õ | ŏ | iŏ | ő | 24 | 39 |
| 0500 | 3 | 11 | i | 3 | 6 | i 6 | 7 | i | Ď | i | Ō | i | õ | i | ŏ | i | ŏ | 1 36 | 72 |
| 0600 | 4 | 15 | 1 | 7 | 13 | 1 16 | 19 | 1 6 | 5 | i ī | ī | i | ī | i | ă | iŏ | ŏ | 1 105 | 162 |
| 0000 | 1 | 4 | ı | 1 | 2 | 1 7 | ė | 1 14 | 13 | i 5 | 4 | i å | • | i | ĭ | i ĭ | Ö | i 99 | 102 |
| 0800 | 0 | 0 | ı | 2 | 4 | 1 3 | 4 | 1 7 | 6 | 1 6 | 5 | i | ō | i i | Ö | io | 0 | i 54 | 57 |
| 0900 | Ō | Ō | i | 4 | В | i ā | À | i 2 | 2 | iŏ | ŏ | i | ĭ | 1 4 | 2 | iŏ | ŏ | 1 42 | 51 |
| 1000 | Ó | Ò | Ì | 1 | 2 | i 4 | 5 | 1 5 | 5 | i a | 2 | i 3 | ż | i 5 | 3 | iŏ | õ | 1 63 | 57 |
| 1100 | 0 | 0 | 1 | Ó | Ö | i 4 | 5 | j 3 | š | 1 4 | 3 | i ž | ī | i e | 4 | i i | ŏ | 1 66 | 48 |
| 1200 | 0 | . 0 | 1 | 3 | 6 | 1 3 | 4 | 1 3 | 3 | i i | ī | i 7 | 4 | i 18 | ģ | i i | ŏ | 1 100 | 81 |
| 1300 | Ó | 0 | 1 | 5 | 9 | 1 6 | 7 | i 5 · | 5 | i | ī | 25 | 15 | i 14 | ź | i ō | ŏ | 1 160 | 132 |
| 1 4930 | O | 0 | 1 | 4 | 8 | (a | 4 | 1 14 | 13 | 1 19 | 14 | 1 11. | 7 | i 7 | 4 | i ŏ | ŏ | 1 174 | 150 |
| 1500 | 0 | 0 | ı | 2 | 4 | 1 5 | 6 | 1 11 | 10 | 1 16 | 12 | 1 4 | Ż | 1 2 | 1 | i ŏ | ō | 1 120 | 105 |
| 1600 | 0 | 0 | 1 | 0 | 0 | 1 2 | 2 | 1 7 | 6 | 1 11 | . 8 | 1 0 | Ö | i i | ī | i o | Ō | 1 63 | 51 |
| 1700 | 0 | 0 | ŧ | O | 0 | 1 0 | 0 | 1 0 | 0 | 1 0 | ` O | 1 0 | Ō | 1 0 | ă | i ō | ŏ | i o | Ö |
| 1800 | 1 | ·4 | ŧ | 2 | 4 | 1 0 | 0 | 1 .0 | 0 | 1 1 | ı | 1 0 | 0 | 1 0 | Õ | 1 0 | 0 | 1 12 | 27 |
| 1900 | 2 | 7 | 1 | 8 | 15 | 1 7 | 8 | 1 0 | 0 | 1 0 | 0 | 1 0 | . 0 | 1 0 | Q | 1 0 | O | 1 51 | 90 |
| 2000 | 2 | 7 | 1 | 4 | 8 | 1 8 | 10 | 1 3 | 3 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 54 | 87 |
| 2100 | 0 | 0 | 1 | 7 | 13 | 1 4 | 5 | 1 18 | 7 | 1 7 | 5 | 1 3 | 2 | 1 0 | Q | 1 0 | 0 | 1 87 | 96 |
| 2200 | -4 | 15 | ı | 2 | 4 | 1 3 | 4 | 1 5 | 5 | 1 7 | 5 | 1 2 | 1 | 1 4 | 2 | 1 0 | 0 | 1 81 | 108 |
| 2300 | 1 | 4 | f - | 4 | 8 | 1 2 | 2 | 1 2 | 2 | 1 3 | 2 | 1 8 | 5 | 1 8 | | 1 1 | 0 | 1 67 | 61 |
| Bin Total | 21 | 79 | | 69 | 133 | 102 | 123 | 108 | 100 | 96 | 74 | 75 | 47 | 83 | 44 | 4 | 0 | 1674 | 1800 |

¹⁾ Numbers have been extrapolated for 20 minute sample time.

Table 82. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 % 12 degree horizontal transducer, for January 17. Indian Point, 1988.

| | | -5 | 5- | | | -15 | 15- | | 20- | | | -3 0 | | - 95 | 35- | | | TOTAL. |
|--------------|------|----|-----|-----|-----|-----|-----|-----|-----|----|-----|-------------|-------|-------------|------|----|-------|--------|
| Hour | P.au | NF | Raw | WF | Raw | WF | Rau | | Rau | NF | Rau | HF | Raw | HF | P.au | HF | Rau | HF. |
| 0100 | 0 | 0 | 1 1 | 2 | 1 2 | 2 | 1 0 | Q | 12 | 2 | I 4 | 2 | 1 5 | 3 | 10 | Q | 1 42 | 33 |
| 0.00 | 1 | 4 | 1 0 | 0 | 1 0 | 0 | 12 | 2 | 10 | O | 15 | 3 | 1 0 | ۵ | 10 | 0 | 1 24 | 27 |
| 0200 | 0 | 0 | 1 1 | 2 | 1 1 | 1 | 1 1 | 1 | 1 1 | 1 | 1 8 | 5 | 1 6 | 3 | 10 | 0 | 1 54 | 39 |
| 000 | 0 | 0 | ΙQ | ٥ | 10 | 0 | 1 1 | 1 | 1.6 | 5 | 19 | 5 | 18 | 4 | 10 | 0 | 1 72 | 45 |
| 0100 | 0 | 0 | 12 | 4 | 1 0 | 0 | 1 1 | 1 | 1 0 | a | 14 | 2 | 1 1 | 1 | 1 0 | 0 | 1 24 | 24 |
| USOO | 2 | 7 | 17 | 13 | 14 | 5 | 1 1 | 1 | 1 1 | 1 | 1 1 | 1 | 1 0 | 0 | 10 | 0 | 1 48 | 84 |
| CA00 | · з | 11 | 1 2 | 4 | 1 1 | 1 | 1 6 | 5 | 1 5 | 4 | 1 2 | 1 | 1 0 | 0 | 10 | 0 | 1 57 | 78 |
| 0200 | 3 | 11 | 14 | 8 | 14 | 5 | 16 | S | 1 0 | 0 | 1 0 | O | 1 1 ' | 1 | 10 | 0 | 1 54 | 90 |
| 0000 | 1 | 4 | 1 3 | 6 | 16 | 7 | 14 | 4 | 1 3 | 2 | 10 | D | 10 | 0 | 10 | 0 | 1 51 | 69 |
| 0300 | 1 | 4 | 115 | 29 | 127 | 92 | 124 | 22 | 110 | 8 | 113 | 8 | 1 3 | 2 | 10 | 0 | 1 279 | 312 |
| 1100 | 1 | 4 | 10 | 0 | 1 3 | 4 | 12 | 2 | 1 2 | 2 | 1 0 | 0 | 1 1 | 1 | 10 | 0 | 1 27 | 39 |
| 100 | 1 | 4 | 1 0 | 0 | 12 | 2 | 14 | · 4 | 15 | 4 | 15 | 3 | 14 | 2 | 1 0 | O | 1 69 | 57 |
| 1300 | 1 | 4 | 10 | 0 | 1 2 | 2 | 12 | 2 | 1 4 | 3 | 1 3 | 2 | 1 0 | ٥ | 1 0 | 0 | 1 36 | 39 |
| 1300 | 0 | 0 | 1 0 | 0 | 1 1 | 1 | 1 4 | 4 | 1 1 | 1 | 1 8 | 5 | 1 1 | 1 | 10. | 0 | 1 45 | 36 |
| 1100 | 1 | 4 | 1 1 | 2 | 14 | 5 | 14 | 4 | 18 | 6 | 1 5 | 9 | 16 | 3 | 1 0 | 0 | 1 87 | 81 |
| 1300 | 1 | 4 | 1 0 | 0 | 15 | 6 | 19 | 8 | 18 | 6 | 1 8 | 5 | 19 | 5 | 1 0 | O | 1 120 | 102 |
| 1100 | 0 | 0 | 1 1 | 2 | 1 2 | 2 | 10 | 0 | 1 1 | 1 | 1 5 | 9 | 1 2 | 1 | i o | 0 | 1 33 | 27 |
| 1300 | 1 | 4 | 1 0 | . 0 | 1 0 | ٥ | 1 1 | 1 | 1 2 | 2 | 14 | 2 | 1 2 | 1 | 1 0 | 0 | 1 30 | 90 |
| 1100 | 0 | 0 | 10 | 0 | 10 | 0 | 1 0 | 0 | 1 3 | 2 | 1 2 | 1 | 1 2 | 1 | 1 0 | 0 | 1 21 | 12 |
| 1300 | 1 | 4 | l l | 2 | 17 | 8 | 16 | 5 | 1 2 | 2 | 1 1 | 1 | 1 1 | 1 | 10 | 0 | 1 57 | 69 |
| 2100 | 1 | 4 | 15 | 9 | 18 | 10 | 18 | 7 | 1 3 | 2 | 12 | 1 | 1 0 | O | 1 0 | 0 | 1 81 | 99 |
| 200 | 1 | 4 | 1 1 | 2 | 1 4 | 5 | 1 0 | 0 | 1 2 | 2 | 10 | 0 | 1 0 | 0 | 10 | 0 | 1 24 | 39 |
| 2200 | 1 | 4 | 14 | 8 | 1 3 | 4 | 14 | 4 | 1 1 | 1 | 1 1 | 1 | 1 1 | 1 | 1 0 | 0 | 1 45 | 69 |
| 2300 | 0 | 0 | 10 | 0 | 1 1 | 1 | 14 | 4 | 14 | 3 | 14 | 2 | 16 | 9 | 10 | 0 | 1 57 | 39 |
| Bin Tatal | 21 | 81 | 49 | 92 | 97 | 103 | 94 | 97 | 74 | 60 | 94 | 56 | 59 | 34 | O | 0 | 1431 | 1539 |

¹⁷ Range bin obstructed by echogram noise. 20 Numbers have been extrapolated for 20 minute sample time.

Table A3. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 X 12 degree horizontal transducer, for January 18. Indian Point, 1988.

| Hour | _ | -5 HF | | -10 Las | - |)-15 HF | 15-20 | WF | 20- Rau | -25 HF | 25 Rau | i-30 WF | _ |)-35 HF | 35- | 1 -40 WF | HOURLY Rew | TOTAL HF |
|--------------|-----|----------|-----|------------|-----|------------|-------|------|------------|-----------|-----------|------------|-----|------------|----------|----------------|---------------|-------------|
| nuur | Pau | | Rau | M | Rau | NF | Rau | MF | | MF | | P41" | Rau | | Rau | | | 74F |
| 0000 | 0 | 0 | 1 0 | 0 | 1 3 | 4 | 1 4 | 4 | 17 | 5 | 18 | 5 | 14 | 2 | 1 | 0 | I 78 | 60 |
| 0100 | Q | 0 | 1 1 | 2 | 1 3 | 4 | 1 7 | 6 | 12 | 2 | 18 | 5 | 17 | · 4 | ı | ´ O | 1 84 | 69 |
| 0200 | o | 0 | 1 1 | . 2 | 14 | 5 | 1 ~ 6 | 5 | 17 | 15 | 16 | 4 | 1 5 | (3 | 1 | 0 | 1 87 | . 72 |
| 0300 | 0 | 0 | 1 1 | 2 | 1 5 | 6 | 1 1 | 1 | 16 | 5 | 14 | 2 | 17 | 4 | l l | 0 | 1 72 | - 60 |
| 0400 | Đ | Q | 1 0 | 0 | 1 1 | 1 | 1 1 | 1 | 1 3 | 2 | 1 4 | 2 | 15 | 9 | 1 | 0 | 1 42 | 27 |
| 0500 | 1 | 4 | 1 1 | 2 | 1 1 | 1 | 1 0 | 0 | 10 | 0 | 1 0 | Ω | 1.3 | 2 | 1 | 0 | 1 18 | 27 |
| 0600 | 3 | 11 | 1 5 | 9. | 19 | 11 | 1 2 | 2 | 1 3 | 2 | 1 1 | 1 | 1 0 | 0 | 1 | Q | 1 69 | 109 |
| 0700 | 2 | 7 | 19 | 17 | 1 2 | 2 | 1 7 | 6 | 17 | 5 | 12 | 1 | 1 0 | 0 | 1 | 0 | 1 97 | 114 |
| 0800 | . 6 | 22 | 1 7 | 13 | 112 | -14 | 1 9 | 8 | 1 2 | 2 | 10 | 0 | 1 1 | 1 | I | 0 | 1 111 | 180 |
| 0900 | 2 | 7 | 17 | 13 | 19 | 11 | 19 | 8 | 17 | 5 | 12 | . 1 | 1 0 | O | • | 0 | 1 108 | 135 |
| 1000 | 0 | O | 16 | 1.1 | 19 | 11 | 1 3 | 3 | 15 | 4 | 15 | 3 | 13 | 2 | t | . 0 | I 93 | 102 |
| 1100 | 1 | 4 | 1 2 | 4 | 1 2 | 2 | 1 1 | 1 | 1 2 | 2 | 15 | 3 | 1 0 | O | ı | 0 | 1 39 | 48 |
| 1200 | 0 | 0 | 16 | 11 | 1 0 | 0 | 15 | 5 | 1 2 | 2 | 15 | 3 | 1 2 | 1 | 1 | 0 | 1 60 | 66 |
| 1300 | 0 | 0 | 10 | 0 | 1 3 | 4 | 1 3 | 3 | 1 4 | 3 | 1 3 | 2 | 12 | 1 | ł | 0 | 1 45 | 39 |
| 1400 | 0 | 0 | 1 0 | 0 | 1 2 | 2 | 1 8 | 7 | 1 8 | 6 | 15 | 3 | 16 | 3 | t | 0 | 1 87 | 69 |
| 1500 | o | 0 | 1 1 | 2 | 12 | 2 | 1 12 | 11 | 110 | 8 | 1 8 | 5 | 1 1 | 1 | 1 | 0 | 1 102 | 87 |
| 1600 | 1 | 4 | 1 1 | 2 | 1 0 | Q | 1 1 | 1 | 1 4 | 3 | 15 | 3 | 1 3 | 2 | 1 | 0 | 1 45 | 45 |
| 1700 | 0 | 0 | 16 | 11 | 1 4 | 5 | 1 4 | 4 | 1 3 | 2 | 18 | 5 | 14 | 2 | 1 | 0 | 1 87 | 87 |
| 1800 | ο. | 0 | 1 0 | 0 | 1 1 | 1 | 1 1 | 1 | 1 0 | 0 | 1 3 | 2 | 1 2 | 1 | 1 | 0 | I 21 | 15 |
| 1900 | 0 | 0 | 1 0 | 0 | 1 1 | 1 | 1 1 | 1 | 12 | 2 | 1 0 | ۵ | 1 1 | 1 | 1 | a | 1 15 | 15 |
| 2000 | 1 | 4 | 1 5 | 9 | 110 | 12 | 1 2 | 2 | 1 3 | 2 | 10 | O | 10 | 0 | 1 | O | 1 63 | 87 |
| 2100 | 0 | 0 | 1 1 | 2 | 16 | 7 | 1 3 | 9 | 1 4 | 3 | 1 1 | 1 | 1 0 | 0 | Ł | O | 1 45 | 48 |
| 2200 | 0 | 0 | 1 3 | 6 | 17 | 8 | 1 12 | . 11 | 16 | 5 | i 1 | 1 | 1 0 | 0 | t | 0 | 1 87 | 93 |
| 2900 | 1 . | 4 | 1 2 | 4 | 13 | 4 | 1 2 | 2 | 12 | 2 | 10 | O | 1 1 | 1 | 1 | 0 | 1 93 | 51 |
| Bin Total | 18 | 67 | 65 | 122 | 99 | 118 | 104 | 96 | 99 | 77 | 84 | 52 | 57 | 34 | 0 | 0 | 1578 | 1698 |

¹⁾ Range bin obstructed by echogram noise.2) Numbers have been extrapolated for 20 minute sample time.

Table R4. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 K 12 degree horizontal transducer, for January 19. Indian Point, 1988.

| | G |)-5 | | 5-1 | 0 | 10 | -15 | 15-2 | 20 | 20-2 | | 25 | i-30 | 30 | -35 | 35- | | HOURLY | |
|--------------|-----|------------|-----|----------|-----|------|-----|------|------|-------|-----|-----|------|-----|------|------|-----|--------|-------|
| Hour | Pau | HF | R | au | WF | Rau | HF | Rau | HF | Raw | WF | Rau | WF | Rau | _ HF | Rau | HF | Rau | NF |
| 0000 | 0 | 0 | 1 | - | 9 | 1 3 | 4 | 1 3 | 3 | 1 7 | 5 | 13 | 2 | 14. | 2 | 10 | Q | ! 75 | 75 |
| 0100 | 0. | 0 | i | 0 | 0 | 1 5 | 6 | 1 1 | 1 | 1 0 | 0 | 12 | 1 | 14 | 2 | 10 | O | 1 36 | 30 . |
| 0200 | O | 0 | 1 | 1 | 2 | 1 3 | 4 | 1 1 | 1 | 1 7 | 5 | 1 5 | 3 | 15 | ` э | 1 2 | 1 | 1 72 | 57 |
| 0300 | 1 | 4 | 1 | 4 | 8 | 1 2 | 2 | 1 10 | 9 | 1 2 | 2 | 17 | 4 | 16 | 3 | 1 0 | 0 | 1 96 | 96 |
| 0400 | . 0 | Ö | İ | 4 | B | i 1 | 1 | 1 1 | 1 | i Ö | 0 | 1 5 | 3 | 1 3 | 2 | 1 1 | O | 45 | 45 |
| 0500 | 1 | 4 | i | 1 | 2 | 1 1 | 1 | 1 1 | 1 | 1 1 | 1 | 1 1 | 1 | 16 | 3 | 10 | 0 | 1 36 | 39 |
| 0600 | 0 | 0 | t | 0 | 0 | 1 0 | 0 | 1 3 | 3 | 1 1 | 1 | 1 1 | 1 | 1 1 | 1 | 10 | 0 | I 18 | 18 |
| 0700 | 0 | 0 | 1 | 1, | 2 | 1 1 | 1 | 1 0 | 0 | 1 0 | O | 1 1 | 1 | 1 0 | 0 | 1 0 | O | 1 9 | 12 |
| 0800 | 9 | 1.1 | 1 | 7 | 13 | 1 12 | 14 | 1 10 | 9 | 1 4 | 9 | 1 0 | 0 | 10 | 0 | 10 | 0 | 1 108 | 150 |
| 0900 | 1 | . 4 | • | 4 | 8 | 1. 3 | 4 | 1 7 | 6 | 1 2 | 2 | 1 2 | 1 | 1 1 | 1 | 10 | ۵ | 1 60 | 78 |
| 1000 | 2 | 7 | J | 9 | 17 | 1 5 | 6 | 1 10 | 9 | 1 7 | - 5 | 1 1 | 1 | 1 0 | 0 | 10 | . 0 | 1 68 | 90 |
| 1100 | 10 | 37 | 1 | 11 | 21 | 1 21 | 25 | 1 10 | 9 | 1 7 | 5 | 1 6 | 4 | 14 | 2 | 10 | 0 | 1 138 | 206 |
| 1200 | 1 | 4 | Ĺ | 8 | 15 | 1 7 | 8 | 1 4 | 4 | 1 7 | 5 | 1 1 | . 1 | 14 | 2 | I- 0 | 0 | 1 64 | 78 |
| 1300 | 1 | 4 | ı | 2 | 4 | i a | 4 | 1 5 | 5 | 1 7 | 5 | 1 0 | 0 | 10 | 0 | 10 | 0 | 36 | 44 |
| 1400 | 1 | 4 | İ | 1 | 2 | 1 2 | 2 | 1 8 | 7 | 1 8 | 6 | 1 5 | 9 | 1 3 | 2 | 1 0 | O | 1 56 | 52 |
| 1500 | Э | 11 | i | 11 | 21 | 1 12 | 14 | 1 21 | 19 | 1 28 | 21 | 111 | 7 | 14. | 2 | 1 0 | 0 | 1 270 | 285 |
| 1600 | 1 | 4 | , i | 5 | 9 | 1 10 | 12 | 1 10 | 9 | 1 8 | 6 | 1 5 | 3 | 1 7 | 4 | 10 | 0 | 1 138 | 141 |
| 1700 | 6 | 22 | i | 5 | 9 | 1 6 | 7 | 1 8 | 7 | 1 9 | 7 | 16 | 4 | 1 3 | 2 | 1 0 | 0 | 1 129 | . 174 |
| 1600 | 3 | 11 | 1 | 7 | 13 | 1 5 | - 6 | 1 1 | 1 | 1 9 | 7 | 15 | 3 | 15 | 3 | 1 0 | 0 | 1 105 | 132 |
| 1900 | 3 | 11 | 1 | 1 | 2 | 1 4 | 5 | 1 1 | 1 | 1 5 | 4 | 1 5 | 3 | 13 | 2 | 1 0 | O | 1 66 | . 84 |
| 2000 | . 1 | 4 | 1. | 4 | 8 | 1 6 | 7 | 1 1 | 1 | 1 1 | 1 | 10 | 0 | 1 0 | 0 | 10 | 0 | 1 39 | 63 |
| 2100 | 9 | 34 | 1 | 27 | 51 | 1 17 | 20 | 1 15 | . 14 | 1 4 | 3 | 10 | 0 | 1 0 | 0 | 10 | 0 | 1 216 | 366 |
| 2200 | 1 | - 4 | 1 | 11 | 21 | 1 7 | . 8 | 1 9 | 9 | 1. 10 | 8 | 10 | 0 | 1 0 | 0 | 1 0 | 0 | 1 114 | 147 |
| 2300 | 7 | 26 | 1 | 9 | 17 | 1 11 | 13 | 1 9 | 8 | 1 6 | 5 | 10 | 0 | 10 | . 0 | 10 | 0 | 1 126 | 207 |
| Bin Total | 55 | 206 | 1 | 38 | 262 | 147 | 174 | 149 | 136 | 140 | 107 | 72 | 46 | 63 | 36 | 3 | 1 | 2120 | 2669 |

¹⁾ Numbers have been extrapolated for 20 minute sample time.

Table 65. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3. intake 35 using 6 % 12 degree horizontal transducer, for January 20. Indian Point, 1986.

| | n | -5 | | 5-1 | 0 | 10- | -15 | 15-20 | 3 | 20-2 | 25 | 25- | -30 | 30 | -35 | 35- | -4 Ω | HOURLY | TOTAL |
|----------------|------|-----|-----|-----|-----|------|-----|----------|-----|------|-----|--------|-----|-----|-----|-----|-----------------|--------|-------|
| Hour | P.au | HF | Re | | WF | Raw | WF | Rau | WF | Rau | WF | Raw | WF | Raw | HF | Raw | NF | Raw | WF |
| 0000 | 4 | 15 | 1 | 5 | 9 | 1 2 | 2 | ı 3 | 3 | 1 5 | 4 | 1 0 | 0 | 10 | 0 | 10 | 0 | I 57 | 99 |
| 0100 | 1 | 4 | l | Э | 6 | 1 4 | 5 | 1 4 | 4 | 1 5 | 4 | 1 0 | 0 | 10 | 0 | 10 | 0 | I 51 | 69 |
| 0208 | 2 | 7 | ł | 4 | 8 | 1 7 | 8 | 16 | 5 | 1 10 | 8 | 1 11 . | 7 | 13 | 2 | 10 | 0 | 1 129 | 135 |
| 0300 | 1 | 4 | ı | 7 | 13 | 1 12 | 14 | I 21 | 19 | 1 20 | 15 | 1 11 | 7 | 1 2 | 1 | 10 | 0 | 1 222 | 219 |
| りょびひ | 1 | 4 | 1 | 6 | 11 | 1 8 | 10 | 1 17 | 15 | 1 9 | 7 | 1 15 | 9 | 1 3 | 2 | 1 0 | 0 | 1 177 | 174 |
| กรอด | 1 | 4 | t | 7 | 13 | 1 6 | 7 | 1 5 | 5 | 1 2 | 2 | 1 7 | 4 | 14 | 2 | 1 0 | 0 | 96 | 111 |
| იციი | 1 | 4 | 1 | 4 | 8 | lЗ | 4 | 1 0 | 0 | 1 6 | ´ 5 | 1 4 | 2 | 10 | 0 | 10 | 0 | 1 54 | 69 |
| 0700 | 0 | . 0 | 1 | 2 | 4 | 1 2 | 2 | 1 1 | 1 | 1 0 | 0 | 1 3 | 2 | 1 2 | 1 | 10 | 0 | 30 | 30 |
| <i>08</i> 00 2 | | Ω | 1 | | ٥ | 1 | 0 | ; | 0 | 1 | 0 | 1 | . 0 | 1 | 0 | 10 | 0. | 1 0 | . 0 |
| 0900 2 | | 0 | ı | | O | 1 | ·O | 1 | O | 1 | O | ı | . 0 | 1 | 0 | 10 | 0 | 1 0 | 0 |
| 1000 2 | | 0 | ı | | 0 | 1 | O | 1 | 0 | 1 | O | ì | Ō | 1 | ٥ | 10 | 0 | 1 0 | O |
| 1100 | 4 | 15 | 1 | 8 | 15 | 1 5 | 6 | 1 6 | 5 | 1 1 | 1 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 75 | 129 |
| 1200 | Э | 11 | 1 | 10 | 19 | 1 6 | 7 | 1 5 | 5 | 1 6 | 5 | 1 2 | .1 | 1 0 | 0 | 1 0 | Ō | 1 96 | 144 |
| 1300 | Ō | 0 | i | 1 | 2 | 1 2 | 2 | 1 2 | 2 | 1 3 | 2 | 1 0 | O | 1 1 | 1 | 1 0 | Ō | 1 27 | 27 |
| 1400 | 0 | Ó | 1 . | 0 | Ō | 1 1 | 1 | 1 1 | 1 | 1 2 | 2 | 1 1 | 1 | 1 0 | Ō | 1 0 | 0 | 1 15 | 15 |
| 1500 | 1 | 4 | i | 5 | 9 | 1 5 | 6 | 1 10 | 9 | 1 5 | 4 | 1 7 | - 4 | 10 | 0 | 1 0 | 0 | 1 99 | 108 |
| 1600 | 0 | 0 | i | 7 | 13 | 1 6 | 7 | 1 4 | 4 | 1 7 | 5 | 1 3 | 2 | 1 0 | 0 | 1 0 | 0 | 1 61 | 93 |
| 1700 | 2 | 7 | ŧ | 7 | 13 | 1 16 | 19 | 1 9 | 8 | 1 17 | 19 | 1 13 | 8 | 1 0 | Ō | ΙÖ | Õ | 1 192 | 204 |
| 1600 | 1 | 4 | 1 | 8 | 15 | 1 17 | 20 | 1 15 | 14 | 1 18 | -14 | 1 9 | 5 | 1 0 | • | 10 | 0 | 1 136 | 144 |
| 1900 | 1 | 4 | 1 | 4 | 8 | 1 12 | 14 | 1 19 " | 12 | 1 8 | 6 | 1 6 | 4 | 1 0 | 0 | 10 | 0 | 1 88 | 96 |
| 2000 | 2 | 7 | 1 | 4 | 8 | 1 4 | 5 | 1 9 | 8 | 1 12 | 9 | 1 5 | 3 | 1 0 | 0. | l D | ٥ | 1 72 | 80 |
| 2100 | 3 | 11 | 1 | 6 | 11 | 1 7 | 8 | 1 8 | 7 | 1 10 | 8 | 1 3 | 2 | 1 0 | • 0 | 10 | 0 | 1 74 | 94 |
| 2200 | 4 | 15 | ł – | 4 | 8 | 1 7 | 8 | 1 0 | 7 | 1 3 | 2 | 1 0 | 0 | 1 0 | O | 1 0 | 0 | 1 52 | 80 |
| 2300 | 3 | 11 | 1 | 6 | 11 | I 10 | 12 | 1.7 | 6 | ; 5 | 4 | 1 1 | 1 | 1 0 | 0 | 10 | 0 | 1 64 | 90 |
| Bin Total | 35 | 131 | 11 | 08 | 204 | 142 | 167 | 154 | 140 | 154 | 120 | 102 | 63 | 15 | 9 | 0 | 0 | 1987 | 2210 |

¹⁾ Numbers have been extrapolated for 20 or 30 minute sample time.

²⁾ Monitoring shut down for redeployment.

Tible R6. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 X 12 degree horizontal transducer, for January 21. Indian Point, 1988.

| | _ | _ | _ | | | | | _ | | | | | | 1 | | 1 | | |
|--------------|-----|----------|------------|-----|------|-----------|-------------|-----|-------------|----------|-----|-----------|-----|-----------|-----|-----------|---------------|--------------|
| Hour | Rau | -5 HF | 5-1 Raw | WF | Raw | -15 WF | 15-2 Rau | WF | 20-2 Rau | CS HF | Rau | -30 WF | Rau | –95 HF | Rau | -40 HF | HOURLY Raw | TOTAL. HF |
| 0000 | 1 | 4 | . 2 | 4 | 1 3 | 4 | 1 0 | 0 | 1 L | 1 | 10 | 0 | 1 | 0 | 1 | 0 | 1 14 | 26 |
| 00 10 | 1 | 4 | 1 6 | 111 | 1 3 | 4 | 1 3 | 3 | 1 1 | 1 | 1 0 | α | 1 | 0 | 1 | 0 | 1 28 | 46 |
| 0200 | 1 | 4 | 1. 2 | 4 | 1 1 | 1 | 1 4 | 4 | 1 3 | 2 | 1 0 | 0 | t . | 0 | 1 | 0 | 1 22 | 30 |
| 0300 | 0 | o | 1 7 | 13 | 1 12 | 14 | 1 9 | 8 | 1 6 | 5 | 1 5 | 3 | t | O | ı | 0 | 1 78 | 86 |
| 0400 | 4 | 15 | 1 19 | 36 | 1 28 | -34 | 1 34 | 31 | 1 41 | 91 | 1 6 | 4 | t | . 0 | t | 0 | 1 264 | 302 |
| 0500 | 1 | . 4 | 1 9 | 17 | 1 23 | 28 | 1 32 | 29 | 1 21 | 16 | 1 3 | 2 | t | 0 | 1 | O | 1 178 | 192 |
| 0100 | 2 | ż | 1 6 | 11 | i 12 | 14 | 1 22 | 20 | 1 22 | 17 | 1 3 | 2 | t | Ō | 1 | ō | 1 134 | 142 |
| 0700 | ī | 4 | 1 4 | ě | 1 4 | 5 | 1 5 | 5 | 1 10 | . 8 | 1 3 | 2 | 1 | Ď | i | ū. | 1 100 | 128 |
| 0100 | ò | o | 1 2 | 4 | 1 6 | 7. | 1 11 | 10 | 1 5 | 4 | 1 5 | · з | 1 | 0 | i i | 0 | 1 58 | 56 |
| 0900 | 3 | 11 | i 9 | 17 | 1 22 | 26 | 1 16 | 14 | 1 13 | 10 | 1 | 0 | ı | Ò | i | O | 1 126 | 156 |
| 1000 | 5 | 19 | 1 12 | 23 | 1 11 | 13 | 1 13 | 12 | 1 14 | 11 | İ | 0 | 1 | Ŏ | Ī | ō | 1 110 | 156 |
| 1100 | 2 | 7 | 1 11 | 21 | 1 15 | 18 | 1 14 | 13 | 1 13 | 10 | 1 | 0 | i | 0 | į. | 0 | 1 110 | 190 |
| 1200 | 2 | 7 | l 6 | 11 | 1 8 | 10 | i 9 | 8 | 1 9 | 7 | 1 | 0 | 1 . | 0 | i | 0 | 1 68 | 86 |
| 1300 | 6 | 22 | i 9 | 17 | 1 17 | 20 | i 12 | 11 | 9 | 7 | i | 0 | 1 | | i | ō | 1 106 | 154 |
| 1400 | 2 | 7 | i 5 | 9 | 1 3 | 4 | i 5 | 5 | 1 7 | 5 | i | Ō | i | Ō. | i | Ō | 1 44 | 60 |
| 1500 | - 1 | 4 | iŏ | Ď | i 6 | 7 | i 9 | ē | 1 10 | 8 | i 7 | . 4 | i | ō | i | ō | I 66 | 62 |
| 1600 3 | - | Ó | i | õ | i | o. | 1 | Õ | 1 | ō | 1 | 0 | ì | ō | i | ō | 1 0 | ā |
| 1700 3 | | ŏ | i | ō | i | ŏ | i | Ď | i . | ō | i | Ď | i | ŏ | i | ñ | io | õ |
| 1800 3 | | ŏ | i | ō | i | o. | i | ō | i | ā | i | õ | i | ō | i | ō | i | ā |
| 1900 3 | | | i | ŏ | i . | õ | i | ŏ | i | ă | i | ō | i | ã | i | ō | i ŏ | ŏ |
| 2900 3 | | ă | i | ō | i " | ā | i | ō | i . | ٥ | i | ٥ | 1 | 0 | i | Ō | i õ | Ω |
| 2100 3 | | 0 | ì | 0 | i | O | 1 | . 0 | 1 | ۵ | 1 | 0 | 1 | . 0 | i | ۵ | 1 0 | 0 |
| 2100 3 | | ō | i | ō | i | ō | i | ō | 1 | ō | 1 | Õ | 1 | ŏ | i | Õ | i ō | ō |
| 2300 3 | | ō | i | Ō | 1 | 0 | 1 | 0 | 1 | 0 | ı | 0 | 1 | ٥ | ŀ | 0 | 1 0 | 0 |
| Bin Total | 32 | 119 | 109 | 206 | 174 | 209 | 198 | 181 | 185 | 143 | 32 | 20 | a | .0 | 0 | 0 | 1514 | 1820 |

¹¹ Range bin obstructed by echogram noise.21 Numbers have been extrapolated for 30 minute sample time.

Table A7. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 % 12 degree horizontal transducer, for January 22. Indian Point, 1988.

| | O | -5 | 5~ | 10 | 10- | -15 | 15-2 | 20 | 20- | 25 | 25 | -30 | 30 | -35 | 35- | -40 | HOURLY | TOTAL |
|--------------|-----|-----|-----|-----|------|-----|------|-----|---------|-----|------|-----|------|------|-----|-----|--------|-------|
| Hour | Rau | HF | Raw | WF | Rau | WF | Rau | HF | Raw | WF | Raw | HF | Rau | HF | Raw | HF | Rau | WF |
| 0000 2 | | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | ļ | 0 | 1 | 0 | 1 | 0 | 1 0 | 0 |
| 0100 2 | | C | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 0 | O, |
| 0200 2 | • | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | ı | 0 | 1 | . 0 | ł | 0 | 1 0 | O |
| 0300 2 | | ۵ | ı | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 . | 0 | 1 | 0 | 1 | 0 | 1 0 | 0 |
| 0400 2 | | 0 | 1 . | 0 | i | Q | 1 | 0 | 1 | 0 | ı | 0 | 1 | 0 | ı | 0 | 1 0 | 0 |
| 0500 2 | | 0 | l | . 0 | t | 0 | 1 | 0 | 1 | 0 | . 1 | 0 | 1 | 0 | t | 0 | 1 0 | 0 |
| 0600 2 | | 0 | ı | ٥ | t | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | t | 0 | 1 0 | 0 |
| 2 0070 | | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | . 0 | 1 | 0 | 1 | 0 | 1 | O | 1 0 | ٥ |
| 0800 2 | | 0 | 1 | 0 | 1 | 0 | 1 | 0 | ı | 0 | 1 | ٥ | 1 | 0 | · t | 0 | 0 1 | 0 |
| 0900 2 | | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 0 | 0 |
| 1000 2 | | 0 | 1 | 0 | 1 | 0 | 1 | 0 | t | 0 | 1 | 0 | • | 0 | 1 | 0 | 1 0 | 0 |
| 1100 2 | | 0 | 11 | 0 | 1 | 0 | 1 | . 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | . 0 | 1 0 | 0 |
| 1200 2 | | 0 | 1 | 0 | ı | 0 | t | 0 | 1 | 0 | 1 | 0 | ı | 0 | 1 | 0 | 1 0 | 0 |
| 1300 | 0 | 0 | 12 | 4 | 1 3 | 4 | 1 0 | 0 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 10 | 0 | 1 36 | 54 |
| 1400 | 2 | 7 | 1 3 | 6 | 1 5 | 6 | 1 4 | 4 | 1 1 | 1 | 1 5 | 9 | 1 4 | 2 | 10 | 0 | 1 49 | 58 |
| 1500 | 5 | 19 | 1 3 | 6 | 1 9 | 11 | 1 5 | 5 | 1 3 | 2 | 1 5 | 9 | 1 2 | . 1 | 10 | 0 | 1 64 | 94 |
| 1600 | 4 | 15 | 12 | 4 | 1 5 | 6 | 1 3 | 3 | 1 7 | 5 | 1 5 | 3 | 1 2 | 1 | 1 1 | 0 | 1 58 | 74 |
| 1700 | 3 | 11 | 19 | 17 | 1 15 | 18 | 1 24 | 22 | 1 24 | 18 | 1 44 | 26 | 1 31 | 16 | 116 | 7 | 332 | 270 |
| 1800 | 6 | 22 | 121 | 39 | 1 25 | 30 | 1 33 | 30 | 1 34 | 26 | 1 26 | 16 | 1 21 | 11 | 135 | 16 | 1 402 | 380 |
| 1900 | 8 | 30 | 1 0 | 15 | 1 13 | 16 | 1 19 | 17 | 1 19 | 10 | 1 14 | 8 | 1 19 | . 10 | 112 | 5 | 1 212 | 222 |
| 2000 | 0 | 0 | 1 3 | . 6 | 1 13 | 16 | 1 10 | 9 | 1 12 | 9 | 1 21 | 13 | 1 17 | . 9 | 19 | 4 | 1 170 | 132 |
| 2100 | 1 | 4 | 10 | Ò | 1 4 | . 5 | 1 9 | . 8 | 1 7 | 5 | 1 8 | 5 | 1 7 | 4 | 1 6 | 3 | 1 84 | 68 |
| 2200 | 1 | 4 | 12 | 4 | 1 3 | 4 | 1 4 | 4 | 1 7 | 5 | 16 | 4 | 1 9 | 5 | 14 | 2 | 1 72 | 64 |
| 2300 | 5 | 19 | 17 | 13 | 1 16 | 19 | 1 13 | 12 | 1 7 | 5 | 1 5 | 3 | 1 3 | 2 | 1 1 | 0 | 1 114 | 146 |
| Bin Total | 35 | 131 | 60 | 114 | 111 | 135 | 124 | 114 | 116 | 87 | 139 | 84 | 115 | 61 | 84 | 37 | 1592 | 1562 |

¹⁾ Numbers have been extrapolated for 30 minute sample time.
2) Monitoring shut down for redeployment.

Table R8. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 X 12 degree horizontal transducer, for January 23. Indian Point, 1988.

| • | O | -5 | • | ~10 | | 10- | -15 | 15-2 | : 0 | `2 | 0-25 | 2 | 5-30 | | 30-35 | | | 35-4 | 10 | HOURLY | TOTAL |
|--------------|-----|-----|-------|-----|----|------|------|------|------------|-----|-------|------|------|-----|------------|-----|---|------|----|--------------|-------|
| Hour | Rau | WF | Reu | , N | F | Ray | HF | Rau | HF | Ro | u HF | Rau | WF | R | ا بيو | WF | R | au | HF | Rau | WF |
| 0000 | 3 | 11 | 1 - | | 8 | | 10 | ı 9 | 8 | 1 1 | 4 11 | 1 11 | 7 | 1 | 4 | 2 | 1 | Э | 1 | 1 112 | 116 |
| 0100 | 3 | 1.1 | 1 7 | 1 | 3 | 15 | 18 | 1 10 | 9 | 1 | 7 5 | 1 4 | 2 | 1 | 2 | 1 | 1 | 0 | 0 | 1 96 | 118 |
| 0200 | 2 | 7 | 1 3 | ı | 6 | 2 | 2 | 1 5 | 5 | 1 | 4 3 | 1 0 | 0 | 1 | 1 | 1 | ı | 0 | 0 | 1 34 | . 49 |
| 0300 | 0 | Ð | 1 1 | | 2 | 1 5 | 6 | 1 3 | 3 | 1 | 2 2 | 1 3 | 2 | 1 | 1 | 1 | ŧ | 4 | 2 | 1 36 | 36 |
| 0400 | 3 | 11 | 1 8 | ı | 6 | 1 | 1 | 1 4 | 4 | ı | 3 2 | 1 4 | 2 | ŧ | 4 | 2 | ı | 1 | 0 | 1 46 | 56 |
| 0500 | 2 | 7 | 1 16 | . 3 | 0 | 1 92 | 30 | 1 33 | 30 | 1 4 | 5 34 | 1 55 | 93 | 1 : | 20 | 10 | ı | 14 | 6 | 1 434 | 376 |
| 0600 | 1 | 4 | 1 6 | 1 | 5 | 27 | 32 | 1 35 | 32 | 1 3 | 0 23 | 1 40 | 24 | 1 | 18 | 9 | ł | 15 | 7 | I 522 | 292 |
| 0700 | 1 | 4 | 1 3 | 1 | 6 | 16 | 19 | 1 13 | 12 | 1 1 | 6 12 | 1 19 | . 11 | 1 | 10 | 5 | 1 | 12 | 5 | 1 178 | 148 |
| 0900 | 0 | 0 | 1 0 | 1 | 0 | 10 | 12 | 1 2 | 2 | 1. | 4 3 | 1 11 | 7 | 1 | 11 | 6 | 1 | 3 | 1 | 1 82 | 62 |
| 0900 | 2 | 7 | 1 3 | 1 | 6 | 1 3 | 4 | 1 4 | 4 | 1 | 5 4 | 1 7 | 4 | 1 | 8 | 4 | ı | 5 | 2 | 1 74 | 70 |
| 1000 | 1 | 4 | 1 3 | 1 | 6 | 1 0 | 0 | 1 1 | 1 | ł | 1 1 | 1 1 | 1 | 1 | 3 | 2 | ı | 1 | 0 | 1 22 | 30 |
| 1100 | 3 | 11 | 1 5 | i | 9 | 9 | 11 | 1 13 | 12 | 1 | 5 4 | 1 6 | 4 | 1 | 4 | 2 | ı | 5 | 2 | 1 100 | 110 |
| 1200 | 5 | 19 | 1 10 | 1 | 9 | 10 | 12 | 1 10 | 9 | 1 | 7 5 | 1 6 | 4 | 1 | 3 | 2 | 1 | O | 0 | 1 102 | 140 |
| 1300 | · 3 | 11 | 1 6 | 1 | 5 | 10 | 12 | 16 | 5 | ı | 7 5 | 1 7 | 4 | ı | 2 | . 1 | t | 0 | 0. | 1 86 | 106 |
| 1400 | 5 | 19 | 1 6 | . 1 | 1 | 1 3 | 4 | 1 4 | 4 | 1 | 2 2 | 1 1 | 1 | 1 | 0 | 0 | ı | 0 | 0 | 1 42 | 82 |
| 1500 | ` 6 | 22 | 1 . 5 | ; | 9 | 1 5 | 6 | 1 7 | 6 | 1 | 6 5 | 1 6 | ~4 | 1 | 4 | 2 | ŧ | 0 | O | 1 78 | 108 |
| 1600 | 2 | 7 | 1 1 | | 2 | 1 1 | 1 | 1 9 | 8 | 1 | 6 5 | 1 2 | . 1 | 1 | 2 | 1 | ı | 4 | 2 | 1 54 | 54 |
| 1700 | 2 | 7 | 1 11 | 2 | 1 | 1 35 | 42 | 1 31 | 28 | 1 3 | 7 28 | 1 46 | 28 | 1 | 16 | 8 | ı | 6 | э | 1 276 | 240 |
| 1800 | 4 | 15 | 1 22 | . 4 | 11 | 1 49 | 59 | 1 66 | 59 | 1 7 | 1 53 | 92 | 55 | 1 | 49 | 25 | 1 | 27 | 12 | 1 380 | 319 |
| 1900 | 12 | 45 | 1 4 | , е | 18 | 75 | . 90 | 1 93 | 84 | 1 7 | 8 59 | 1 63 | 38 | 1 | 98 | 19 | 1 | 43 | 19 | 1 449 | 442 |
| 2000 | 1 | 4 | 1 10 | 1 | 9 | 23 | 28 | 1 25 | 23 | 1 2 | 7 20 | 1 22 | 13 | 1 | 3 3 | 17 | ı | 29 | 13 | 1 170 | 197 |
| 2100 | 8 | 90 | 1 6 | 1 | 5 | 1 12 | .14 | 1 12 | 11 | 1 | 9 10 | 1 23 | 14 | ł | 19 | · 7 | ı | 17 | 8 | I 106 | 109 |
| 2200 | 0 | 0 | 1 9 | 1 | 7 | 1 8 | 10 | 1 14 | 13 | 1 1 | 2 9 | 1 7 | 4 | | 9 | 5 | ı | 5 | 2 | 1 64 | 60 |
| 2300 | 3 | 11 | 1 6 | 1 | 1 | 1 6 | 7 | 1 4 | 4 | 1 | 9 7 | 1 7 | 4 | 1 | 9 | 5 | 1 | 8 | 4 | 1 52 | 53 |
| Bin Total | 72 | 267 | 199 | 97 | 5 | 365 | 438 | 413 | 376 | 41 | 1 312 | 442 | 267 | 2 | 64 | 197 | à | 202 | 89 | 3597 | 3320 |

¹⁾ Numbers have been extrapolated for 20, 30 or 60 minute sample time.

Table A9. Hourly estimates of raw and weighted fish numbers (with high and low tide heights) in front of unit 3, intake 35 using 6 % 12 degree horizontal transducer for week 1, January 16 to 23. Indian Point, 1988.

| Hour | RAH J | IAH 16 HF | Tide | | RAH | JAN 17 HF | | i- | RAW | JAN 1 W | | RAN | JAN 1 | | RAH | JAN 20 HF | | RAN | JAN 3 | | RAH | JAN H | | i de | RAN | JAN 23 HF | | HEI TO RAH | KLY IAL HF |
|-------|-------|--------------|------|-----|-------|--------------|-------|-----|------|------------|-------|-------|-------|------|-------|--------------|------|-------|--------|-------|-------|--------|-----|------|-------|--------------|------|------------------|------------------|
| 0000 | 51 | 18 | | | 42 | 33 | | ī | 78 | 60 | | 1 75 | | | 1 57 | | | 1 1. | | 1.4 | 1 | 0 0 | | | 1112 | 116 | | 1 399 | 427 |
| 0100 | 150 | 132 | | (| 24 | 27 | | • | 84 | 69 | | 1 36 | 30 | | 5 51 | | | 1 20 | | | 1 | 0 0 | 1. | ۰. | 96 | | | 1 439 | 491 |
| 0200 | 36 | 42 | 0. | 0 | 54 | 39 | | 1 | 87 | 72 | | 1 72 | | | 1 129 | | | 1 2: | | | ļ | ō ō | | | 34 | 48 | 1.4 | 1 434 | 423 |
| 0300 | 3 | 12 | | - (| 72 | 45 | -0. 1 | | 72 | 60 | | 1 96 | | | 222 | | | J 70 | | | į. | 0 0 | | | 1 36 | 36 | | 1 581 | 554 |
| 0400 | . 24 | . 39 | | 1 | 24 | 24 | | | 42 | 27 | -0.2 | 1 45 | | | 1 177 | | | 1 26 | | | • | 0 0 | | ~ | 46 | 56 | | 1 622 | 667 |
| 0500 | 36 | 72 | | - 1 | 40 | 64 | , | .1 | 18 | 27 | | 1 36 | | -0.3 | 1 96 | | | 1 170 | | | • | 0 0 | | | 1 434 | 976 | | 1 846 | 901 |
| 0600 | 105 | 162 | | | 57 | 78 | | 1 | 69 | 100 | | 1 10 | 1.0 | e, | 1 54 | | -0.3 | 1 13 | | | .1 | 0 0 | | 1 | 522 | 292 | | 1 959 | 869 |
| 0700 | 99 | 102 | | ٠ (| 54 | 90 | | 1 | 67 | 114 | | 1 9 | 12 | | 1 30 | 30 | | 1 100 | | -Q. 3 | ŧ | 0 0 | _ | | 178 | 1-49 | _ | 1 565 | 624 |
| 0600 | 54 | 57 | . 1. | 4 (| 51 | 69 | | ı | 111 | 160 | | 1 106 | | | 1 0 | . 0 | | 1 5 | | | • | 0 0 | -0. | . 3 | 1 82 | | -0.2 | 1 464 | 574 |
| 0900 | 42 | 51 | | | 279 | 912 | 1.5 | 5 5 | 108 | 195 | | 1 60 | | | 1 0 | 0 | , | 1 120 | | • | 1 | 0 0 | | | 1 74 | 70 | | 1 689 | 602 |
| 1000 | 63 | 57 | | 1 | 1 27 | 39 | | | 93 | 102 | 1.6 | | | _ | , a |) <u>(</u> | | 1 110 | | | ŧ | 0 0 | | | 1 22 | 30 | | 1 363 | 474 |
| 1100 | 66 | 48 | | - 1 | 63 | 57 | | ı | 33 | | | 1 136 | | 1.7 | 1 75 | | | 1 160 | | | ŧ | 0 0 | | | ł 100 | 110 | | 1 591 | 736 |
| 1200 | 108 | 81 | | - 1 | 1 ⊋6 | 39 | | 1 | 60 | 66 | | 1 64 | 79 ° | | 1 96 | | 1.7 | 1 6 | | 1.6 | į. | 0 0 | | | 102 | 140 | | 1 534 | 694 |
| 1300 | 168 | 132 | | | 45 | 36 | | ı | 45 | 39 | | 1 36 | | | 1 27 | | | 1 10 | | | 1 3 | 6 54 | 1. | . 6 | I 86 | 106 | | 1 549 | 592 |
| 1400 | 174 | 150 | | | 1 87 | 01 | | 1 | 87 | 69 | | 1 56 | | | 1 15 | | | 1 4 | | | | ia 58 | | | 42 | 82 | 1.5 | 1 553 | 561 |
| 1500 | 120 | 105 | ~0. | 1 | 1 120 | 102 | | | 103 | 87 | | 1 270 | | | 1 99 | | | 1 6 | 6. 65 | | | 4 94 | | | 979 | 100 | | 1 919 | 951 |
| 1600 | 63 | 51 | | - 1 | 33 | .27 | -0.2 | 5 | 45 | 45 | | 1 136 | | | 1 81 | | | • | 0 | | | 9 74 | | | 1 54 | 54 | | 1 472 | 465 |
| 1700 | 0 | 3 | | - | 1 90 | 30 | | ı | 87 | 87 | -O. 3 | 1 129 | | | 1 192 | | | R (| 0 0 | | 1 33 | | | | 276 | 249 | | 1 1046 | 1013 |
| 1800 | 12 | 27 | | | 1 21 | 12 | | 1 | 31 | 15. | - | 1 103 | | -0.4 | 1 136 | | | • | 0 0 | | .1 40 | | | | 980 | 319 | | 1 1077 | 1029 |
| 1900 | . 51 | 90 | _ | _ " | 57 | 69 | ٠ | į | 15 | 15 | | 1 66 | | • | : 98 | | -0.4 | | 0 0 | -0.4 | 1 21 | | _ | _ | 449 | 442 | | 1 930 | 1010 |
| 2000 | 54 | 87 | | 3 | i er | 99 | | . ! | E3 | 87 | | 1 39 | | | 1 72 | | | 1 | 0 0 | | 1 17 | | -0 | . 3 | 170 | 137 | | 1 649 | 685 |
| 2100 | 87 | 96 | | 1 | 24 | 39 | 1.2 | £ į | 45 | 48 | | 1.216 | 366 | | 1 74 | | | | 0 | | | 4. 68 | | | 106 | 109 | -0.2 | 1 634 | 820 |
| 2200 | -61 | 108 | | | 1 45 | 69 | | | 87 | 93 | 1,9 | 1 114 | | | 52 | | | | 0 | | | 2 64 | | | 64 | 60 | | 1 515 | 621 |
| 2300 | 87 | 61 | | | 57 | 39 | | 1 | 33 | - 51 | | 1 126 | 207 | 1.3 | 1 64 | 90 | | | u 0 | | 1 11 | 4 146 | | | 1 52 | 53 | | 1 593 | 667 |
| Deily | 1674 | 1800 | | | 1431 | 1539 | | | 1578 | 1698 | | 2120 | 2669 | | 1987 | 2210 | | 151 | 4 1820 | | 159 | 2 1562 | | | 3597 | 3319 | | 15393 | 14818 |

Tide heights for low and high tide only, New York (the Bettery), N.Y. and times edjusted for Indian Point Location.

Table R10. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3. intake 35 using 6 X 12 degree horizontal transducer, for January 24. Indian Point, 1988.

| | 0- | 5 | 5-1 | ο . | 10- | -15 | 15-2 | 0 | 20-2 | 5 | 25- | -30 | 30- | ·35 | 35- 4 | 40 | HOURLY | TOTAL |
|--------------|-----|------|------|-----|------|-----|------|------|------|-----|------|-----|-------|------|--------------|-------|--------|-------|
| Hour | Rau | HF | Raw | NF | Rau | WF | Raw | WF | Rau | WF | Raw | WF | Raw | ИF | Raw | WF | Rau | HF |
| 0000 | 8 | 30 | 1 12 | 23 | 1 26 | 31 | I 21 | 19 | 1 21 | 16 | 1 11 | 7 | 1, 7 | 4 | 1 0 | 0 | 1 106 | 130 |
| 0100 | 6 | 22 | 1 17 | 32 | 1 34 | 41 | 1 23 | 21 | 1 7 | 5 | 1 22 | 13 | 1 6 | 3 | 1 0 | 0 | 1 115 | ~ 137 |
| 0200 | 2 | . 7 | 1 12 | 23 | 1 21 | 25 | 1 13 | 12 | 1 4 | . 3 | 1 6 | 4 | 1 3 | 2 | 1 0 | 0 | 1 61 | 76 |
| 0300 | 5 | 19 | 1 5 | 9 | 1 5 | 6 | 16 | 5 | 1 3 | 2 | 1 2 | 1 | 1 4 | 2 | 1 0 | 0 | 1 30 | 44 |
| 0400 | 3 | 11 | i e | 15 | 1 5 | 6 | 1 2 | 2 | 1 8 | 6 | 1 4 | 2. | 1 3 | 2 | 1 1 | 0 | 1 34 | 44 |
| 0500 | 0 | 0 | 1 1 | 2 | 1 12 | 14 | 1 9 | 8 | ı 9 | 7 | 1 14 | 8 | 1 4 | 2 | 1 3 | 1 | l 52 | 42 |
| 0600 | 4 | . 15 | 1 27 | 51 | 1 28 | 34 | 1 28 | 25 | 1 27 | 20 | 1 34 | 20 | 1 10 | 9 | 1 15 | 7 | 1 181 | 181 |
| 0700 | 12 | 45 | 1 25 | 47 | 1 28 | 34 | 1 29 | 26 | 1 26 | 20 | 1 27 | 16 | 1 33 | 17 | 1 14 | 6 | 1 194 | 211 |
| 0800 | 6 | 22 | 1 15 | 28 | 1 20 | 24 | 1 22 | .20 | 1 13 | 10 | 1 10 | 6 | 1 14 | 7 | 1 17 | 8 | 1 117 | 125 |
| 0900 | 6 | 22 | 1 9 | 17 | 1 11 | 13 | 1 9 | 8 | 16 | 5 | 1 9 | 5 | 1 2 | · 1 | 1 2 | 1 | 1 54 | 72 |
| 1000 | 3 | 11 | 1 6 | 11 | 1 11 | 13 | 1 10 | 9 | 1 6 | 5 | 1 9 | 5 | 16 | 3 | 1 2 | . 1 | I 53 | 50 |
| 1100 | 4 | 15 | 1 4 | 8 | 1 4 | 5 | 1 7 | 6 | 1 9 | 7 | 1 9 | 5 | 16 | 3 | 1 2 | 1 | 1 45 | 50 |
| 1200 | 1 | 4 | 1 8 | 15 | 1 13 | 16 | 1 18 | 16 | 1 9 | 7 | 1 7 | 4 | 1 . 8 | 4 | 1 1 | 0 | 1 65 | 66 |
| 1300 | 7 | 26 | 1 13 | 24 | 1 30 | 36 | 1 20 | 18 | 1.17 | 13 | 1 33 | 20 | 1 15 | 8 | 1 6 | 3 | 141 | 148 |
| 1400 | 6 | 22 | 1 9 | 17 | 1 17 | 20 | 1 16 | 14 | 1 11 | В | 1 11 | 7 | 1 3 | 2 | 1 1 | ø | 1 74 | 90 |
| 1500 | 6 | 22 | 1 6 | 11 | 1 8 | 10 | 1 7 | 6 | 1 9 | 7 | 1 8 | 5 | 1 4 | 2 | 1 2 | 1 | 1 50 | 64 |
| 1600 | 7 | 26 | 1 10 | 19 | 1 11 | 13 | 1 10 | 3 | 1 8 | 6 | 1 6 | 4 | 1 4 | 2 | 1 3 | . 1 | I 59 | 60 |
| 1700 | 4 | 15 | 1 4 | 8 | 1 9 | 11 | 1 3 | 3 | : 8 | 6 | 1 6 | 4 | 16 | Э | 1 4 | 2 | 1 . 44 | 52 |
| 1800 | 9 | 11 | 1 5 | 9 | 1 9 | 11 | 1 12 | . 11 | 1 11 | 8 | 1 11 | 7 | 1 10 | 5 | 1 7 | 3 | 1 68 | 65 |
| 1 300 | 14 | 52 | 1 28 | 53 | 1 41 | 49 | 1 29 | 26 | 1 31 | 23 | 1 36 | 22 | 1 25 | 13 | 1 26 | 12 | 1 230 | 250 |
| 2000 | 5 | 19 | 1 26 | 49 | 1 27 | 92 | 1 30 | 2:7 | 1 26 | 20 | 1 33 | 20 | 1 30 | . 15 | 1 31 | - 14 | 1 209 | 196 |
| 2100 | 6 | 22 | 1 17 | 92 | 1 26 | 31 | 1 16 | 14 | 1 12 | 9 | 1 10 | 6 | 1, 11 | 6 | 1 12 | 5 | 1 110 | 125 |
| 2200 | 3 | 11 | 1 11 | 21 | 1 20 | 24 | 1 9 | 8 | 1 9 | 7 | 1 13 | 8 | 1 8 | 4 | 1 10 | 5 | 1 83 | 88 |
| 2300 | 2 | 7 | 1 6 | 11 | 1 5 | 6 | 1 9 | 8 | 1 10 | 9 | 1 8 | 5 | I 5 | 3 | 1 10 | 5 | i 55 | 53 |
| Bin Total | 123 | 456 | 284 | 595 | 421 | 505 | 358 | 921 | 900 | 228 | 339 | 204 | 295 | 122 | 169 | 76 | 2229 | 2447 |

¹⁾ Numbers have been extrapolated for 60 minute sample time.

Table All. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 % 12 degree horizontal transducer, for January 25. Indian Point, 1988.

| | 0- | · 5 | 5- | 10 | 10- | -15 | 15-2 | :0 | 20-2 | 25 | 25 | -30 | 30- | 95 | 35- | 40 | HOURLY | TOTAL |
|--------------|-----|------------|------|-----|--------|------|------|-----|------|-----|------|-----|------|----------|------|------------|--------|-------|
| Hour | Pau | HF | Raw | ИF | Rau | WF | Raw | WF | Rau | WF | Rau | WF | Raw | ИF | Rau | WF | Rau | HF |
| 0000 | 2 | 7 | 1 1 | 2 | 1 1 | 1 | . 5 | 5 | 1 6 | | 1 6 | 4 | 1 O | 0 | 1 1 | 0 | 1 33 | 36 |
| 0100 | 9 | 34 | 1 9 | 17 | 1 20 | 34 | 1 23 | 21 | 1 25 | 19 | 1 24 | 14 | i 4 | ž | iò | õ | 1 122 | 141 |
| 0200 | . 7 | 26 | 1 21 | 39 | 1 27 | 32 | 1 27 | 24 | 1 26 | 20 | 1 31 | 19 | i B | 4 | i 6 | 3 | 1 159 | 167 |
| 0300 | 5 | 19 | 1 5 | 9 | 1 20 | 24 | 1 15 | 14 | 1 10 | 8 | i 2 | 1 | i 4 | 2 | 1 1 | Ö | 62 | 77 |
| 0400 | 2 | . 7 | 1 11 | 21 | 1 15 | 18 | 1 10 | 9 | 1 9 | 7 | 1 12 | 7 | iai | 2 | ii | <u> </u> | 1 63 | 71 |
| 0500 | 3 | 11 | 1 4 | 8 | 1 5 | 6 | 1 7 | 6 | 1 7 | 5 | 1 11 | 7 | i 4 | 2 | ii | ō | 1 42 | 45 |
| 0600 | 4 | 15 | 1 9 | 17 | 1 15 | 18 | 1 6 | 5 | 1 10 | . 8 | 01 | 6 | 1 10 | 5 | 1 4 | 2 | 68 | 76 |
| 0700 | 5 | 19 | 1 9 | 17 | 1 17 | 20 | 1 17 | 15 | 1 29 | 22 | 1 21 | 13 | i 12 | 6 | 1 10 | 5 | 1 120 | 117 |
| 0800 | 10 | 37 | 1 10 | 19 | 1 21 | 25 | 1 28 | 25 | 1 30 | 29 | 1 35 | 21 | 1 24 | 12 | 1 17 | ě | 1 175 | 170 |
| 0900 | 6 | 22 | 1 16 | 30 | 1: 24 | 29 | 1 22 | 20 | 1 11 | 8 | 1 13 | Ē | i 11 | 6 | 1 11 | 5 | 1 114 | 128 |
| 1000 | Э | 11 | 1 6 | 11 | 1 5 | 6 | 1 8 | 7 | 1 6 | 5 | 1 6 | 4 | 1 3 | 2 | 1 1 | ō | 1 36 | 46 |
| 1100 | 2 | 7 | 1 1 | 2 | 1 9 | 4 | 1 8 | 7 | 1 4 | 3 | iž | 1 | 1 1 | · 1 | ia | 2. | i 25 | 27 |
| 1200 | 1 | . 4 | 1 4 | 8 | 1 4 | 5 | 1 6 | 5 | 1 6 | 5 | i ā | 2 | i ī | ï | i 9 | 4 | i 35 | 34 |
| 1900 | Ž | 7 | i 5 | 9 | i 5 | 6 | iэ | 3 | įž | 2 | iż | 4 | i 2 | i | iá | | 1 29 | 33 |
| 1400 | 10 | 37 | 1 16 | 30 | . OE 1 | 36 | i 15 | 14 | 1 24 | 18 | 1 17 | 10 | i 5 | 3 | io | ò | i 117 | 148 |
| 1500 | 8 | 30 | 1 16 | 30 | 1 17 | 20 | 1 22 | 20 | 1 35 | 26 | 1 39 | 23 | i 9 | 5 | i 2 | ĭ | 1 148 | 155 |
| 1600 | 5 | 19 | 1 18 | 34 | 1 13 | 16 | i 11 | 10 | 1 12 | -9 | 1 16 | 10 | 1 21 | 11 | i 2 | i | 98 | 110 |
| 1700 | Ž | 26 | 1 11 | 21 | i 12 | 14 | i i2 | 11 | 1 20 | 15 | i 12 | ., | 4 | 2 | i â | i | 1 61 | 97 |
| 1900 | 2 | 7 | 1 7 | 13 | 1 11 | - 13 | 1 17 | 15 | 1 11 | 8 | 1 14 | ė | i e | <u> </u> | 1 5 | ż | i 75 | 70 |
| 1900 | 4 | 15 | i 10 | 19 | i 7 | ē | 1 9 | ē | i 5 | 4 | 1 6 | 4 | i 2 | 7 | i 5 | 2 | 1 48 | 61 |
| 2000 | 1 | 4 | 1 6 | 11 | 1 9 | 11 | i ż | 6 | 1 12 | 9 | i 5 | 3 | i 5 | 9 | i 9 | 4 | 1 54 | 51 |
| 2100 | 3 | 11 | 1 6 | 11 | 1 12 | 14 | i 11 | 10 | 1 8 | 6 | i ă | 2 | i 9 | 5 | i 10 | 5 | 1 62 | 64 |
| 2200 | 4 | 15 | 1 9 | 17 | i 14 | 17 | 1 19 | 17 | 1 10 | ě | i ë | 5 | i ž | 4 | 1 13 | 6 | 1 84 | 89 |
| 2300 | 2 | 7 | 1 6 | 11 | 1 10 | 12 | 1 11 | 10 | 1 10 | à | i 5 | 3 | i e | 2 | i 7 | 9 | 54 | 56 |
| Bin Total | 107 | 397 | 216 | 406 | 325 | 389 | 319 | 287 | 329 | 251 | 309 | 186 | 160 | 86 | 125 | 5 5 | 1900 | 2069 |

¹⁾ Numbers have been extrapolated for 60 minute sample time.

Table R12. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 X 12 degree horizontal transducer, for January 26. Indian Point, 1988.

| Hour | 0- Rau | ·5 WF | • | 5-1 Rau | 0 WF | F | 10- | 15 WF | F | 15-20 Rau | WF | | 20-25 Rau | HF | R | 25-30 Raw | WF. | Ra | 30-95 u | WF | | 35-40 | WF | | IOURLY | TOTAL WF |
|--------------|-----------|----------|----------|------------|---------|----|----------|----------|---|--------------|-----|----|--------------|-----|-----|--------------|-----|----|------------|-----|---|-------|-----|-----|--------|-------------|
| | | | | | | | | | | | | - | | | | | | | | | | | | | | |
| 0000 | 0 | |) (| 5 | 9 | ı | 8 | 10 | ı | 8 | 7 | 1 | 14 | 11 | ı | 10 | 6 | 1 | 7 | 4 | 1 | 4 | 2 | ı | 56 | 49 |
| 0100 | 3 | 1 1 | | 9 | 17 | ı | 4 | - 5 | ı | 6 | 5 | 1 | 7 | 5 | ı | 7 | 4 | ı | 2 | 1 | 1 | 2 | 1 | . 1 | 40 | 49 |
| 0200 | 8 | 30 | | 23 | 43 | ŧ | 23 | 28 | ı | 26 | 23 | l | 93 | 25 | - 1 | 15 | 9. | 1 | 5 | 3 | 1 | 6 | 3 | l | 139 | 164 |
| 0300 | 10 | 37 | | 25 | 47 | 1 | 23 | 28 | ţ | 29 | 26 | ŀ | 97 | 28 | 1 | 19 | 11 | t | 4 | 2 | i | 2 | 1 | ı | 149 | 180 |
| 0400 | 8 | 30 |) (| 17 | 32 | ı | 15 | 18 | ı | 19 | 17 | ı | 13 | 10 | ı | 13 | 8 | 1 | 2 | 1 | ı | 1 | .0 | ſ | 88 | 116 |
| 6500 | 1 | | 1 1 | 9 | 17 | 1 | 9 | 11 | 1 | 5 | 5 | ŧ | 6 | 5 | ı | 7 | 4 | 1 | 1 | 1 | ì | 3 | 1 | 1 | 41 | 48 |
| 0600 | 5 | 15 | € (| 8 | 15 | l | . 7 | 8 | 1 | 9 | 8 | t | 7 | 5 | 1 | 7 | 4 | t | 2 | 1 | ı | 2 | 1 | 1 | 47 | 61 |
| 0700 | 3 | 1 ! | L (| 5 | 9 | ı | 6. | 7 | 1 | 12 | 11 | 1 | 11 | 8 | 1 | 13 | 8 | 1 | 8 | 4 | i | 6 | 3 | 1 | 64 | 61 |
| 0000 | 4 | 15 | 5 (| 9 | 17 | t | 11 | 19 | 1 | 15 | 14 | 1 | .9 | 7 | 1 | 14 | . 8 | 1 | 4 | 2 | 1 | 7 | . 3 | ı | 73 | 79 |
| 0900 | 6 | 27 | 2 (| 11 | 21 | ł | 15 | 19 | 1 | 15 | 14 | 1 | . 11 | 8 | 1 | 17 | 10 | 1 | 14 | 7 | 1 | 13 | 6 | ı | 102 | 106 |
| 1000 | . 2 | 7 | 7 1 | 1 4 | 8 | 1 | 13 | 16 | 1 | 14 | 13 | 1 | 17 | 13 | 1 | 16 | 10 | 1 | 13 | 7 | 1 | 10 | 5 | t | 89 | 79 |
| 1100 | . 3 | 1 | ı i | 6 | 11 | i | B | 10 | i | 4 | 4 | i | 2 | 2 | 1 | а | 2 | 1 | ā | Ö | i | 1 | Ō | Ė | 27 | 40 |
| 1200 | ī | - | 4 | 1 1 | 2 | È | 8 | 10 | ì | 2 | 2 | ì | 2 | 2 | ì | ā | 0 | 1 | 9 | 2 | į | 2 | 1 | i | 19 | 23 |
| 1300 | 4 | 1: | 5 | i | ā | ŧ | ā | 4 | i | 2 | 2 | i | 4 | 3 | 1 | 2 | 1 | í | S | ā | i | 2 | ĩ | i | 22 | 29 |
| 1400 | Ď | | 5 | i 2 | ă | i | ŏ | Ó | i | 2 | 2 | i | 1 | 1 | Ť | 1 | ī | i | ō | ō | i | ī | Ď | ì | 12 | 14 |
| 1500 | . 0 | | 5 | i 3 | 6 | i | 2 | 2 | i | ĩ | 1 | ì | à | Ď | i | 2 | 1 | i | 1 | ī | i | 2 | ī | i | 11 | 12 |
| 1600 | 1 | | 4 | ĭ | 2 | i | <u> </u> | 4 | i | ā | 3 | i | ā | 2 | i | ā | ŏ | i | Ĭ. | ī | i | ō | ā | i | 12 | 16 |
| 1700 | 6 | 2: | - | 24 | 45 | i | 13 | 16 | i | 26 | 23 | i | 22 | 17 | i | 15 | 9 | i | ż | ä | i | ě | 4 | i | 121 | 140 |
| 1800 | 6 | 2 | | 1 13 | 24 | i | iš | 16 | i | 23 | 21 | i | 28 | 21 | i | 12 | Ž | i | ė | 4 | i | 5 | 2 | i | 144 | 156 |
| 1900 | 2 | | 7 | 1 2 | 4 | 1 | 7 | 8 | ì | 7 | 6 | 'n | 6 | 5 | i | ĝ | 5 | i | 2 | 1 | 1 | 2 | 1 | ì | 37 | 37 |
| 2000 | 498 | 185 | В | 456 | 857 | ì | 584 | 701 | ì | 6 | 5 | 1 | 6 | 5 | Ė | 2 | 1 | 1 | 1 | . 1 | i | 3 | 1 | i | 9112 | 6859 |
| 2100 | 1176 | 438 | 6 | 1710 | 9215 | 12 | 2358 | 2830 | Ĺ | 20 | 18 | 1 | 9 | 7 | i | 7 | 4 | i | 11 | 6 | Ī | 17 | 8 | i | 5300 | 10474 |
| 2200 | 1104 | 411 | | 11980 | 9722 | | 912 | 9974 | Ĺ | 96 | 92 | i | 13 | 10 | i | 8 | 5 | 1 | 12 | 6 | ĺ | 9 | _ Ā | i | 6474 | 11071 |
| 2300 | 736 | 274 | 5 | 11920 | 2482 | 12 | 2208 | 2650 | 1 | 10 | 9 | 1 | 3 | 2 | 1 | 1 | 1 | 1 | 9 | 2 | ŧ | 3 | 1 | ł | 6426 | 11636 |
| Bin Total | 3587 | 1337 | 9 | 5643 | 10609 | | 3653 | 10387 | | 300 | 271 | | 264 | 202 | | 200 | 119 | 1 | 16 | 64 | | 111 | 50 | ; | 22613 | 42499 |

¹⁾ Numbers have been extrapolated for 20-60 minute sample time.

Table Al3. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 X 12 degree horizontal transducer, for January 27. Indian Point, 1988.

| Hour | Q-5 Pau | HF | P | 5-10 | WF | Þ | 10-1 | IS MF | | 15-20 au | WF | 20-25 Rau | ИF | c | 25-30 |) WF | , | 30-35 Rau | ИF | | 95-40 au | ИF | | OURLY | TOTAL HF |
|--------------|------------|------|----|------|-----|----|------|----------|---|---------------|-----|--------------|-----|---|-----------|---------|---|--------------|----|---|-------------|----|---|-------|-------------|
| | r.up | | | | | r. | | | | - | | | | | | | | ~~~~ | | | | | | | ••• |
| 0000 | 1 | 4 | 1 | 72 | 135 | 1 | 42 | 50 | 1 | 3 | 3 | 1 2 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | t | 2 | 1 | 1 | 492 | 784 |
| 0180 | 4 | · 15 | ı | 22 | 41 | ŧ | 52 | 62 | 1 | 5 | 5 | 1 3 | 2 | 1 | 25 | 15 | 1 | 2 | 1 | t | 2 | 1 | 1 | 138 | 170 |
| 0200 | 3 | 11 | 1 | 9. | 17 | 1 | 11 | 13 | 1 | 6 | 5 | 1 16 | 12 | 1 | 2 | 1 | t | 2 | 1 | 1 | 3 | 1 | ı | 52 | 61 |
| 0300 | 2 | 7 | ı | 5 | 9 | ı | 8 | 10 | 1 | 8 | 7 | 1 6 | 5 | 1 | 10 | 6 | ı | 5 | 3 | 1 | 3 | 1 | t | 47 | 48 |
| 0400 | 4 | 15 | ı | 5 | 9 | • | 10 | 12 | 1 | 10 | 9 | 1 17 | 13 | ı | 23 | 14 | 1 | 10 | 5 | 1 | 9 | 4 | t | 68 | 81 |
| 0!500 | Э | 11 | 1 | 12 | 23 | 1 | 26 | 31 | 1 | 26 | 23 | 1 20 | 15 | 1 | 37 | 22 | ı | 10 | 5 | 1 | 1 | 0 | 1 | 135 | 130 |
| 0600 | 6 | 22 | 1 | 13 | 24 | 1 | 14 | 17 | t | 14 | 13 | 1 17 | 13 | t | 16 | 10 | ı | 10 | 5 | ł | 6 | 3 | 1 | 96 | 107 |
| 0700 | 17 | 63 | 1 | 22 | 41 | 1 | 20 | 24 | ı | 20 | 18 | † 29 | 21 | ı | 10 | 6 | ı | 13 | 7 | 1 | 5 | 2 | 1 | 135 | 182 |
| 0800 | 6 | 22 | ı | 8 | 15 | 1 | 15 | 18 | t | 15 | 14 | 1 12 | 9 | ı | 12 | 7 | ı | 8 | 4 | 1 | 5 | 2 | 1 | 81 | 91 |
| 0900 | 0 | 0 | ı | 2 | 4 | ŀ | 11 | 13 | ı | 11 | 10 | 1 4 | 3 | ı | 4 | 2 | ŧ | 3 | 2 | ı | 5 | 2 | 1 | 49 | 43 |
| 1000 | 2 | 7 | 1 | 0 | 0 | 1 | 9 | 1.1 | t | 9 | 8 | 1 0 | O | 1 | 2 | . 1 | 1 | D | 0 | J | 5 | 2 | ŧ | 32 | 35 |
| 1100 | 3 | 11 | 1 | 5 | 9 | 1 | 4 | 5 | ı | 4 | 4 | 1 8 | 6 | ı | 6 | 4 | 1 | 5 | 3 | ŧ | 5 | 2 | • | 40 | 44 |
| 1200 | 1 | 4 | 1 | 8 | 15 | ł | 11 | tЭ | ŧ | 11 | 10 | 1 7 | 5 | t | 8 | . 5 | 1 | 5 | 3 | 1 | 8 | 4 | | 59 | 59 |
| 1300 | 1 | 4 | 1 | 4 | 8 | 1 | 5 | 6 | t | ` 5 | 5 | 1 2 | 2 | t | 0 | 0 | ł | 1 | 1 | 1 | 1 | 0 | 1 | 25 | 35 |
| 1400 | 0 | 0 | ı | 5 | 9 | ŧ | 1 | 1 | 1 | 1 | 1 | l 5 | 4 | t | 2 | 1 | ı | 1 | 1 | 1 | 7, | 3 | ŧ | 22 | 20 |
| 1500 | 1 | 4 | 1 | 2 | 4 | 1 | 0 | 0 | 1 | . 0 | 0 | 1 4 | 3 | ı | 3 | 2 | ı | 1 | 1 | 1 | 2 | 1 | ŧ | 13 | 15 |
| 1600 | 1 | 4 | 1. | 2 | 4 | 1 | 0 | 0 | ŧ | 0 | 0 | 1 0 | ΄Ω | ı | 4 | 2 | 1 | 5 | 3 | 1 | . 1 | 0 | • | 13 | 13 |
| 1700 | 0 | 0 | 1 | 4 | 8 | | 7 | 8 | ı | 7 | 6 | 1 10 | 8 | t | 8 | 5 | ı | 5 | Э | 1 | 3 | 1 | t | 44 | 39 |
| 1800 | 2 | 7 | 1 | 4 | θ | 1 | 8 | 10 | ı | 8 | 7 | 1 6 | 5 | ı | 3 | 2 | ı | 7 | 4 | i | 3 | 1 | 1 | 41 | 44 |
| 1900 | 2 | 7 | 1 | 7 | 13 | 1 | :9 | 11 | ı | 9 | 8 | 1 12 | 9 | ı | 8 | 5 | ı | 2 | 1 | i | 3 | 1 | 1 | 52 | 55 |
| 2000 | 3 | 11 | 1 | 9 | 17 | 1 | 12 | 14 | t | 12 | 11 | l 13 | 10 | i | 21 | 19 | ı | 4 | 2 | 1 | 5 | 2 | ı | 79 | 80 |
| 2100 | . Э | 11 | 1 | 7 | 13 | 1 | 9 | 11 | 1 | 9 | 8 | 1 18 | 14 | 1 | 3 | 2 | ı | 8 | 4 | t | 6 | Э | 1 | 63 | 66 |
| 2200 | 1 | 4 | 1 | 1 | 2 | • | 2 | 2 | ŀ | 2 | 2 | 1 4 | • э | ı | 7 | 4 | 1 | 2 | 1 | ı | 3 | 1 | 1 | 22 | 19 |
| 2300 | Q | 0 | 1 | . 6 | 11 | ì | 5 | 6 | l | 5 | 5 | 1 3 | 2 | 1 | 6 | 4 | t | 1 | 1 | ı | 5 | 2 | ı | 41 | 41 |
| Bin Total | 66 | 244 | | 294 | 439 | | 291 | 348 | | 200 | 182 | 217 | 166 | | 221 | 134 | | 110 | 61 | | 98 | 40 | | 1859 | 2262 |

¹⁾ Numbers have been extrapolated for 15-60 minute sample time.

Table R14. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 % 12 degree horizontal transducer. for January 28. Indian Point, 1988.

| | 0-5 | | 5-10 | | 10- | 15 | 15-20 | | 20-25 | | 25-3 | ıo | 30-3 | 5 | 35-40 | 3 | HOURLY | TOTAL |
|--------------|-----|-----|------|-----|-----|-------|-------|-----|-------|-----|------|-----|------|-----|-------|----|--------|-------|
| Hour | Raw | WF | Raw | HF | Raw | HF | Raw | WF | Rau | HF | Pau | WF | Raw | WF | Rau | ИF | Rau | MF |
| 0000 | 1 | 4 | 1 6 | 11 | 2 | 2 | . 3 | 3 | 1 10 | 8 | 1 13 | | 1 7 | 4 | 1 5 | 2 | 1 47 | 42 |
| 0100 | . 2 | 7 | 1 3 | 6 | 5 | 6 | 1 5 | 5 | 1 4 | 3 | 1 6 | 4 | 1 4 | 2 | 1 4 | 2 | 1 33 | 35 |
| 0200 | 0 | Ô | 1 2 | 4 | 3 | 4 | 1 1 | 1 | 1 4 | 3 | 1 7 | 4 | i | Õ | 1 3 | 1 | 1 20 | 17 |
| 0300 | 1 | 4 | 1 4 | 8 | 7 | 8 | 1 11 | 10 | 1 18 | 14 | 1 16 | 10 | 1 3 | 2 | 1 6 | 3 | 1 66 | 59 |
| 0400 | 4 | 15 | 1 12 | 23 | 10 | 12 | 1 24 | 22 | 1 23 | 17 | 1 16 | 10 | 1 6 | 3 | 1 2 | 1 | 1 146 | 155 |
| 0500 | . 9 | 94 | 1 12 | 23 | 28 | 34 | 1 12 | 11 | 1 13 | 10 | 1 21 | 13 | i 7 | 4 | 1 2 | 1 | 1 104 | 130 |
| 0600 | 4 | 15 | 1 9 | 17 | 9 | 11 | 1 12 | 11 | 1 10 | 8 | 1 5 | 9 | 1 2 | 1 | 1 0 | Õ | 1 51 | 66 |
| 0700 | 6 | 22 | 1 8 | 15 | 16 | 19 | 1 8 | 7 | 1 14 | -11 | 1 15 | 9 | 1 5 | ā | 1 2 | 1 | 1 74 | 87 |
| 0000 | 10 | 37 | 1 21 | 39 | 25 | 30 | 1 17 | 15 | 1 19 | 14 | 1 15 | 9 | 1 6 | 3 | 1 1 | 0 | 1 114 | 147 |
| 0900 | 4 | 15 | 1 7 | 13 | 2 | 2 | 9 | 8 | 1 15 | 11 | 1 15 | 10 | 1 8 | 4 | i 4 | 2 | 1 65 | 65 |
| 1000 | 5 | 19 | 1 5 | 9 | 5 | 6 | 1 11 | 10 | 1 15 | 11 | 1 10 | 6 | 1 17 | 9 | 1 1 | 0 | 1 69 | 70 |
| 1100 | 4 | 15 | 1 7 | 13 | 14 | 17 | i 9 | 8 | 1 13 | 10 | 1 14 | B | 1 11 | 6 | 1 13 | 6 | 1 85 | 83 |
| 1200 | 1 | 4 | 1 7 | 13 | 7 | 8 | 1 12 | 11 | 1 23 | 17 | 1 16 | 10 | 1 21 | 11 | 1 7 | 3 | 1 94 | 77 |
| 1300 | 2 | 7 | 1 1 | 2 | 10 | 12 | 1 8 | 7 | 1 7 | 5 | 1 9 | 5 | 1 10 | 5 | 1 8 | 4 | 1 55 | 47 |
| 1400 | G | 0 | 1 0 | Ō | 0 | O | i o | 0 | 1 0 | 0 | 1 0 | 0 | 1 0 | . 0 | 1 0 | O | 1 0 | 0 |
| 1500 | 0 | 0 | 1 1 | `2 | 1 | 1 | 1 0 | 0 | 1 2 | 2 | 1 1 | . 1 | 1 4 | 2 | 1 1 | 0 | 1 10 | 9 |
| 1600 | 0 | 0 | 1 2 | 4 | 3 | 4 | 1 4 | 4 | 1 10 | 8 | 1 14 | 8 | 1 3 | 2 | 1 3 | 1 | 1 39 | 31 |
| 1700 | 3 | 11 | 1 3 | 6 | 1 | 1 | 1 2 | 2 | 1 6 | 5 | 1 6 | 4 | 1 6 | 3 | 1 2 | 1 | 1 29 | 33 |
| 1600 | 5 | 19 | l 21 | 39 | 3 | 4 | 1 36 | 92 | 1 43 | 32 | 1 21 | 19 | 1 4 | 2 | 1 5 | 2 | 1 138 | 143 |
| 1900 | 4 | 15 | 1 13 | 24 | 12 | 14 | 1 15 | 14 | l 18 | 14 | 1 13 | 8 | 1 8 | 4 | 1 3 | 1 | 1 86 | 94 |
| 2000 | 2 | 7 | 1 8 | 15 | 9 | 11 | 1 11 | 10 | 1 12 | 9 | 1 16 | 10 | 1 10 | 5 | 1 1 | 0 | 1 69 | 67 |
| 2100 | 1 | 4 | 1 13 | 24 | 16 | 19 | ı 25 | 23 | 1 24 | 19 | 1 29 | 17 | 1 13 | 7 | 1 4 | 2 | 1 125 | 114 |
| 2200 | 1 | 4 | 1 5 | 9 | 7 | 8 | 1 11 | 10 | 1 27 | 20 | J 21 | 19 | 1 13 | 7 | 1 1 | 0 | 1 86 | · 71 |
| 2300 | 1 | 4 | 1 3 | 6 | 10 | 12 | 1 6 | 5 | 1 9 | 7 | 1 14 | 8 | 1 17 | 9 | 1 7 | 3 | 1 67 | 54 |
| Bin Total | 70 | 262 | 173 | 325 | 205 | 245 | 252 | 229 | 339 | 257 | 31.4 | 191 | 185 | 98 | 85 | 36 | 1672 | 1695 |

¹⁾ Numbers have been extrapolated for 40-60 minute sample time.

Table RIS. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 % 12 degree horizontal transducer, for January 29. Indian Point, 1988.

| | 0-5 | | | 5-10 | | | 10-1 | 5 | | 15-20 | | 20-25 | | | 25-30 | 1 | | 30-35 | • | | 95-4 0 | | L | IOURLY | TOTAL |
|--------------|-----|-----|---|--------|-----|---|------|-----|-------|-------|-----|-------|-------|----|--------------|-----|---|--------|-----|-------|---------------|-------|---|--------|-------|
| Hour | Rau | WF | F | gan 10 | HF | R | au · | WF | | tau . | WF | Rau | MF | F | 59n -2-2/ | WF | F | Sen 22 | HF | 5 | Raw | WF | • | Sau. | WF |
| 0000 | 5 | 19 | 1 | 7 | 13 | 1 | 6 | 7 | 1 | 13 | 12 | | 5 | 1 | 14 | 8 | | 18 | 9 | 1 | 11 | 5 | 1 | 81 | 78 |
| 0100 | 3 | 11 | i | 11 | 21 | t | 14 | 17 | Ĺ | 19 | 17 | 1 20 | 15 | ì | 24 | 14 | i | 13 | Ž | ì | 19 | 9 | 1 | . 123 | 111 |
| 0200 | . 1 | 4 | i | 7 | 13 | ì | э : | 4 | i | 5 | 5 | 1 18 | 14 | i | 19 | 11 | i | 14 | 7 | i | 5 | 2 | i | 72 | 60 |
| 0300 | i | 4 | i | Ö | Õ | i | 4 | 5 | i | 4 | 4 | 1 4 | 3 | ī | 4 | 2 | i | 2 | i | i | ĩ | Ō | Ĺ | 20 | 19 |
| 0400 | 1 | . 4 | i | . 6 | 15 | i | 8 | 10 | ì | 8 | 7 | 15 | 11 | ì | 18 | 11 | i | 3 | 2 | i | 4 | 2 | i | 65 | 62 |
| 0500 | 9 | 34 | i | 22 | 41 | i | 21 | 25 | i | 19 | 17 | 1 32 | 24 | i | 21 | 13 | ì | ā | 2 | i | 6 | 3 | i | 194 | 159 |
| 0600 | 9 | 94 | 1 | 21 | 39 | i | 25 | 30 | i | 16 | 14 | 1 23 | 17 | i | 22 | 13 | į | 2 | - 1 | i | Ō | 0 | i | 110 | 148 |
| 0700 | 14 | 52 | i | 22 | 41 | ì | 18 | 22 | i | 22 | 20 | 1 25 | 19 | i | 19 | 11 | i | 8 | 4 | i | 2 | 1 | i | 130 | 170 |
| 0800 | 16 | 60 | i | 51 | 96 | Ĭ | 41 | 49 | i | 55 | 50 | 45 | 34 | i | 47 | 28 | i | 19 | . 7 | i | 9 | 4 | i | 277 | 328 |
| 0900 | 15 | 56 | i | 23 | 43 | j | 24 | 29 | i | 31 | 28 | 1 17 | 19 | ì | 93 | 20 | į | 15 | ė. | 'n | 14 | 6 | i | 172 | 203 |
| 1000 | 4 | 15 | ì | 9 | 17 | í | 18 | 22 | ì | 13 | 12 | 1 9 | 7 | i | 5 | | i | 4 | 2 | i | 5 | 2 | i | 67 | 80 |
| 1100 | . 2 | 7 | i | a · | . 6 | i | 2 | 2 | i | 10 | 9 | į ž | Ś | ì | 8 | 5 | i | ż | 1 | i | 2 | 1 | i | 36 | 36 |
| 1200 | 2 | ż | i | . а | 6 | i | 11 | 13 | i | 15 | 14 | i 12 | 9 | 1. | 13 | ē | i | 21 | 11 | i | 11 | 5 | i | 88 | 79 |
| 1300 | ā | ò | i | 5 | ğ | i | ii | 13 | i | 11 | 10 | 1 16 | 12 | i | 24 | 14 | ï | 13 | 7 | i | 17 | ē | i | 97 | 73 |
| 1400 | ĩ | 4 | i | 7 | 13 | i | 18 | 22 | i | 13 | 12 | 1 17 | 13 | i | 14 | 8 | i | 16 | ė | i | 17 | 8 | i | 103 | 88 |
| 1500 | ī | 4 | i | Ś | 9 | i | 14 | 17 | i | 16 | 14 | i 30 | 29 | i | 46 | 28 | i | 18 | 9 | i | 15 | . 7 | i | 145 | 111 |
| 1600 | À | 30 | i | 5 | 9 | i | 16 | 19 | i | 21 | 19 | 1 23 | 17 | i | 39 | 23 | i | 16 | 8 | i | ā | i | i | 131 | 126 |
| 1700 | ī | 4 | i | Š | ģ | i | 2 | ž | i | 11 | 10 | i Ö | 6 | i | 11 | 7 | i | ŏ | ŏ | i | 2 | ĭ | i | 40 | 39 |
| 1900 | 7 | 26 | i | · 3 | 6 | i | 7 | 8 | ì | 7 | 6 | 1 10 | 9 | i | 13 | 8 | Ĺ | ă | Ž | i | 7 | 3 | i | 58 | 67 |
| 1900 | 7 | 26 | Ì | 16 | 30 | ì | 30 | 36 | i | 31 | 28 | 1 28 | 21 | 1 | 19 | 11 | i | 13 | 7 | Ì | 4 | 2 | 1 | 148 | 161 |
| 2000 | 9 | 34 | 1 | 21 | 39 | - | 16 | 19 | ı | 26 | 25 | 1 29 | 22 | ı | 36 | 22 | ı | 19 | 7 | i | 7 | 9 | ı | 159 | 171 |
| 2100 | 20 | 75 | 1 | 39 | 79 | t | 34 | 41 | 1 | 40 | 36 | 1 27 | 20 | ı | 29 | 17 | i | 11 | . 6 | 1 | 6 | Э | 1 | 206 | 271 |
| 2200 | 42 | 157 | ŧ | 57 | 107 | t | 49 | 59 | ı | 46 | 41 | 1 40 | 30 | t | 97 | 22 | ı | 41 | 21 | ŧ | 19 | 6 | 1 | 325 | 443 |
| 2300 | 9 | 34 | | 19 | 24 | ı | 15 | 18 | 1 | 26 | 29 | 1 95 | 26 | 1 | 37 | 22 | ı | 29 | 15 | ı | 8 | 4 | 1 | 172 | 166 |
| Bin Total | 197 | 701 | | 363 | 679 | | 407 | 489 | | 480 | 433 | 497 | 374 | | 552 | 329 | | 293 | 152 | | 188 | 86 | | 2967 | 3243 |

¹⁾ Numbers have been extrapolated for 60 minute sample time.

Table R16. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 X 12 degree horizontal transducer, for January 30. Indian Point, 1988.

| | 0-5 | | | 5-10 | | | 10-15 | , . | 15-2 | . . | | 20-25 | | | 25-30 | 1 | | 30-35 | | | 35~40 | | н | OURLY | TOTAL |
|--------------|-------|-----|------|------|----------------|------------|-------|------------|------|------------|----|-----------|-----|---------|-------|------|---|--------|-----|----------|------------|----|----|---------------|-------|
| Hour | Rau | WF | F | ?au | HF | ₽. | aw | HF | Raw | HF | | Raw | HF | 1 | Raw | WF | F | tau | HF | - 1 | Rau | WF | R | a u, . | HF |
| 0000 | 11 | 41 | 1 | 9 | 17 | ī | 8 | 10 | 1 10 | 9 | 1 | 67 | 50 | 1 | 87 | 52 | ı | 26 | 13 | 1 | 18 | В | 1 | 236 | 200 |
| 0100 | 11 | 41 | ı | 22 | 41 | i | . 3 | 4 | 1 3 | 3 | ì | 35 | 26 | 1 | 40 | 24 | 1 | 15 | 8 | i | 12 | 5 | į. | - 141 | 152 |
| 0200 | 2 | 7 | i | 2 | 4 | i | 12 | 14 | 1 15 | 14 | i | 21 | 16 | i | 35 | 21 | i | 19 | 10 | i | 11 | 5 | i, | 117 | 91 |
| 0300 | 1 | 4 | i | 5 | 9 | i | 5 | 6 | 1 14 | 13 | ı | 21 - | 16 | i | 17 | 10 - | i | 9 | 5 | 1 | 14 | 6 | i | 86 | 69 |
| 0400 | Ĩ | 4 | i | 3 | 6 | i | 3 | 4 | 1 3 | Э | ı | . 2 | 2 | 1 | 10 | 6 | Ĺ | 6 | 3 | ŧ | 5 | 2 | 1 | 33 | 30 |
| 0500 | 6 | 22 | 1 | 6 | 11 | ı | 5 | 6 | 1 6 | 5 | ı | 17 | 13 | 1 | 6 | 4 | 1 | 4 | 2 | 1 | 4 | 2 | ŧ | 54 | 65 |
| 0600 | . 13 | 48 | i | 29 | 55 | ı | 25 | 30 | 1 27 | 24 | 1 | 36 | 27 | ì | 34 | 20 | ŧ | 14 | 7 | i | 7 | 9 | ı | 185 | 214 |
| 0700 | Э | 11 | ı | 7 | 13 | 1 | 15 | 10 | 1 10 | . 16 | 1 | 15 | 11 | Ĺ | 15 | 9 | 1 | 1 | 1 | 1 | 0 | O | ı | 74 | 79 |
| 0800 | 10 | 97 | ı | 11 | 21 | 1 | 25 | 30 | 1 10 | 16 | ١ | 16 | 12 | ı | 19 | 11 | 1 | 3 | 2 | 1 | 0 | 0 | 1 | 102 | 129 |
| 0900 | 16 | 60 | 1 | 94 | 64 | 1 | 59 | 64 | 1 81 | 73 | -1 | 35 | 26 | 1 | 42 | 25 | • | 20 | 10 | 1 | 8 | 4 | ı | 289 | 326 |
| 1000 | 14 | 52 | 1 | 19 | 36 | 1 | 91 | 97 | 1 28 | 25 | 1 | 27 | 20 | 1 | 31 | 19 | 1 | 16 | 9 | - 1 | 4 | 2 | ı | 170 | 199 |
| 1100 | 2 | 7 | 1 | 5 | 9 | 1 | .9 | 11 | 1 6 | 5 | ŧ | 11 | 8 | 1 | 10 | 6 | 1 | 7 | 4 | ı | 0 | Ö | ı | 50 | 50 |
| 1200 | 1 | 4 | 1 | 4 | 8 | 1 | 15 | 18 | 1 24 | 22 | ı | 21 | 16 | 1 | 24 | 14 | 1 | 9 | 5 | 1 | 11 | 5 | t | 109 | 92 |
| 1300 | 2 | 7 | 1 | 3 | 6 | 1 | 10 | 12 | 1 21 | 19 | 1 | 23 | 17 | 1 | 39 | 23 | ı | 17 | 9 | 1 | 7 | Э | ŧ | 122 | 96 |
| 1400 | 1 | 4 | 1 | 1 | 2 | 1 | 4 | 5 | 1 14 | 13 | 1 | 26 | 20 | ŀ | 41 | 25 | ı | 15 | 8 | ı | 20 | 9 | t | 122 | 86 |
| 1500 | 2 | 7 | 1 | 2 | 4 | ı | 9 | 11 | 1 15 | 14 | 1 | 94 | 26 | ı | 23 | 14 | ı | 15 | 9 | 1 | 13 | 6 | ŧ | 113 | 90 |
| 1600 | 0 | 0 | 1 | 6 | 11 | 1 | 14 | 17 | 1 22 | 20 | 1 | 9 | . 7 | ı | 16 | 10 | 1 | 5 | 3 | ŧ | 4 | 2 | 1 | 76 | 70 |
| 1700 | 0 | 0 | 1 | 0 | 0 | ı | 4 | 5 | 1 13 | 12 | 1 | 12 | 9 | ı | 14 | 8 | 1 | 9 | 2 | 1 | 2 | 1 | 1 | 48 | 37 |
| 1800 | 0 | Ö | 1 | 1 | 2 | t | 6 | 7 | 1 6 | 5 | 1 | 14 | 11 | , 1 | 11 | 7 | 1 | 4 | 2 | ŧ | 5 | 2 | ŧ | 47 | 36 |
| 1900 | O | 0 | 1 | 3 | 6 | ` t | 0 | 0 | 1 3 | 3 | ı | Э | 2 | ı | 9 | 5 | 1 | 9 | 2 | ı | 3 ' | 1 | t | 24 | 19 |
| 2000 | 0 | 0 | 1 | 10 | 19 | ı | 21 | 25 | 1 23 | 21 | ı | 90 | 23 | ì | 27 | 16 | • | 12 | 6 | ı | 4 | 2 | ł | 127 | 112 |
| 2100 | 3 | 11 | 1 | 16 | 30 | 1 | 17 | 20 | 1 14 | 13 | ı | 16 | 12 | ı | 13 | 8 | ı | 11 | 6 | 1 | 7 | 9 | ı | 97 | 103 |
| 2200 | 2 | 7 | 1 | 21 | 39 | 1 | 19 | 23 | 1 16 | 14 | 1 | 20 | 15 | 1 | 22 | 19 | ı | . 9 | | • | 3 | 1 | | 111 | 116 |
| 2300 | 6 | 22 | | 21 | 9 9 | | 23 | 28 | 1 90 | 27 | | 26 | 20 | - 1 | 97 | 22 | 1 | 26 | E 1 | <u> </u> | 18 | | | 187 | 179 |
| Bin Total | 107 | 396 | | 240 | 452 | | 936 | 405 | 430 | 389 | | 597 | 405 | | 622 | 372 | | 268 | 141 | | 180 | 80 | | 2720 | 2640 |

¹⁾ Numbers have been extrapolated for 60 minute sample time.

Table NIP. Hourly estimates of rev and veighted fish numbers (with high and low tide heights) in front of unit 3, intake 35 using 6 % 12 degree horizontal transducer for week 2, January 24 to 20. Indian Point, 1988.

| | • | RN 24 | | | | RN 25 | | | JAN 26 | | | JRN 27 | | | | AN 28 | | | JRN 29 | | | JIW 90 | • | HEE | |
|-------|---------|-------|-------|-----|------|-------|------|--------|--------|------|-------|--------|------|-----|-----------|-------|------|-------|--------|------|--------|--------|--------|--------|-------|
| Hour | FAU | NF | Tide | R | RM . | HF | Tide | PAH | WF | Tide | P:FIH | HF | Tide | PAH | | HF | Tide | RAH | HF | Tide | RAH | UF | T 1,40 | RAM | HF |
| 0000 | i0i | 130 | | | 33 | 36 | | 1 56 | 49 | | 1 492 | 784 | 0.0 | 1 | 47 | 42 | | 1 61 | 78 | | 1 230 | 200 | | 1 1051 | 1319 |
| 0100 | 115 | 137 | | i | 122 | 141 | | 1 40 | 49 | | 1 138 | | | | 33 | 33 | 0.0 | 1 123 | 111 | | 1 14 | | | 1 712 | 795 |
| 0200 | 61 | 76 | | à | 153 | 167 | | 1 139 | 164 | | 1 52 | | | i | 20 | 17 | | i 72 | 60 | 0.1 | 1 111 | 91 | | 1 614 | 636 |
| 0300 | 30 | 44 | 1.4 | 1 | 62 | .77 | | 1 149 | 180 | | 1 47 | 48 | | 1. | 66 | 59 | | 1 20 | 19 | | 1 90 | 69 | 0. 1 | 1 460 | 496 |
| 0400 | 34 | 44 | | | 63 | 71 | 1.4 | 1 66 | 116 | | 1 56 | 61 | | 1 1 | 46 | 155 | | 1 65 | 62 | | 1 33 | 30 | | 1 517 | 559 |
| 0500 | 52 | 42 | | • | 42 | 45 | | 1 41 | 48 | 1.4 | 1 195 | 130 | | 1 1 | 04 . | 130 | | 1 194 | 159 | | I 5 | 1 65 | | 1 562 | 619 |
| 0600 | 101 | 181 | | | 69 | 76 | | 1 47 | 61 | | 1 96 | 107 | 1.3 | 1 | 51 | 66 | | 1 110 | 149 | | 1 16: | 214 | | 1 7-16 | U53 |
| 0700 | 194 | 211 | | • | 120 | 117 | | 1 64 | 61 | | 1 135 | 192 | | 1 | 74 | 87 | 1.3 | | 170 | | 1 . 74 | | | 1 791 | 907 |
| ถอบด | 117 | 125 | | • | 175 | 170 | | 1 79 | 79 | | 1 01 | 91 | | 1 1 | 14 | 147 | | 1 277 | 328 | 1.3 | 1 102 | | | 1 939 | 1(169 |
| 0990 | 54 | 72 | -O. I | 1 | 114 | 128 | | 1 105 | 106 | | 1 48 | 49 | | ŀ | 63 | 65 | | 1 172 | 203 | | 1 289 | 326 | 1.9 | 1 8-14 | 643 |
| 1000 | 53 | 58 | | ı | 38 | 46 | 0.0 | 1 09 | 79 | | 1 92 | | | 1. | 69 | 70 | | 1 67 | 80 | | 1 170 | | | 1 510 | 567 |
| 1100 | 45 | 50 | | ı | 25 | 27 | | 1 27 | 40 | | 1 40 | 44 | | 1 | 85 | 69 | | 1 36 | 36 | | 1 50 | 50 | | 1 306 | 330 |
| 1200 | 65 | 66 | | - 1 | 35 | 3-1 | | 1 19 | 23 | D. i | 1 59 | 59 | | 1 | 94 | 77 | | 1 98 | 73 | | 1 109 | 92 | | 1 469 | 424 |
| 1300 | 141 | 148 | | 1 | 29 | 33 | | 1 22 | 29 | | 1 25 | 35 | 0.1 | t | 35 | 47 | | 1 97 | 73 | | 1 122 | . % | | 1 491 | 461 |
| 1400 | 74 | 90 | | - 1 | 117 | 148 | | 1 12 | 14 | | 1 22 | 20 | | 1 1 | 0 | 0 | 0.1 | 1 103 | 98 | | 1 122 | 96 | | 1 450 | -1-16 |
| 1500 | 50 | 64 | 1.3 | 1 | 1-40 | 155 | | 1 11 | 12 | | 1 13 | | | ı | 10 | . 8 | | 1 145 | 111 | 0.0 | 1 113 | | 0.0 | 1 490 | 455 |
| 1600 | 59 | 80 | | 1 | 98 | 110 | 1.2 | 1 12 | 16 | | 1 13 | 19 | | ı | 39 | 91 | | 1 131 | 126 | | 1 76 | | | 1 428 | 446 |
| 1700 | 44 | 52 | | - | 91 | 97 | | 1 121 | 140 | 1.1 | 1 44 | | | ŧ | 29 | 33 | | 40 | 39 | | 1 46 | 37 | | 1 407 | 437 |
| 1000 | 60 | 65 | | | 75 | 70 | | 1 144 | 156 | | 1 41 | | 1.0 | 1 1 | 38 | 143 | | 1 58 | 67 | | 1 4 | 36 | | 1 571 | 501 |
| 1900 | 230 | 250 | | ı | 48 | 61 | | 1 37 | 37 | | 1 52 | | | ı | 86 | 94 | 1.0 | 1 40 | 161 | | 1 2 | | | 1 625 | 677 |
| 3000 | 208 | 196 | • | . 1 | 54 | 51 | | 1 9112 | 6858 | - | 1 79 | | | ı | 69 | 67 | | 1 159 | 171 | 1.0 | 1 12 | 112 | | 1 3606 | 7535 |
| 2100 | 110 | 125 | | 1 | 62 | 64 | | 1 5308 | 10474 | | 1 63 | | | 1 1 | 25 | 114 | | 1 206 | 271 | | 1 9 | | 1.0 | 1 5971 | 11217 |
| 2200 | 83 | 88 | -0.2 | -11 | - 84 | 89 | | 1 6474 | 11971 | | 1 22 | | | | 86 | 71 | | 1 325 | 443 | | 1 111 | 116 | | 1 7185 | 12697 |
| 2300 | 55 | 53 | | ı | 54 | 56 | -0.1 | 1 6426 | 11639 | | 1 41 | 41 | | 1 | 67 | 54 | | 1 172 | 166 | | 1 187 | 179 | | 1 7002 | 12307 |
| Deily | 2229 | 2447 | | | 1900 | 2069 | | 22612 | 42499 | | 1859 | 2262 | | 16 | 72 | 1695 | | 2967 | 3243 | | 2720 | 2640 | | 35959 | 54055 |

Tide heights for low and high tide only, New York (the Battery), N.Y. and times edjusted for Indian Point Location.

Table fil8. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 % 12 degree horizontal transducer, for January 31. Indian Point, 1988.

| Hour | 0-5 Rau | HF | R | 5-10 | ИF | Ra | 10-15 w | HF | | 15-20 | HF | | 20-25 Su | HF | F | 25-30 Rau | ИF | ı | 30-95 Rau | WF | F | 35-40 lau | WF | | IOURLY | TOTAL HF |
|--------------|------------|-----|----------|------|-----|----|------------|-----|-----|-----------|------|---|-------------|-----|---|--------------|-----|---|--------------|----------------|-----|--------------|-----|----|--------|-------------|
| 0000 | · 4 | 15 | <u> </u> | 15 | 28 | 1 | 9 | 11 | 1 | 20 | 18 | 1 | 26 | 20 | 1 | | 22 | 1 | 14 | - - | 1 | 14 | 6 | 1 | 139 | 127 |
| 0100 | n | Ō | i | 1 | 2 | i | 2 | 2 | i | 10 | 9 | 1 | 8 | 6 | i | 23 | 14 | i | 26 | 13 | i | 8 | 4 | i | 78 | 50 |
| 0300 | 2 | 7 | i | 9 | 15 | i | 22 | 26 | i | 26 | 23 | i | 35 | 26 | i | 47 | 28 | i | 420 | 214 | i | 19 | 9 | i. | 579 | 348 |
| 0300 | Ã | 15 | ï | 5 | 9 | i | 15 | 18 | i | 14 | 13 | i | 10 | | i | 22 | 13 | i | 19 | 10 | i i | 20 | ý | i | 109 | 95 |
| 0400 | Ó | Õ | i | Ď | Ó | i | ě | iō | i | 14 | 19 | i | 8 | 6 | ì | 23 | 14 | i | 16 | 8 | i | 7 | Š | i | 76 | 54 |
| 0500 | . 1 | 4 | i | 2 | 4 | i | 2 | 2 | i | 3 | э | i | ă | 3 | i | 6 | 4 | i | 2 | ī | i | i | ō | i | 21 | 21 |
| 0600 | B | 30 | i | 2 | 4 | i | 2 | 2 | i | 7 | 6 | i | 13 | 10 | ì | 5 | 3 | i | 4 | 2 | i | ō | ·ō | i | 41 | 57 |
| 0700 | 2 | 7 | i | 11 | 21 | i | 14 | 17 | i | 14 | 13 | ì | 13 | 10 | í | 19 | 11 | i | 19 | 7 | ì | 3 | 1 | ì | 89 | 87 |
| 0800 | Ō | 0 | i | 9 | 17 | i | 7 | 8 | ì | 10 | 9 | i | 11 | 8 | i | 17 | 10 | i | iõ | 5 | İ | 5 | Ž | 1 | 69 | 59 |
| 0900 | 2 | 7 | i | 13 | 24 | ì | 18 | 22 | i | 27 | 24 | i | 28 | 21 | 1 | 20 | 17 | ŧ | 8 | 4 | Ì | 6 | 3 | İ | 190 | 122 |
| 1000 | 10 | 97 | i | 31 | 58 | 1 | 43 | 52 | Ĺ | 30 | 27 | i | 41 | 31 | ı | 92 | 19 | ı | 12 | 6 | i | 3 | 1 | 1 | 202 | 231 |
| 1100 | 1 | 4 | 1 | 9 | 17 | 1 | 9 | 11 | 1. | 17 | 15 | 1 | 18 | 14 | t | 27 | 16 | 1 | 11 | 6 | ı | 18 | 8 | • | 110 | 91 |
| 1200 | 1 | 4 | 1 | 5 | 9 | • | 16 | 19 | ı | 14 | . 13 | l | 15 | 11 | ı | 27 | 16 | 1 | 11 | 6 | 1 | 12 | 5 | 1 | 273 | 224 |
| 1300 | Ó | 0 | 1 | 5 | 9 | i | 10 | 12 | 1 | 15 | 14 | 1 | 28 | 21 | ı | 54 | 32 | ı | 17 | 9 | 1 | 18 | 8 | ı | 147 | 105 |
| 1400 | • 3 | 11 | 1 | 15 | 28 | ı | 15 | 10 | 1 | 20 | 18 | 1 | 29 | 22 | ı | 43 | 26 | 1 | 24 | 12 | i | 26 | 12 | İ | 175 | 147 |
| 1500 | 0 | Ō | Ī | 25 | 47 | i | 28 | 34 | i | 14 | 13 | 1 | 18 | 14 | i | 18 | 11 | 1 | 13 | 7 | Ĵ. | 22 | 10 | ı | 136 | 136 |
| 1600 | 9 | 11 | ı | 5 | 9 | 1 | 19 | 23 | į | 15 | 14 | ì | 17 | 13 | 1 | 23 | 14 | 1 | 12 | 6 | i | 7 | 3 | 1 | 101 | 93 |
| 1700 | 1 | 4 | ì | 4 | 8 | 1 | з - | 4 | l | 4 | 4 | t | 10 | 8 | ı | 17 | 10 | 1 | 5 | 3 | i | 2 | 1 | 1 | 46 | 42 |
| 1000 | 5 | 19 | i | 15 | 29 | 1 | 6 | 7 | 1" | 16 | 14 | t | 17 | 13 | ı | 18 | 11 | 1 | 11 | 6 | ı | 7 | 3 | ı | 95 | 101 |
| 1900 | 1 | 4 | · | 4 | 8 | 1 | 3 . | 4 | Ĺ | 4 | 4 | t | 10 | 8 | ı | 17 | 10 | 1 | 5 | 3 | 1 | 12 | 5 | i | 56 | 46 |
| 2000 | 5 | 19 | ı | 15 | 28 | 1 | 6 | 7 | ı | 16 . | 14 | t | 17 | 13 | ı | 18 | 11 | ı | 11 | 6 | 1 | 7 | 3 | 1 | 95 | 101 |
| 2100 | 2 | 7 | 1 | 18 | 34 | ı | 31 | 37 | t | 28 | 25 | 1 | 91 | 23 | 1 | 39 | 23 | 1 | 17 | 9 | ı | 11 | 5 | • | 177 | 163 |
| 2200 | 10 | 97 | 1 | 24 | 45 | 1 | 29 | 35 | 1 | 20 | 18 | 1 | 17 | 13 | 1 | 26 | 16 | 1 | 8 | 4 | 1 | 6 | 9 | ı | 140 | 171 |
| 2300 | 21 | 78 | ı | 33 | 62 | ı | 47 | 56 | l . | 59 | 53 | 1 | 70 | 53 | 1 | 48 | 29 | ŀ | 40 | 20 | 1 | 13 | 6 | t | 931 | 957 |
| Bin Total | 86 | 320 | | 274 | 514 | 3 | 964 | 437 | | 417 | 377 | - | 494 | 375 | | 634 | 380 | | 729 | 374 | | 247 | 110 | | 3417 | 3028 |

¹⁾ Numbers have been extrapolated for 22-60 minute sample time.

Table Al9. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 9, intake 35 using 6 % 12 degree horizontal transducer, for February 1. Indian Point, 1988.

| | 0-5 | | | 5-10 | | | 10-15 | | ٠. | 15-20 | | 20- | 25 | | 25-30 | n | | 3035 | | , | 35-40 | | | OURLY | TOTAL. |
|--------------|-----|-----|----|-------|------|---|-----------|-----|----|--------------|-------------|------|--------|------------|-------|-----|---|------|-----|-----|---------------------|-----|----------|-----------|--------|
| Hour | Rau | HF | F | tau . | HF | R | 90 | MF | | ań 10 100 | HF | Rew | | F | Raw | HF | | Rau | HF | | 33-70 3 4 | WF | | aw | WF |
| 0000 | 7 | 26 | 1 | 43 | B1 | 1 | 51 | 61 | 1 | 47 | 42 | 1 54 | | !! | 62 | 37 | 1 | 40 | 20 | 1 | 14 | 6 | <u> </u> | 318 | 314 |
| 0100 | 1 | 4 | i | 14 | 26 | i | 27 | 32 | i | 44 | 40 | 1 65 | | 19 | 1 78 | 47 | ī | 45 | 23 | i | 26 | 12 | i | 324 | 252 |
| 0200 | 4 | 15 | t | 15 | 28 | i | 23 | 28 | i | 50 | 45 | B4 | | 3 | 1 109 | 65 | i | 27 | 14 | i | 26 | 12 | į., | 338 | 270 |
| 0300 | 2 | 7 | È | 14 | 26 | i | 16 | 19 | i | 27 | 24 | 1 43 | _ | 2 | 76 | 46 | i | 22 | 11 | i | 26 | 12 | : | 226 | 177 |
| 0400 | 4 | 15 | i | ī | ~2 | i | 5 | 6 | i | 20 | 18 | i 14 | _ | 1 | 1 16 | 10 | i | 15 | è | | 12 | 5 | : | 220 87 | 75 |
| 0500 | o | Õ | Ĭ. | à | - 5 | i | 3 | 4 | i | - 6 | 5 | i 9 | • | ż | | 4 | ; | 13 | 7 | i | -5 | 3 | ; | 48 | 36 |
| 0600 | . 1 | 4 | i | 10 | 19 | i | 16 | 19 | i | 9 | ě | 21 | 1 | 6 | 1 24 | ાનં | i | .5 | ં | i | Š | 2 | i | 93 | 86 |
| 0700 | 6 | 22 | ı | 17 | 32 | i | 24 | 29 | ì | 29 | 26 | 1 35 | | 6 | 1 29 | 17 | i | 12 | 6 | i | 2 | ī | i | 153 | 159 |
| 0800 | 14 | 52 | ı | 41 | 77 | i | 53 | 64 | Ī | .43 | 39 | 1 44 | 3 | 3 | 1 31 | 19 | i | 6 | ē | i | ö | Ŏ | ì | 232 | 287 |
| 0900 | 6 | 30 | • | 29 | 55 | 1 | 26 | 31 | İ | 27 | 24 | 1 26 | 2 | . 0 | 25 | 15 | i | 19 | • 7 | i | 2 | 1 | i | 156 | 183 |
| 1000 | 9 | 34 | ŧ | 24 | 45 | • | 26 | 31 | j | 27 | 24 | ! 23 | 1 | 7 | 1 19 | 11 | Ì | 16 | ø | t | 3 | Ĩ | į | 147 | 171 |
| 1100 | 9 | 94 | ı | 24 | 45 | ı | 26 | 31 | 1 | 27 | 24 | 1 23 | 1 | 7 | 1 19 | 11 | ı | 16 | 8 | ţ | 3 | 1 | ı | 147 | 171 |
| 1200 | 8 | 30 | t | 14 | 26 | ı | 16 | 19 | ı | 17 | 15 | 1 92 | 2 | 4 | 1 43 | 26 | 1 | 29 | 15 | i | 24 | 11 | ı | 183 | 166 |
| 1300 | 4 | 15 | ı | 4 | 8 | • | 11 | 13 | 1 | 24 | 22 | 1 15 | 1 | 1 | 1 27 | 16 | ŀ | 17 | 9 | 1 . | 26 | 12 | 1 | 120 | 106 |
| 1400 | 2 | 7 | 1 | 5 | 9 | 1 | 8 . | 10 | t | 22 | 20 | 1 36 | 2 | ? | 40 | 24 | ı | 55 | 28 | 1 | 94 | 15 | t | 202 | 140 |
| 1500 | 5 | 19 | 1 | 13 | 24 | 1 | 93 | 40 | ı | 56 | 50 | 1 70 | 5 | 3 | 1 68 | 41 | ı | 39 | 17 | 1 | 44 | 20 | ı | 322 | 264 |
| 1600 | 4 | 15 | ı | 11 | 21 | ŀ | 36 | 43 | t, | 38 | 34 | 1 38 | 2 | :9 | 48 | 29 | 1 | 30 | 15 | 1 | 23 | 10 | ı | 228 | 196 |
| 1700 | 2 | 7 | 1 | 10 | 19 | 1 | 12 | 14 | 1 | 22 | 20 \ | 1 25 | 1 | 9 | 1 21 | 19 | ı | 10 | 5 | i | 10 | 5 | i | 121 | 110 |
| 1800 | 0 | Ω | 1 | 3 | 6 | ı | 14 | 17 | ı | 7 | 6 | 1 16 | 1 | 2 | 1 42 | 25 | ı | 11 | 6 | i | 5 | 2 | i | 297 | 224 |
| 1900 | 2 | 7 | 1 | 5 | 9 | 1 | 4 . | 5 | 1 | 10 | 9 | 1 12 | | 9 | 1 29 | 17 | ı | 16 | 8 | 1 | 6 | 3 | Ì | 68 | 70 |
| 2000 | 3 | 11 | 1 | 4 | 8 | 1 | 3 | 4 | 1 | 1 | 1 | 1 5 | | 4 | 1 10 | 6 | ı | 4 | 2 | i | 5 | 2 | 1 | 35 | 38 |
| 2100 | 2 | 7 | 1 | 1 | 2 | 1 | 5 | 6 | 1 | 2 | 2 | 1 6 | | 5 | 1 4 | 2 | i | 2 | 1 | 1 | O | ā | i | 88 | 100 |
| 2200 | 2 | 7 | 1 | 1 | 2 | 1 | 11 | 13 | ı | 15 | 14 | 1 14 | 1 | 1 | 15 | 9 | ĺ | Õ | ŏ | i | 1 | . 0 | i | 113 | 108 |
| 2300 | 10 | 37 | 1 | 20 | . 38 | ı | 17 | 20 | ı | 21 | 19 | 1 21 | i | 6 | 1 25 | 15 | i | 4 | 2 | 1 | Ō | .ŏ | į | 118 | 147 |
| Bin Total | 109 | 405 | | 326 | 614 | | 466 | 559 | • | 591 | 531 | 791 | 55 | :2 | 866 | 519 | | 443 | 227 | 3 | 304 | 136 | | 4192 | 3050 |

¹⁾ Numbers have been extrapolated for 15-60 minute sample time.

Table R20. Hourly estimates of raw and weighted fish remakers by range bin (in meters) in front of unit 3, intake 35 using 6 X 12 degree horizontal transducer, for February 2. Indian Point, 1988.

| | 0-5 | | | 5-10 | | | 10-1 | 5 | | 15-20 | | | 20-25 | ٠ | | 25~90 | | | 3095 | | | 35~40 | | | HOURLY | TOTAL |
|--------------|-----|-----------|---|------|------|---|------|-----|-----|-------|-----|---|-----------|-----|---|--------|-----|---|--------|-----|----|-------|-----|-----|--------|--------------|
| Hour | Rau | HF | 5 | ;au | HF | R | lau | HF | | Rau | H | | pan Ta | HF | F | Sau St | WF | R | tau 30 | ИF | 5 | Rau . | WF | | Sen | WF |
| 0000 | 3 | 11 | ı | 12 | 23 | 1 | 14 | 17 | 7 | 28 | 25 | 1 | 17 | 13 | 1 | 29 | 17 | ī | 11 | 6 | 1 | 73 | 33 | 1 | 413 | 322 |
| 0100 | 4 | 15 | t | 4 | 8 | 1 | 5 | 6 | 1 | 15 | 14 | 1 | 16 | 12 | 1 | 17 | 10 | 1 | 2 | 1 | ı | 2 | 1 | 1. | 65 | 67 |
| 0200 | 7 | 26 | 1 | 26 | 49 | 1 | 41 | 49 | ì | 42 | 36 | 1 | 76 | 57 | 1 | 86 | 52 | í | 40 | 24 | į | 25 | 11 | 1 | 351 | 306 |
| 0300 | 16 | 60 | 1 | 32 | . 60 | ŧ | 42 | 50 | Ĺ | 50 | 45 | 1 | 78 | 59 | ı | 67 | 40 | 1 | 36 | 10 | ì | 91 | 14. | ı | 352 | 346 |
| 0400 | 3 | 11 | i | 37 | 70 | i | 45 | 54 | i | 43 | 39 | 1 | 67 | 50 | i | 89 | 53 | t | 22 | 11 | í | 24 | 11 | ì | 330 | 299 |
| 0500 | 2 | 7 | i | 16 | 30 | ı | 21 | 25 | i | 22 | 20 | • | 23 | 17 | 1 | 38 | 23 | i | 19 | 10 | i | 16 | 7 | ì | 157 | 139 |
| 0600 | 1 | 4 | 1 | 10 | 19 | 1 | 8 | 10 | ì | 15 | 14 | 1 | 12 | 9 | i | 35 | 21 | i | a | 4 | i | 12 | 5 | 1 | 101 | 86 |
| 0700 | 1 | 4 | i | э | 6 | Ĺ | 3 | 4 | ì | - 6 | 5 | 1 | 4 | 3 | i | 18 | 11 | i | 44 | 2 | i | 4 | 2 | ı | 43 | 37 |
| 0900 | 3 | 11 | í | 7 | 13 | i | 5 | 6 | i | 16 | 14 | ı | 10 | 8 | i | 19 | 11 | i | 10 | 5 | ì | 4 | 2 | 1 | 74 | 70 |
| 0900 | 1 | 4 | 1 | 7 | 13 | ì | 9 | 11 | i | 15 | 14 | 1 | 1-4 | 11 | 1 | 13 | 8 | l | :2 | 1 | 1. | 2 | 1 | ì | 63 | 63 |
| 1000 | 12 | 45 | ı | 25 | 47 | 1 | 25 | 30 | . 1 | 32 | 29 | 1 | 17 | 13 | ı | 18 | 11 | ı | O | . 0 | 1 | 0 | o | • | 129 | 175 |
| 1100 | 12 | 45 | 1 | 18 | 34 | ı | 16 | 19 | ı | 19 | 17 | į | 27 | 20 | ı | 17 | 10 | 1 | 7 | 4 | 1 | O | 0 | | 116 | 149 |
| 1200 | 8 | 90 | ı | 14 | 26 | t | 36 | 43 | 1 | 39 | 35 | ı | 97 | 20 | ı | 27 | 16 | t | 19 | 10 | 1 | 3 | 1 | ľ | 183 | 189 |
| 1300 | 1 | 4 | 1 | 6 | 11 | 1 | 22 | 26 | ì | 21 | 19 | ı | 16 | 12 | 1 | 19 | 11 | ſ | 1-4 | 7 | ŧ | . 12 | 5 | 1 | 211 | 95 |
| 1400 | 1 | 4 | ı | 2 | 4 | 1 | 3 | 4 | ì | 9 | 8 | 1 | 8 | 6 | 1 | 5 | 3 | 1 | 16 | 8 | 1 | 13 | 6 | 1 | 57 | 43 |
| 1500 | 2 | 7 | ı | 21 | 39 | 1 | 31 | 37 | i | 52 | 47 | 1 | 35 | 26. | t | 39 | 23 | ı | 33 | 17 | 1 | 44 | 20 | 1 | 202 | 238 |
| 1600 | 0 | 0 | 1 | 1 | 2 | ı | 3 | 4 | i | Э | 3 | ı | 4 | 3 | 1 | 4 | 2 | 1 | O | 0 | ı | 2 | 1 | i | 142 | 125 |
| 1700 | 0 | 0 | ı | 0 | 0 | 1 | 0 | 0 | 1 | Ò | D | 1 | 0 | CI | 1 | 0 | 0 | 1 | O | 0 | i | 0 | 0 | 1 | G | 0 |
| 1900 | 1 | 4 | ı | 7 | 19 | 1 | 14 | 17 | - 1 | 13 | 12 | 1 | 4 | 3 | 1 | 9 | 5 | t | э | 2 | ı | 7 | 3 | ı | 63 | 65 |
| 1900 | 2 | . 7 | 1 | 4 | 8 | t | 6 | 7 | - 1 | 7 | 6 | 1 | 7 | 5 | 1 | 12 | 7 | 1 | 8 | 4 | 1 | 12 | 5 | 1 | 58 | 49 |
| 2000 | 0 | 0 | 1 | O | 0 | ı | . 4 | 5 | 1 | 5 | 5 | ı | 1 | 1 | 1 | 6 | 4 | 1 | 2 | 1 | 1 | . 2 | 1 | 1 | 20 | 17 |
| 2100 | . 0 | 0 | ı | 1 | 2 | ł | 3 | 4 | ì | 3 | 3 | ı | 4 | Э | ſ | 3 | 2 | į | 22 | 1 | i | • 0 | 0 | ŧ | 16 | 15 |
| 2200 | 2 | 7 | ł | 5 | 9 | ı | 7 | 9 | | 10 | 9 | ı | 9 | 7 | ı | 9 | 5 | 1 | 8 | 2 | • | 0 | 0 | 1 | 45 | 47 |
| 2900 | 0 | 0 | 1 | 10 | 19 | | 29 | 28 | 1 | 41 | 87 | 1 | 95 | 26 | 1 | 99 | 29 | ŀ | 21 | 11 | 1 | 10 | 5 | _ [| 179 | 149 |
| Bin Total | 82 | 306 | | 268 | 505 | | 386 | 464 | | 506 | 450 | | 521 | 392 | | 615 | 368 | | 290 | 149 | | 299 | 134 | | 3349 | 309 0 |

¹⁾ Numbers have been extrapolated for 7-60 minute sample time.

Table A21. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 X 12 degree horizontal transducer, for February 3. Indian Point, 1988.

| | 0-5 | | | 5-10 | * | 11 |)-15 | | 15-20 | ٠. | | 20-25 | | | 25~3 | n | | 30-35 | | | 35-40 | | н | OURLY | TOTAL |
|--------------|-----|-----|---|------|-------------|------|-------|-----|-------|-----|---|-------|------|----|------|-----|---|-------|-----|----|--------------|----|---|-------|-------|
| Hour | Raw | HF | R | au | HF | Rau | HF | 1 | Raw | HF | | 90 | HF | R | au : | HF | R | eu | WF | | au | WF | | 20 | WF |
| 0000 | 2 | 7 | 1 | | - <u></u> - | 1 | 1 | | 21 | 19 | 1 | 10 | 8 | 1 | 12 | 7 | 1 | 7 | 4 | 1 | 9 | 1 | 1 | _341 | 300 |
| 0100 | 0 | Q | Ĺ | 1 | 2 | 1 6 | 5 7 | ı | 4 | 4 | 1 | Θ | 6 | I. | 15 | 9. | 1 | 13 | 7 | 1 | 8 | 4 | ı | 131 | 93 |
| 0200 | . 1 | 4 | i | 5 | 9 | 1 17 | ? 20 | 1 | 16 | 14 | 1 | 24 | . 18 | 1 | 23 | 14 | 1 | 5 | 3 | ı | 9 | 4 | ı | 100 | 86 |
| 0300 | · 1 | 4 | i | 10 | 19 | 3: | 3 40 | 1 | 36 | 32 | 1 | 18 | 14 | ı | 24 | 14 | i | 10 | 5 | j | 2 | 1 | ī | 147 | 142 |
| 0400 | Ġ | Ö | i | 0 | 0 | i |) 0 | i | Ō | 0 | 1 | 0 | O | 1 | 0 | 0 | i | O | 0 | 1 | 0 | 0 | i | 0 | 0 |
| 0500 | 3 | 11 | i | 7 | 13 | 1 12 | 2 14 | i | 6 | 5 | 1 | 6 | 5 | ı | 13 | 8 | i | 8 | 4 | 1 | 8 | 4 | t | 100 | 101 |
| 0600 | 4 | 15 | i | 8 | 15 | 1 | 9 11 | 1 | 7 | 6 | 1 | 5 | 4 | t | 7 | 4 | İ | 4 | 2 | Ĺ | 2 | 1 | ı | 46 | 58 |
| 0700 | 0 | 0 | i | 0 | 0 | 1 | l 1 | - 1 | 6 | 5 | ı | 1 | 1 | ŧ | 2 | 1 | ı | 2 | ` 1 | 1 | 2 | 1 | 1 | 14 | 10 |
| 0800 | ٥ | O | 1 | 0 | 0 | 1 : | 5 6 | i | 2 | . 2 | 1 | 6 | 5 | ŧ | 1 | 1 | ŧ | O | 0 | ı | ı | 0 | ŧ | 18 | 17 |
| 0900 | 3 | 11 | t | 2 | 4 | 1 | 3 10 | 1 | 12 | 11 | l | 9 | 7 | 1 | 13 | 8 | • | 3 | 2 | 1 | 1 | 0 | 1 | 65 | 68 |
| 1000 | 0 | 0 | t | 1 | 2 | 1 1 | l 13 | - 1 | 13 | 12 | ı | 21 | 16 | 1 | 15 | 9 | 1 | 4 | 2 | 1 | 6 | 3 | 1 | 71 | 57 |
| 1100 | 1 | 4 | • | 9 | 17 | 1 10 | 3 22 | ı | 21 | 19 | • | 18 | 14 | 1 | 15 | 9 | 1 | 6 | 3 | 1. | 2 | 1 | 1 | 90 | 89 |
| 1200 | 3 | 11 | 1 | 4 | 8 | 1 20 | 24 | - 1 | 19 | 17 | 1 | 21 | 16 | t | 17 | 10 | ı | 13 | 7 | 1. | 10 | 5 | 1 | 107 | 98 |
| 1300 | 2 | 7 | 1 | 13 | 24 | 1 1 | 3 10 | ı | 16 | 14 | ı | 24 | 18 | t | 17 | 10 | ı | 13 | 7 | ı | 12 | 5 | 1 | 120 | 108 |
| 1400 | 1 | 4 | ı | 4 | 8 | 1 .1 | 3 10 | 1 | 5 | 5 | 1 | 10 | 8 | t | 10 | 6 | f | 12 | 6 | ł | . 4 | 2 | ı | 54 | 49 |
| 1500 | • 1 | 4 | ı | 4 | 8 | 1 : | 5 6 | 1 | 11 | 10 | 1 | 15 | 11 | t | 9 | 5 | t | 12 | 6 | ı | 2 | 1 | ı | 59 | 51 |
| 1600 | 0 | 0 | t | 4 | 8 | 1 1: | 2 14 | 1 | 16 | 14 | ı | 21 | 16 | 1 | 29 | 17 | t | 12 | 6 | 1 | 12 | 5 | ı | 106 | 80 |
| 1700 | 0 | 0 | t | .1 | 2 | 1 | 7 8 | - 1 | ` 4 | 4 | ı | 9 | 7 | 1 | 13 | 9 | ı | 11 | 6 | 1 | 2 | 1 | t | 112 | 86 |
| 1900 | 0 | 0 | 1 | 8 | 15 | 1 1 | 4 17 | . [| 19 | 17 | 1 | 7. | 5 | ı | 23 | 14 | ı | 20 | 10 | 1 | 3 | 1 | ı | 94 | 79 |
| 1900 | 1 | 4 | 1 | . 4 | 8 | 1 2 | 3 24 | | 12 | 11 | 1 | 7 | 5 | 1 | 20 | 12 | 1 | 24 | 12 | i | 5 | 2 | ı | 93 | 78 |
| 2000 | 1 | 4 | ı | 2 | 4 | 1 (| 0 0 | i | 5 | 5 | ŧ | 4 | 3 | 1 | 3 | 2 | 1 | 3 | 2 | ı | 5 | 2 | 1 | 23 | 22 |
| 2100 | , n | 0 | ı | 0 | ٥ | 1 (| o a | 1 | Ω | 0 | ŧ | 1 | 1 | 1 | 3 | 2 | 1 | 0 | Q | ı | 2 | 1 | ŧ | 16 | 11 |
| 2200 | 4 | 15 | i | 16 | 30 | 1 10 | 3 22 | i | 18 | 16 | ı | 20 | 15 | 1 | 13 | 8 | 1 | 4 | 2 | ı | 2 | 1 | 1 | 105 | 120 |
| 2300 | 2 | 7 | İ | 10 | 19 | | 9 10 | - | 11 | 10 | 1 | 12 ~ | 9 | 1 | 8 | 5 | 1 | 4 | 2 | 1 | 2 | 1 | 1 | 228 | 252 |
| Bin Total | 30 | 112 | | 115 | 219 | 24 | 1 290 | 1 | 260 | 252 | | 277 | 212 | , | 305 | 103 | | 190 | 99 | | 105 | 47 | | 2239 | 2054 |

¹⁾ Numbers have been extrapolated for 10-60 minute sample time.

Table R22. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 95 using 6 X 12 degree horizontal transducer, for February 4. Indian Point, 1988.

| | 0-5 | | 5-10 | מ | 10- | 15 | 15-20 | | 20-25 | • | 25-3 | n | 30-3 | 5 | 35-40 | 1 | HOURLY | TOTAL |
|--------------|-----|-----|------|-----|------|-----|-------|-----|-------|-----|------|-----|-------|-----|-------|--------|--------|-------|
| Hour | Rau | HF | Rau | WF | Rau | HF | Raw | HF | Rau | WF | Rau | HF | Raw | WF | Rau | ИF | Reu | WF |
| 0000 | 1 | 4 | 1 16 | 30 | 1 28 | 94 | 1 24 | 22 | 1 16 | 12 | 1 18 | 11 | 1 6 | - 3 | 1 2 | 1 | l ·139 | 1 46 |
| 0100 | 10 | 37 | 1 34 | 64 | 1 38 | 46 | 1 19 | 17 | 50 | 38 | 1 45 | 27 | 1 19 | 10 | i 15. | - | 1 230 | 246 |
| 0200 | 6 | 22 | 1 18 | 34 | 1 30 | 36 | 1 42 | 38 | 1 39 | 29 | 1 40 | 24 | i ié | 9 | 1 6 | , 3 | 1 398 | 390 |
| 0300 | 2 | 7 | 1 9 | 17 | i 17 | 20 | 1 23 | 21 | i 21 | 16 | 1 29 | ĩż | 1 12 | 6 | 1 14 | 6 | 254 | 220 |
| 0400 | 4 | 15 | 1 14 | 26 | 1 44 | 53 | i 42 | 38 | 1 49 | 37 | 1 59 | 35 | i 33 | 17 | 16 | 7 | 1 261 | 228 |
| 0500 | ū | Ď | i 4 | 8 | 1 16 | 19 | i 15 | 14 | 1 20 | 15 | 1 23 | 14 | 1 12 | 6 | iB | . 4 | 98 | 80 |
| 0600 | ō | Ŏ | i | Ž | i 7 | 8 | i 10 | 9 | 1 4 | э. | i 20 | 12 | i 5 | 3 | 1 6 | 9 | i 53 | 40 |
| 0700 | ī | 4 | i ā | ē | 1 5 | 6 | i 9 | ě | 1 10 | ē | 1 6. | 4 | i 12 | 6 | 1 14 | 6 | 1 61 | 50 |
| 0800 | ī | 4 | i a | 6 | iā | 5 | i a | ā | i 6 | 5 | 1 8 | 5 | i 7 | 3 | 1 4 | 2 | i 35 | 33 |
| 0900 | Ö | o | 1 1 | . 2 | i ai | Š | ii | · ī | 1 2 | 2 | i ž | ī | iii | ĭ | i 7 | ö | 1 12 | 12 |
| 1000 | 1 | 4 | i i. | 2 | i 10 | 12 | į ž | 6 | 1 6 | 5 | 1 6 | 4 | i 4 | Ž | i | õ | 40 | 39 |
| 1100 | 2 | 7 | i 5 | 9 | i 5 | 6 | i 11 | 10 | 1 9 | Ž | 1 6 | 4 | 1 4 | 2 | i ō | ŏ | 1 42 | 45 |
| 1200 | · O | 0 | 1 2 | 4 | 1 2 | 2 | 1 6 | 5 | I B | 6 | i ž | 4 | io | ō | iõ | Ď | i 25 | 21 |
| 1300 | . 3 | 11 | i ā | . 6 | i 10 | 12 | 1 10 | 9 | 1 15 | 11 | 1 5 | a | i i | Ţ. | i | ō | i 47 | 53 |
| 1400 | 1 | 4 | 1 4 | 8 | 1 6 | 7 | 1 11 | 10 | 1 11 | ė | i 10 | 6 | i i . | i | 1 2 | ī | 46 | 45 |
| 1500 | Ó | 0 | 1 6 | 11 | i 4 | 5 | 1 7 | 6 | 1 5 | 4 | 1 12 | 7 | iż | - 1 | ; 7 | ò | 41 | 38 |
| 1600 | 1 | 4 | 1 9 | 17 | 1 5 | 6 | 1 19 | 12 | 1 12 | 9 | i ä | 5 | 1 5 | ā | iš | 2 | 59 | 58 |
| 1700 | 2 | 7 | i 5 | 9 | 1 8 | 10 | 1 15 | 14 | 1 24 | 18 | 1 10 | 6 | i š | ă | i 2 | 3 | 1 77 | 70 |
| 1800 | 2 | 7 | i '5 | 9 | 1 10 | 12 | 1 14 | 13 | 1 9 | 7 | 1 15 | 9 | 1 14 | 7 | i 2 | ĭ | i 71 | 65 |
| 1900 | 2 | 7 | 1 1 | 2 | 1 9 | 11 | 9 | ě | iá | 6 | 1 12 | 7 | 1 13 | 7 | i 2 | i | 56 | 49 |
| 2000 | 1 | 4 | i i | 2 | 1 3 | 4 | i 5 | Š | i 4 | ă | i 7 | i | 1 3 | 2 | i 2. | • | 20 | 22 |
| 2100 | Õ | Ď | 1 2 | · 4 | i 3 | Ä | i ī | ĭ | i s | 2 | i ż | i | i 2 | 7 | i | ż | 1 18 | 15 |
| 2200 | ī | 4 | 1 2 | . 4 | ii | 1 | i | ö | i 2 | 2 | i ī | i | i 4 | ż | i i | ō | 1 13 | 15 |
| 2300 | · 1 | 4 | 1 1 | 2 | 1 3 | 4 | 1 4 | 4 | i 2 | 2 | 1 2 | i | 1 1 | ī | ii | ŏ | 1 15 | 18 |
| Bin Total | 42 | 156 | 151 | 286 | 272 | 328 | 901 | 274 | 385 | 255 | 347 | 209 | 184 | 97 | 115 | 50 | 2109 | 1998 |

¹⁾ Numbers have been extrapolated for 30-60 minute sample time.

Table R23. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 % 12 degree horizontal transducer, for February 5. Indian Point, 1988.

| | 0-5 | | | 5-10 | | 10-1 | 5 | 15-20 | | 20-25 | | 25-3 | n | 30-3 | 5 | 35-40 | 1 | HOLIE | Y TOTAL |
|--------------|-----|----|-----|-----------|----|------|-----|-------|-----|-------|----|------|----------|------|----|-------|-----|--------|---------|
| Hour | Rau | HF | Ra | | NF | Raw | WF | Rau | WF | Reu | HF | Rau | WF | Raw | WF | Raw | HF | Rau | HF |
| 0000 | 0 | 0 | 1 | 5 | 9 | 1 6 | 7 | 1 6 | 5 | 1 7 | 5 | 1 2 | | ι ο | | 1 0 | 0 | 1 . 26 | 27 |
| 0100 | a | 0 | 1 | 2 | 4 | i 1 | 1 | 1 4 | . 4 | 1 4 | 3 | 1 3 | 2 | 1 0 | 0 | 1 0 | 0 | 1 15 | |
| 0500 | D | 0 | i | 1 | 2 | i i | 1 | i i | 1 | 1 2 | 2 | 1 2 | <u>ī</u> | i 3 | 2 | 1 1 | ā | 1 11 | |
| 0300 | 1 | 4 | i | Õ | ō | Ó i | Ō | 1 3 | ã. | i 5 | 4 | 1 3 | Ž | i ŏ | ō | iò | o. | 1 12 | |
| 0400 | 7 | 26 | i | Ō | ō | i ī | 1 | i ī | ī | i ă | 3 | 1 2 | ī | i ŏ | Ö | i ă | 2 | 1 19 | |
| 0500 | 2 | 7 | i | 0 | 0 | 1 3 | 4 | i 5 | 5 | 1 10 | 8 | 1 17 | 10 | i 5 | 3 | 1 1 | Ö | 1 43 | |
| 0600 | 1 | 4 | 1 | O | 0 | i ė | 10 | 1 6 | 5 | 1 2 | 2 | 1 4 | 2 | 1 2 | ī | 1 1 | 0 | 1 24 | |
| 0700 | 1 | 4 | ı | 3 | 6 | 1 2 | 2 | 1 2 | 2 | 1 2 | 2 | 1 7 | 4 | 1 2 | 1 | 1 0 | 0 | 1 19 | 21 |
| 0800 | Ó | O | 1 | 0 | 0 | 1 0 | 0 | 1 1 | 1 | 1 0 | 0. | 1 3 | 2 | 1 0 | 0 | 1 1 | 0 | 1 6 | . 3 |
| 0900 | 0 | 0 | i | 0 | 0 | 1 2 | 2 | 1 1 | 1 | 1 0 | 0 | i | Ō | 1 1 | 1 | 1 0 | O | 1 5 | 5 |
| 1000 | 0 | 0 | ı | 2 | 4 | 1 3 | 4 | 1 1 | 1 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 6 | Q. | 1 13 | 19 |
| 1100 | 0 | 0 | ı | 6 | 11 | 1 4 | 5 | 1 2 | 2 | 1 4 | 3 | 1 2 | 1 | 1 1 | 1 | 1 0 | 0 | 1 19 | 23 |
| 1200 | 0 (| 0 | 1 | 1 | 2 | 1 0 | 0 | 1 2 | 2 | 1 4 | 3 | 1 2 | 1 | 1 1 | 1 | 1 0 | 0 | 1 10 | 9 |
| 1300 | 0 | 0 | 1 | 2 | 4 | 1 10 | 12 | 1 3 | 3 | 1 2 | 2 | 1 1 | 1 | 1 0 | C | 1 0 | 0 | 1 18 | 22 |
| 1400 | Q | O | 1 | 3 | 6 | 1 1 | 1 | 1. 2 | 2 | 1 3 | 2 | 1 2 | 1 | 1 0 | 0 | 1 3 | 1 | 1 14 | 13 |
| 1500 | - 1 | 4 | 1 | 1 | 2 | 1 3 | 4 | 1 9 | 8 | 1 8 | 6 | 1 7 | 4 | 1 6 | 3 | 1 1 | 0 | 1 36 | 31 |
| 1600 | 0 | 0 | 1 | 1 | 2 | 1. 3 | 4 | 1 4 | 4 | 1 5 | 4 | 1 4 | 2 | 1 0 | 0 | 1 0 | 0 | 1 17 | 16 |
| 1700 | 0 | 0 | ı | 1 | 2 | 1 2 | - 2 | 1 2 | 2 | 1 3 | 2 | 1 3 | 2 | 1 1 | 1 | 1 0 | . 0 | 1 13 | 12 |
| 1900 | 1 . | 4 | 1 | 2 | 4 | 1 1 | 1 | 1 6 | 5 | 1 4 | 3 | 1 10 | 6 | 1 5 | 3 | 1 1 | 0 | 1 30 | 26 |
| 1900 | 1 | 4 | 1 | 0 | 0 | 1 0 | 0 | 1 1 | 1 | 1 2 | 2 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 4 | 7 |
| 2000 | 1 | 4 | l i | 0 | 0 | 1 0 | 0 | 1 1 | 1 | 1 2 | 2 | 1 0 | 0. | 1 0 | 0 | 1 0 | . 0 | 1 4 | · 7 |
| 2100 | 0 | 0 | 1 | 1 | 2 | 1 1 | 1 | 1 3 | 3 | 1 3 | 2 | 1 0 | G | 1 0 | 0 | 1 0 | 0 | 1 8 | 8 |
| 2200 | 0 | ۵ | 1 | 0 | 0 | 1 3 | 4 | 1 2 | 2 | 1 2 | 2 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 8 | 9 |
| 2300 | 1 | 4 | 1 | 1 | 2 | 1 5 | 6 | 1 2 | 2 | 1 1 | 1 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 11 | 16 |
| Bin Total | 17 | 65 | | 32 | 62 | 60 | 72 | 70 | 66 | 80 | 64 | 76 | 45 | 27 | 17 | 13 | 3 | 385 | 406 |

¹⁾ Numbers have been extrapolated for 32-60 minute sample time.

Table A24. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 % 12 degree horizontal transducer, for February 6. Indian Point, 1988.

| | 0-5 | | 5-: | 10 | | 10-1 | 5 | 15-20 | | 20-25 | | 25-3 | 30 | 30-3 | 5 | 35-40 | ı | HOURLY | TOTAL |
|--------------|------------|------|-------|----|-----|------|----|-------|-----|-------|-----|------|-----|-------|----|-------|-----|--------|-------|
| Hour | Rau | HF | Rau | | ₽. | Raw | NF | Rau | WF | Rau | WF | Rau | HF. | Rau | WF | Rau | HF | Rau | WF |
| 0000 | 2 | 7 | 1 4 | | 8 1 | 3 | 4 | 1 5 | . 5 | 1 3 | 2 | 1 2 | 1 | 1 0 | 0 | 1 0 | 0 | 1 . 19 | 27 |
| 0100 | 1 | 4 | 1 2 | | 4 1 | 6 | 7 | 1 1 | 1 | 1 3 | 2 | E 1 | 2 | 1 2 | 1 | 1 0 | 0 | 1 19 | 23 |
| 0200 | 1 | 4 | 1 2 | | 4 1 | 3 | 4 | 1 4 | 4 | 1 1 | 1 | 1 2 | . 1 | 1 0 | 0 | 1 0 | 0 | 1 13 | 16 |
| 0300 | ٥ | . 0 | 1 1 | | 2 1 | 6 | 7 | 1 6 | 5 | 1 10 | - 8 | 1 4 | 2 | 1 2 | 1 | 1 2 | . 1 | 1 31 | 26 |
| 0400 | ٥ | 0 | 1 4 | | 8 1 | 0 | Q | 1 3 | 3 | 1 . 3 | 2 | 1 3 | 2 | 1 1 | 1 | 1 3 | 1 | 1, 17 | 17 |
| 0500 | 1 | 4 | 1 1 | | 2 1 | • 0 | 0 | 1 1 | 1 | 1 0 | ۵ | l 2 | 1 | 1 0 | 0 | 1 1 | 0 | 1 6 | 6 |
| 0600 | ٥ | 0 | 1 4 | | 8 1 | 6 | 7 | 1 2 | 2 | 1 7 | 5 | 1 0 | 0 | ιco | 0 | 1 0 | O | 1 19 | 22 |
| 0700 | 1 | 4 | 1 3 | | 6 1 | 11 | 13 | 1 1 | 1 | 1 4 | 3 | 1 4 | 2 | 1 0 | 0 | 1 0 | O | 1 24 | 29 |
| 0000 | 0 | 0 | 1 0 | | 0 1 | . 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | . 1 0 | 0 | 1 0 | 0 | 1 0 | C |
| 0900 | 0 | 0 | 1 1 | | 2 l | 0 | 0 | 1 0 | . 0 | 1 0 | 0 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 2 | 3 |
| 1000 | 0 | 0 | 1 1 | | 2 1 | 0 | 0 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 2 | 3 |
| 1100 | Ð | O | 1 2 | | 4 1 | 0 | 0 | 1 1 | 1 | 1 0 | O | 1 0 | 0 | 1 1 | 1 | 1 0 | 0 | 1 4 | ε |
| 1200 | O . | 0 | 1 3 | | 6 1 | 1 | 1 | 1 4 | 4 | 1 3 | 2 | t 1 | 1 | 0 1 | 0 | 1 0 | . 0 | 1 . 12 | 1- |
| 1300 | 1 | 4 | į ž | | 4 1 | Ŏ | O | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 0 | a | 1 4 | 9 |
| 1400 | Ò | o | i 2 | | 4 1 | 3 | 4 | i 7 | 6 | 1 2 | 2 | 1 0 | 0 | i i | 1 | 1 0 | 0 | 1 15 | 17 |
| 1500 | Ö | Õ | 1 3 | | 6 1 | ĭ | 1 | i 0 | 0 | 1 4 | 3 | 1 0 | 0 | i o | Ö | 1 0 | 0 | | 10 |
| 1600 | ū | Ō | i 1 | | 2 1 | Ŏ | Ō | 1 1 | 1 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 3 | |
| 1700 | Ď. | ŏ | i ā | | ōi | ō. | ٥ | i i | 1 | 1 4 | 3 | i 1 | 1 | 1 0 | 0 | 1 1 | 0 | 1 7 | 5 |
| 1800 | Ŏ | Õ | i ā | | οi | Õ | Ō | i | . 0 | i i | 1 | 1 2 | 1 | i ë | 0 | 1 1 | 0 | 1 4 | 2 |
| 1900 | Ö | ŏ | 1 2 | | 4 1 | 2 | 2 | 1 . 1 | 1 | 1 0 | O | 1 0 | Ö | 1 2 | 1 | 1 0 | O | 1 7 | ε |
| 2000 | Ö | Ŏ | i . ī | | 2 1 | ō | ō | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 1 | 1 | 1 0 | 0 | 1 3 | 4 |
| 2100 | Ō | Ō | i o | | Ōi | · ŏ | 0 | 1 . 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 1 | 1 | 1 0 | 0 | 1 2 | 2 |
| 2200 | Ó | 0 | i o | | 0 1 | Ō | 0 | 1 0 | 0 | 1 0 | 0 | 1, 1 | 1 | 1 1 | 1 | 1 0 | Q | 1 2 | * |
| 2900 | 0 | 0 | ,1 1 | | 2 1 | 1 | 1 | 1 1 | 1 | 1 9 | 2 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 7 | |
| Bin Total | 7 | . 27 | 40 | | 90 | 43 | 51 | 43 | 41 | 49 | 97 | 27 | 1.7 | 12 | 9 | 8 | 2 | 230 | 266 |

¹⁾ Numbers have been extrapolated for 55-60 minute sample time.

Table fi25. Hourly estimates of rew and weighted fish numbers (with high and low tide heights) in front of unit 3, intake 35 using 6 X 12 degree horizontal transducer for week 3, January 31 to February 6. Indian Point, 1988.

| | J | RN 31 | | | FEB 1 | | | EB 2 | | | FEB 3 | | , | FEB 4 | | F | EB 5 | | | EB 6 | | HEE | |
|--------|------|-------|------|-------|-------|-------|-------|------|------|-------|-------|------|-------|-------|------|------|------|-------|------|------|------|--------|-------|
| Heur | PRH | HF | Tide | RFM | HF | Tide | RAM | MF | Tide | RAH | MF | Tich | PAH | MF | Tide | RAM | HF | Tide | RAN | HF | Tide | P.P.H | HF |
| DEIGIO | 139 | 127 | | 1 316 | 314 | | 1 419 | 323 | | 1 341 | 900 | | 1 139 | 1-46 | 1.2 | 1 26 | 27 | 1.2 | 1 19 | 27 | | 1 1395 | 1263 |
| 0100 | 78 | 50 | | 1 35- | 252 | | 1 65 | 67 | | 1 131 | 93 | | 1 230 | 2-6 | | 1 15 | 15 | | 1 19 | 23 | 1.2 | 1 862 | 745 |
| 0200 | 579 | 348 | | 1 336 | 270 | | I 951 | 306 | | 1 100 | 86 | | 1 398 | 390 | | 1 11 | 9 | | 1 19 | 18 | | 1 1790 | 1427 |
| 0360 | 109 | 95 | 9.0 | 1 226 | 177 | • | 1 352 | 346 | | 1 147 | 142 | | 1 254 | 220 | | 1 12 | 13 | | 1 31 | 26 | | 1 1131 | 1019 |
| 0400 | 76 | 54 | | 6 67 | 75 | 0.0 | 1 930 | 299 | | 1 0 | 0 | | 1 261 | 228 | | 1 19 | 34 | | 1 17 | 17 | | 790 | 707 |
| 0500 | 21 | 21 | | 1 46 | | | 1 157 | 199 | 0.0 | 1 100 | 101 | | 1 98 | 90 | | 1 43 | 37 | | 1 6 | a | | 1 473 | 422 |
| 06.00 | 41 | 57 | | 1 93 | 86 | | 1 101 | 86 | | 1 46 | 58 | -0.1 | 1 59 | 40 | 0.0 | 1 24 | 24 | | 1 19 | 23 | | 1 377 | 979 |
| 0700 | 89 | 87 | | 1 153 | 159 | | 1 43 | 87 | | 1 14 | 10 | , | 1 61 | 50 | | 1 19 | 21 | 0.0 | 1 24 | 29 | 0.0 | 1 403 | 993 |
| neco | 69 | 59 | | 1 232 | 297 | | 1 74 | 70 | | 1 16 | 17 | | 1 95 | 33 | | 1 6 | 3 | - | 1 0 | ò | | 1 434 | 469 |
| 0900 | 130 | 122 | 1.4 | 1 154 | 183 | | 1 63 | 63 | | 1 65 | 68 | | 1 12 | 12 | | 1 5 | 5 | | 1 2 | 3 | | 1 434 | 456 |
| 1000 | 202 | 291 | - | 1 147 | 171 | 1.4 | 1 129 | 175 | | 1 71 | 57 | | 1 40 | 39 | | 1 13 | 19 | | 1 2 | 3 | | 604 | 694 |
| 1100 | 110 | 91 | | 1 147 | 171 | • • • | 1 116 | 149 | 1.4 | 1 90 | 89 | 1.4 | 42 | 45 | | 1 19 | 29 | | 1 4 | ě | | 528 | 574 |
| 1200 | 273 | 224 | | 1 182 | 166 | | 103 | 189 | | 1 107 | 98 | | 1 25 | 21 | 1.4 | 1 10 | 9 | 1.3 | 1 12 | 14 | | 793 | 721 |
| 1300 | 147 | 105 | • | 1 126 | | - | 1 111 | 95 | | 1 120 | 108 | | 1 47 | 59 | | 1 10 | 22 | • | 1 4 | 9 | 1.2 | 573 | 498 |
| 1400 | 175 | 147 | | 1 202 | | | 57 | 43 | | 1 54 | 49 | | 1 46 | 45 | | 1 14 | 13 | | 1 15 | 17 | ••• | 563 | 454 |
| 1500 | 138 | 136 | | 1 922 | | | 202 | 238 | | 1 59 | 51 | | 1 41 | 38 | | 1 36 | 31 | • | 1 8 | 10 | | 1 986 | 767 |
| 1600 | 101 | 93 | -0.1 | 1 226 | | | 1 142 | 125 | | 1 106 | 80 | | 50 | 58 | | 1 17 | 16 | | i š | - 4 | | 655 | 572 |
| 1700 | 46 | 42 | | 1 12 | | -O. I | 1 0 | 0 | | 1 112 | 86 | | 1 77 | 70 | | 1 13 | 12 | | i ž | 5 | | 376 | 325 |
| 1800 | 95 | 101 | | 1 297 | | | 1 63 | 65 | O. 1 | 1 94 | 79 | -0.1 | 71 | 65 | | 1 90 | 26 | | i à | ž | | 654 | 562 |
| 1900 | 54 | 46 | | 1 01 | | | 1 50 | 49 | | 1 98 | 70 | | 1 54 | 49 | -0.1 | 1 4 | 7 | -O. 1 | i 7 | ē | | 1 342 | 207 |
| 2000 | 93 | 101 | • | 1 35 | | | 1 20 | 17 | | 1 23 | 22 | | 1 20 | 22 | | 1 4 | 7 | | 1 3 | 4 | 0.0 | 200 | 211 |
| 2100 | 177 | 163 | | 1 96 | | | 1 16 | 15 | | 1 16 | 11 | | 1 10 | 15 - | | į ė | 8 | | 1 2 | ż | | 325 | 314 |
| 2200 | 140 | 171 | 1.1 | | | 1.1 | 1 45 | 47 | | 1 105 | 120 | | 1 13 | 15 | | 1 0 | 9 | | 1 2 | 2 | | 426 | 472 |
| 2300 | 331 | 357 | | 1 118 | | | 1 179 | 149 | 1.2 | | 252 | | 1 15 | 10 | | i 11 | 16 | | 1 7 | 7 | | 1 889 | 946 |
| Deily | 3417 | 3028 | | 4) 92 | 3050 | | 3949 | 8090 | | 2239 | 2054 | ţ | 2109 | 1990 | | 205 | 406 | | 290 | 266 | | 15921 | 14692 |

Tide heights for low end high tide only. New York (the Bettery). N.Y. end times adjusted for Indian Point Location.

Table 826. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 X 12 degree elliptical horizontal transducer, for February 7. Indian Point, 1988.

| | 05 | | 5-10 | | 10~15 | | 15-20 | 20-25 | | | 25-3 | 0 | 30-35 | i | 35-4 | 0 | HO | DURLY TO | TOTAL | |
|--------------|-----|----------|------|------|-------|-----|-------|-------|----|---------|------|-----|----------|-------|------|-----|----------|------------|-------|-----|
| Hour | Rau | WF | Rau | W | F | ?au | WF | Rau | WF | Rau | WF | Rau | WF | Raw | WF | Rau | WF | Ra | | MF |
| 0000 | 1 | 4 | i 1 | | 2 I | 2 | 2 | 1 2 | 2 | 1 3 | 2 | 1 3 | <u>2</u> | 1 0 | 0 | 1 0 | 0 | 1. | 12 | 14 |
| 0100 | O | 0 | 1 0 | + | Ó | 2 | . 2 | 1 0 | 0 | 1 7 | 5 | 1 2 | 1 | 1 2 | 1 | 1 0 | 0 | 1 | 27 | 19 |
| 0200 | 0 | 0 | i o | | Ói | . 2 | 2 | 1 0 | 0 | i .6 | 5 | 1 4 | 2 | 1 0 | ā | i ī | Õ | · j | 13 | 9 |
| 0300 | Ō | Û | i a | | Ōi | 1 | 1 | i i . | 1 | i š | 2 | 1 3 | Ž | 1 2 | 1 | 1 2 | ī | 1 | 12 | 3 |
| 0400 | ū | Ŏ | 1 2 | | 4 1 | 2 | 2 | i o | Ŏ | 1 4 | 3 | i | ō | i ō | Ŏ | i Ž | i | i | 10 | 10 |
| 0500 | 0 | O | i a | ٠.,٠ | 0 1 | Ō | ã | i ö | O | 1 2 | 2 | 1 1 | ī | i i | 1 | i 2 | ī | 1 | 6 | 5 |
| 0600 | 1 | 4 | 1 0 | 1 | o i | 1 | 1 | 1 0 | O | 1 2 | 2 | 1 1 | 1 | 1 0 | Ô | 1 1 | Ō | i | E | Э |
| 0700 | Ó | O | 1 0 | 1 | o i | O. | 0 | 1 0 | 0 | 1 0 | 0 | 1 0 | Ō | i o | Ō | 1 0 | Ō | i | Ū | O |
| 0800 | 0 | Ū. | 1 0 | | 0 1 | O | ū | 1 0 | o | 1 2 | 2 | io | . 0 | i o | 0 | 1 0 | Ö | i | 2 | 2 |
| 0900 | 1 | 4 | 1 0 | | 0 1 | o | Û | 1 0 | ũ | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 | 1 | 4 |
| 1000 | 0 | Ü, | 1 0 | f | 1 0 | 3 | 4 | 1 3 | Э | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 | 7 | ij |
| 1100 | υ | Û | 1 0 | 1 | 0 1 | 3 | 4 | 1 3 | Э | 1 1 | 1 | 1 0 | O | 1 0 | 0 | 1 0 | 0 | ł | 7 | 13 |
| 1200 | 0 | Û | 1 1 | | 2 | . 1 | 1 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 4 | 3 | 4 |
| 1300 | ٥ | 0 | 1 0 | 1 | 0 1 | 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 | O | O |
| 1400 | Q | Û | 1 0 | 1 | 0 1 | o | 0 | 1 0 | 0 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 0 | ٥ | ŧ | 1 | 1 |
| 1500 | υ | 0 | 1 0 | 1 | 0 1 | 2 | 2 | 1 0 | 0 | 1 1 | 1 | 1 1 | 1 | 1 0 | ٥ | 1 0 | 0 | ŧ | 4 | 4 |
| 1600 | 0 | 0 | 1 0 | 1 | ו ט | 2 | 2 | 1 0 | 0 | 1 1 | 1 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 | 4 | 4 |
| 1700 | 0 | 0 | 1 0 | | 0 1 | 2 | 2 | 1 2 | 2 | 1 4 | 3 | 1 5 | 3 | 1 1 | . 1 | 1 0 | O | t | 14 | 1.1 |
| 1800 | 0 | 0 | 1 3 | | 6 1 | . 1 | 1 | ıo | 0 | 1 2 | 2 | 1 3 | 2 | 1 1 | 1 | 1 0 | . 0 | 1 | 10 | 12 |
| 1900 | O. | 0 | 1 2 | | 4 1 | ı. | 1 | 1 1 | 1 | 1 4 | 3 | 1 1 | 1 | 1 0 | Q | 1 1 | 0 | 4 | 10 | 10 |
| 2000 | o | o | 1 0 | | 0 1 | O | 0 | 1 2 | 2 | 1 1 | 1 | 1 3 | 2 | : 2 | 1 | 1 0 | 0 | 1 | 8 | 6 |
| 2100 | • 0 | o | 1 0 | | 0 1 | 0 | Û | 1 0 | 0 | 1 0 | 0 | 1 2 | 1 | 1 2 | 1 | 1 1 | 0 | . f | 5 | 2 |
| 2200 | 0 | ō | 1 0 | | ום | 1 | 1 | 1 0 | 0 | 1 0 | O | 1 0 | 0 | 1 0 | 0 | 1 0 | ٥ | ŧ | 1 | 1 |
| 2300 | 0 | <u> </u> | ; 1 | | 2 I | 0 | 0 | ; O | 0 | 1 4 | 3 | 1 3 | 2 2 | 1 | 1 | 1 0 | <u> </u> | 1 | 9 | 8 |
| Bin Total | 3 | 12 | 110 | 2 | 0 | 26 | 28 | 15 | 15 | 49 | 40 | 33 | 22 | 12 | 8 | 10 | 3 | | 172 | 158 |

¹⁾ Numbers have been extrapolated for 29-60 minute sample time.

Table R27. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 X 12 degree elliptical horizontal transducer, for February 8. Indian Point, 1988.

| | 0-5 | | 5-10 | | 10-1 | 5 | 15-20 | | 20-25 | | 25-30 |) | 30-35 | i | 35~40 | | HOUPLY | Y TOTAL |
|--------------|------------|----|------|-----|------|-------|--------------------|------|-------|----------|-------|-----|-------|-----|-------|----|--------|----------------|
| Hour | Pau | WF | Rau | | Raw | WF | P.au | WF . | Rau | WF | Rau | HF | Raw | WF | Rau | WF | Rau | ₩ - |
| 0000 | 0 | 0 | 1 3 | 6 1 | 4 | 5 | 1 3 | 3 | | 0 | 1 · 5 | 3 | 1 1 | 1 | 1 0 | ٥ | 1 16 | 18 |
| 0100 | ō | ō. | i ō | Ō | 1 | 1 | 1 1 | 1 | 1 3 | 2 | 1 1 | . 1 | 1 0 | 0 | 1 0 | 0 | 1 6 | 5 |
| 0200 | ă | ŏ | 1 5 | 9 i | 2 | 2 | 1 2 | 2 | 1 2 | 2 | 1 1 | 1 | 1 1 | 1 | 1 0 | oʻ | 1 13 | 17 |
| 0300 | ā | ŏ | 1 1 | 2 | 2 | 2 | 1 1 | 1 | 1 1 | 1 | 1 1 | 1 | 1 0 | O | 1 1 | 0 | 1 7 | ? |
| 8400 | ŏ | ă | 1 3 | 6 | . 1 | 1 | 1 1 | ī | 1 3 | 2 | 1 1 | 1 | 1 2 | 1 | 1 0 | 0 | 1 11 | 12 |
| 0500 | ō | ō | 1 2 | 4 | 2 | 2 | i 4 | 4 | 1 3 | 2 | 1 5 | 3 | 1 2 | 1 | 1 0 | 0 | 1 18 | 16 |
| ~ 0600 | ī | 4 | iī | 2 1 | . 1 | 1 | 1 2 | 2 | i 6 | 5 | 1 7 | 4 | 1 2 | 1 | 1 1 | 0 | 1 21 | 1.3 |
| 0700 | o o | o | i 5 | 9 i | 0 | Õ | $i = \overline{1}$ | 1 | 1 0 | O. | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 6 | 10 |
| 0800 | ū | ã | 1 0 | Ď | ū | Ö | 1 2 | 2 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 3 | 3 |
| 0900 | · i | .4 | 1 1 | 2 1 | 1 | ĩ | 1 0 | 0 | 1 0 | 0 | 1 0 | Ð | 1 0 | 0 | 1 0 | 0 | ; 3 | 7 |
| 1000 | Ŏ | o | ii | 2 | 2 | 2 | 1 3 | 3 | 1 1 | 1 | 1 '1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 9 | 10 |
| 1100 | ō | Ō | 1 1 | 2 | 0 | ស | 1 2 | 2 | 1 0 | 0 | 1 0 | Q | 1 0 | 0 | 1 0 | 0 | 1 3 | 4 |
| 1200 | ō | O | 1 0 | 0 | 0 | 0 | 1 0 | o | 1 1 | 1 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 2 | 2 |
| 1300 | . 0 | 0 | 1 1 | 2 1 | 1 | 1 | 1 0 | O | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 3 | -4 |
| 1400 | 0 | Û | 1 1 | 2 1 | 1 | 1 | 1 0 | a | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 3 | 4 |
| 1500 | 0 | 0 | 1 0 | 0 1 | | O | 1 0 | 0 | 1 3 | . 2 | 1 1 | 1 | 1 0 | Ū | 1 1 | 0 | 1 5 | :3 |
| 1600 | Ω | 0 | 1 1 | 2 1 | 1 | 1 | 1 0 | 0 | 1 0 | Ō | 1 2 | 1 | 1 3 | 2 | 1 2 | 1 | 1 9 | 7 |
| 1700 | 3 | 11 | 1 0 | 0.1 | 1 | 1 | 1 0 | .0 | 1 0 | O | 1 0 | 0 | 1 0 | 0 | 1 -1 | 0 | 1 5 | 12 |
| 1300 | 1 | 4 | 1 2 | 4 1 | 1 | 1 | 1 3 | 3 | 1 2 | 2 | 1 2 | 1 | 1 4 | 2 | 1 1 | O | 1 16 | 17 |
| 1900 | 0 | 0 | 1 1 | 2 (| 2 | 2 | 1 1 | 1 | 1 0 | O | 1 0 | 0 | 1 1 | 1 | 1 2 | Ţ | 1 7 | 7 |
| 2000 | 0 | Û | 1 0 | 0 (| 0 | 0 | 1 2 | 2 | 1 0 | O | 1 0 | 0 | 1 0 | , O | 1 1 | 0 | ; 3 | 2 |
| 2100 | 1 | 4 | 1 0 | 0 (| i O. | O | 1 3 | 3 | 1 1 | 1 | 1 2 | ł | 1 0 | 0 | 1 4 | 2 | 1 11 | 11 |
| 2200 | 1 | 4 | 1 0 | 0 (| 0 | 0 | 1 1 | 1 | 1 1 | 1, | 1 0 | O | 1 1 | 1 | 1 1 | 0 | 1 5 | 7 |
| 2300 | 0 | G | 1 1 | 2 1 | 0 | 0 | 1 0 | 0. | 1 0 | O | 1 0 | O | I 0 | 0 | 1 1 | 0 | 1 2 | 2 |
| Bin Total | 8 | 31 | 30 | 58 | 23 | 24 | . 32 | , 32 | 30 | 25 | 30 | 20 | 17 | 11 | 16 | 4 | 167 | 206 |

¹⁾ Numbers have been extrapolated for 55-60 minute sample time.

Tible R28. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 9, intake 35 using 6 X 12 degree elliptical horizontal transducer, for February 9. Indian Point, 1988.

| | 0-5 | | | 5-10 | | 10-1 | | 15-20 | | 20-25 | | 25-3 | | 30-3 | | 35-40 | | HOUPLY | |
|--------------------------|-------|------|----|--------|-----|-------|-----|-------|----|-------|------|----------------|----------|-------|-----|-------|----|--------|-------------|
| Heir | Flau | WF · | R. | aw | HF | P.au | WF | Rau | WF | Rau | lif. | Rau | WF | Rau | WF | Rau | WF | Rau | 54 1 |
| 130310 | O | o | ı | 1 | 2 | 1 2 | 2 | 1 1) | 0 | 1 1 | 1 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | l: 5 | |
| OCC D | υ | 0 | 1 | 0 | 0 | 1 1 | 1 | 1 5 | 5 | 1 0 | O | 1 1 | 1 | 1 0 | O | 1 0 | 0 | 1 7 | Ī |
| (J2)(O | υ | O | 1 | 0 | O | 1 0 | Ü | 1 2 | 2 | 1 0 | 0 | 1 3 | 2 | 1 3 | 2 | i o | 0 | 1 8 | 1 |
| (JAC)(O | 0 | Ð | ı | 2 | 4 | 1 0 | O | 1 1 | 1 | 1 1 | 1 | 1 1 | 1 | 1 2 | 1 | i i | õ | 8 | 1 |
| OICIO | . 1 | 4 | ı | ŧ | 2 | 1 1 | 1 | 1 6 | 5 | 1 1 | 1 | 1 3 | 2 | i ā | 2 | 1 2 | 1 | 1 18 | 12 |
| 13210 | 0 | O | t | 2 | ં 4 | 1 0 | Đ | 1 3 | 3 | 1 2 | 2 | 1 4 | 2 | 1 1 | 1 | 1 1 | Ō | 1 13 | 1: |
| CHACHO | 0 | ۵ | t | 1 | 2 | 1 0 | O | 1 3 | 3 | 1 1 | 1 | 1 1 | <u>ī</u> | i i. | 1 | i ŏ | Ō | 1 7 | 1 |
| いだの | · 0 | 0 | ŧ | 0 | O | 1 0 | O | 1 2 | 2 | 1 0 | 0 | 1 0 | Ŏ | i ŏ | Ŏ | i ō | Õ | 1 2 | |
| (39. 1() | Q | Ð | 1 | 4 | • | 1 2 | 2 | 1 0 | 0 | 1 2 | 2 | 1 0 | 0 | 1 0 | 0 | i o | 0 | i e | 1. |
| OKO | Ú | 0 | 1 | 0 | ٥ | 1 0 | 0 | 1 2 | 2 | 1 0 | · O | 1 0 | 0 | 1 0 | O | 1 0 | 0 | 1 2 | |
| DICHO . | O | 0 | 1 | ı | 2 | 1 1 | 1 | 1 0 | 0 | 1 2 | 2 | 1 0 | 0 | 1 3 | 2 | 1 0 | o | 1 7 | |
| u coo 🦈 | 0 | 0 | 1 | 0. | 0 | 1 0 | 0 | 1 0 | G | : 0 | .0 | 1 0 | 0 | 1 1 1 | . 1 | 1 0 | O | 1 1 | |
| 120:0 | · • 1 | 4 | 1 | 1 | 2 | 1 1 | 1 | 1 2 | 2 | 1 0 | 0 | 1 0 | 0 | 1 0 | Ŏ | 1 1 | ō | 1 6 | |
| 19010 | Ð | 0 | 1 | э . | 6 | 1 1 | 1 | 1 0 | 0 | ו ס | 0 | 1 1 | 1 | 1 0 | · ō | i õ | ō | i s | : |
| 14CiO | 0 | O | Ĺ | 0 | G | i o | o | 1 2 | 2 | 1 2 | . 2 | i 2 | . 1 | 1 0 | ŏ | i ō | õ | 1 6 | |
| ECIO | 0 | 0 | 1 | 0 | 0 | 1 0 | Ö | 1 0 | 0 | 1 3 | 2 | $\overline{1}$ | ī | i 0 | Ö | i ă | ō | i ă | |
| BÜO | Ð | 0 | i | 0 | O | 1 1 | . 1 | 1 1 | ī | 1 2 | 2 | 1 3 | 2 | i ŏ | ŏ | i ō | Õ | i 7 | |
| PEIO | . 0 | 0 | 1 | o | 0 | 1 0 | Ö | i 1 | 1 | i | 0 | 1 3 | 2 | i õ | ã | iõ | ō | 1 5 | |
| (ECIO | Ò | 0 | Ĺ | Ō | Ō | 1 3 | 4 | 1 0 | Ď | ii | ī | i a | 2 | ii | ĭ | io | ŏ | i | • |
| ERCIO | 0 | 0 | ı | Ō | 0 | 1 0 | o | 1 2 | 2 | 1 6 | 5 | 1 6 | 4 | . 5 | ā | i š | ĭ | 1 22 | |
| 200 | o | 0 | ŧ | 2 | 4 | 1 0 | o | 1 2 | 2 | 1 1 | 1 | 1 5 | э | i 6 | ž | i õ | õ | 1 16 | i |
| 300 | 0 | 0 | 1 | O | 0 | 1 0 4 | ٥ | 1 1 | 1 | 1 2 | 2 | 1 0 | 0 | 1 0 | ŏ | 1 6 | 3 | 1 9 | |
| 2000 | 0 | 0 | 1 | 0 | 0 | 1 1 | 1 | 1 0 | Ó | 1 | 1 | iŏ | ō | i ō | ō | iõ | ō | 1 2 | |
| .2K(O ^ | O | 0 | 1 | L | 2 | 1 0 | ۵ | 1 1 | 1 | 1 0 | 0 | 1 0 | Ö | 1 0 | Ô | 1 0 | Ō | 1 2 | |
| Bri Tatal | 2 | 8 | | 19 | 38 | 14 | 15 | 36 | 35 | 28 | 26 | 38 | 26 | 26 | 17 | 14 | 5 | 178 | 17 |

D Numbers have been extrapolated for 52-60 minute sample time.

Table H29. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 % 12 degree elliptical horizontal transducer, for February 10. Indian Point, 1988.

| Hour | 0-5 Pau | HF | Par | 5~10 | WF | 10 2au | -15 HF | | 15-20 au | ИF | 20-25 Raw | HF. | 25- Rau | -30 WF | j | 30-35 Raw | i WF | | 95-40 nu | WF | HOURLY Raw | TOTAL. WF |
|--------------|------------|----|-----|----------|-----|-----------|-----------|-----|-------------|-----|--------------|-----|------------|-----------|-----|--------------|---------|----------|-------------|----|---------------|--------------|
| | | | | | | | | | | | | | | | | | | | | | | |
| DOOD / | 1 | 4 | 1 | <u> </u> | 2 | 1 1 | 1 | ! | 1 | 1 | ! . 1 | 1 | 1 0 | 0 | | Ď | O | • | ŏ | 0 | 1 5 | 1.0 |
| 0110 | 1 | 4 | 1 | O | 0 | 1 1 | 1 | 1 | 2 | 2 | 1 2 | 2 | 1 1 | 1 | | 0 | ņ | • | Ō | O | 1 7 | 10 |
| 0200 | 1 | -1 | 1 | 4 | В | 1 3 | 4 | 1 | 4 | 4 | 1 4 | 3 | 1 2 | . 1 | ı | Ō | 0 | 1 | 0 | O | 1 18 | 24 |
| OUNG | Û | I) | t | I) | 0 | 1 5 | E | | 1 | 1 | 1 1 | 1 | 1 4 | 2 | • | 0 | 0 | 1 | o | 0 | 1 14 | 13 |
| 1)-100 | 0 | U | 1 | I) | Ú | 1 2 | 2 | 1 | 2 | 2 | 1 3 | 2 | 1 2 | 1 | 1 | 0 | O | 1 | ο | 0 | 1 8 | |
| 0500 | 0. | () | 1 | IJ | 0 | 1 2 | 2 | 1 | 1 1 | 1 | 1 1 | 1 | 1 2 | 1 | 1 | 2 | 1 | ı | 4 | 2 | 1 12 | E |
| DECIO | n | 0 | 1 | 2 | 4 | 1 2 | 2 | 1 | 3 | Э | 1 3 | 2 | 1 4 | 2 | | 1 | 1 | ı | . 1 | Q | 1 16 | 1. |
| 0200 | 1 | 4 | ı | 1 | 2 | 1 2 | 2 | 1 | 2 | 2 | 1 2 | . 2 | 1 4 | 2 | 1 | 3 | 2 | ŧ | 2 | 1 | 1 17 | 17 |
| DIBCIO | 0 | Ü | 1 | I) | 0 | 1 1 | 1 | 1 | 0 | O | 1 0 | O | 1 2 | 1 | - 1 | , 2 | 1 | 1 | 1 | 0 | 1 6 | 3 |
| Ú:WIO | 0 | Q | 1 | 1) | Ö | 1 2 | 2 | 1 | 1 | 1 | 1 1 | 1 | 1 3 | 2 | 1 | 7 | 4 | 1 | Ü | 0 | 1 14 | 11 |
| 1000 | 2 | 7 | 1 | 0 | 0 | 1 1 | 1 | t | O | O | 1 0 | 0 | 1 0 | 0 | 1 | 0 | 0 | t | 0 | 0 | 1 3 | l: |
| 1100 | O | 0 | t | 1) | 0 | 1 2 | - 2 | ŧ | 0 | O | 1 0 | 0 | 1 0 | a | 1 | O | 0 | ŧ | ù | 0 | 1 2 | . 3 |
| 1200 | 0 | O | i | ŋ | 0 | 1 0 | Ŭ | t | 1 | . 1 | 1 1 | 1 | 1 1 | 1 | - 1 | 1 | -1 | t | O | 0 | 1 4 | • |
| 13:00 | ā | O | i | I) | O | 1 0 | 0 | 1 | 0 | 0 | 1 0 | 0 | 1 0 | O | 1 | 0 | 0 | ı | 0 | 0 | 1 0 | t. |
| L-4CIO | Ō | O | i | 1 | 2 | 1 0 | 0 | 1 | 0 | Ω | 1 0 | 0 | 1 1 | 1 | | O | O | 1 | 1 | O | 1 3 | 9 |
| 11500 | õ | Ð | 1 | ò | ū | 1 0 | O | 1 | 0 | o | 1 0 | 0 | 1 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 0 | Ç |
| 1600 | Ö | ñ | i | i) | . 0 | 1 1 | 1 | 1 | 1 | 1 | 1 1 | . 1 | 1 0 | 0 | Ιİ | 0 | 0 | 1 | Ü | 0 | 1 3 | 3 |
| 1700 | Ö | 13 | i | ī | 2 | i i | 1 | 1 | Ö | Ö | 1 0 | 0 | 1 0 | 0 | ì | 0 | 0 | 1 | 0 | 0 | 1 2 | 3 |
| LUCO | ĩ | 4 | i | ò | ō | 1 1 | 1 | i | O | 0 | 1 0 | 0 | 1 1 | 1 | . 1 | 2 | 1 | 1 | o | 0 | 1 5 | 7 |
| 130.0 | ā | 13 | i | Ď | Õ | 1 5 | 6 | 1 | i | 1 | 1 1 | 1 | 1 .1 | 1 | . 1 | 1 | 1 | ı | O | 0 | 1 10 | 11 |
| 2000 | õ | Ü | i | 4 | . 8 | 1 3 | | - 1 | 1 | 1 | 1 1 | 1 | 1 0 | O | 1 | 0 | 0 | 1 | 0 | 0 | 1 9 | 1 -1 |
| 3100 | ő | Ö | i | 2 | 4 | 1 4 | 5 | i | 5 | 5 | 1 5 | 4 | 1 0 | 0 | 1 | O | 0 | 1 | 1 . | 0 | 1 17 | 16 |
| 2200 | õ | õ | i | ñ | 0 | i c | o | i | 3 | 3 | 3 | 2 | 1 1 | 1 | Ü | 3 | 2 | ı | 2 | 1 | 1 12 | . • |
| 2300 | 0 | Ö | ŧ | ĺ | 2 | 1 0 | 0 | 1 | · · L | 1 | 1 1 | 1 | 1 0 | 0 |) | 0 | 0 | <u> </u> | 1 | 0 | 1 4 | ם |
| Bir Total | 7 | 27 | | 17 | 34 | 39 | 44 | | 30 | 30 | 30 | 26 | 29 | 16 | 3 | 22 | 14 | | 19 | 4 | 191 | 201 |

⁽⁾ Numbers have been extrapolated for 48-60 minute sample time.

Table R3D. Hourly estimates of raw and weighted fish numbers by range bin (irm meters) in front of unit 3, intake 35 using 6 X 12 degree elliptical horizontal transducer, for February 11. Indian Point, 1988.

| | n. | -5 | 5- | 10 | . 10 | -15 | 15- | רוכי | 20- | 26 | 25 | -30 | 20 | ı∽ 3 5 3 | 5-40 | HOURLY | TOTAL |
|-----------------|-----|----|-----|-----|---------|-----|------|------|------|----|-------|-----|-----|-----------------|------|--------|-------|
| Haur | Rau | NF | Raw | NF | Pau | HF | Rau | WF | Rau | WF | Rau | WF | Ray | Wi™ Re | | Raw | WF |
| 13100 | o | 0 | 10 | 0 | 12 | 2 | 10 | 0 | 10 | | l D | 0 | | 11 1 1 | 0 | | 3 |
| ares | 1 | 4 | 1 0 | O | 10 | 0 | 1 0 | 0 | 1 1 | ĩ | ii | i | iò | 01 1 1 | ŏ | i .4 | 6 |
| 0200 | O | a | 1 1 | 2 | 1 1 | · 1 | 14 | 4 | 10 | ā | 1 0 | Ö | 1 0 | OI I O | ā | 1 6 | 7 |
| 12 31310 | 0 | 0 | 1 3 | 6 | 1 0 | 0 | 1 0 | 0 | 1 1 | 1 | i i | 1 | i o | ai i o | _ | 5 | 8 |
| 134130 | o | ŋ | 1 0 | G | 1 2 | 2 | 10 | 0 | 12 | 2 | 1 2 | 1 | 1 0 | ai i o | 0 | 1 6 | 5 |
| OUECI | 0 | 0 | 10 | Ū | 1 2 | 2 | 10 | . 0 | 12 | 2 | 12 | ī | 1 0 | ai i o | Õ | 1 6 | 5 |
| 00£0 | 0 | 0 | 11 | 2 | 1 1 | · 1 | 10 | 0 | 1 1 | 1 | 1 1 | ı | 1 2 | H 1 O | 0 | i 6 | 6 |
| 10000 | O | 0 | 1 1 | 2 | 10 | 0 | 0 1 | 0 | 1 2 | 2 | 1 2 | . 1 | i i | 1 1 1 | Õ | į | 6 |
| 0100 | 0 | 0 | 1 0 | 0 | 1 1 | 1 | 10 | ٥ | 14 | 3 | 1.4 | 2 | 1 0 | 010 | G | 1 9 | 6 |
| CHOO | O | 0 | 1 0 | ٥ | 1 3 | - 4 | 1 0. | 0 | 10 | 0 | 1 0 | 0 | 1 0 | 010 | | 1 3 | 4 |
| 1100 | 1 | 4 | 1 0 | 0 | 1 2 | 2 | 1.1 | 1 | 10 | 0 | 1 0 | 0 | 10 | 010 | G | 1 4 | 7 |
| 1000 | 0 | 0 | 10 | 0 | 1 0 | . 0 | 1 1 | 1 | 1 0 | 0 | 10 | 0 | 10 | C 1 0 | Ō | 1 1 | 1 |
| 1300 | 0 | 0 | 1 0 | 0 | .I O I. | 0 | 1 0 | 0 | 1 1 | 1 | 1 1 | 1 | 1 0 | CIIO | 0 | 1 2 | 2 |
| 1300 | 0 | 0 | 10 | 0 | 1 0 | 0 | 1 0 | Ω | 10 | 0 | 1 0 | Ó | 1 1 | 1 1 1 | 0 | 1 2 | ī |
| 1430 | 0 | 0 | 10 | ٥ | 10 | G | 1 0 | 0 | 10 | 0 | 1 0 | O | 1 0 | aio | | 1 0 | ñ |
| 1500 | 1 | 4 | 10 | 0 | 1 1 | 1 | 1 1 | 1 | 1 1 | 1 | 1 0 | O | 10 | CIIO | | i 4 | 7 |
| 1300 | 0 | 0 | 1 1 | 2 | 10 | 0 | 1 1 | 1 | 1 0 | Ö | 1 1 | 1 | 1 0 | 0 1 0 | | 1 6 | 8 |
| 1700 | Ŭ | υ | 10 | 0 | 1 1 | 1 | 1 0 | 0 | 1 (1 | 0 | 1 0 | Ō | 1 0 | a i o | ō | i ī | ĭ |
| 1100 | 0 | ŋ | 10 | 0 | 1 1 | 1 | 1 1 | 1 | 1 0 | 0 | 10 | 0 | 1 0 | 0 1 1 | Ō | 1 3 | ž |
| 1300 | 0 | 0 | 1 1 | . 2 | 1 1 | 1 | 1 1 | 1 | 1 0 | 0 | ΙÖ | ō | 1 2 | 1 1 0 | Ō | i 5 | • 5 |
| 2100 | 0 | a | 1 1 | 2 | 1 0 | 0 | 1.0 | O | 1 1 | 1 | ΙÕ | ō | 10 | a i o | ő | . 2 | . 3 |
| 3100 | Q | 0 | 10 | 0 | 10 | . 0 | 1 1 | i | 16 | 5 | 1 i ' | ī | 1 3 | 2 1 1 | ō | 1 12 | 9 . |
| :2200 | ` O | 0 | 1 0 | o | 10 | 0 | 1 1 | 1 | 1 3 | .2 | 16 | 4 | 1 0 | ci i o | Ŏ | 1 10 | Ž |
| 2100 | ů | 0 | 10 | O | 1 1 | 1 | 1 0 | 0 | 1 2 | 2 | 1 3 | 2 | 1 2 | 1 1 1 | Ö | i 9 | 6 |
| Ein Tital | 3 | 12 | 9 | 18 | 19 | 20 | 12 | 12 | 27 | 24 | 25 | 17 | 12 | 8 7 | 0 | 117 | 115 |

U. Numbers have been extrapolated for 32-60 minute sample time.

Table A31. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 X 12 degree elliptical horizontal transducer, for February 12. Indian Point, 1988.

| | n- | -5 | 5- | 10 | 10 | -15 | 15- | ·20 | 20- | -25 | 25 | -30 | 30 | -35 | 35- | -dan | HOURLY | TOTAL |
|--------------|-----|------|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|--------|-------|
| Hour | Rau | | Rau | WF | P.au | ИF | Rau | WF | Raw | HF | Rau | WF | Raw | WF | Rau | HF | Rau | WF |
| 0000 | 0 | υ ; | 0 | 0 | 1 0 | 0 | 10 | O | 1 1 | 1 | 1 0 | 0 | 10 | 0 | 1.0 | o | 1 1 | 1 |
| 0100 | 0 | 0 1 | 0 | 0 | 10 | 0 | 1 0 | O | 1 0 | 0 | 1 0 | 0 | 1.0 | Q | 10 | 0 |) O | O |
| 0200 | 0 | 0 1 | 0 | 0 | 1 1 | 1 | 12 | 2 | 1 1 | 1 | 1 1 | · L | 1 0 | 0 | 10 | 0 | 1 5 | 5 . |
| 0000 | 0 | 0 (| Ü | 0 | 12 | 2 | 1 2 | 2 | t 1 | 1 | 1 0 | . 0 | 1 0 | 0 | 10 | 0 | 1 5 | 5 |
| 0:400 | 0 | 0 1 | 0 | 0 | 1 0 | 0 | 1 2 | 2 | 1 2 | 2 | 1 1 | 1 | 1 1 | 1 | 10 | 0 | 1 6 | 6 |
| Q5Q O | 0 | 0 1 | Q | ; 0 | 1 1 | 1 | 10 | O | 1 1 | 1 | 1 1 | 1 | 1 0 | 0 | 1 1 | 0 | 1 4 | 3 |
| 0600 | 0 | i) i | 0 | 0 | 12 | 2 | 1 3 | 3 | 1 3 | 2 | 12 | 1 | 1 1 | 1 | 1 1 | 0 | 1 13 | 9 |
| orroo | 1 | 4 1 | . 0 | 0 | 10 | 0 | 1 1 | . 1 | 1 0 | Q | 1 1 | 1 | 1 1 | 1 | 12 | 1 | 1 6 | -8 |
| 0000 | 0 | 0 1 | · L | 2 | 1 1 | 1 | 1 1 | 1 | 12 | 2 | 1 0 | O | 1 0 | 0 | 1 4 | 2 | 1 ,9 | 8 |
| 0900 | O | 0 1 | 2 | 4 | 1 1 | 1 | 1 0 | O | 13 | . 3 | 1 0 | 0 | 1 1 | 1 | 1 2 | 1 | 1 9 | 9 |
| I COCO | O | 0 1 | O | O | 1 1 | 1 | 1 2 | 2 | 1 0 | 0 | 1 0 | 0 | 1 1 | 1 | 1 2 | 1 | 16 | 5 |
| 1100 | . 1 | 4 1 | 0 | 0 | 1 0 | 0 | 1 1 | 1 | 1 0 | 0 | 1 1 | 1 | 1 2 | ŧ | 1 1 | 0 | 1 6 | 7 |
| 1200 | 0 | 0 1 | 1 | 2 | 1 1 | 1 | 1 1 | 1 | 1 0 | 0 | 1 1 | 1 | 1 2 | 1 | 1 2 | 1 | 1 8 | 7 |
| 1300 | n | 0 1 | 0 | 0 | 1 0 | 0 | 0 1 | 0 | 1 1 | 1 | 1 1 | 1 | 1 1 | 1 | 10 | 0 | 1 3 | 3 |
| 1:400 | 0 | 0 1 | O | . 0 | 13 | 4 | 1 1 | 1 | 1 1 | 1 | 10 | 0 | 1 0 | a | 1 1 | 0 | 1 6 | 6 |
| 1500 | 0 | 0 1 | O. | O. | 10 | 0 | 10 | 0 | 10 | 0 | 10 | 0 | 1 1 | 1 | 10 | 0 | 1 1 | 1 |
| 1600 | ø | 0 1 | 0 | 0 | 10 | 0 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 1 | 0 | 1 2 | 1 |
| 1700 | 0 | 0 1 | 2 | 4 | 1 1 | 1 | 1.0 | 0. | 10 | 0 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 3 | 5 |
| 1430/0 | 0 | 0 1 | 4 | 8 | 12 | 2 | 1 3 | .3 | 12 | 2 | 1 3 | 2 | 1 2 | 1 | 1 1 | . 0 | 1 17 | 16 |
| 1900 | ۵ | 0 1 | 2 | 4 | 14 | 5 | 1.5 | 5 | 13 | 2 | 1 0 | 0 | 10 | 0- | -10 | 0 | 1 14 | 16 |
| 2000 | 1 | 4 1 | 1 | 2 | (3 | 4 | ۱4 | 4 | 14 | 3 | 1 1 | 1 | 1 3 | 2 | 1 0 | 0 | 1 17 | 20 |
| 2100 | 0 | 0 (| 0 | 0 | 1 3 | 4 | 1 1 | 1 | 10 | 0 | 1 3 | 2 | 10 | 0 | 1 0 | . 0 | 1 7 | 7 |
| 2200 | • 0 | 0 (| 0 | 0 | 10 | O | 1 1 | 1 | 10 | 0 | 1 1 | 1 | 1 0 | O | 10 | 0 | 1 2 | 2 |
| 2300 | 1 | 4 1 | 0 | 0 | 1 2 | 2 | 13 | 3 | 1 3 | 2 | 1 2 | 1 | 10 | 0 | 10 | 0 | 1 11 | 12 |
| Bin Total | 4 | 16 | 13 | 26 | 28 | 92 | 34 | 34 | 28 | 23 | 19 | 15 | 16 | 12 | 18 | 6 | 161 | 165 |

¹⁾ Numbers have been extrapolated for 55-60 minute sample time.

Table fi32. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 % 12 degree elliptical horizontal transducer, for February 13. Indian Point, 1988.

| | Ŋ. | -5 | 5- | 10 | 10 | -15 | 15-20 |) | 20~ | 25 | 25 | -30 | 30 | -35 | 35~ | 40 | HOURLY | TOTAL |
|---------------|------|------|------|------|------|-----|-------|-----|-----|----|-----------|-----|-----|-----|-----|----|--------|-------|
| Hour | F:au | WF | Raw | HF | Rau | WF | Raw | HF | Raw | HF | Rau | MF | Rau | HE. | Pau | WF | Raw | HF- |
| DOCIO | 0 | 0 | 1 1 | 2 | 1 3 | 4 | | .1 | 16 | 5 | 1 1 | 1 | 1 2 | 1 | 14 | 2 | 1 10 | 16 |
| 01CiO | 1 | 4 | 1 1 | 2 | 1 0 | 0 | l 2 | 2 | 1 0 | 0 | 1 1 | 1 | 10. | 0 | 1 1 | 0 | 1 6 | 9 |
| 0200 | 0 | ,O | 1 0 | . 0 | 1 1 | 1 | 1 0 | O | 1 1 | 1 | 1 1 | 1 | 1 0 | 0 | 1 3 | 1 | 1 6 | 4 |
| 09010 | 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 1 | 1 | 1 0 | 0 | i 1 | 1 | 1 1 | 1 | 10 | 0 | 1 3 | 9 |
| 0400 | 0 | Ü | 1 0 | ø | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 1 0 | Q | 10 | 0 | 1 0 | ε |
| 0500 | . 0 | 0 | 1 1 | 2 | 1 1 | 1 | 1 1 | 1 | 1 1 | 1 | 10 | 0 | 1 0 | 0 | 10 | 0 | 1 4 | 5 |
| りゃくん | D | O | 1 0 | D | 1 1 | 1 | 1 2 | 2 | 1 0 | 0 | 10 | O | 10 | 0 | 1 1 | Ð | 1 4 | 5 |
| りてい | 0 | 0 | 1 0 | 0 | 1 1 | 1 | 1 0 | 0 | 1 1 | 1 | 1 1 | 1 | 1 0 | 0 | 10 | 0 | 1 3 | Ξ |
| 08010 | a | 0 | 1 0 | 0 | 1 0 | 0 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 10 | 0 | 1 1 | 1 |
| 3900 | 1 | 4 | 1 1 | 2 | 1 4 | 5 | l 2 | . 2 | 1 0 | 0 | 1 0 | 0 | 1 0 | 0 | 10 | 0 | 1 8 | 13 |
| OCIO | 5 | 19 | 1 0 | O | 1 7 | 8 | 1 1 | 1 | 1 0 | 0 | 10 | 0 | 1 0 | 0 | 1 1 | 0 | 1 14 | 26 |
| 1100 | 72 | 269 | 1 78 | 147 | 1 55 | 66 | 1 0 | 0 | 15 | 4 | 15 | 3 | 1 0 | 0 | 1 0 | 0 | 1 1264 | 2875 |
| 1200 | 115 | 429 | 1146 | 274 | 1 79 | 95 | 16 | 5 | lЭ | 2 | 1 0 | 0 | 1 0 | 0 | 10 | Q | 2052 | 4733 |
| 13010 | 173 | 645 | 1227 | 427 | 1166 | 199 | (172 | 155 | 115 | 11 | 16 | 4 | 1 2 | 1 | 10 | 0 | 1 4475 | 8479 |
| 1 4C 1O | 111 | 414 | 1142 | 267 | 1 95 | 114 | 1 2 | . 2 | 1 2 | 2 | 12 | 1 | 1 0 | 0 | 1 1 | 0 | 2087 | 470 |
| 150:0 | 17 | 63 | 1 50 | 109 | 1 6B | 82 | 15 | 5 | 1 0 | 0 | 10 | 0 | 1 0 | 0 | 1 0 | 0 | 1 870 | 1523 |
| 16010 | 3 | 1.1 | 1 23 | 43 | 1 61 | 73 | 1 17 | 15 | 1 0 | 0 | 1 1 | 1 | 1 0 | 0 | 1 1 | 0 | 1 106 | 143 |
| 17010 | 0 | 0 | 1 4 | 9 | 1 24 | 29 | 15 | 5 | 1 0 | O | 10 | 0 | 1 0 | 0 | 1 0 | 0 | 1 33 | 43 |
| I GCIO | 1 | 4 | 1 9 | 17 | 1 5 | 6 | 1 4 | 4 | 12 | 2 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 1 22 | 3- |
| 1900 | O | 0 | 1 0 | 0 | 1 0 | 0 | 1. 0 | Ü | 10 | 0 | 1 -1 | 1 | t 1 | 1 | 10 | 0 | 1 2 | |
| 20CIO | 0 | Ū | - | 2 | 1 2 | 2 | 1 1 | 1 | 10 | ប | 1 1 | 1 | 10 | 0 | 1 0 | a | 1 5 | • |
| 21010 | . 2 | 7 | | 8 | 1 0 | 0 | 1 0 | 0 | 15 | 4 | 1 1 | 1 | 1 0 | 0 | I D | 0 | 1 12 | 20 |
| 220:0 | 6 | 22 | | 118 | 1 69 | 83 | 1 18 | 16 | 10 | 0 | 1 0 | 0 | 1 0 | 0 | 10 | 0 | 1 917 | 1405 |
| 2300 | 63 | 310 | 1 68 | 128 | 1 93 | 112 | 1 67 | 60 | 112 | 9 | . 1 5 | 3 | 1 0 | | 10 | O | 1 1929 | 3657 |
| Bir: Total | 590 | 2201 | 927 | 1226 | 735 | 882 | 308 | 279 | 53 | 42 | 28 | 21 | 6 | 4 | 12 | 3 | 13842 | 27709 |

¹⁾ Numbers have been extrapolated for 10-60 minute sample time.

Table fi33. Hourly estimates of rew and weighted fish numbers (with high and low tide heights) in front of unit 3, intake 35 using 6 X 12 degree elliptical horizontal transducer for week 4, February P to 13. Indian Point, 1988.

| | | FEB 7 | • | | FEB | a . | | FEB ' | • | | FEB | 10 | | FEB 1 | 1 \$ | | FEÐ 1 | 12 | F | EB 13 | | HEEK | |
|-------|------|-------|------|-------|------|------|------|-------|-----|------|---------|------|-------|-------|------|------|-------|------|--------|-------|------|--------|-------|
| Hour | PAH | | Tide | | | Tide | RALI | HF | | RAH | HF | Tide | | HF | Tide | PAH | HF | Tide | | HF | Tide | PAH | MF |
| 0000 | 12 | 14 | | 1 16 | 18 | | 1 5 | 6 | | 1 5 | 9 | | 1 4 | 3 | | 1 1 | | | 1 18 | 16 | | 1 61 | 67 |
| 0100 | 27 | 19 | 1.2 | 1 6 | 5 | | 1 7 | . 7 | | 1 7 | 10 | | 1 4 | 6 | | 1 0 | 0 | | 1 6 | 9 | 0. 1 | 1 58 | 56 |
| 0200 | 13 | 9 | | 1 19 | 17 | 1.2 | 1 8 | 6 | 1.2 | 1 18 | 24 | | 1 6 | 7 | | 1 5 | 5 | | 1 6 | -4 | | 1 69 | 72 |
| 0300 | 12 | a | | 1 7 | 7 | | 1 8 | 8 | | 1 14 | 13 | 1.2 | 1 5 | a | | 1 5 | 3 | | 1 3 | 9 | | 1 54 | 52 |
| 0400 | . 10 | -10 | | 1 11 | 12 | | 1 18 | 18 | | 1 8 | 7 | | 1 6 | 5 | 1.2 | i 6 | 6 | | 1 0 | . 0 | | 59 | 56 |
| 050Q | 6 | 5 | . ~ | 1 18 | iš | | 1 13 | 12 | | 1 12 | B | | i ē | 5 | | 1 4 | э | 1.2 | 1 4 | 5 | | 1 63 | 54 |
| 06.00 | 6 | 8 | | 1 21. | 19 | | 1 7 | | | 1 16 | 14 | | 1 6 | 6 | | 1 13 | 9 | | i 4 | 3 | 1.3 | 1 73 | 67 |
| 0700 | Ď | 0 | | 1 6 | 10 | | 1 2 | 2 | | 1 17 | 17 | | i ž | - 6 | | 1 6 | à | | 1 3 | 3 | | 1 41 | 46 |
| 0000 | 2 | 2 | 0.0 | 1 3 | 3 | 0. 1 | i B | 12 | | 1 6 | ~ B | | i ė | 6 | | 1 9 | B | | 1 1 | 1 | | 1 38 | 25 |
| 0500 | ī | 4 | | 1 3 | Ž | | i ž | 2 | 0.2 | 1 14 | 10 | | 1 3 | ä | | 1 9 | 9 | | 1 0 | 13 | | 1 40 | 49 |
| 1000 | Ž | A | | i 9 | 10 | | 1 7 | 7 | | 1 3 | Ä | 0.2 | 1 4 | 7 | | 1 6 | Ś | _ | 1 14 | 26 | | 1 50 | 73 |
| 1100 | 7 | Ä | | 1 3 | · 4 | | 1 1 | ī | | i 2 | 2 | | 1 1 | i i | | iš | 7 | | 1 1264 | 2875 | | 1 1294 | 2898 |
| 1200 | 9 | . 4 | | 1 2 | · • | | 1 6 | ġ | | i 4 | 4 | | 1 . 2 | ż | 0. 2 | i B | - | | 1 2052 | 4733 | * | 1 2077 | 4761 |
| 1300 | ă | | 1.2 | ·i 3 | 3 | | i 5 | Ä | | iò | ó | | i 2 | - 7 | | | à | 0.2 | 1 4475 | 8479 | | 1 4488 | 8495 |
| 1400 | ī | ī | | i 3 | | 1.1 | i | 5 | | i ā | ā | | i ō | å | | | ě | | 1 2007 | 4704 | 0. 1 | 1 2107 | 4723 |
| 1500 | 4 | À | | i 5 | a a | ••• | i 4 | . 3 | | iõ | ŏ | 1.1 | i 4 | 7 | | i 7 | 7 | | 870 | 1523 | | 888 | 1541 |
| 1600 | 4 | à | | ાં ક | š | | , , | | | i 3 | - | | i 6 | ė | 1.0 | i 2 | i | | 1 106 | 143 | 4, | 1 137 | 172 |
| 1700 | 14 | 11 | | | 12 | | i | 3 | | , , | | | 1 7 | - 7 | ••• | | Š | 1.0 | | 42 | • | 69 | 77 |
| 1600 | iò | 12 | | 1 16 | 17 | | i ā | Ā | | i 5 | 7 | | iá | • | ~ | 1 12 | 18 | | 1 22 | 34 | | 81 | 98 |
| 1900 | 10 | 10 | | 1 7 | · '> | | 1 22 | 15 | | 1 10 | · • • • | | i š | = | | 1 14 | 16 | | 1 7 | 2 | 1.0 | 1 70 | 66 |
| 2000 | Ä | | 0.0 | i a | ÷ | 0.0 | | 13 | | | 14 | | i 5 | 3 | | 1 17 | 20 | | i 5 | | | 1 60 | 64 |
| 2100 | - 3 | 5 | 0.0 | | | | 1 9 | - 7 | 0.1 | 1 17 | 10 | | i 15 | | | 1 7 | -2 | | 1 12 | 20 | | 73 | 73 |
| 2200 | • | 7 | | . 5 | | | i 5 | | | 1 12 | | 0. 1 | i iō | ~ ~ | | 1 3 | - | | 917 | 1405 | - 4 | 1 949 | 1433 |
| 2300 | • | ė | | i 2 | ż | | ·i 2 | 3 | | 1 4 | á | ٠ | i '9 | 6 | 0.1 | i 11 | 12 | | 1 1929 | 3657 | * | 1 1966 | 3692 |
| Daily | 172 | 158 | | 187 | 206 | | 178 | 171 | | 191 | 201 | | 117 | .115 | · | 161 | 145 | | 13842 | 27709 | · | 14948 | 20725 |
| Total | | | | | | | | | | - | | | | | | - | | | | | | | |

¹³ Tide heights for low and high tide only, New York (the Battery), N.Y. and times adjusted for Indian Point Location.

Table R34. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 X 12 degree elliptical horizontal transducer, for February 14. Indian Point, 1988.

| | 0- | 5 | 5- | 10 | 10- | 15 | 15-20 | | 20-25 | | 25-30 | 0 | 30-35 | 5 | 35-40 |) | HOURLY | TOTAL |
|--------------|-----|------|-------|----------|-------|-----|-------|-----|-------|----|-------|-----|-------|-----|-------|-----|--------|-------|
| Hour | Rau | WF | Raw | WF | Raw | HF | Rau | WF | Raw | WF | Raw | HF | Rau | WF | Raw | WF | Raw | WF |
| 0000 | 136 | 507 | 1 147 | 276 | 1 142 | 170 | 1 64 | 58 | 1 36 | 27 | 1 3 | 2 | 1 0 | 0 | 1 1 | O | 1 6369 | 12522 |
| 0100 | 102 | 380 | 1 150 | 202 | 1 135 | 162 | 1 63 | 57 | 1 4 | 3 | 1 0 | 0 | 1 1 | 1 | 1 2 | 1 | 1 5502 | 10667 |
| 0200 | 67 | 250 | 1 136 | 256 | 1 117 | 140 | 1 77 | 69 | 1 5 | 4 | 1 0 | 0 | 1 0 | O | 1 0 | 0 | 1 4840 | 8657 |
| 0300 | 10 | 37 | 66 | 124 | 1 110 | 132 | 1 50 | 45 | 1 16 | 12 | 1 8 | 5 | 1 1 | 1 | † 1 | 0 | 1 262 | 356 |
| 0400 | 0 | 0 | 1 13 | 24 | 1 12 | 14 | 1 8 | 7 | 1 2 | 2 | 1 1 | 1 | 1 1 | 1 | 1 1 | 0 | 1 38 | 49 |
| 0500 | 1 | 4 | 1 2 | 4 | 1 2 | 2 | 1 1 | 1 | 1 1 | 1 | l 5 | 3 | 1 1 | 1 | 1 0 | 0. | 1 13 | 16 |
| 0600 | 1 | 4 | Į. 2 | 4 | 1 1 | 1 | 1 0 | O | 1 0 | 0 |) 1 | 1 | 1 0 | 0 | 1 0 | 0 | .[. 5 | 10 |
| 0700 | 1 | 4 | i 3 | 6 | 1 0 | 0 | 1 0 | . 0 | 1 1 | 1 | 1 2 | 1 | 1 1 | 1 | 1 0 | . 0 | 1 8 | 13 |
| 0800 | 0 | ٥ | 1 2 | 4 | 1 3 | 4, | 1 12 | 11: | 1 10 | 8 | : 3 | 2 | 1 5 | 3 | 1 0 | 0 | 1 35 | 32 |
| 0900 | 0 | 0 | 1 7 | 13 | 1 4 | 5 | 1 8 | . 7 | 1 9 | 7 | 1 3 | 2 | l 5 | . 3 | 1 3 | .1 | 1 39 | 38 |
| 1000 | 0 | 0 | 1 1 | . 2 | 1 2 | 2 | 1 3 | Э Э | 1 2 | 2 | 1 6 | 4 | 1 2 | 1 | 1 1 | 0 | 1 17 | 14 |
| 1100 | 0 | 0 | 1 2 | 4 | 1 2 | 2 | 1 4 | 4 | 1 3 | 2 | 1 19 | 11 | 1 4 | 2 | 1 2 | 1 | 1 36 | 26 |
| 1200 | 0 | ٥ | 1 1 | 2 | 1 1 | 1 | 1 2 | 2 | 1 1 | 1 | 1 2 | 1 | 1 0 | 0 | 1 0 | 0 | 1 7 | 7 |
| 1300 | 0 | 0 | 1 0 | 0 | 1 0 | O | 1 2 | 2 | 1 6 | 5 | 1 7 | 4 | 16 | 3 | 1 7 | 3 | 1 28 | 17 |
| 1400 | 0 | 0 | 1 0 | 0 | î व | 5 | 1 1 | 1 | 1 8 | 6 | 1 5 | 3 | 1 4 | 2 | 1 6 | 3 | 1 28 | 20 |
| 1500 | 2 | 7 | 1 1 | 2 | 1 3 | 4 | 1 3 | Э | 1 4 | Э | 1 9 | - 5 | 1 1 | 1 | 1 6 | Э | 1 29 | 28 |
| 1600 | 0 | 0 | 1 0 | . 0 | 1 2 | 2 | 1 0 | 0 | 1 0 | 0 | 1 2 | 1 | 1 3 | 2 | 1 1 | 0 | 1 6 | 5 |
| 1700 | 0 | 0 | 1 1 | 2 | 1 1 | 1 | 1 0 | 0 | 1 0 | ٥ | 1 0 | Ò | 1 0 | 0 | 1 0 | 0 | 1 2 | 3 |
| 1800 | 1 | 4 | 1 1 | 2 | 1 3 | .4 | 1 3 | 3 | 1 2 | 2 | 1 3 | 2 | 1 1 | 1 | 1 0 | 0 | 1 14 | 18 |
| 1900 | 0 | . 0 | 1 0 | 0 | 1 . 6 | 7 | 1 3. | 3 | 1 0 | Q | : 2 | 1 | 1 0 | 0 | 1 0 | 0 | 1 11 | 11 |
| 2000 | 0 | 0 | 1 1 | 2 | 1 4 | 5 | 1 2 | 2 | 1 2 | 2 | 16 | 4 | 1 1 | 1 | 1 0 | O. | 1 16 | 16 |
| 2100 | 2 | 7 | 1 2 | 4 | 1 3 | 4 | 1 4 | 4 | 1 1 | 1 | 1 2 | 1 | 1 0 | 0 | 1 1 | 0 | 1 15 | 21 |
| 2200 | 0 | . 0 | 1 ,2 | 4 | 1 6 | 7 | 1 9 | 8 | 1 5 | 4 | 1 5 | , 3 | 1 0 | Q | 1 0 | 0 | 1 27 | 26 |
| 2300 | 1 - | 4 | 1 .2 | 4 | 1 0 | 0 | 1 7 | 6 | 1 8 | 6 | 1 5 | 3 | 1 2 | 1 | 1 0 | 0 | 1 90 | 28 |
| Bin Total | 324 | 1208 | 542 | 1021 | 563 | 674 | 326 | 296 | 126 | 99 | 99 | 60 | 39 | 25 | 32 | 12 | 17379 | 32600 |

¹⁾ Numbers have been extrapolated for 5-60 minute sample time.

Table 835. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 9, intake 35 using 6 X 12 degree elliptical horizontal transducer, for February 15. Indian Point, 1988.

| | 0-5 | | | 5-10 | ٠ | | 10-15 | | 15-20 | | 20-2 | 25 | | 25-30 | | 30- | -35 | 35 | 5-40 | t | HOURLY | TOTAL |
|--------------|-----|-----|-----|------|----|----|------------|-----|-------|-----|------|-----|-----|-------|-----------|------|-----|-----|------|----------|--------|---------|
| Hour | Raw | WF | F | Raw | WF | Re | au. | HF | Rau | WF | Rau | WF | 1 | Ray | NF | Rau | ИF | Rau | | HF | Rau | WF |
| 0000 | 1 | 4 | 1 | 1 | 2 | 1 | 2 | 2 | 1 6 | 5 | 1 B | | | | 4 | ı 3 | 2 | 1 | 4 | 2 | 1 32 | - 27 |
| 0100 | o | 0 | ì | 1 | 2 | i | 8 | ιõ | 1 5 | 5 | i e | É | i | 8 | 5 | i ž | 1 | i. | 2 | <u> </u> | 1 34 | 30 |
| 9200 | 0 | 0 | İ | 2 | 4 | i | 3 | 4 | 1 3 | 3 | 1 14 | 11 | i | 9 | 5 | i ā | ž | i | 5 | 2 | i 39 | |
| 0300 | 0 | 0 | Ť | 1 | 2 | | 1 | 1 | 1 0 | o | 1 4 | 3 | | 2 | 1 | i | Ö | | ĭ | ō | 1 9 | 7 |
| 0400 | O | 0 | i | 1 | 2 | i | 2 | 2 | 1 1 | 1 | 1 0 | Č | | 3 | Ž | iŏ | ō | i | 1 | ŏ | l B | 7 |
| 0500 | G | 0 | İ | O | 0 | i | 1 | 1 | 1 1 | 1 | 1 2 | 2 | : i | Õ | Ō | i | Ö | i | ā | Õ | 1 4 | - |
| 0600 | 0 | 0 | ı | 2 | 4 | t | 7 | 8 | 1 4 | 4 | 1 7 | 5 | | 4 | 2 | i ō | Ō | i | Ŏ | Ō | 1 31 | 29 |
| 0700 | 2 | 7 | i | .3 | 6 | 1 | 13 | 16 | 1 10 | 9 | 1 17 | 13 | ì | 8 | 5 | i 2 | 1 | i | ŏ | ō | 1 55 | 57 |
| 0800 | 0 | O | Ĺ | 6 | 11 | 1 | 8 | 10 | 1 7 | 6 | 1 6 | 5 | | 9 | -5 | i 7 | Ă | ì | ŏ | Ō | 1 43 | 41 |
| 0900 | 0 | Ō | i | 2 | 4 | i | 11 | 13 | 1 8 | 7 | 1 3 | 2 | | 3 | 2 | i 1 | 1 | ì | ĭ | 0 | 1 29 | 29 |
| 1000 | 0 | ā | ì | 2 | 4 | 1 | 7 | В | 1 12 | 11 | 1 5 | 4 | | 5 | 3 | į | 4 | Ì | á | 4 | 1 46 | 36 |
| 1100 | G | Ö | ì | 1 | 2 | ì | 4 | - 5 | 1 5 | 5 | 1 6 | | - | 5 | 3 | i | á | 1 | 3 | 1 | 32 | 25 |
| 1200 | Ö | õ | i | Ŏ | ō | ì | . 2 | 2 | 1 3 | 3 | ii | 1 | i | ă | 2 | 1 1 | i | i | 2 | ī | 1 12 | 10 |
| 1300 | · O | · Ď | i | 4 | 8 | i | 4 | 5 | i 6 | 5 | i 4 | Ē | i | 5 | 3 | . A | 2 | i | 5 | • | 1 32 | 28 |
| 1400 | ž | 7 | i | ż | 4 | i | í | 1 | 1 9 | ē | i ż | Ē | | 14 | 8 | i 6 | 3 | i | ă | 4 | 49 | 40 |
| 1500 | ō | Ď | i | 2 | 4 | i | 6 | Ž | i A | 7 | 1 4 | ž | | ė | 5 | ; ă | 2 | - | 3 | 6 | 45 | 94 |
| 1600 | 2 | 7 | i | 5 | Ä | i | ě | 10 | iii | • | i 5 | | - | ě | Š | ; ; | ī | • • | × = | 2 | 1 32 | 34 |
| 1700 | ō | ò | i | ī | 2 | i | ă | 5 | iė | 5 | iā | | ; i | 2 | ĭ | i | ; | i | 1 | ñ | 1 22 | 19 |
| 1800 | ŏ | ŏ | i | ī | 2 | i | 2 | ·2 | i 🍒 | 4 | 1 4 | 5 | | 2 | • | . 3 | • | i | 'n | ă | 1 16 | 1- |
| 1900 | 2 | . 7 | . i | ġ | 6 | i | 6 | 5 | i 5 | 5 | . 4 | ž | | ā | ŝ | , , | 1 | • | ŏ | . 0 | 1 29 | 94 |
| 2000 | ō | Ġ | i | 2 | 4 | i | ັ 2 | 2 | i 5 | 5 | 6 | 5 | | 7 | 4 | i ż | i | i | ŏ | | 1 24 | 21 |
| 2100 | ŏ | ŏ | i | 2 | 4 | i | 5 | 6 | i 5 | · 5 | 1 10 | È | - | . 8 | 5 | i 5 | à | i | ñ | ă | i 55 | 31 |
| 2200 | ī | . 4 | i | 2 | 4 | i | 5 | 6 | i 6 | 5 | i 15 | 11 | | 7 | 4 | i a | 2 | i | ŏ | ň | 1 39 | 36 |
| 2300 | . 0 | 0 | i | 3 | 6 | i | 5 | 6 | i 11 | 10 | i 10 | Ē | _ | 10 | 6 | i 12 | 6 | i | 3 | ī | 54 | 43 |
| Bin Total | 10 | 36 | | 46 | 91 | ; | 117 | 139 | 131 | 120 | 156 | 121 | | 145 | 86 | 77 | 44 | E | 2 | 26 | 751 | 669 |

¹⁾ Numbers have been extrapolated for 47-60 minute sample time.

Table R36. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 % 12 degree elliptical horizontal transducer, for February 16. Indian Point, 1988.

| • | 0-5 | | 5-1 | D. | 10- | 15 | 15-20 | | 20-25 | | 25-30 | 0 | 30-3 | 35 | 35-4 | D | HOURLY | TOTAL |
|--------------|-----|-----|------|-----|-------|------------|-------|-----|-------|------|-------|-----|------|------------|------|----|--------|-------|
| Hour | Rau | WF | Rau | WF | Rau | WF | Rau | HF | Raw | WF | Rau | WF | Raw | WF | Raw | HF | Rau | NF |
| 0000 | 0 | 0 | 1 2 | 4 | 1 6 | 7 | 1 4 | 4 | 1 11 | 8 | 1 12 | 9 | 1 9 | <u>-</u> 5 | l 15 | 7 | 1 64 | 48 |
| 0100 | 1 | 4 | 1 1 | 2 | 1 1 | 1 | 1 4 | 4 | 1 7 | . 5 | 1 14 | 11 | 1 9 | 5 | 1 10 | 5 | 1 47 | 97 |
| 0200 | 4 | 15 | 1 5 | 9 | 1 12 | 14 | 1 17 | 15 | 1 14 | 11 | 1 23 | 17 | 1 21 | 11 | 1 16 | 7 | 1 112. | |
| 0300 | 2 | 7 | 1 4 | 8 | 1 9 | 11 | 1 14 | 13 | l 19 | 14 | 1 11 | 8 | 1 6 | 3 | 1 8 | 4 | 1 73 | 68 |
| 0400 | O | 0 | 1 1. | · 2 | 1 3 | 4 | 1 3 | 3 | 1 0 | 0 | 1 2 | 2 | 1 1 | 1 | i 2 | 1 | 1 12 | 13 |
| 0500 | . 1 | 4 | 1 1 | 2 | 1 5 | 6 | 1 2 | 2 | 1 2 | 2 | 1 1 | 1 | 1 1 | . 1 | 1 1 | 0 | 1 14 | 18 |
| 0600 | 0 | 0 | 1 0 | 0 | 1 7 | 8 | 1 3 | 3 | 1 1 | 1 | 1 0 | O | 1 0 | 0 | 1 1 | 0 | 1 12 | 12 |
| 0700 | 2 | 7 | 1 2 | 4 | 16 | 7 | 1 7 | 6 | 1 1 - | 1 | 1 6 | 5 | 1 1 | 1 | 1 0 | Ö | 1 25 | 31 |
| 0800 | . 2 | 7 | 1 7 | 13 | 1 8 | 10 | 1 11 | 10 | 1 9 | 7 | 1 5 | 4 | 1 1 | 1 | i o | 0 | 1 43 | 52 |
| 0900 | 8 | 30 | 1 8 | 15 | 1 6 | 7 | 1 7 | 6 | 1 4 | Э | 1 5 | 4 | 1 2 | 1 | 1 0 | 0 | 1 40 | 66 |
| 1000 | 1 | 4 | 1 4 | 8 | 1 9 | - 11 | 1 8 | 7 | I 10 | 8 | 1 7 | 5 | 1 1 | . 1 | 1 0 | 0 | 1 40 | 44 |
| 1100 | 0 | 0 | 1 4 | 8 | 1 10 | 12 | 1 9 | 8 | 1 12 | 9 | 1 12 | 9 | 1 2 | . 1 | 1 4 | 2 | 1 53 | 49 |
| 1200 | 0 | 0 | 1 0 | 0 | ı a | 4 | 1 8 | 7 | 1 7 | 5 | 12 | 9 | I 10 | . 5 | 1 9 | 4 | 1 49 | 34 |
| 1300 | 0 | 0 | 1 2 | 4 | 1 6 | 7 | 1 5 | 5 | 1 7 | 5 | 10 | 8 | 1 15 | 8 | 1 11 | 5 | 1 56 | 42 |
| 1400 | 1 | 4 | 1 10 | 19 | 1 18 | 22 | 1 22 | 20 | 1 21 | 16 | 1 24 | 18 | 1 12 | 6 | 1 19 | 9 | 1 127 | 114 |
| 1500 | · 1 | 4 | 1 5 | 9 | 1 18 | 22 | 1 15 | 14 | 1 14 | . 11 | 1 11 | Θ | 1 15 | 8 | 1 1 | 0 | 1 60 | 76 |
| 1600 | 1 | 4 | 1 1 | . 2 | 1 4 | . 5 | 1 6 | 5 | 1 5 | 4 | 1 1 | 1. | 1 10 | 5 | 1 2 | 1 | 1 30 | 27 |
| 1700 | . 0 | 0 | 1 0 | 0 | 1 10 | 12 | 1 2 | 2 | 1 1 | • 1 | 1 2 | 2 | 1 4 | 2 | 1 2 | 1 | 1 21 | 20 |
| 1000 | 0 | 0 | 1 2 | 4 | 1 4 | 5 | 1 3 | 3 | 1 1 | . 1 | 1 6 | 5 | 1 3 | 2 | 1 2 | 1 | 1 21 | 21 |
| 1900 | 2 | . 7 | 1 0 | 0 | 1 . 0 | 0 | 1 1 | 1 - | 1 5 | 4 | 1 3 | 2 | 1 4 | 2 | 1 1 | 0 | 1 16 | - 16 |
| 2000 | 1 | 4 | 1 5 | 9 | 1 3 | 4 | 1 7 | 6 | 1 5 | 4 | 1 2 | 2 | 1 2 | 1 | 1 0 | 0 | 1 25 | 30 |
| 2100 | 2 | 7 | 1 4 | . 8 | 1 4 | 5 | 1 7 | 6 | 1 11 | 8 | 1 5 | 4 | 1 0 | 0 | 1 0 | 0 | 1 33 | 38 |
| 2200 | 2 | 7 | 1 1 | 2 | 1 9 | 11 | 1 8 | 7 | 1 1 | 1 | 1 5 | 4 | 1 3 | 2 | 1 1 | 0 | 1 30 | 34 |
| 2300 | 1 | 4 | 1 1 | 2 | 1 5 | 6 | 1 5 | 5 . | 1 . 7 | 5 | 1, 9 | 7 | 1 6 | | 1 0 | 0 | 1 34 | 32 |
| Bin Total | 32 | 119 | 70 | 134 | 166 | 201 | 179 | 162 | 175 | 134 | 188 | 145 | 138 | 75 | 105 | 47 | 1057 | 1021 |

¹⁾ Numbers have been extrapolated for 55-60 minute sample time.

Table R37. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 X 12 degree elliptical horizontal transducer, for February 17. Indian Point, 1988.

| | 0-5 | | | 5-10 | | 10- | 15 | 15-20 | | 20-25 | | 25-30 | n | 90 -3 | 5 | 35-40 | | HOURLY | TOTAL |
|--------------|-----|-----|----|--------------|-----|------|-------|-------|-----|-------|-----|-------|-----|--------------|-----|-------|----|--------|-------|
| Hour | Rau | WF | Ra | | WF | Rau | WF | Raw | HF | Raw | HF | Raw | WF | Raw | WF | Raw | WF | Raw | KF |
| 0000 | 1 | 4 | 1 | 5 | 9 | 1 6 | 7 | 1 13 | 12 | 1 26 | 20 | 1 17 | 10 | 1 15 | 8 | 11 4 | 2 | 1 67 | 72 |
| 0100 | 0 | 0 | 1 | 2 | 4 | 1 4 | 5 | 1 7 | 6 | 1 11 | Θ | 1 10 | 6 | 1 14 | 7 | 11 4 | 2 | 1 52 | 38 |
| 0200 | 0 | 0 | 1 | 3 | 6 | 1 10 | 12 | 1 8 | 7 | 1 6 | 5 | 1 9 | 5 | 1 5 | 3 | 11 6 | 3 | 1 47 | 41 |
| 0300 | 1 | 4 | 1 | 4 | 8 | 1 26 | 31 | 18 | 16 | I 19 | 14 | 1 21 | 13 | 1 13 | • 7 | II 10 | 5 | 1 112 | 98 |
| 0400 | Ö | O | i | 0 | 0 | 1 1 | 1 | 5 | 5 | j 9 | 7 | 1 3 | 2 | 1 4 | 2 | 11 4 | 2 | 1 26 | 19 |
| 0500 | Ō | Ō | 1 | 3 | 6 | 1 5 | 6 | 1 4 | 4 | 1 4 | 3 | 1 3 | 2 | 1 4 | 2 | 11 1 | O | 1 24 | 23 |
| 0600 | 1 | · 4 | t | Ó | 0 | 1 0 | υ | 1 0 | 0 | 1 0 | 0 | 1 1 | . 1 | 1 0 | 0 | 11 1 | 0 | 1 3 | 5 |
| 0700 | o | 0 | ı | 1 | 2 | 1 2 | 2 | 1 4 | 4 | 1 4 | 3 | 1 4 | 2 | 1 0 | 0 | 11 0 | 0 | 1 17 | 15 |
| 0000 | 0 | O | 1 | 3 | 6 | 1 5 | 6 | 1 5 | 5 | 1 3 | 2 | 1 5 | 3 | 1 0 | . 0 | 11 0 | 0 | 1 21 | 22 |
| 0900 | 2 | 7 | i | 6 | 11 | 1 2 | 2 | 1 4 | 4 | 1 2 | 2 | 1 3 | 2 | 1 0 | O | 11 0 | 0 | 1 19 | 28 |
| 1000 | 1 | 4 | 1 | 6 | 11 | 1 5 | 6 | 1 7 | 6 | 1 1 | 1 | 1 0 | 0 | 1 0 | 0 | 11 O | 0 | 1 20 | 28 |
| 1100 | 8 | 30 | 1 | 5 | 9 | 1 11 | 13 | 1 1 | 1 | 1 1 | 1 | 1 3 | 2 | 1 0 | 0 | 11 0 | 0 | 1 29 | 56 |
| 1200 | Q | 0 | t | 4 | 8 | 1 6 | 7 | 1 2 | 2 | 1 2 | 2 | 1 2 | 1 | 1 3 | 2 | 11 1 | 0 | 1 20 | 22 |
| 1300 | 0 | 0 | ı | 5 | 9 | 1 3 | 4 | 1 4 | 4 | 1 2 | 2 | 1 2 | 1 | 1 5 | 3 | 11 0 | O | 1 21 | 23 |
| 1400 | Ō | Ō | 1 | 4 | . 8 | 1 8 | 10 | 1 8 | 7 | 1 12 | 9 | 1 11 | 7 | 1 11 | - 6 | 11 7 | 3 | 1 61 | 50 |
| 1500 | 2 | 7 | ı | 4 | 8 | 1 6 | 7 | 1 8 | 7 | 1 8 | 6 | 1 12 | 7 | l 15 | 8 | 11 14 | 6 | 1 69 | 56 |
| 1600 | . 0 | O | 1 | 4 | 8 | 1 22 | 26 | I 15 | 14 | 1 13 | 10 | 1 19 | 11 | 1`20 | 10 | 11 9 | 4 | 1 102 | 83 |
| 1700 | 1 | 4 | 1 | 5 | 9 | 1 13 | 16 | 1 8 | 7 | 1 9 | 2 | 1 13 | 8 | 1 3 | . 2 | 11 5 | 2 | 1 51 | 50 |
| 1600 | Ĩ | 4 | | a | 0 | 1 3 | 4 | 1 5 | 5 | 1 2 | 2 | 1 4 | 2 | 1 2 | 1 | 11 1 | 0 | 1 18 | 18 |
| 1900 | Ō | 0 | ı | 3 | 6 | 1 3 | 4 | 1 1 | 1 | , 2 | 2 | 1 2 | 1 | 1 1 | - 1 | 11 0 | 0 | 1 12 | 15 |
| 2000 | 1 | 4 | ı | 2 | 4 | 1 6 | 7 | 1 1 | 1 | : 3 | 2 | 1 2 | 1 | 1 1 | 1 | II 1. | 0 | 1 17 | 20 |
| 2100 | 2 | 7 | ŧ | 4 | 8 | 1 6 | 7 | 1 12 | 11 | 1 6 | 5 | 1 4 | 2 | 1 1 | 1 | 11 0 | 0 | 1 35 | 41 |
| 2200 | 2 | 7 | 1 | 4 | 8 | 1 2 | 2 | 1 9 | 8 | 1 5 | 4 | 1 2 | 1 | 1 0 | 0 | 11 D | 0 | 1 24 | 30 |
| 2300 | 4 | 15 | 1 | 3 | 6 | 1 4 | 5 | 1 6 | 5 | 1 1 | 1 | 1 2 | 1 | 1 0 | 0 | 11 0 | 0 | 1 20 | 33 |
| Bin Total | 27 | 101 | | 8 0 . | 154 | 159 | 190 | 155 | 142 | 145 | 113 | 154 | 91 | 117 | 64 | 68 | 29 | 907 | 886 |

¹⁾ Numbers have been extrapolated for 52-60 minute sample time.

Table A38. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 X 12 degree elliptical horizontal transducer, for February 18. Indian Point, 1988.

| | 0-5 | | | 5-10 | | 10- | 15 | 15-20 | | | 20-25 | | 25- | 30 | | 30~35 | 5 | | 35-40 | | | HOURLY | TOTAL |
|--------------|-----|------|-----|------|-----|------|-----|-------|-----|---|-------|-----|------|-----|---|-------|----|---|-------|----|---|--------|-----------|
| Hour | Rau | WF | R | au | WF | Raw | WF | Raw | WF | ş | Rau | WF | Rau | WF | ١ | Raw | WF | | lau | HF | | Raw | NF |
| 0000 | 1 | 4 | ı | 4 | 8 | 1 2 | 2 | 1 3 | 3 | 1 | 7 | 5 | 1 1 | 1 | | 1 | 1 | 1 | 2 | 1 | 1 | 21 | 25 |
| 0100 | 1 | 4 | ı | 4 | 8 | 1 12 | 14 | 1 20 | 18 | ı | 16 | 12 | 1 8 | 5 | ı | 9 | 5 | ŧ | 4 | 2 | i | 74 | 68 |
| 0200 | 0 | O | ı | 17 | 32 | 1 41 | 49 | 1 46 | 41 | 1 | 45 | 34 | 1 76 | 46 | 1 | 22 | 11 | i | 14 | 6 | i | 261 | 219 |
| 0900 | 2 | 7 | i | 4 | 8 | 1 26 | 31 | 1 19 | 17 | 1 | 27 | 20 | 1 20 | 12 | 1 | 19 | 10 | 1 | 12 | 5 | ì | 258 | 220 |
| 0400 | . 2 | 7 | 1 | 2 | 4 | 1 8 | 10 | 1 3 | 3 | 1 | 6 | 5 | 1 17 | 10 | | . 5 | 3 | i | 7 | ž | i | 100 | € 90 |
| 0500 | O | 0 | 1 | 2 | 4 | 1 4 | 5 | 1 5 | 5 | 1 | 5 | 4 | 1 12 | 7 | Ĺ | 4 | 2 | i | 2 | ī | i | 68 | 56 |
| 0600 | 2 | 7 | 1 | Э | 6 | 1 4 | 5 | 1 7 | 6 | t | 3 | 2 | 1 3 | 2 | Ì | 2 | 1 | i | 2 | ī | i | 26 | 30 |
| 0700 | 0 | ۵ | i | 0 | 0 | 1 1 | 1 | 1 2 | 2 | ١ | 4 | 3 | 1 2 | 1 | i | 3 | 2 | i | ā | Ŏ | i | 12 | 9 |
| 0300 | 2 | 7 | 1 | 4 | 8 | 1 3 | 4 | 1 4 | 4 | i | 6 | 5 | 1 4 | 2 | i | Ō | õ | i | 1 | Õ | i | 24 | 30 |
| 0900 | 0 | 0 | l | 3 ' | 6 | 1 8 | 10 | i 9 | 8 | i | 5 | 4 | i a | 2 | i | 1 | 1 | i | Ō | ō | i | 29 | 31 |
| 1000 | 1 | 4 | Ĺ | Ö | 0 | 1 6 | 7 | 1 5 | 5 | i | 6 | 5 | ii | ī | i | Ŏ | ñ | ì | ŏ | Ö | i | 19 | 22 |
| 1100 | 0 | 0 | t | 2 | 4 | 1 5 | 6 | 1 4 | 4 | i | 5 | 4 | 1 6 | ā | i | Š | ā | i | Ď | ō | i | 27 | 25 |
| 1200 | 1 | 4 | | 8 | 15 | 1 12 | 14 | 1 4 | 4 | i | 11 | 8 | 1 2 | 1 | i | Ž | ĭ | i | ŏ | õ | i | 40 | 47 |
| 1300 | 0 | 0 | 1 | 2 | 4 | 1 3 | 4 | 1 5 | 5 | i | 2 | 2 | i 1 | 1 | i | Ž | 1 | i | ā | 1 | i | 18 | 18 |
| 1400 | 1 | 4 | 1 | 1 | 2 | i i | í | iã | . 4 | i | ī | 1 | i 1 | ī | i | 1 | ī | i | 1 | ō | i | 11 | 14 |
| 1500 | Ŏ | o | 1 | 4 | 8 | 1 5 | 6 | i 10 | 9 | i | 17 | 13 | 18 | 11 | i | Ž | 4 | i | Š | 2 | i | 66 | 53 |
| 1600 | Ò | 0 | 1 | 5 | 9 | 1 15 | 18 | 1 25 | 23 | i | 20 | 15 | i 17 | 10 | i | 12 | 6 | i | Ğ | 4 | i | 103 | 65 |
| 1700 | . 2 | 7 | Ī | 10 | 19 | 1 9 | 11 | 1 10 | 9 | i | 6 | 5 | i 17 | 10 | - | 7 | 4 | i | Ś | 2 | i | 66 | 67 |
| 1800 | 2 | 7 | i | 2 | 4 | i 9 | 11 | i ii | 10 | i | 10 | 8 | i 9 | 5 | - | ż | 4 | i | š | 3 | i | 56 | 52 |
| 1900 | ā | - 11 | , i | ā | 6 | iá | 10 | 1 10 | 9 | i | 10 | 8 | iž | ĭ | i | • | i | i | ž | ī | i | 39 | 47 |
| 2000 | ĭ | 4 | i | 2 | 4 | i 1 | - 1 | i 3 | á | i | -4 | ă | i | ā | i | ī | ī | i | ī | Ö | i | 19 | 20 |
| 2100 | Ž | 7 | i | 10 | 19 | i 6 | ż | i 6 | 5 | i | i | 1 | i 2 | i | i | ò | Ġ | i | â | ă | i | 27 | 40 |
| 2200 | ō | ò | i | 4 | B | i 9 | 11 | i ă | 4 | i | Ś | 4 | 1 4 | ž | i | ŏ | ŏ | i | ŏ | Ö. | | 26 | 29 |
| 2900 | ō | ŏ | i, | э | 6 | i ź | 2 | iò | o | i | 4 | 9 | i i | 1 | i | ŏ | ŏ | i | ŏ | ŏ | i | 10 | 12 |
| Bin Total | 23 | 84 | - | 99 | 192 | 200 | 240 | 219 | 201 | | 226 | 174 | 233 | 141 | | 111 | 62 | | 76 | 32 | | 1400 | 1309 |

¹⁾ Numbers have been extrapolated for 30-60 minute sample time.

Table R39. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 % 12 degree elliptical horizontal transducer, for February 19. Indian Point, 1988.

| ٠ | 0-5 | | | 5-10 | | 10-1 | 5 | 15-20 | | 20-25 | | 25-9 | n | 30~3! | 5 | 35-40 | | HOURLY | TOTAL |
|--------------|-----|-----|---|--------------|-----|-------|--------------|-------|-----|-------|-----|------|------------|-------|----|-------|----|--------|-----------|
| Hour | Raw | HF | R | an 2 - 10 | NF | Rau | WF | Rau | HF | Raw | WF | Rau | WF | Rau | WF | Rau | WF | Raw | HF |
| 0000 | 0 | 0 | 1 | 8 | 15 | | - | . 7 | 6 | 1 4 | 3 | 1 4 | <u>-</u> - | 1 4 | 2 | 1 1 | 0 | 34 | 35 |
| 0100 | Ō | 0 | i | 3 | 6 | 1 4 | 5 | i 3 | 3 | 1 6 | 5 | 1 2 | 1 | 1 0 | 0 | 1 1 | 0 | 1 19 | 20 |
| 0200 | Ó | Ď | i | 2 | 4 | i 2 | . 2 | i 2 | 2 | 1 2 | 2 | 1 4 | 2 | 1 5 | 3 | 1 2 | 1 | 4 19 | 16 |
| 0300 | ī | 4 | i | 14 | 26 | 1 27 | 32 | 31 | 28 | 28 | 21 | 1 52 | 31 | 1 21 | 11 | 1 17 | 8 | 1 191 | 161 |
| 0400 | . 4 | 15 | i | 17 | 32 | 1 15 | 18 | 29 | 26 | 1 32 | 24 | 1 40 | 24 | 1 2 | 1 | 1 12 | 5 | 1 302 | 290 |
| 0500 | 0 | O | 1 | 2 | 4 | 1 7 | 8 | 9 | . 0 | 1 9 | 7 | 1 9 | 5 | 1 3 | 2 | 1 0 | 0 | 78 | 60 |
| 0600 | 1 | 4 | 1 | 2 | 4 | 1 6 | 7 | 1 6 | 5 | 1 7 | 5 | 1 11 | 7 | 1 5 | Э | 1 1 | 0 | 1 78 | 70 |
| 0700 | 0 | 0 | 1 | 0 | 0 | t 1 | 1 | 1 1 | 1 | 1 7 | 5 | 1 6 | 4 | 1 3 | 2 | 1 0 | O | 1 36 | 26 |
| 0800 | 0 | 0 | 1 | 0 | 0 | 1 4 | 5 | 1 2 | 2 | 1 3 | 2 | 1 2 | 1 | 1 2 | 1 | 1 0 | 0 | 1 13 | 11 |
| 0900 | 0 | 0 | 1 | 1 | 2 | 1 4 | 5 | 1 1 | 1 | I 3. | 2 | 1 2 | 1 | 1 1 | 1 | 1 0 | 0 | 1 12 | 12 |
| 1000 | 3 | 11 | 1 | 1 | 2 | 1 16 | 19 | 1 6 | 5 | 1 5 | 4 | 1 3 | 2 | 1 0 | 0 | 1 0 | 0 | 1 34 | 43 |
| 1100 | 0 | 0 | 1 | 2 | 4 | 1 4 | 5 | 1 4 | 4 | 1 4 | 3 | 1 3 | 2 | 1 0 | 0 | 1 0 | 0 | 1 17 | 18 |
| 1200 | 0 | Ø | ı | 4 | 8 | 1 6 | 7 | 1 3 | 3 | 1 4 | 3 | 1 6 | 5 | 1 1 | 1 | 1 0 | O | 1 26 | 27 |
| 1300 | 2 | 7 | ı | 3 - | 6 | 1 5 | 6 | 1 8 | 7 | 1 2 | 2 | 1 0 | 0 | 1 3 | 2 | 1 1 | 0 | 1 24 | 30 |
| 1400 | 2 | 7 | t | 2 | 4 | 1 1 - | í | 1 2 | 2 | 1 2 | 2 | 1 4 | 2 | 1 2 | 1 | 1 9 | 1 | 1 10 | 20 |
| 1500 | 0 | 0 | 1 | 1 | 2 | 1 2 | 2 | 1 1 | 1 | 1 3 | 2 | 1 3 | 2 | 1 0 | 0 | 1 0 | 0 | 1 83 | 75 |
| 1600 | 0 | 0 | 1 | . 5 | 9 | 1 7 | 8 | 1 16 | -14 | 1 9 | 7 | 1 28 | 17 | 1 18 | 9 | 1 9 | 4 | 1 92 | 68 |
| 1700 | 1 | 4 | 1 | 6 | 11 | 1 17 | 20 | 1 20 | 10 | 1 28 | 21 | 1 51 | 31 | 1 24 | 12 | 1 21 | 9 | 1 168 | 126 |
| 1800 | Ò | . 0 | • | 4 | 8 | 1 10 | 12 | 1 22 | 20 | 21 | 16 | 1 26 | 16 | i 14 | 7 | 1 15 | 7 | 1 112 | B6 |
| 1900 | 1 | . 4 | ı | 3 | 6 | 1 12 | 14 | 1 8 | 7 | 1 11 | 8 | 1 18 | 11 | 1 B | 4 | 1 7 | Э | 1 68 | 57 |
| 2000 | 1 | 4 | ı | 2 | 4 | 1 4 | 5 | 1 9 | 8 | 1 11 | 8 | 1 12 | 7 | 1 11 | 6 | 1 2 | 1 | 1 52 | 43 |
| 2100 | 1 | 4 | ı | 1 | 2 | 1 10 | 12 | 1 8 | 7 | 1 3 | 2 | 1 2 | 1 | 1 0 | 0 | 1 2 | 1 | 1 27 | 29 |
| 2200 | 1 | 4 | ı | 1 | 2 | 1 5 | 6 | 1 8 | 7 | 1 4 | 3 | 1 5 | 9 | 1 0 | 0 | 1 0 | O | 1 24 | 25 |
| 2900 | 0 | 0 | 1 | 3 | 6 | 1 6 | 7 | 1 3 | 3 | 1 2 | 2 | 1 2 | 1 | 1 0 | 0 | 1 0 | 0 | 1 16 | 19 |
| Bin Total | 18 | 68 | | 87 | 167 | 161 | 214 | 209 | 188 | 210 | 159 | 297 | 178 | 127 | 68 | 94 | 40 | 1543 | 1375 |

¹⁾ Numbers have been extrapolated for 7-60 minute sample time.

Table 840. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 % 12 degree elliptical horizontal transducer, for February 20. Indian Point, 1988.

| | 0-5 | | | 5-10 | | | 10-1 | 5 | | 15-20 | | 20-25 | | | 25-30 | 0 | | 30-35 | | | 35-4U | | н | OUPLY | TOTAL |
|--------------|-----|-----|-----|------|------|---|------|-----|----|----------|------|-------|-----|---|----------|-----|---|-------|-----|---|-------|----|-------|------------|--------|
| Hour | Rau | WF | F | ે અન | , WF | P | au | MF | P | au au | WF | P.au | ME | 1 | Pau | WF | F | ≷au | WF | R | lau | HF | R | 5 4 | WF |
| 0000 | 5 | 19 | 1 | 8 | 15 | 1 | 8 | 10 | 1 | 6 | 5 | 1 9 | 7 | 1 | .4 | 2 | 1 | Ū | U | 1 | 0 | 0 | 1 | -40 | 58 |
| סמוט | Ď | Ď | i | 1 | 2 | i | 8 | 10 | i | 9 | 8 | 1 3 | 2 | i | 2 | 1 | i | 0 | 0 | 1 | 1 | O | 1 | 24 | 23 |
| 0200 | 1 | 4 | i | Ā | 8 | i | ž | 8 | i | 4 | .4 | 1 4 | 3 | Ĺ | 6 | 4 | ì | 2 | 1 | 1 | Ô | 0 | i | 28 | 32 |
| 0300 | á | o | i | i | 2 | i | ż | 8 | i | 5 | 5 | 1 7 | 5 | i | 4 | 2 | i | 6 | Э | i | 5 | 2 | t | 35 | 27 |
| 0400 | ĭ | 4 | i | Š | 9 | i | 22 | 26 | i | 25 | 23 | 39 | 29 | i | 43 | 26 | i | 16 | . 9 | ī | 14 | 6 | i | 165 | 131 |
| 0500 | ĩ | 4 | i | 12 | 23 | i | 47 | 56 | i | 47 | 42 | 46 | 35 | i | 91 | 55 | i | 30 | 15 | i | 10 | 5 | i | 284 | 235 |
| 0600 | ā | o i | i | 13 | 24 | i | 92 | 38 | i | 28 | - 25 | 1 24 | 19 | i | 30 | 18 | ì | 26 | 14 | i | 18 | 8 | Ĺ | 173 | 145 |
| 0700 | 4 | 15 | i | 4 | _ e | i | 19 | 23 | i | 25 | 23 | i 7 | - 5 | i | 23 | 14 | ì | 15 | 8 | i | 5 | 2 | i | 102 | 98 |
| 0000 | ò | ō | i | e | 15 | i | 16 | 19 | i | 23 | 21 | i 2 | 5 | i | 14 | 8 | i | 6 | 3 | i | 2 | 1 | i | 76 | 72 |
| 0900 | õ | ă | i | ī | 2 | i | 2 | 2 | i. | 3 | 3 | i 6 | 5 | i | - i | 2 | ì | 2 | 1 | i | 1 | Ö | ì | 18 | 15 |
| 1000 | ā | õ | i | à | 6 | i | ī | 1 | i | ĭ | ĭ | i j | 2 | i | ž | . 4 | i | 1 | ì | i | ă | ā | i | 16 | 15 |
| 1100 | 2 | ž | i | 1 | 2 | i | 6 | ż | ; | 4 | 4 | 1 2 | 2 | i | 6 | 4 | i | ۵ | Ŏ | i | Ō | Ō | 1 | 21 | 26 |
| 1200 | ā | Ġ | i | ā | - 6 | i | ă | 4 | ì | э́ | э | i 2 | 2 | i | 5 | э | i | Õ | ā | ì | Ö | O | i | 16 | 18 |
| 1300 | 2 | 7 | i | 6 | 11 | i | 3 | નં | i | 6 | 5 | i 5 | 4 | i | ã | 2 | t | ž | ĩ | 1 | Ō | Ö | i | 27 | 3-1 |
| 1400 | ă٠ | ò | i | 4 | ē | i | · 4 | s | i | 4 | 4. | 1 3 | 2 | i | 4 | 2 | i | 4 | 2 | i | 0 | Q. | i | 23 | 23 |
| 1500 | ī | 4 | i | i | 2 | i | 2 | 2 | ī | э | э | i i | 1 | i | 5 | 3 | ì | 4 | 2 | 1 | 1 | 0 | 1 | เช | 17 |
| 1600 | i | 4 | ì | ì | 2 | ì | 3 | 4 | i. | 15 | 5 | 1 14 | 11 | ì | 28 | 17 | i | 10 | 5 | 1 | 11 | 5 | 1 | 74 | 53 |
| 1700 | 2 | 7 | i | Ž | 13 | i | 12 | 14 | i | 25 | 23 | 1 28 | 21 | ī | 37 | 22 | ١ | 14 | 7 | ı | 14 | 6 | t | 139 | 113 |
| 1900 | 3 | 11 | i | 1-4 | 26 | i | 34 | 41 | ì | 29 | 26 | 1 19 | 14 | i | 18 | 11 | i | 15 | 8 | 1 | 6 | 3 | 1 | 138 | 140 |
| 1900 | · 3 | 11 | i | 20 | 38 | i | 30 | 36 | i | 38 | 34 | 1 19 | 14 | 1 | 2-4 | 14 | 1 | 11 | 6 | 1 | 5 | 2 | 1 | 150 | 155 |
| 3000 | 2 | . 7 | - 1 | 17 | 32 | 1 | 26 | 31 | 1 | 10 | 16 | 1 1-4 | 11 | 1 | 13 | 8 | 1 | 18 | 9 | - | 4 | 2 | 1 | 112 | 116 |
| 2100 | 4 | 15 | t | 1 | 2 | t | Э | 4 | 1 | 13 | 12 | I 5 | 4 | 1 | 1 | 1 | 1 | 4 | 2 | ı | 2 | 1 | 1 | 33 | ું. ના |
| 2200 | 2 | 7 | J | 3 | 6 | 1 | 2 | 2 | 1 | 3 | Э | 1 4 | 3 | 1 | 7 | 4 | ı | 2 | 1 | 1 | 4 | 2 | 1 | 27 | 28 |
| 2300 | 2 | 7 | ı | √3 | 6 | 1 | 7 | 8 | ı | 5 | 5 | 1 6 | 6 | | 5 | 3 | 1 | -3 | 2 | 1 | 0 | 0_ | 1 | 33 | 37 |
| Bin Total | 36 | 133 | | 141 | 268 | | 304 | 363 | | 333 | 303 | 279 | 211 | | 383 | 230 | | 193 | 93 | | 103 | 45 | | 1772 | 1652 |

¹⁾ Numbers have been extrapolated for 60 minute sample time.

Table A41. Hourly estimates of row and weighted fish numbers (with high and low tide heights) in front of unit 3, intake 35 using 6 K 12 degree elliptical horizontal transducer for week 5, February 14 to 20. Indian Point, 1988.

| | | | | | | | | F FD 4. | _ | | | | | CC0 11 | _ | | FFD 44 | • | | FF0 00 | | HEER | |
|----------------|-------|-------------|-------|------|-----------|-------|-------|----------------|------|------|-----------|------|-------|--------|------|-------|--------|------|-------|--------------|------|--------------|-------|
| Hour | PAU | 38 14 HF | Tide | PAH | FE8 HF | Tide | RRM | FEB 1: | Tide | RAM | FEB HF | | PAH | FEB 16 | Tide | RAH | FEB 19 | Tido | PAH | FEB 20 HF | Tide | TOTA RASH | uf uf |
| 0000 | 6369 | 12522 | | 1 32 | 27 | | 1 64 | 49 | | 1 87 | 72 | | 1 21 | 25 | | 1 34 | 35 | | 1 40 | 59 | | 1 6647 | 12786 |
| 0100 | 5502 | 10667 | | 1 34 | 30 | | 1 47 | 37 | | 1 52 | 38 | | 1 74 | 68 | | 1 19 | . 20 | | 1 24 | 23 | 1.6 | 1 5752 | 10663 |
| 02:00 | 4840 | 8657 | 0.1 | 1 39 | 3 [| | 1 112 | 99 | | 1 47 | 41 | | 1 261 | 219 | | 1 19 | 16 | | 1 28 | \ 32 | | 1 5346 | 9095 |
| 0300 | 262 | 356 | | 1 9 | 7 | -0. 1 | 1 73 | 68 | | 1112 | 98 | • | 1 258 | 220 | | 1 191 | 161 | | 1 35 | 27 | | 1 940 | 937 |
| 0400 | 38 | 49 | | 1 8 | 7 | | 1 12 | 13 | -0.2 | 1 26 | 19 | | 1 100 | 90 | | 1 302 | 290 | | 1 165 | 131 | | 651 | 599 |
| 0500 | 13 | 16 | | 1 4 | 4 | | 1 14 | . 18 | | 1 24 | 23 | -0.3 | 1 69 | 56 | | 1 78 | 68 | | 1 284 | 235 | | 1 495 | 420 |
| 0600 | 5 | 10 | | 1 31 | 29 | | 1 12 | 12 | | 1 3 | 5 | | 1 26 | 30 | -0.3 | 1 78 | 70 | | 1 173 | 145 | | 1 328 | 301 |
| 0700 | 8 | 13 | | 1 55 | 57 | | 1 25 | 31 | | 1 17 | 15 | | 1 12 | 9 | | 1 36 | 26 | -0.4 | 1 102 | 98 | -0.3 | 1 255 | 249 |
| 12000 | 35 | 32 | 1.4 | 1 43 | 41 | | 1 43 | 52 | | 1 21 | 22 | | 1 24 | 30 | | 1 13 | . 11 | | 76 | 72 | | 255 | 260 |
| 0900 | 39 | 38 | | 1 29 | 29 | 1.5 | 40 | 66 | | 1 19 | 28 | | 1 29 | 31 | | 1 12 | 12 | | 1 18 | 15 | | 1 166 | 219 |
| 1000 | 17 | . 14 | | 1 46 | 38 | | 1 40 | 44 | 1.6 | 1 20 | 29 | 1.6 | 1 19 | 22 | | 1 34 | 43 | | 1 16 | 15 | | 1 192 | 204 |
| 1100 | 36 | 26 | | 1 32 | 25 | | 1 59 | 49 | | 1 29 | 56 | | 1 27 | 25 | 1.7 | 1 .17 | 10 | | 1 21 | 26 | | 1 215 | 225 |
| 1200 | 7 | 7 | | 1 12 | 10 | | 1 49 | 34 | | 1 20 | 22 | | 1 40 | 47 | | 1 26 | 27 | 1.6 | 1 16 | 18 | | 1 170 | 165 |
| 1 300 | 28 | 17 | | 1 32 | 29 | | 1 56 | 42 | | 1 21 | 23 | | 1 18 | 18 | | 1 24 | 30 | | 1 27 | 34 | 1.5 | 1 206 | 192 |
| 1400 | 28 | 20 | | 1 49 | 40 | | 1 127 | 114 | | 1 61 | 50 | | 1. 11 | 14 | | 1 18 | 20 | | 1 23 | 23. | | 317 | 281 |
| 1500 | 29 | 28 | -0.1 | 1 45 | 94 | | 1 80 | 76 | | 1 69 | 56 | | 1 66 | 53 | | 1 63 | 75 | | 1 18 | 17 | | 1 390 | 339 |
| 1600 | 8 | Ś | | 1 32 | 34 | -0.2 | 1 30 | 27 | | 1102 | 83 | | 1 103 | 85 | | 1 92 | 68 | | 1 74 | 53 | | 1 441 | 355 |
| 1700 | 2 | 3 | | 1 22 | 19 | | 1 21 | 20 | -0.3 | 1 51 | 50 | -0.4 | 1 66 | 67 | | 1 168 | 126 | | 1 139 | 118 | | 1 469 | 398 |
| 1800 | 14 | 18 | | 1 16 | 14 | • | 1 21 | 21 | | 1 18 | 10 | | 1 56 | 52 | -0.4 | 1 112 | 86 | | 1 138 | 140 | | 1 375 | 349 |
| 1900 | 11 | 11 | | 1 29 | 34 | | 1 16 | 16 | • | 1 12 | 15 | | 99 | 47 | | 1 60 | 57 | -0.4 | 1 150 | 155 | | 1 325 | 395 |
| 2000 | 16 | 16 | . 1.1 | 1 24 | 21 | | 1 25 | 30 | | 1 17 | 20 | | 1 19 | 20 | | 1 52 | 49 | | 1 112 | 116 | -0.3 | 1 265 | 266 |
| 2100 | 15 | 21 | • | 1 95 | 81 | 1.2 | 1 33 | 39 | | 1 35 | 41 | | 1 27 | 40 | | 1 27 | 29 | | 1 33 | 41 | | 1 205 | 241 |
| 2200 | 27 | 26 | | 1 39 | 36 | | 1 30 | 34 | 1.1 | 1 24 | 30 | | 1 26 | 29 | | 1 24 | 25 | | 1 27 | 28 | | 1 197 | 206 |
| 2300 | 30 | 28 | | 1 54 | 43 | * | 1 34 | 32 | | 1 20 | 33 | 1.5 | 1 10 | 12 | 1.6 | 1 16 | 19 | | 1 33 | 37 | | 1 197 | 204 |
| Daily Total | 17379 | 92600 | | 751 | 669 | | 1057 | 1021 | | 907 | 986 | | 1400 | 1309 | | 1543 | 1375 | | 1772 | 1652 | | 24909 | 39512 |

Tide heights for low and high tide only, New York (the Battery), N.Y. and times edjusted for Indian Point Location.

Table R42. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3, intake 35 using 6 % 12 degree elliptical horizontal transducer, for February 21. Indian Point, 1988.

| | 0-5 | | | 5~10 | | 10-1 | 5 | 15~20 | | 20-25 | | 25-3 | 0 | 30-3 | 5 | 35-40 | | HOURLY | TOTAL |
|--------------|------------|-----|----|-------|-----|------|------|-------|-----|-------|-----|------|-----|------|-----|-------|----|--------|-------|
| Hour | Paw | WF | R | lau . | HF | Raw | . WF | Rau | WF | Rau | HF | Raw | WF | Rau | WF | Rau | WF | Raw | WF |
| 0000 | 2 | 7 | 1 | 6 | 11 | 12 | 14 | 1 21 | 19 | ı 25 | 19 | 1.14 | 8 | t 1 | 1 | 1 0 | 0 | 1 104 | 101 |
| 0100 | 0 | 0 | ı | 2 | 4 1 | 8 | 10 | 1 9 | 7 | 1 11 | . 8 | 1 8 | 5 | 1 2 | 1 | 1 0 | 0 | 1 39 | 35 |
| 0200 | 1 | 4 | ı | 3 . | 6 (| 2 | 2 | 1 4 | 4 | 1 3 | 2 | 1 4 | 2 | 1 0 | 0 | 1 0 | 0 | 1 17 | 20 |
| 0300 | 0 | 0 | 1 | 1 | 2 | 3 | 4 | 1 3 | 3 | 1 2 | 2 | 1 1 | - 1 | 1 3 | 2 | 1 0 | 0 | 1 13 | 14 |
| 0400 | 1 | 4 | 1 | 4 | 8 1 | 9 | 11 | 1 13 | 12 | 1 15 | 11 | l 25 | 15 | 1 11 | 6 | 1 12 | 5 | I 90 | 72 |
| 0500 | 1 | 4 | i | 11 | 21 | 14 | 17 | 1 24 | 22 | 1 35 | 26 | ! 65 | 39 | 1 27 | 14 | l 22 | 10 | 1 199 | 153 |
| 0600 | ~ 3 | 11 | ı | Ž | 13 | 20 | 24 | 1 26 | 23 | 1 29 | 22 | 1 45 | 27 | 1 15 | 8 | 1 22 | 10 | 1 167 | 138 |
| 0700 | 3 | 11 | Ť. | 6 | 11 | 20 | 24 | 1 23 | 21 | 1 16 | 12 | l 12 | · 7 | 1 13 | 7 | I 10 | 5 | 1 103 | 98 |
| 0800 | 3 | 11 | i | 10 | 19 | 14 | -17 | 1 10 | 9 | 1 5 | 4 | 1 11 | . 7 | 1 7 | 4 | 1 4 | 2 | 1 64 | 73 |
| 0900 | 0. | 0 | i. | 2 | 4 | 4 | 5 | 1 2 | 2 | 1 7 | 5 | 1 5 | 3 | 1 2 | 1 | 1 6 | 3 | 1 29 | 23 |
| 1000 | 1 | 4 | i | 4 | 8 | 9 | 11 | 1 3 | 3 | 1 5 | 4 | 1 1 | 1 | 1 2 | 1 | 1 2 | 1 | 1 27 | 33 |
| 1100 | 0 | 0 | Ĺ | a | 0 | 1 | 1 | 1 3 | 3 | 1 2 | 2 | 1 0 | 0 | 1 3 | 2 | 1 1 | 0 | 1 10 | . В |
| 1200 | O | 0 | 1 | 5 | 9 | 3 | 4 | 1 6 | 5 | 1 6 | 5 | 1 3 | 2 | 1 0 | 0 | 1 0 | 0 | 1 23 | 25 |
| 1300 | 0 | 0 | i | ž | 4 | 1 | 1 | 1 0 | 0 | 16 | 5 | 1 4 | 2 | 1 1 | 1 | 1 0 | O | 1 14 | 13 |
| 1400 | ĩ | 4 | 1 | ā | 0 | 2 | 2 | 1 1 | 1 | 1 0 | O | 1 2 | 1 | 1 1 | 1 | 1 . 0 | 0 | 1 14 | 18 |
| 1500 | Ō | ū | i | Ö | ō | Õ | | i | Ō | 1 0 | Ó | 1 0 | Ö | 1 0 | 0 | 1 0 | O | 1 0 | 0 |
| 1600 | Õ | ū | 1 | Ŏ | 0 | 0 | 0 | 1 0 | O | 1 2 | 2 | 1 0 | 0 | 1 0 | 0 | l o | 0 | 1 8 | 8 |
| 1700 | · 1 | 4 | i | ٩ | 8 | 11 | 13 | 1 14 | 13 | 1 8 | 6 | 1 9 | 5 | 1 5 | 3 | 1 2 | 1 | 1 54 | 53 |
| 1800 | 2 | 7 | i | . 7 | 13 | 18 | 22 | 1 35 | 32 | 1 41 | 31 | 1 26 | 16 | 1 19 | 10 | 1 11 | 5 | 1 159 | 136 |
| 1900 | 3 | 11 | i | 22 | 41 | 92 | 38 | 1 26 | 23 | 1 29 | 22 | 1 37 | 22 | 1 7 | . 4 | 1 12 | 5 | 1 168 | 166 |
| 2000 | Э | 11 | i | 21 | 39 | 10 | 12 | 1 14 | 13 | 1 11 | 8 | 1 8 | 5 | 1 5 | 3 | 1 2 | 1 | 1 74 | 92 |
| 2100 | 1 | 4 | 1 | 2 | 4 | 1 4 | 5 | 1 5 | 5 | 1 8 | 6 | 1 19 | 11 | 1 5 | 3 | 1 0 | 0 | 1 44 | 38 |
| 2200 | 1 | 4 | 1 | 0 | 0 | . 0 | 0 | 1 1 | 1 | 1 1 | 1 | 1 2 | 1 | 1 0 | . 0 | 1 1 | 0 | 1 6 | 7 |
| 2300 | 2 | 7 | 1 | 1 | 2 | 0 | 0 | 1 4 . | 4 | 1 2 | 2 | 1 2 | 1 | 1 1 | 1 | 1 0 | 0 | 1 14 | 20 |
| Bin Total | 29 | 108 | | 120 | 227 | 197 | 297 | 246 | 225 | 269 | 205 | 303 | 181 | 130 | 73 | 107 | 48 | 1439 | 1345 |

¹⁾ Numbers have been extrapolated for 15-60 minute sample time.

Table A43. Hourly estimates of raw and weighted fish numbers by range bin (in meters) in front of unit 3. intake 35 using 6 X 12 degree elliptical horizontal transducer, for February 22. Indian Point, 1988.

| Hour . | 0-5 Rau | HF | 5-1 Raw | O HF | 10- Rau | 15 WF | 15-20 Rau | ИF | 20-25 Rau | WF | 25-3(Rau | D HF | 30- Reu | -35 WF | 35-40 Rau |) WF | HOURLY Rau | TOTAL WE |
|--------|------------|-----|------------|------|------------|----------|--------------|-----|--------------|-----|--------------|------|------------|---------------|--------------|----------|---------------|----------|
| | | | ~~~~ | | | | | | | | | | | | | | | |
| 0000 | 1 | 4 | 1 2 | 4 | 1 8 | 10 | 1 5 | 5 | ! 4 | 3 | 1 ? | 4 | 1 0 | 0 | 1 0 | 0 | 1 27 | 30 |
| 0100 | Ų | 0 | 1 2 | 4 | 1 5 | 6 | 1 3 | 3 | 1 6 | 5 | 1 6 | 4 | 1 0 | 0 | 1 0 | 0 | 1 22 | 22 |
| 0200 | . 1 | 4 | 1 | 2 | 1 5 | 6 | 1 6 | 5 | 1 4 | 3 | 1 5 | 3 | 1 0 | O | 1 0 | O | 1 22 | . 23 |
| 0300 | Q | 0 | ! 1 | 2 | 1 6 | . 7 | 1 4 | 4 | 1 3 | 2 | 1 2 | 1 | 1 2 | 1 | 1 1 | 0 | 1 19 | 17 |
| 0400 | 0 | O | 1 | 2 | 1 4 | 5 | 1 5 | ร์ | 1 0 | 0 | 1 | . 1 | 1 0 | , O | 1 2 | 1 | 1 13 | 14 |
| 0500 | 1 | - 4 | 1 3 | 6 | 1 2 | 2 | 1 10 | . 9 | i 9 | 7 | 1 13 | 8 | 1 4 | 2 | 1 3 | 1 | 45 | 39 |
| 0600 | 0 | O | 1 3 | 6 | 1 6 | 7 | 1 5 | 5 | 1 12 | 9 | 1 7 | 4 | 1 7 | 4 | 1 9 | 4 | 1 49 | 39 |
| 0700 | 0 | 0 | 1 2 | 4 | 1 2 | 2 | 1 3 | 3 | 1 2 | 2 | 1 8 | 5 | 1 0 | 0 | 1 - 0 | 0 | 1 17 | 16 |
| 0600 | 0 | 0 | 1 3 | 6 | 1 3 | 4 | 1 2 | 2 | 1 6 | 5 | 1 4 | 2 | 1 | 1 | 1 5 | 2 | 1 24 | 22 |
| 0900 | 1 | 4 | 1 1 | 2 | 1 2 | 2 | 1 1 | 1 | 1 2 | 2 | 1 2 | 1 | 1 0 | 0 | 1 0 | 0 | 1 12 | 15 |
| 1000 | 0 | 0 | (Э | 6 | 1 1 | 1 | 1 0 | O | 1 2 | 2 | 1 1 | 1 | 1 0 | 0 | 1 1 | 0 | 1 8 | 10 |
| 1100 | 0 | 0 | 1 0 | 0 | 1 1 | . 1 | 1 0 | 0 | l 1 | 1 | 1 1 | 1 | 1 0 | 0 | 1 1 | 0 | 1 4 | 3 |
| 1200 | 0 | - 0 | 1 0 | 0 | 1 1 | 1 | 1 7 | 6 | Ι З. | 2 | 1 2 | 1 | 1 0 | 0 | i | ā | 1 13 | 10 |
| 1300 | 2 | 7 | 1 3 | 6 | 1 10 | 12 | 1 3 | 3 | i - 2 | 2 | 1 5 | 3 | i | Ŏ | iŏ | ٠ | 1 25 | 33 |
| 1400 | ä | Ď | 1 4 | B | i 3 | -4 | i ā | 4 | i | - 3 | iii | ī | 1 2 | ĭ | i ŏ | ă | 1 18 | 21 |
| 1500 | Ž. | 7 | 1 6 | 11 | 1 2 | ė | 1 13 | 12 | i a | ž | i è | 5 | i ā | · 2 | i ž | 7 | i 44 | 48 |
| 1600 | 1 | 4 | ; 3 | 6 | . 5 | 6 | 1 5 | - 5 | iš | 2 | i 4 | 2 | i > 2 | 4 | i | â | 1 57 | 57 |
| 1700 | - | Ó | ; | ŏ | ; - | Ö | ; - | ŏ | i | ō | i ' | ō | | n | ; | ŏ | 1 0 | o o |
| 1800 | | ŏ | i | ŏ | i | ñ | ; | ŏ | i | Ď. | i | ŏ | i. | Ď | ; | | 1 0 | Ö |
| 1900 | | . 0 | i | ŏ | : | ŏ | ; | ŏ | ; | ŏ | ì | Ö | | Ö | • | . 0 | 1 0 | Ö |
| 2000 | | õ | i | Ď | | Õ | ì | õ | i | ŏ | • | Ö | ì | 0 | ì | Ö | 1 0 | ŭ |
| 2100 | | õ | i | ŏ | i | ñ | i | ñ | i | ň | ; | ő | ì | Ö | | ä | 1 0 | ŭ |
| 2200 | | ŏ | i | ŏ | i | ñ | j | ő | i | ñ | i | Ö | i | ŏ | i | 9 | i 0 | o o |
| 2300 | | ŏ | | Õ | i | ñ | ; | ŏ | | Ö | 1 | | ; | ٥ | : | 0 | 1 0 | Ö |
| | | | ' | | , | | · | | ' | | • | | · | . | · | <u>0</u> | i U | 0 |
| Bin | 9 · | 34 | 38 | 75 | 71 | 84 | 76 | 72 | 66 | 52 | 77 | 47 | 26 | 15 | 25 | 9 | 419 | 420 |
| Total | | | - | | | | | | | | | | | | | | | |

¹⁾ Numbers have been extrapolated for 31-60 minute sample time.

Isble A44. Hourly estimates or non-ord weighted fish numbers (with high and low tide heights) in front of unit 3, intake 35 using 6 X 12 degree elliptical horizontal transducer for week 6, February 21 to 22. Indian Point, 1988.

| | | EB 21 | | | FEB | 22 | | DRY | 3 | | DAY | 4 | | DAY | 5 | | DRY | | | DAY | 7 | HEE | KLY |
|----------------|------|-------|------|------|-----|-------|-----|-----|------|-----|-----|---|-------|-----|---|-----|-----|------|-----|-----|------|-------|------|
| Har | FIFM | HF | Tide | PAH | | | RAH | HF | Tide | RAH | | | RAH | HF | | RAM | HF | Tide | RPH | MF | Tide | RPH | HF |
| `0000 | 104 | 101 | | 1 27 | 30 | | 1 | | | 1 | | | I | | | 1 | | | 1 | | | 1 131 | 131 |
| อตถ | 99 | 35 | 1.6 | 1 22 | 22 | | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | 1 61 | 57 |
| യാര | 17 | 20 | | 1 22 | 2.3 | 1.5 | 1 | | | 1 | | | J | | | 1 | | | • | | | 1 39 | 43 |
| CHOO | 13 | 14 | | 1 19 | 17 | | 1 | | | 1 | | | 1 | | | ı | | | 1 | | | i 92 | 31 |
| CACC | 90 | 72 | | 1 13 | 14 | | i | | | 1 | | | Ĺ | | | 1 | | | 1 | | | 1 109 | 86 |
| 0500 | 199 | 153 | | 1 45 | 319 | | i | | | 1 | | | 1 | | | 1 | | | 1 | | | 1 244 | 192 |
| 0600 | 167 | 138 | | 1 49 | 349 | | i | | | 1 | | | i | | | i | | | ŧ | | | 1 216 | 177 |
| ത്ത | 103 | 98 | | 1 17 | 16 | | i | | | Ì | | | 1 | | | 1 | | | i | | | 1 120 | 114 |
| CHOO | 64 | 73 | -0.2 | 1 24 | 22 | | i | | | i | | | i | | | ì | | | i | | | 1 89 | 95 |
| 000 | 28 | 23 | | 1 12 | 15 | -o. i | j | | | i | | | i | | | i | | | i | | | 1 40 | 38 |
| 1300 | 27 | 33 | | 1 8 | 10 | | i | | | i | | | t | | | i | | | i | | | 1 35 | 43 |
| 1100 | 10 | 8 | | i 4 | 3 | | ì | | | i | | | i | | | i | | | i | | | 1 14 | 11 |
| 1200 | 23 | 25 | | 1 13 | 10 | | i | | | i | | | i | | | i | | | i | | | 36 | 35 |
| 1300 | 14 | 13 | | 1 25 | 33 | | i | | | ì | | | i | | | i | | | i | | | 39 | 46 |
| 1400 | 14 | 18 | 1.4 | | 21 | | i | | | i | | | i | | | i | | | i | | | i 92 | 39 |
| 1300 | Ö | Ö | • | 1 44 | 46 | 1.3 | i | | | i | | | i | | | ì | | | i | | | i 44 | 46 |
| 1300 | ě | ě | | 1 57 | 57 | | i | | | i | | | i . | | | ì | | | i | | | 65 | 65 |
| 1700 | 54 | 53 | | 1 D | Ď | • | i | | | i | | | i ' | | | i | | | i | | | 54 | 53 |
| 1300 | 159 | 136 | | i õ | Õ | | i | | | i | | | ì | | | i | | | i | | | 1 159 | 194 |
| DOE | 168 | 166 | | 1 0 | Õ | | i | | | i | | | i | | | í | | | i | | | 1 160 | 166 |
| 2000 | 74 | 92 | -0.2 | io | Ó | | i | | | i | | | į | | | i | | | i | | | 1 74 | 92 |
| 300 | 44 | 38 | | 1 0 | Ò | | i | | | i | | | i | | | i | | | i | | | 1 44 | 38 |
| 22:00 | 6 | 7 | | ŧ 0 | Ö | | i | | | i | | |) | | | i | | | i | | | 1 6 | 7 |
| 2900 | 14 | 20 | | I D | Ü | | 1 | | | 1 | | | 1 | | | 1. | • | | 1 | | | i 14 | 20 |
| Drily Total | 1439 | 1945 | | 419 | 420 | | O | 0 | | 0 | 0 | | 0 | 0 | | 0 | O | | 0 | ٥ | | 1 959 | 1765 |

 $[\]mathcal V$ Tide heights for low and high tide only, New York (the Battery). N.Y. and times adjusted for Indian Point Location.

APPENDIX B:

Target Strength Data

APPENDIX B:

Dual-beam Target Strength Measurements and Interpretation

Introduction

A fish's target strength is a measure of its echo reflecting power. The larger the target strength, the greater the sound energy reflected by a fish when it is ensonified by an acoustic beam. Acoustic backscattering from a fish is a complex phenomenon. The intensity of an echo reflected from a fish depends on a variety of factors, including acoustic frequency, fish size, orientation in the beam, and swim bladder characteristics. Despite the many variables, empirical relationships have been derived between average fish length and average target strength for many species of fish. (Haslett 1969, Love 1971, McCartney and Stubbs 1971). In the last decade, techniques have been developed to measure target strengths of freely swimming fish in their natural habitats (Burczinski and Dawson 1984; Ehrenberg 1984a, 1984b).

Target strengths are expressed on a logarithmic scale in decibel units. Typical values for fish range from -60 to -20 dB. The arithmetic equivalent of target strength (TS) is the backscattering cross section (σ_{bs}) in units of m⁻² where:

$$TS = 10 \log(\sigma_{bs}) \tag{1}$$

The voltage output of a single-beam system is related to a fish's backscattering cross section (and target strength) by the following equation:

$$V^2 = k \sigma_{bs} b^2 (\theta, \emptyset)$$
 (2)

where

V = detected output of an echo sounder at a 40 log R time-varied gain. The echo intensity (I) is proportional to V^2 .

k = a constant determined from system calibration and equipment settings.

- bs = backscattering cross section of the fish. This is a measure of the power of the fish's acoustic return to the transducer. Target strength is related to TS by equation (1).
- $b(\theta,0) = beam pattern factor of the transducer. This is the ratio of the acoustic beam's transmitted intensity (I) at the angular coordinates <math>(\theta,\emptyset)$ to that at the acoustic axis of the transducer, i.e.,

$$b(\theta,\emptyset) = \frac{I(\theta,\emptyset)}{I(0,0)}$$

 $b(\theta,\emptyset)$ is also a measure of the transducer's receiving sensitivity. Because a single-beam echo sounder uses the same transducer for both transmitting and receiving, this quantity is squared in equation (2).

Under controlled laboratory conditions, the values of V^2 , k, and $b^2(\theta,\emptyset)$ can be measured and equation (2) solved for σ_{bs} . However, in the open environment, the b^2 value cannot be measured because there is no way to determine a fish's exact coordinates (θ,\emptyset) in the beam. In other words, a single-beam system cannot make direct *in situ* target strength measurements because the fundamental equation (2) contains two unknowns (σ_{bs}, b^2) .

A dual-beam system overcomes this problem by utilizing a second transducer element, and hence a second equation. The b^2 value is factored out and equations (3) and (4) are solved for σ_{bs} . Specifically, a dual-beam system transmits pulses on a narrow-beam transducer element and receives the returning echoes on both narrow- and wide-beam elements. The narrow- and wide-beam squared voltage outputs are:

$$V_n^2 = k_n \sigma_{bs} b_n^2(\theta, \emptyset)$$
 (3)

$$V_w^2 = k_w \sigma_{bs} b_w^2(\theta, \emptyset)$$
 (4)

By assuming the dual-beam system is designed such that $b_w(\theta,\emptyset) = 1$ over the main lobe of the narrow beam, the squared voltages (3) and (4) from the received echo signal become:

$$\frac{V_n^2}{V_w^2} = \frac{k_n b_n (\theta, \emptyset)}{k_w}$$
 (5)

This can be rearranged into the form:

$$b_{n}(\theta,\emptyset) = \frac{V_{n}^{2} k_{w}}{V_{w}^{2} k_{n}}$$
 (6)

Inserting this $b_n(\theta,\emptyset)$ value into equation (3) and rearranging the formula allows computation of a fish's backscattering cross section according to:

$$\sigma_{bs} = \frac{V_w^2 k_n}{V_n^2 k_w^2} \tag{7}$$

The backscattering cross section value can then be converted into target strength using equation (1).

2.0 METHODS

Dual-beam data were collected at the Indian Point Unit 3 intakes between January 13 and March 4, 1988. Approximately 34 hours of data were recorded over the study period and used to evaluate changes in mean acoustic size of the fish population over time, with depth, and in response to hammer operation.

2.1 Instrumentation

The equipment used to collect target strength information consisted of a BioSonics Model 101 dual-beam echo sounder, two BioSonics Model 111 thermal chart recorders, an oscilloscope, a BioSonics 6° X 15° dual-beam transducer and a digital tape recording

system. The recording system used a BioSonics Model 171 tape interface, Sony digitizer, and Sony Beta VCR to digitally encode the data on video tape. These tapes were then shipped to Seattle for further analysis.

2.2 Data Collection

The dual-beam transducer was mounted on the end of a 10 ft long steel pole, which was attached to the catwalk approximately one meter in front of the intake at a depth of 0.5 meters below the mean low water level (MLW). This mount was located at Intake 35 during the first six weeks of the study. After February 28, the transducer was moved to Intake 36, due to the failure of the two hammers at Intake 35. At both locations, the mount was centered in the intake directly above the hammers.

Dual-beam data were collected at three different transducer orientations. Objectives were to evaluate target strength distributions at various distances offshore from the intake and also to verify that the single-beam system threshold was correctly set. The location, transducer orientation and time of dual-beam data collection are shown in Table B1. On January 13 and 20, dual-beam data were collected with the transducer aimed 35° from vertical (0° = straight down), the same orientation as the 15° oblique transducer. On January 28 and February 22, side-scan data were collected at a 90° vertical aiming angle and used to evaluate the population being sampled by the horizontally-aimed 6° X 12° elliptical transducer. After February 22, all data were collected with the transducer aimed straight down, at a 0° vertical aiming angle. These data were used to estimate the acoustic size of the population directly in front of the intake and to evaluate any changes in target strength distribution with respect to hammer operation. This orientation also provided the least variable estimate of the population target strength.

Table B1. Dual-beam sampling schedule, Indian Point Unit 3, 1988.

| Date | St. Time | End Time | Tape # | Location | Orientation |
|------|----------|----------|--------|-----------|-------------|
| 1/12 | 1328 | 1533 | 1 | 35 | 35° |
| 1/20 | 0900 | 1107 | 2 | 35 | 35° |
| 1/28 | 1335 | 1540 | 3 | 35 | 90° |
| 2/22 | 1700 | 1955 | 4 | 35 | 90° |
| 2/22 | 2000 | 2244 | 5 | 35 | 90° |
| 2/23 | 1745 | 2041 | 6 | 35 | O |
| 2/24 | 1015 | 1220 | 7 | 35 | O |
| 2/24 | 1915 | 2128 | 8 | 35 | O° |
| 2/24 | 2136 | 2228 | 9 | 35 | o |
| 2/25 | 1130 | 1239 | 9 | 35 | . 0° |
| 2/26 | 0753 | 1100 | 10 | 35 | % |
| 2/27 | 0022 | 0327 | 11 | 35 | ው |
| 2/27 | 1011 | 1150 | 12 | 35 | o |
| 2/27 | 1750 | 1911 | 12 | 35 | O P |
| 2/28 | 1405 | 1515 | 13 | 35 | o |
| 3/03 | 0515 | 0706 | 13 | 36 | œ |
| 3/04 | 1815 | 1834 | 14 | 36 | o ° |

2.3 Data Analysis

After dual-beam data collection was complete, the data tapes were returned to Seattle and processed using a BioSonics Model 181 Dual-beam Processor. The Model 181 operates by first selecting only single target echoes based on detection criteria entered by the user. Returns from noise, structure, multiple echoes, and other non-fish targets were excluded from the output data, which was dumped to an IBM-compatible computer file. These files were then analyzed using TS, a BioSonics software program,

which outputs target strength distribution by depth. Comparisons between different conditions and locations were made by combining the appropriate input files.

Fish detections in the first 1.3 m from the transducer were not used for target strength calculations, as an accurate 40 log R amplification is not applied within this range. Transducer sampling ranges varied with mount orientation, with 6.5 meters range on the vertical mount, 9 meters on the oblique, and 40 meters range on the side-scan mount. Changes in target strength with depth on the vertically-oriented transducer were evaluated at 1 m intervals. The mean target strength over the sample range was used to evaluate system performance at the other two orientations.

3.0 RESULTS

Data were collected on January 12 and 20 with the transducer aimed obliquely into the river 35° out from vertical (0° = straight down). This information was analyzed and used to evaluate the target strength of the population sampled by the 15° oblique single-beam transducer. The axis of this transducer intersected the bottom about 5 m out from the intake trashrack. The mean target strength of the population on January 12 was found to be -41.02 dB, while on January 20 a mean target strength of -48.97 dB was observed, indicating smaller fish were present on the latter date (Table B2). Both values were significantly greater than the -60 dB minimum detection threshold of the single-beam system, indicating that all targets of interest were acoustically visible.

The dual-beam information acquired on January 28 and February 22 was used to assess the detection threshold of the side-scan transducers. On January 28, a mean target strength in side-aspect of -46.70 was observed. This result was 4 to 6 dB larger than the two samples acquired on the evening of February 22, which showed target strengths of -50.63 dB and -52.15 dB. All of these values are well within the -60 detection threshold of the hydroacoustic system.

Between February 23 and March 4, data were collected with the transducer aimed straight down at a 0° vertical aiming angle. This orientation provided the least variable estimate of target strength distribution as fish are more uniform reflectors when ensonified in dorsal aspect. At other aspects, small changes in orientation may result in significant changes in target strength. For this reason, data collected at different aspects should not be compared with one another.

To evaluate changes in the acoustic size of the fish population over time, dorsal target strength estimates were grouped on a daily basis. These values are presented in Table B3. Dual-beam data collected during periods of low fish activity were not included.

Table B3. Mean Target Strength vs. Hammer Operation, Indian Point Unit 3, 1988.

| Seq# | Date | St. Time | End Time | Hammers On/Off | Sample | TS |
|---------------------------------|------|----------|----------|----------------------|--------|--------|
| 1 | 2/23 | 1804 | 1822 | Off | 228 | -50.60 |
| 2. | 2/23 | 1822 | 1837 | 1&3 On | 172 | -50.02 |
| 3 | 2/23 | 1915 | 1941 | Off | 103 | -50.21 |
| 2 3 4 5 6 7 8 | 2/23 | 1941 | 1959 | 1&3 On | 222 | -49.24 |
| 5 | 2/23 | 1959 | 2015 | Off | 524 | -52.42 |
| 6 | 2/23 | 015 | 2026 | 1&3 On | 828 | -52.14 |
| 7 | 2/23 | 2026 | 2041 | Off | 590 | -52.09 |
| 8 | 2/24 | 1923 | 1957 | Off | 552 | -50.50 |
| 9 | 2/24 | 1957 | 2010 | 1&3 On | 627 | -52.94 |
| 10 | 2/24 | 2010 | 2128 | Off | 817 | -51.23 |
| 11 | 2/26 | 0756 | 0806 | Off | 439 | -49.20 |
| 12 | 2/26 | 0806 | 0810 | 1,3&5 On | 506 | -50.88 |
| 13 | 2/26 | 0810 | 0814 | Off | 222 | -50.56 |
| 14 | 2/26 | 0814 | 0817 | 5 On | 274 | -50.03 |
| 15 | 2/26 | 0817 | 0822 | 1&3 On | 482 | -51.19 |
| 16 | 2/26 | 0822 | 0828 | Off | 596 | -50.43 |
| 17 | 2/26 | 0828 | 0835 | 1&3 On | 57 | -50.73 |
| 18 | 2/26 | 0825 | 0849 | Off | 143 | -51.07 |
| 19 | 2/26 | 0849 | 0859 | 1,3&5 On | 670 | -49.32 |
| 20 | 2/26 | 0859 | 0924 | Off | 2221 | -49.57 |
| 21 | 2/26 | 0924 | 0934 | 1,3&5 On | 2191 | -50.22 |
| 22 | 2/26 | 0934 | 1007 | Off | 3574 | -49.73 |
| 23 | 2/26 | 1007 | 1017 | 5 On | 723 | -50.33 |
| 24 | 2/27 | 1750 | 1800 | 1,3 &5 On | 2066 | -51.60 |
| 25 | 2/27 | 1800 | 1810 | Off | 1358 | -52.28 |
| 26 | 2/27 | 1810 | 1820 | 1,3&5 On | 584. | -51.23 |
| 27 | 2/27 | 1820 | 1830 | Off | 786 | -51.44 |
| 28 | 2/27 | 1830 | 1840 | 1,3&5 On | 2297 | -52.00 |
| 29 | 2/27 | 1840 | 1851 | Off | 616 | -50.92 |
| 30 | 2/27 | 1851 | 1900 | 1&3 On | 724 | -50.83 |
| 31 | 2/27 | 1900 | 1910 | Off | 643 | -51.74 |

The mean observed target strength of the population did not change significantly over the 11 day sample period (Table B3). The average acoustic size of the fish were also similar between Intakes 35 and 36, with measured target strengths between -50.0 dB and -52.4 dB. A target strength of -51.0 dB would correspond to a fish length of 5.0 cm, using Love's equation, an empirical relationship relating average dorsal-aspect target strength to fish length (Love 1971).

Average target strength comparisons were also made between individual hammer on and hammer off treatments to evaluate if the mean acoustic size of the population was different when the hammers were operating. This might indicate a size-dependent or species-specific response to the hammers (Table B4).

However, mean target strength over the test period did not appear to be correlated with hammer operation. The observed values were consistent, between -49.20 dB and -52.94 dB, and consistant changes in response to hammer operation were not observed. The average target strength of fish in the smaple area appeared to be similar, regardless of hammer condition. This does not necessarily indicate that the same population was present during hammer-on and hammer-off treatments. If the size distribution was fairly homogeneous across the intake, movement through the acoustic beam could occur without significantly affecting the observed mean target strength.

Table B4. Mean Target Strength by Day, 2/23 - 3/4/88, Indian Point Unit 3, 1988.

| Date | St. Time | End Time | Tape # | Location | Mean TS |
|------|----------|----------|--------|-----------|---------|
| 2/23 | 1745 | 2041 | 6 | Intake 35 | -51.60 |
| 2/24 | 1015 | 1220 | 7 | Intake 35 | -50.62 |
| 2/24 | 1915 | 2128 | . 8 | Intake 35 | -51.57 |
| 2/26 | 0753 | 1100 | 10 | Intake 35 | -50.00 |
| 2/27 | 1750 | 1911 | 12 | Intake 35 | -51.67 |
| 2/28 | 1405 | 1515 | 13 | Intake 35 | -51.27 |
| 3/03 | 0515 | 0706 | 13 | Intake 36 | -52.40 |
| 3/04 | 1815 | 1834 | 14 | Intake 36 | -50.67 |

To evaluate vertical changes in target strength distribution in response to the hammers, four dual-beam hammer tests were analyzed with respect to depth. These data were collected between February 23 and 27 at Intake 35. Mean target strength values were calculated for 5 strata between 1.3 m and 6 m range from the transducer. Preliminary results from the vertical 6° transducer indicated some fish may have been exhibiting vertical movement in response to hammer operation. For each test, target strength estimates were generated in one-meter strata, comparing hammer-on and hammer-off conditions. This was done to determine whether the acoustic size of fish was correlated with the vertical response to the hammers. The frequency of target strength vs. depth were also calculated. These results are presented graphically in Figures B1 through B5.

On a daily basis, vertical changes in target strength distribution in response to hammer operation were somewhat variable. On February 23, an increase in target strength was noted in the upper two meters with the hammers on. However, on February 24, larger fish targets appeared to move out of these upper strata when the hammers were operating. Results from February 26 and 27 were ambiguous, with similar target strengths observed below 3 m depth and scattered fish of differing size present in the upper two strata.

When data for all four days were combined and evaluated with respect to hammer operation, significant differences with depth were not observed. Both treatments exhibited a general decrease in mean target strength from the surface down to 5.0 m depth and an increase in acoustic size in the stratum nearest the bottom. The largest fish appeared to orient at the bottom and near the surface. However, the overall size distribution was not large. Using Love's equation, the range of observed mean target strengths, -49.05 dB to -52.25 dB, corresponded to mean fish lengths of between 4.3 cm and 6.3 cm.

Target strength frequency with depth was also compared to hammer operation. In most cases, greater numbers of targets were detected in the upper water column when the hammers were on. This is illustrated by the 3-D plots in Figures B1 through B5. Figures B1, B2, B4 and B5 show a shift in the number of targets observed towards the surface during hammer treatments. While mean fish target strength was generally similar with depth, more of the population was observed higher in the water.

4.0 CONCLUSIONS

- 1. The detection threshold of the hydroacoustic system employed for the Indian Point Unit 3 study in 1988 was well below the target strength of the fish population. All fish of interest in the sampled areas were readily detected by the equipment.
- 2. The mean target strength of the population was generally uniform between February 23 and March 4, 1988; and between Intakes 35 and 36.
- 3. Consistent changes in target strength distribution were not observed in response to hammer operation.
- 4. Bottom-oriented fish near the face of a hammer may move higher vertically in the water column when the hammer is operating.

| Depth (m) | 1.3-2.0 | 2.0-3.0 | 3.0-4.0 | 4.0-5.0 | 5.0-6.0 | MeanTS |
|-------------|---------|---------|---------|---------|---------|--------|
| Hammers On | -49.05 | -50.59 | -51.81 | -52.25 | -49.91 | -51.14 |
| Hammers Off | -49.58 | -49.98 | -51.08 | -51.98 | -50.07 | -50.58 |

2/23/88 - 2/27/88

Mean Target Strength by Depth

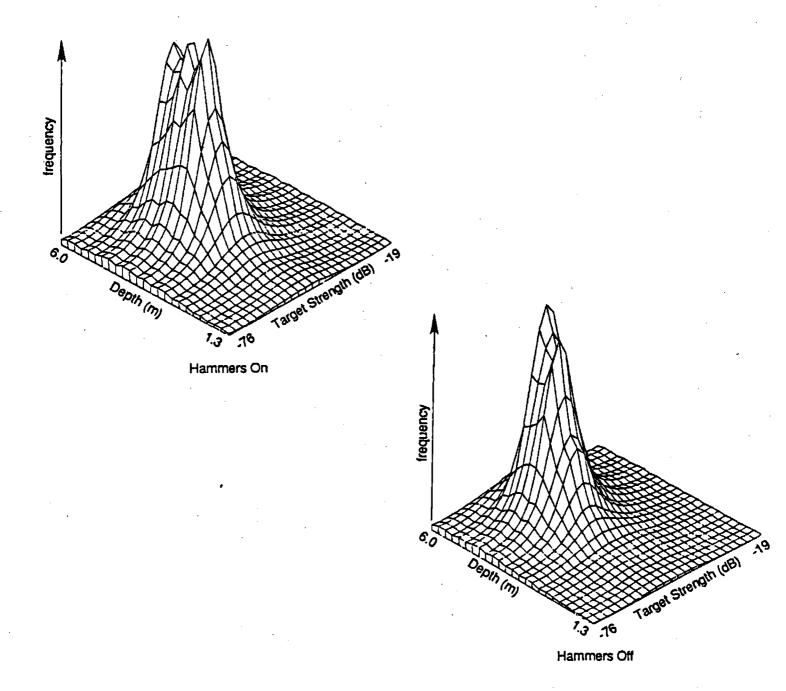


Figure B1. Target strength vs. depth, shown with hammers on and off, for February 23-27, Indian Point Power Plant Unit 3, 1988.

| · <u></u> | Target Streng | th by Depth | 2/23/88 | 180 | 4 – 2041 h | |
|---------------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Depth (m) | 1.3-2.0 | 2.0-3.0 | 3.0-4.0 | 4.0-5.0 | 5.0-6.0 | MeanTS |
| Hammers On Hammers Off | -48.72 -52.82 | -49.02 -51.94 | -49.65 -49.08 | -52.81 -52.77 | -50.60 -51.62 | -51.31 -51.84 |

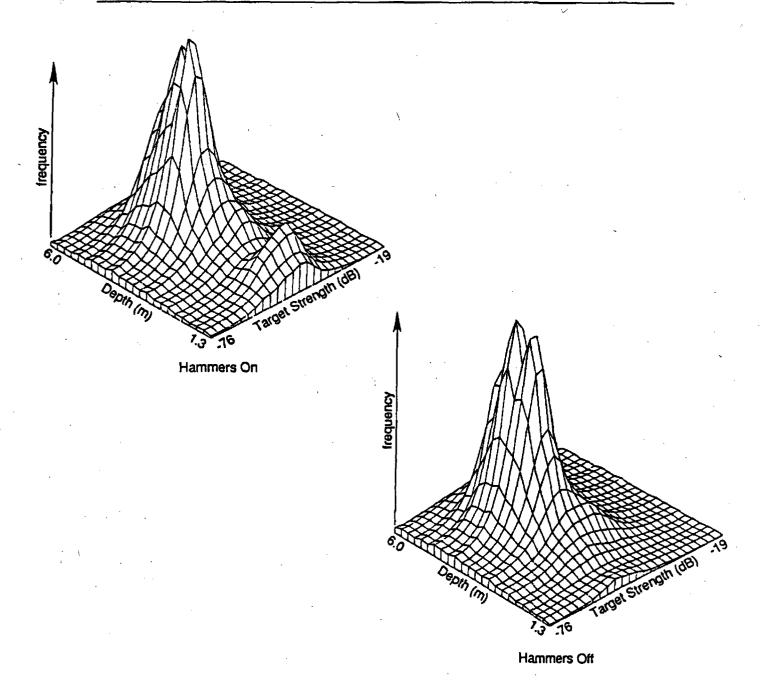


Figure B2. Target strength vs. depth, shown with hammers on and off, for February 23, Indian Point Power Plant Unit 3, 1988.

| | Target Streng | th by Depth | 2/24/88 | 192 | 3 – 2128 h ––––– | |
|---------------------------|---------------|-------------|------------------|------------------|---------------------|------------------|
| Depth (m) | 1.3-2.0 | 2.0-3.0 | 3.0-4.0 | 4.0-5.0 | 5.0-6.0 | MeanTS |
| Hammers On Hammers Off | -47.59 | -48.39 | -53.35 -49.22 | -53.68 -51.50 | -50.02 -51.16 | -52.94 -50.94 |

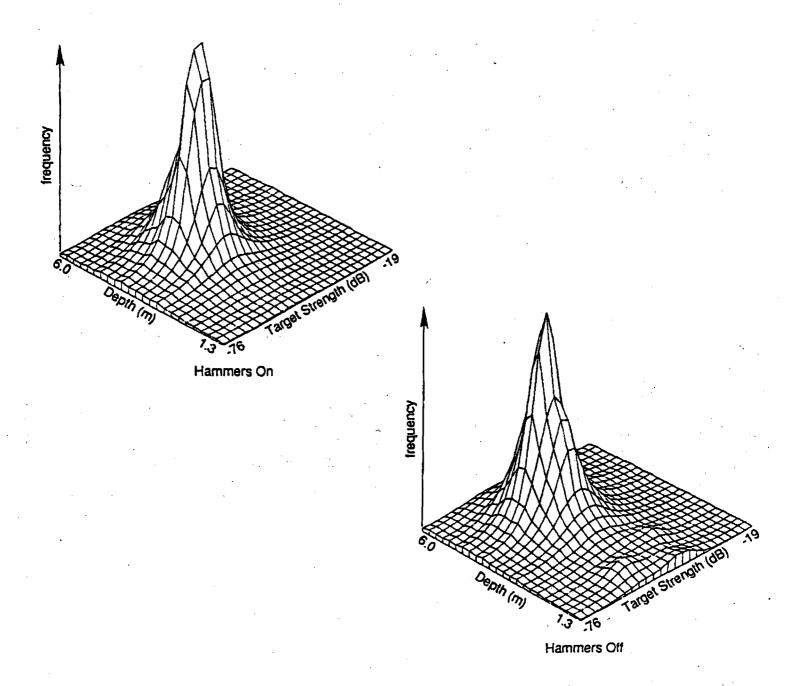


Figure B3. Target strength vs. depth, shown with hammers on and off, for February 24, Indian Point Power Plant Unit 3, 1988.

| | Target Streng | th by Depth | 2/26/88 | 084 | 9 – 1017 h | |
|---------------------------|---------------|-------------|------------------|------------------|------------------|------------------|
| Depth (m) | 1.3-2.0 | 2.0-3.0 | 3.0-4.0 | 4.0-5.0 | 5.0-6.0 | MeanTS |
| Hammers On Hammers Off | -54.57 | -51.07 | -49.49 -47.51 | -51.67 -51.65 | -49.74 -49.45 | -50.35 -49.78 |

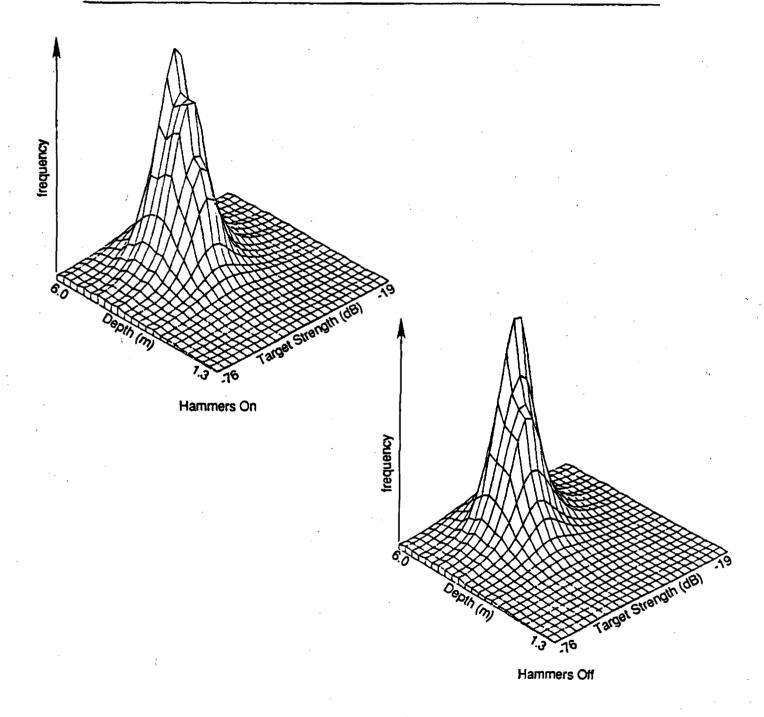


Figure B4. Target strength vs. depth, shown with hammers on and off, for February 26, Indian Point Power Plant Unit 3, 1988.

| Depth (m) | 1.3-2.0 | 2.0-3.0 | 3.0-4.0 | 4.0-5.0 | 5.0-6.0 | MeanTS | | | |
|---------------------------|---------|------------------|------------------|------------------|------------------|------------------|--|--|--|
| Hammers On Hammers Off | -49.60 | -52.56 -50.25 | -52.22 -53.43 | -52.24 -52.11 | -50.11 -51.41 | -51.62 -51.74 | | | |

2/27/88

1750 - 1910 h

Target Strength by Depth

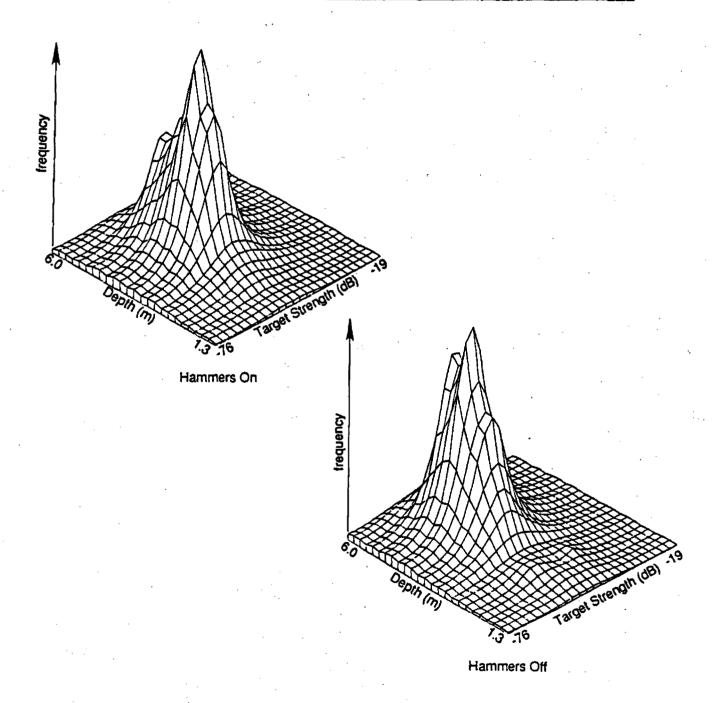


Figure B5. Target strength vs. depth, shown with hammers on and off, for February 27, Indian Point Power Plant Unit 3, 1988.

APPENDIX C:

Hammer Tests Monitored By
15° Oblique Transducer

Table C1. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 15 MI | NUTES DU | RING TE | ST PERIO |) | | DANGE / | neters> | | | | | | | |
|-------------------------------|--------------------------------|--------------------------------|---------------------------|----------------------------------|----------------------------------|-----------------------------|---------------------------------|-------------------------------------|-------------|------------|----------|---|-------|--|
| | | | | | | | | | 2 | | ARE F-HA | | | |
| race | | 0-2 | | 2-4 | | 4-6 | | 6-8 | | Total | | EST PERI | | |
| Type | Rau | 4F | наЯ | HF. | Rau | | Rau | HF | : Rau | uf | Rau | HF | | |
| .S | 7 | 53 | 55 | 207 | 81 | 203 | 36 | 68 | 179 | 531 | 168 | 527 | | |
| šl. | 0 | U | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | O | 0 | O | | |
| 1C | 3 | 23 | 23 | 87 | 48 | 120 | 13 | 25 | 87 | 255 | 114 | 313 | | |
| (H | 0 | 0 | . 0 | | 0 | .0 | Ò | 0 | . 0 | 0 | 0 | 0 | | |
| fotal | 10 | 76 | 78 | 294 | 129 | 323 | 49 | 93 | 266 | 786 | 282 | 629 | | |
| 16 | | | r PERIOD | 2 | | | | | • | - | | • | | |
| 15 MI | NUIES NE | | PERIOD | | | RANGE (| neters> | | 1 | • | | | | |
| _ | • | 0-2 | | 2-4 | | 4-6 | | 6-8 | | Z Total | | CHI-SQUARE VALUE | | |
| irace Type | Ran | WF. | Rau | HF | Rau | HF | Rai | 4 UF | Rau | ИF | FOR 2 TI | EST PERI | | |
| | 14 | 107 | 61 | 230 | 47 | 118 | 25 | 67 | -: : 157 | 522 | | Rau |) HF | |
| 5L | 0 | o | 0 | 0 | 0 | | 0 | 0 | : 0 | 0 % | LS | 1.440 | 0.07 | |
| NC | . 1 | 8 | 26 | 98 | 80 | 201 | 33 | 63 | 140 | 370 | SL. | · · | | |
| uu . | | o | 0 | a | 0 | 0 | 0 | 0 | : 0 | 0 | NC | 12.374 | 21.16 | |
| rotal | 15 | 115 | 87 | 328 | 127 | 319 | 68 | 130 | 297 | 892 | HH | | | |
| | • | | | | | | | | = | | TOTAL | 1.707 | 6.69 | |
| CHI-SQUARE F-HAT 0-2 | | | | | 4 | 4-6 | | 6-8 | | | | CHI-SQUARE = 3.841 (d.f. = 1) (alpha = .05) | | |
| LS SL NC NU TOTAL | Ram 11 0 2 0 13 | NF 80 0 16 0 96 | Rau 58 0 25 0 | HF 219 0 93 0 311 | Rau 64 0 64 0 128 | 161 0 161 0 321 | Rai 36 0 23 0 59 | 4 UF 68 0 44 . 0 112 | | | • | | | |
| CHI-SQU VALUES | | | | 2-4 4-6 | | 6-8 | | | | | | | | |
| LS SL | 2.333 | NF 18.225 | 0.310 | 4F 1.211 | 9.031 | | 0.014 | 0.007 | | | | | | |
| NC HM | 1.000 | 7.250 | 0.184 | 0.654 | 8.000 | 20.439 | 8.696 | 16.409 | | | | . • | | |
| TOTAL | 1.000 | 7.963 | 0.491 | 1.859 | 0.016 | 0.025 | 3.085 | 6.139 | | | | | | |

Table C2. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | | | High Tide | | Treatment | t Tupe: | 10 sec | on 20 sec off | Test Ti | | 0100 | |
|-----------------------|-----------|-------------|----------|----------------|---------------------------------------|----------|------------|-------------|----------------------------------|---------------|---------|--|--------|--|
| 10 MINU | ITES BEF | ORE TES | r PERIOD | | Rf | WGE (| meters> | | | | CMT_EOU | 00E E-NO | | |
| _ | 0 | 0-2 | | -4 | 4-6 | | (| 6-8 | | Total | | CHI-SQUARE F-HAT FOR 3 TEST PERIODS | | |
| Trace Type | Rau MF | | Rau MF | | Raw MF | | Rau MF | | Rau | Rau HF | | Rau MF | | |
| LS | 0 | 0 | 1 | 4 | 4 | 10 | 2 | 4 | 7 | 18 | 15 | 37 | | |
| SL | 0 | 0 | . 0 | 0 | 1 | 3 . | 0 | 0 | | 3 | . 1 | 2 | | |
| NC | G | 0 | 0 | ٥ | a | 0 | Ö | o | . 0 | o o | 1 | 6 | | |
| HH | 0 | . 0 | 0 | ٥ | 0 | 0 | ٥ | 0 | 0 | 0 | . 0 | 0 | | |
| Total | 0 | 0 | 1 | 4, | 5 | 13 | 2 | 4 | 8 | 21 | . 17 | 44 | | |
| 10 MIM | ITES DUR | ING TES | T PERIOD | | Rí | MGE (| neters> | | - - - - | | | · · · · · · · · · · · · · · · · · · · | | |
| | 0 | -2 | 2-4 | | 4-6 | | | 6-8 | | : : Yotal | | CHI-SQUARE VALUES | | |
| Trace Tupe | Rau | WF | Ran | HF | Rau | ИF | Rau | uf | : Rau | UF | FOR 3 T | EST PERI | | |
| LS | 0 | 0 | 3 | 11 | 20 | 50 | 2 | 4 | 25 | 65 | | Rass | MF | |
| SL. | ٥ | o | 9 | 0 | 1 | 3 | 0 | 0 | 1 1 | 3 | LS : | 10.533 | 33.139 | |
| NC . | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | o | . 0 | 0 | SL. | 0.000 | 3.000 | |
| HH | 0 | 0 | 0 | e | ٥ | 0 | 0 | 0 | : 0 | 0 | NC | 12.000 | 31.167 | |
| Total | 0 | 0 | 3 | 11 | 21 | 53 | 2 | 4 | : 26 | 68 | 144 | | | |
| 10 MT | WTES AF | TER TES | Γ PERIOD | | | | | `- | : | | TOTAL | 0.500 | 27.136 | |
| 0-2 2-4 | | | | RANGE (neters) | | | • | Total | CHI-SQUARE = 5.991 (d.f. = 2) | | | | | |
| Trace | | -2 | Rau | HF | Rau | HF. | Rau | | Rau | UF | (elpha | | | |
| Type LS | RAH | | | 0 | 8 | 20 | | | 12 | 28 | | | | |
| L3 SL | o | a | | 0 | • • • • • • • • • • • • • • • • • • • | 0 | 0 | 0 | | 0 | | | | |
| »L NC | 1 | 8 | . 1 | 4 | 1 | 3 | 1 | 2 | | 17 | | | | |
| MM · | 0 | 0 | 0 | 0 | • | 0 | • | | | | | | | |
| Total | <u>-</u> | <u>-</u> | | - - | | 23 | <u>-</u> - | | 16 | | | | | |
| CHI —SQUAL | æ | _ | | | | | _ | | | _ | | | | |
| F-HAT 0-2 | | | 2-4 | | 4-6 | | | 6-8 | | | | | | |
| ĻS | Rau | WF O | Rau 1 | HF 5 | Rau 11 | ИF 27 | Ran 3 | 5 | | | | | | |
| SL NC | Ŏ, | | Ö | 0 | 1 | 2 | Ö | <u> </u> | | | | | | |
| Ш | ō | 9 9 9 | ٥ | Ō | Ŏ | Õ | Ö | ۵ | | | | | | |
| TOTAL | Õ | 3 | 2 . | 6 | 12 | 30 | 3 | 6 | | | | | | |
| CHI — SQUAI VALUES | ₹E 0~2 | | 2- | 4 | 4~1 | 5 | 6. | -8 | | | | _ | | |
| | Rau | HF | Rau | HF | RAH | uf | Ran | HF | | | | | • | |
| ĻS | | | 6.000 1 | 2.400 | 11,636 3: | 1.111 | 0.000 | 3.200 | | | | | | |
| LS SL NÇ | 1 | 3.333 | 1 | 2.000 | | 5.000 | | 2.000 | | | | | | |
| HH | | | | | | | | | | | | | | |
| TOTAL | 1 | 3,333 | 0.500 | 6.500 | 10.583 27 | 7.900 | 2.000 | 4.000 | | | | | | |

Indian Point hawner test monitoring using 15 degree oblique transducer located at unit $\mathbf{3}_{\sigma}$ intake $\mathbf{35}_{\sigma}$.

| | | | | | 2 Hrs afte High Tide | | Treatment | Tupe: | 10 min 10 sec (| on. 20 | sec off | Test Da Test Ti | me: (| 0140 |
|---|---|------------------|---|---|--|--|--|---|----------------------|-----------------------------|--------------|--------------------|-----------|--------------|
| 10 HINUT | ES BEFOR | E TEST | r. PERIOD | | | | neters) | | | | - | | ARE F-HAI | |
| race | 0-2 | 2 | 2- | 4. | 4 | -6 | 6- | -8 | | Total | | FOR 3 T | EST PERIC | 005 |
| upe | Rau L | lF. | Ran | HF | Rau | HF | Rau | HF | Rasa | HF | | Rau | WF | |
| .s | 0 | 0 | 1 | 4 | 15 | 38 | 2 | 4 | 18 | 46 | | 21 | 51 | |
| L | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | | 1 | 3 | |
| ic . | 0 | 0 | 0 | a | . 1 | 3 | 0 | 0 | 1 | 3 | | 1 1 | 2 | |
| IH | | ٥. | 0 | _ 0 | ٥ | 0 | 0 | o | _0 | 0 | | 0 | . 1 | |
| otal | o | 0 | 1 | 4 | 16 | 41 | 2 | 4 | 19 | 49 | _ | 23 | 54 | |
| 10 HINUT | ES DURIP | 4 G TES 1 | r PERIOD | | · Ri | ANGE (| meters) | : | | | | | : | |
| | g-2 | 2 | 2- | 4 | 4 | -6 | 5- | -e : | | Total | | CHI - SOU | ARE VALUE | E |
| race Type | Rau i | 4F | Rau | WF | Ran | HF | Rau | ИF | Rau | HF | | FOR 3 I | EST PERI | ups Cups |
| .s | 0 | 0 | > | 11 | 11 | 28 | 7 | 13 | 21 | 52 | | | 0.657 | 3.21 |
| iL | ٥ | 0 | 0 | D | 1 | 3 | . 0 | 0 | 1 | 3 | | LS SL | 2.000 | 3.3 |
| ic . | ο . | 0 | 0 | 0 | Ò | 0 | 1 | 2 | 1 | 2 | | MC · | 0.000 | 1.50 |
| | | _ | ٥ | ۵ | 0 | 0 | 0 | 0 : | 0 | 0 | | | 0,000 | |
| 111 | 0 | 0 | U | • | _ | _ | | | | | | | | |
| Total | 0 | 0 | 3 | 11 | 12 | 31 | 8 | 16 | 23 | 57 | - | TOTAL | 1.391 | |
| Total 10 MINU | 0 | O ER TES | | 11 | 12 R | | (neters) | 16 | 23 | 57 Total | - | TOTAL CHI-SQU | ARE = 5.1 | 5.33 |
| Total 10 MINU Trace | O ITES AFTI | O ER TES | 3 T PERIOD 2- | 11 | 12 R | ANGE (| (neters) | | 23 Rau | - | | TOTAL | ARE = 5.1 | 5.5 |
| 10 MINU | O ITES AFTI | O ER TES | 3 T PERIOD 2- | 11 | 12 R | ANGE (| (noters> | -8 | | Total | | TOTAL CHI-SQU | ARE = 5.1 | 5.5 |
| 10 MINU Frace Upe | O O O O O O O O O O O O O O O O O O O | O ER TES | 3 r PERIOD 2- Ram | 11 -4 WF | 12 R 4 Reu | ANGE (| (neters) 6- Ran | -e | Rau | Total UF | | TOTAL CHI-SQU | ARE = 5.1 | 5.5 |
| IN Total 10 MINU Trace Tupe LS SL NG | O TES AFTI | O ER TES | 3 F PERIOD 2- Ram 2 | 11 -4 MF -8 | 12 R 4 Rau | ANGE 6 | Ran 11 | -9 UF | Rau 24 | Total UF 57 | | TOTAL CHI-SQU | ARE = 5.1 | 6.00 5.33 |
| fotal 10 MINU Frace Tupe .5 SL | O O O O | O ER TES | PERIOD 2- Ram 2 0 | 11 -4 MF 8 | 12 R 4 Rau 11 2 | ANGE (| Cheters> 6- Rau 11 | 21 0 | Rau 24 2 | Fotal UF 57 | <u>-</u> | TOTAL CHI-SQU | ARE = 5.1 | 5.33 |
| Total 10 HINU Frace Tupe .S SL HC | O O O O | O ER TES | 3 T PERIOD 2- Ram 2 0 | 11 HF 8 0 | 12 R 4 Rau 11 2 | ANGE (| 6- Rau 11 0 | -8 MF 21 0 | Rau 24 2 | Fotal UF 57 5 | | TOTAL CHI-SQU | ARE = 5.1 | 5.33 |
| Total 10 MINU Frace Tupe S S NC WM Fotal CHI-SQUARE | O O O O O | O ER TES | 2- Ram 2 0 | 11 UF 8 0 | 12 R Rass 11 2 0 1 | 28 5 0 | 6- Ran 11 0 0 | 21 0 0 | Rau 24 2 0 1 | Total UF 57 5 8 | <u>-</u> | TOTAL CHI-SQU | ARE = 5.1 | 5.33 |
| Total 10 HINU Frace Fupe LS SL NC NH Total CHI-SQUARE F-HAT | 0 -2 -2 | O ER TES | 2-Ram 2 0 0 2-2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 11 HF 8 0 | 12 R 4 Rau 11 2 0 1 | ANGE (-6 4F 28 5 0 3 36 6 | 6-Rau 11 0 0 11 6-1 | 21 0 0 | Rau 24 2 0 1 | Total UF 57 5 8 | | TOTAL CHI-SQU | ARE = 5.1 | 5.5 |
| Total 10 MINU Frace Upe S S INC IN Fotal CHI-SQUARE F-HAT | 0-2 Ray 1 0-2 Ray 1 | O ER TES | 2-Ram 2 0 0 2-Ram 2 Ram 2 0 0 0 0 2 | 11 UF 8 0 0 0 8 | 12 Rau 11 2 0 1 14 Rau 12 | 28 5 0 | 6- Ran 11 0 0 | 21 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | Rau 24 2 0 1 | Total UF 57 5 8 | | TOTAL CHI-SQU | ARE = 5.1 | 5.5 |
| Total 10 MINU Frace Tupe _S SL NC NG CHI—SQUARE F-NAT LS SL | 0-2-Raid 0 | O ER TES | 2-4 RaM 2 0 0 0 0 2 | 11 MF 8 0 0 0 | 12 Reserved 11 2 0 1 14 Reserved 12 1 | 28 5 0 3 36 6 MF 31 3 1 | 6-1 Raw 11 0 0 0 11 6-1 | 21 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rau 24 2 0 1 | Total UF 57 5 8 | | TOTAL CHI-SQU | ARE = 5.1 | 5.33 |
| 10 MINU Frace Tupe _S SL NC HH Totel CHI-Square F-NAT _ LS SL NC | 0-2 | O ER TES | 2-Ram 2 0 0 2-Ram 2 0 0 0 2 2-4 Ram 2 | 11 UF 0 0 0 0 0 | 12 Results Results 11 2 0 1 14 4 | 28 5 0 3 36 6 WF 31 3 | 6-Ran 11 0 0 0 11 6-Ran 7 | 21 21 21 21 21 21 21 21 21 21 21 21 21 2 | Rau 24 2 0 1 | Total UF 57 5 8 | | TOTAL CHI-SQU | ARE = 5.1 | 5.33 |
| 10 MINU Frace Tupe S S L NC NH Total CHI-SQUARE NC NC NC NC NC CHI-SQUARE | 0 O O O O O O O O O O O O O O O O O O O | O ER TES | 2-Ram 2 0 0 2-Ram 2 0 0 0 2 2-4 Ram 2 0 0 0 2 2-4 | 11 MF 8 0 0 0 8 1 MF 8 0 0 0 0 8 8 1 | Results 12 | 28 5 0 3 36 6 UF 31 36 | 6-Rau 11 0 0 11 6-1 Rau 7 0 0 | 21 : 0 : 0 : 0 : 0 : 0 : 0 : 0 : 0 : 0 : | Rau 24 2 0 1 | Total UF 57 5 8 | | TOTAL CHI-SQU | ARE = 5.1 | 5.5 |
| Total 10 MINU Frace Tupe LS SL NC NH Total CHI-SQUARE F-NAT | 0 O O O O O O O O O O O O O O O O O O O | O ER TES | 2 | 11 MF 8 0 0 8 1 MF 8 | RaH 11 2 0 1 1 1 4 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 28 5 0 3 36 6 WF 31 36 6 | 6-Rau 11 0 0 11 6-1 Rau 7 0 0 7 | 21 : 0 : 0 : 21 : 3 : 3 : 3 : 3 : 3 : 3 : 3 : 3 : 3 : | Rau 24 2 0 1 | Total UF 57 5 8 | | TOTAL CHI-SQU | ARE = 5.1 | 5.33 |
| 10 MINU Frace TupeS SL NC NH Fote1 CMI—SQUARE F-HAT LS SL NC NC NC NC NC NC NC NC NC NC NC NC NC | 0 O O O O O O O O O O O O O O O O O O O | O ER TES | 2-Ram 2 0 0 2 Ram 2 0 0 0 2 2-4 Ram 2 0 0 2 | 11 MF 8 0 0 0 8 1 MF 8 0 0 0 0 8 8 1 | Rau 11 2 0 14 4 Rau 12 1 0 0 14 Rau 12 1 0 0 14 | 28 5 0 3 36 6 UF 31 36 6 UF 35 11 36 6 | 6-Ran 11 0 0 0 11 6-1 Ran 7 0 0 0 7 7 | 21 | Rau 24 2 0 1 | Total UF 57 5 8 | | TOTAL CHI-SQU | ARE = 5.1 | 5.5 |
| 10 MINU Trace Tupe S S S I I I I I I I I I I I I I I I I | 0 O O O O O O O O O O O O O O O O O O O | O ER TES | 2-RaM 2 0 0 0 2 2-4 RaM 2 0 0 2 2 -4 RaM | 11 MF 8 0 0 0 8 1 MF 8 0 0 0 1 | Rau 11 2 0 14 4 Rau 12 1 0 14 4 Rau 1.917 2.000 | 28 5 0 36 6 WF | 6-Ran 11 0 0 0 11 6-1 Ran 7 0 0 7 7 6-1 Ran 4.957 10 | 21 | Rau 24 2 0 1 | Total UF 57 5 8 | | TOTAL CHI-SQU | ARE = 5.1 | 5.5 |

Table C4. Indian Point hanner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | ridel P | hase: | 2 hrs aft High Tide | • | Duration Treatmen | of Test t Type: | | Har 5 only on, 30 sec off | Test Da Test Ti | | 2/4/88 0200 |
|-------------------------------|-----------|--------|---------------------------------|----------------------------------|----------------------------------|--|--------------------------------|-------------------------------|----------|------------------------------|-------------------------------|----------------------|----------------|
| 10 HIML | ITES DURY | NG TES | F PERIO | D | 5 | | neters> | | | | | RRE F-HA | • |
| Trace | 0-: | 2 | | 2-4 | | 1-6 | | 6-8 | · | Total | FOR 2 T | EST PERI | oos |
| Tupe | Rau | HF. | Rau | ИF | Rass | uf | Rau | HF | Rau | ИF | Rau | UF | |
| LS | ٥ | 0 | 3 | 11 | 9 | 23 | . 11 | 21 | - 23 | 55 | 21 | 49 | • |
| SL | 0 | 0 | . 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 2 , | 5 | |
| NC | 0 | . 0 | 0 | 0 | 3 | | o | 0 | | | 5 | 13 | |
| ни | 0 | 0 | Đ | 0 | 0 | D | 0 | 0 | . 0 | D | 1 | 2 | |
| Total | 0 | 0 | 3 | 11 | 12 | 31- | 12 | 2) | : 27 | 65 | 27 | 69 | |
| 10 MI | NTES AFT | ER TES | ST PERIO | D . | 1 | LANGE C | neters> | | : | | | | |
| Trace | 0-: | 2 | | 2-4 | | 1-6 | | 6-8 | | Total | CHI-SQU | ARE VALU EST PERI | E Ons |
| Type | Rau | ЫF | Rau | ИF | Rası | HF | Rau | HF | Rau | HF | 700 Z 1 | Rau | ur |
| LS | 0 | 0 | 2 | 11 | 6 | 15 | 9 | 17 | 18 | 43 | LS | | - |
| SL | 0 | 0 | 2 | 8 | 0 | 0 | 0 | 0 | 2 | · • | SL . | 0.610 | 1.469 |
| NC | Q | 0 | 2 | 8 | 3 | 8 | 1 | 2 | 6 | 10 | | 0.333 | 5.600 |
| WH | 0 | a | Ω | o | 1 | 3 | <i>i</i> o | 0 | 1 | 3 | NC | 1.000 | 3.646 |
| Total | 0 | | 7 | 27 | 10 | 26 | 10 | 19 | 27 | 72 | 1464 | 1.000 | 3.000 |
| | | | | | | | | | E | | TOTAL | 0.000 | 0.356 |
| CHI - SQUAI F-HAT | 0-2 | | 2 | -4 | | -6 | 6 | -8 | | | CHI-SQU (d.f. = (a) pha | | 9-1 1 |
| | Ran | uF _ | Rau | HF 11 | Rau | KF 19 | Rau 10 | HF 19 | | | Caz prisa | 05/ | |
| LS SL NC | ŏ | ŏ | 1 | 4 | Š | 0 | 1 | i | | | | | |
| HU TOTAL | 9 | ĕ | ģ | 0 19 | 11 | 2 29 | , Ö | 21 | | | | | ÷ |
| CHI-SQUAI | 0-2 E | | . 2 | -4 | 4 | - 6 | · 6 | -8 | | | | | |
| LS SL NC HH TOTAL | | HF | Raid 0.000 2.000 2.000 | 0.000 8.000 8.000 6.737 | 0.600 0.000 1.000 0.182 | UF 1-684 0.000 3.000 0.439 | Rau 0.200 1.000 1.000 | HF 0.421 2.000 2.000 | | | | | |

Table C5. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | idal Ph | - 1 | 2.5 Hr af High Tide | | Treatment | t Tupe: | 10 | D sec c | mr 5 only m, 40 sec off | Test Dat Test Tin | • • • | 2/4/80 220 |
|-------------------------------|------------|-----------------------|-------------------------|-------------|-------------------------|--|--------------------------------|--|------------|---|----------------------------|---------------------------------|----------|---------------|
| 10 HINUI | | | | | | | meters) | a M M # # # # | | 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | : | cHI-SQUA | • | |
| _ | 0-2 | 2 | 2. | -4 | , 4 | -6 | | 5-8 | _ | • | Total | FOR 2 TE | | |
| Trace Type | Ran L | af | Rau | WF | Rau | MF | Rau | uf | : | Rau | HF | Rau | uf | |
| .s | 0 | 0 | 2 | 8 | 9 | 23 | 1 | 2 | -: | 12 | 23 | 11 | 29 | |
| L | G | 0 | . 0 | 0 | 0 | 0 | | 2 | Ī | 1 | .2 | 1 | 1 | |
| C | į o | 0 | 0 | 0 | ì | > | 0 | 0 | Ī | 1 | 3 | 2 | 5 | |
| u · | o , | ٥ | 0. | 0 | 0 | 0 | 0 | Ó | i | 0 | 0 | 1 | 2 | |
| otal | 0 | 0 | 2 | 9 | 10 | 26 | . 2 | 4 | -[| 14 | 39 | 14 | 36 | • |
| 10 HIM | ITES AFT | ER TEST | PERIOD | | | ANGE (| neters> | •. | | | | | • | |
| | 0-2 | 2 | . 2 | -4 | 4 | -6 | • | 6-8 | | | Total | CHI-SQUA | RE VALUE | <u> </u> |
| race upe | Rau: I | uf . | Rau | HF | Reu | NF . | Raw | HF | Ē | Rau | MF | FOR 2 TE | | |
| | 0 | 0 | 0 | 0 | • | 20 | 2 | 4 | - <u>:</u> | 10 | 24 | | Rau | MF |
| L | 0 | 0 | 0 | 0 | 0 | 0 | oʻ | 0 | į | 0 | 0 | LS . SL | 0.182 | 1. |
| C · | 0 | 0 | 0 | 0 | 9 | ŋ. | 3 | 6 | | 3 | 6 | , | 1.000 | 2. |
| м | ٥ | 0 | , . • | 0 | | | 0 | . 0 | • | 1 | 3 | MC | 1.000 | 1. 3. |
| otal | 0 | ٥ | 0 | 0 | 9 | 23 | 5 | 10 | | 14 | 33 | TOTAL | 0.000 | ٥. |
| HI ~SQUARI —HAT | E 0−2 | · | 2~ | 4 | 4 | 6 | £- | -8 | • | | | CHI-SQUA (d.f. = (alpha = | RE = 3.6 | |
| S L C H OTAL | Rau (| 0 0 0 0 0 | Rам 1 0 0 0 | #F 40004 | Rau 9 0 1 1 | 22 0 2 2 25 | Rau 2 1 2 0 4 | HF 3 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | | | • , | Carpile - | | |
| HI-SQUARI ALVES | 0-2 | | 2- | 4 | 4- | 6 | 6- | -8 | | | | | | |
| .S SL IC IN FOTAL | | WF | | #F 9.000 | 1.000 | NF 0.209 3.000 3.000 0.184 | Rau 0.333 1.000 3.000 | UF 0.667 2.000 6.000 | | | | | | |

Table C6. Indian Point hanner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidal Ph | ase: | 3 Hr afte High Tide |) } | Duration Treatment | of Test : Type: | : 10 min 20 sec | Her 5 only on, 20 sec Dff | Test Date: Test Time: | 2/4/88 0240 |
|-------------------------------|---------------------------|-------------------|------------------------------|----------------|-------------------------------|-----------------------------------|----------------------------------|--|-----------------------|------------------------------|-------------------------------------|---|
| | UTES DURIN | | | | 1 | RANGE | (neters) | | | | | • |
| | 0-2 | : | 2 | | | 1-6 | | 5-8 | , | Total | CHI-SQUAR FOR 2 TES | F-HRI FPERIODS |
| Trace Type | Rate 5 | F | Rau | MF | Rass | HF | Rau | NF | Rau | UF | Rau | MF |
| LS | 0 | Ġ. | 2 | 8 | 7 | 18 | 1 | 2 | 10 | 28 | 7 | 19 |
| SL | o | • | 0 | • | 0 | . 0 | 0 | . 0 | 0 | ٥ | 1 | 2 |
| NC | ٥ | 0 | 0 | 0 | • | 0 | 0 | 0 | 0 | ٥ | 1 | 1 |
| MM | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 3 | 1 | 3 |
| Total | 0 | 0 | 2 | 9 | 8 | 21 | 1 | 2 | 11 | 31 | • | 25 |
| 10 HI | NUTES AFTE | R TES | T PERIOD | ı | | RANGE | (neters) | | - - - - - | | | |
| Trace | 0-2 | | 2 | -4 | | 1-6 | | S-8 | | Total | CHI-SQUAR | E VALUE |
| Type | Rau L | ıF | Rau | HF | Rau | MF | Ran | HF | Rau | HF | | Rau HF |
| LS | ο, | 0 | 1 | 4 | . 2 | 5 | 0 | 0 | 3 | 9 | | .769 9.75 |
| SL | 0 | 0 | 0 | 0 | . 0 | , o | 2 | 4 | 2 | 4 | | 2.000 4.00 |
| NC | 0 | ٥ | ٥ | 0 | 0 | 0 | 1 | 2 | 1 | 2 | | 1.000 2.00 |
| MM | , 0 | 0 | 0 | 0 | 1 | 3 | 0 | . 0 | 1 | <u> </u> | | 0.000 0.00 |
| Total | 0 | 0 | 1 | 4 | 3 | 8 | 3 | 6 | 7 | 18 | | 0.089 3.44 |
| CHI -SQURI F-HAT | RE 0-2 | _ | 2- | 4 | 4 | -6 | 6- | -0 | • | | CHI-SQUAR (d.f. = 1) (alpha = | E - 3.841 |
| LS SL NG HU TOTAL | Raw 6 0 0 0 0 | if 0 0 0 | Rau 2 0 0 0 2 | NF 6 | Raid 5 0 0 1 6 | HF 12 0 0 3 15 | Rate 1 1 1 0 2 | HF 1 2 1 0 4 | | | | |
| CHI-SQUAI | RE 0-2 | | 2- | 4 | 4 | -6 | 6- | -8 | • | • | | • |
| LS SL NC UU TOTAL | | | | 1.333 1.333 | 2.778 | UF 7.348 0.000 5.829 | 2.000 2.000 1.000 1.000 | HF 2.000 4.000 2.000 2.000 | | | | |

Table C7. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidal Pt | | 2 Hr befo Lou Tide | 0 7* | Duration Treatmen | | | Har 5 only on, 30 sec | | Test Da Test Ti | He: C | 2/4/86 300 |
|--------------------------------|----------|-------------|----------|------------|-----------------------|-------------|----------------------|------------|-----|--------------------------|-------------|---|------------------------|---------------|
| | | | | | | BREE OF | LI QUE | | | | | | | • |
| 10 HINUT | res duri | NG TE | T PERIO | • | 1 | RANGE (| (neters) | | · | | | | | |
| • | . 0- | -2 | 2 | 2-4 | | 4-6 | (| 6-8 | | Total | | | ARE F-HAT EST PERIO | |
| Trace Type | Rau | ИF | Rau | UF | Rau | UF | Rau | UF | Rau | ИF | | Ran | HF | |
| S | 0 | ō | 6 | 23 | 2 | 5 | 0 | Ó | 8 | 28 | | 9 | 25 | |
| i. | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | Q | 0 | 0 | | 0 | 0 | |
| (C | ٥ | 0 | 0 | • | 0 | . 0 | 0 | Q | . 0 | • | | • | 0 | |
| iu | ٥ | ٥ | . 0 | 0 | 0 | 0 | 0 | 0 | . 0 | ٥ | | • | . 0 | |
| otal | 0 | 0 | 6 | 23 | 2 | s | Ô | 0 | 8 | 28 | | 9 | 25 | |
| 10 HINL | ITES OF | reo Te | T PERIO | , | | | | | | | | | | |
| 10 11114 | DIES MPI | ER (E) | PI PERLO | | | RANGE (| (neters) | | į | | | | | |
| • | 0- | -2 | : | 2-4 | | 4-6 | (| 6-8 | | Total | | CHI-SQU | ARE VALUE | |
| race upe | Rau | HF | Rau | ИF | Rau | 뺘 | Rau | H F | Rau | HF | | FUK Z I | | AUS MF |
| .s | 0 | 0 | 0 | 0 | 6 | 15 | 3 | 6 | 9 | 21 | | LS | 0.059 | 1.0 |
| SL. | 0 | ٥ | ٥ | 0 | 0 | o | 0 | 0 | | o . | | _ | | |
| ec . | ۵ | 0 | 0 | 0 | 0 | ٥ | ٥ | Đ | . 0 | 0 | | SL. | | • |
| 444 | 0 | 0 | 0 | ٥ | 0 | . 0 | 9 | 0 | | 0 | | NC | | • |
| Total | 0 | 0 | 0 | 0 | 6 | 15 | 3 | 6 | 9 | 21 | | 144 | | |
| | _ | | | | | | | | • | | | TOTAL | 0.059 | 1 |
| HI —SQUARI F—HAT | 0-5 | | . 2- | - ∢ | 4 | -6 | . 6 | -8 | | | | <d.f< td=""><td>MRE = 3.8</td><td>141</td></d.f<> | MRE = 3.8 | 141 |
| _ | Rau | HF | Raw | uF . | Rau | | Ran | HF. | | | | <alpha< td=""><td>us/</td><td></td></alpha<> | us/ | |
| .S iL iC | 0 | 8 | 3 | 12 | 4 0 | 10 | 3 . | 3 | | | | | | |
| NC | ō | . 0 | 0 | ŏ | Ō | Ŏ | Ŏ | ă | | | | | | |
| 414 | Ō | Ō | Ō | . 0 | Q | 0 | 0 | ō | | | | | | |
| TOTAL | ō | Ô | 3 | 12 | 4 | 10 | 2 | 3 | | | | | | |
| CHI —S QUAR I JALUÉS | 0-2 E | | 2. | -4 | 4 | -6 | 6 | -e ` | | | | | | |
| | Rau | NF | Rau | UF | Rau | uf. | Rau | | | | | | • | |
| _\$ SL HC | | | 6.000 | Z3.000 | 2.000 | 5.000 | 3.000 | 6.000 | | | | | | |
| ic | | | | | | ~- | | | | | | | | |
| 44 . | | | <u></u> | | | | | | _ | - | | | | |
| TOTAL | | | 6.000 2 | 23.000 | 2.000 | 5-000 | 3.000 | 6.000 | | | | | , | |

Table C8. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | • | Tidal Ph | | 3 Hr befo Lou Tide | | Treatmon | t Tupe: | - 2 | 20 sec o | mr 5 only n, 40 sec o | ff To | st Da | | /4/ 88 320 |
|---------------------|-----------|------------|---------|----------|-----------|-----------------------|-------------|----------|-------------|------------|----------|--------------------------|----------|--------|------------------------|--------------------------|
| | IUTES DUR | | | | | | | noters) | | | -458454 | | | | | |
| | • | -2 | | • | -4 | _ | 4-6 | | 5-8 | | | Total | | | ARE F-HAT EST PERIO | |
| Trace Tupe | Rau | | | Rau | uF | Rau | WF | Rau | | = | Rau | HF | | 2 I | HF | US |
| LS | | | <u></u> | 1 | | 2 | | 4 | | - | 7 | 17 | | 7 | 16 | |
| SL. | 0 | | 0 | - | 0 | 1 | 2 | 0 | . 0 | į | 1 | 3 | | 1 | 2 | |
| MC | 0 | | 0 | 0 | ٥ | - D | 0 | | 0 | į | ο . | 0 | | • | 2 | |
| мы | 0 | | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | Ē | 0 | 0 | | 0 | 0 | |
| Total | | | 0 | | <u>-</u> | <u>-</u> | | <u>-</u> | <u>-</u> | - <u>i</u> | | 20 | | 8 | . 19 | |
| | _ | | _ | _ | | _ | _ | • | | i | _ | | | _ | | |
| 10 HI | NUTES AF | TER | TES | T PERIOD | ì | | RANGE (| neters> | | | | • | | | | |
| . | 0 |)-2 | | 2 | -4 | | 4-6 | | 8-2 | į | | Total | CH | i –zeu | ARE VALUE | |
| Trace Tupe | Rau | HF | | Rau | WF | Rau | HF | Rau | HF | | Rau | ИF | Fü | K 2 1 | | |
| LS | 0 | | 0 | 0 | 0 | 3 | 8 | 3 | 6 | ; | 6 | 14 | LS | | Rau 0.077 | UF 0.29 |
| SL | 0 | | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | • | 0 | a | 51 | | 1.000 | 3.00 |
| NC | 0 | 1 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | : | 1 | 3 | NC NC | • | 1.000 | 3.00 |
| ш | 0 | | 0 | . 0 | o | a | 0 | 0 | . 0 | _: | 0 | 0 | NA. | | 1.000 | 3.00 |
| Total | 0 | | 0 | 0 | 0 | 4 | 11 | 3 | 6 | - | 7 | 17 | | TAL | 0.067 | 0.24 |
| CHI SQUF | | | | | | • | | | | • | | | _ | | ARE - 3.8 | |
| F-HAT | 0-2 | | | 2- | 4 | 4 | -6 | 6. | -8 | | | | ₹₫ | .f. = | 1) = ,05> | 7. |
| | RaH | HF | _ | Rau | HF | Ran | HF | Rau | | | | | ` | x pres | 09/ | |
| L \$ SL | 0 | i | 0 | 0 | 2 | . 1 | 7 2 2 | 4 | 7 | | | • | | | | |
| NC NH | 0 | | 0 | 0 | 0 | 1 | 2 | 0 | 0 | | | | | | | |
| TOTAL | ŏ | | ŏ | ĭ | 2 | 4 | 10 | 4 | 7 | | | | | | | |
| CHI —SQUA VALUES | RE 0-2 | | | 2 | -4 | 4 | -6 | 6. | -8 | | | | | | | • |
| | Rau | MF | | Rau | MF | Rau | HF. | Ray | WF | | | | | | | |
| LS | | | | | 4.000 | 0.200 | 0.692 | 0.145 | 0.286 | | | | | | | |
| SL NC | | | | | | 1.000 | 3.000 | | | | | | | | | |
| ш | | | | | | | | | | | | | | | | |
| TOTAL | | | | 1.000 | 4.000 | 0.143 | 0.474 | 0.143 | 0.286 | | | | | | | |

Table C9. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| IO MINU | ES DUR | ING | TES | T PERIOD |) | | RANGE (| meters) | | - | | CMTSOU | ARE F-HAT | |
|-----------------------|---------|------------|------------|----------|---------|---|---------|---------|---------|-----|----------|------------|-----------|------------|
| Trace | | -2 | | 2 | t-4 | | 1-6 | | 5-8 | | Total | | EST PERIC | |
| Tupe | Rau | μF | | Rau | HF | Rau | HF | Ram | ИF | Rau | ЦF | Rass | ИF | |
| LS | , O | | 0 | 0 | 0 | 8 | 20 | 11 | 21 | 19 | 41 | 15 | 31 | |
| SL | 0 | | 0 | 0 | O | 1 | 3 | 0 | 0 | 1 | 3 | 1. | 3 | |
| NC | 0 | | 0 | 1 | 4 | 0 | 0 | 1 | 2 | 2 | 6 | 2 | • • | |
| ш | ٥ | | 0 | . 0 | Ð | 0 | 0 | 0 | a | 0 | 0 | 0 | 0 | |
| Total | 0 | | 0 | 1 | 4 | 9 | 23 | 12 | 23 | 22 | 50 | 17 | 38 | |
| 10 HIM | ITES AF | TER | TES | T PERIO | • | • • | RANGE C | neters) | | | | | * | |
| _ | • |)-2 | | 4 | t-4 · | • | 1-6 | • | i-e | | Total | CHI - SOU | ARE VALUE | <u>.</u> _ |
| Trace Type | RaH | HF | | Rau | NF | Ran | MF | Ran | MF | Rau | HF | FOR 2 T | EST PERIC | |
| LS | 0 | | 0 | 0 | 0 | > | • | 7 | 13 | 10 | 21 | | Rau | WF |
| SL | 0 | | 0 | ٥ | 0 | 1 | 3 | 0 | ٥ | 1 | . 3 | LS | 2.793 | 6.452 |
| NC | | | 0 . | ٥ | 0 | . 0 | 0 | 1 | 2 | 1 | 2 | SI. | 0.000 | 0.000 |
| HU | 0. | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NC | 0.333 | 2.000 |
| Tatal | 0 | | 0 | 0 | 0 | 4 | 11 | 8 | 15 | 12 | 26 | 144 | | |
| | _ | | | | | | | | - | ; | | TOTAL | 2.941 | 7.579 |
| CHI —SQUARI F—HAT | 0-2 | | | 2- | -4 | 4 | -6 | 6- | -6 | | • | CHI-50U | ARE - 3.6 | 141 |
| | Rau | HF | _ | Rau | WF | Rass | HF | Rau | WF | | | Cal pha | 057 | |
| LS SL NC NH | 8 | | 8 | 0 | ê | , <u>, , , , , , , , , , , , , , , , , , </u> | 14 | 9 | 17 0 | | | | | |
| NC · | 0 | | 0 | 1 | 2 | 0 | 0 | 1 | 2 | | | | | |
| TOTAL. | ŏ | | ŏ | ĭ | 2 | ř | 17 | 10 | 19 | | | | | 1 |
| CHI —SQUARI VALUES | 0-2 | | | 2- | · -4 | | 4 | 6- | -8 | | | | | |
| • | Rau | HF | | Rau | W | 2.273 | MF | Rau | uf . | | | | • | |
| LS SL NC | | | | | | 2.273 | 5.143 | 0.009 | 1.882 | | | • | | |
| NC | | | | 1.000 | 4.000 | | | 0.000 | 0.000 | | | | • | |
| HH TOTAL | | | | 1.000 | 4.000 | 1.923 | 4.235 | 0.800 | 1.684 | | | | | |

Table C10. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidel Pi | | 2 Hr befo Lou Tide | | Duration Treatmen | t Tupe: | 30 ₽ | - | Her 5 only on, 30 sec off | Test Da Test Ti | Me: | 2/4/89 0400 |
|----------------------|--------------|-------------|----------------|------------|--------------------------------|--------------------------------|----------------------|-------------|----------|-----|------------------------------|---|-----------|----------------|
| 10 MIN | UTES DUR | ING TES | ST PERIO | D . | | | neters> | | | | | CHI -SQU | ARE F-HA | : Г |
| Frace | 0 | -2 | | 2~4 | | 4-6 | ا | 6-8 | <u> </u> | | Total | FOR 2 T | EST PERI | 00\$ |
| Гуре | Rau | ИF | Ran | HF · | Rau | HF | Rau | MF | R | 844 | MF | Rate | uf | |
| .s | 0 | 0 | 0 | . 0 | 3 | | 3 | 6 | | 6 | 14 | 15 | 35 | |
| iL. | 0 | 0 | 0 | 0 | 2 | 5 | O | 0 | • | 2 | 5 | 1 | 3 | |
| IC . | 0 | 0. | 0 | 0 | 3 | • | 0 | 0 | Ī. | 3 | • | > | 10 | |
| Hi | 0 | 0 | 0 | 0 | 0 | 0 | 0 | a | Ī', | 0 | Q | 0 | 0 | |
| Total | 0 . | 0 | 0 | 0 | 9 | 21 | 3 | 6 | 1 | 1 | 27 | 10 | 47 | |
| 10 MI | NUTES AF | TER YES | ST PERIO | D | 1 | RANGE (| neters> | | : : | | | | | |
| Trace | 0 | -2 | | 2-4 | | 4-6 | | 6-8 | _ | | Total | CHI-SQU | ARE VALUE | E Mos |
| rupe | Rau | HF | Ran | WF | Rau | LIF | Rass | WF | R | 44 | MF | , on 2 . | Rau | LUF LUF |
| .s | 0 | 0 | 2 | 9 | 12 | 30 | 9 | 17 | 2 | 3 | 55 | LS | 9.966 | 24.34 |
| 5L, | 0 | 0 | 0 | 0 | 0 | 0 | O | 0 | : | 0 | . • | SL. | 2.000 | 5.00 |
| IC | 1 | 8 | 1 | · 4 | 9 | 0 | 0 | 0 | • | 2 | 12 | | | |
| 414 | . 0 | 0 | . 0 | 0 | 0 | . 0 | 0 | 0 | | 0 | • | NC | 0.200 | 0.80 |
| rotal | 1 | 8 | 3 | 12 | 12 | 30 | 9 | 17 | 2 | 5 | 67 | TOTAL | 5.444 | 17.02 |
| CHI-SQUA | 6 5 | | • | | | | | • | • | | • | | ARE - 3.4 | |
| F-HAT | 0-2 | | 2. | -4 | 4 | -6 | 6 | -8 | | | | <d.f. <alpha<="" =="" td=""><td>1)</td><td></td></d.f.> | 1) | |
| _ | Rau | WF | Rau | HF. | Ran | | RaH | | | | | /at biia | 05/ | |
| .S SL | 0 | 0 | 0 | 3 | 8 | 19 | 6 | 12 0 | | | | | | |
| LS SL NC HH | 1 0 | 4 | 1 | 2 | 2 | 40 | 0 | 0 | | | | | | |
| TOTAL | 1 | 4 | 2 | 6 | 10 | 26 | 6 | 12 | | | | | | |
| CHI —SQUR! VALUES | RE 0-2 | | 2- | - - | 4 | -6 | 6 | -8 | | | | | | |
| LS SL NC | Rau 1.000 | HF 9.000 | 2.000 1.000 | 4.000 | RaH 5.400 2.000 3.000 | MF 12.737 5.000 8.000 | 3.000 | UF 5.261 | | | | | * | |
| UU TOTAL | 1.000 | 8.000 | 3.000 | 12.000 | 0.800 | 1-580 | 3.000 | 5.261 | | | | - | | |

Table C11. Indian Point hanner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | 1879 zako de | | Tidal Ph | | 1.5 Hr b | | Treatmen | of Test | : 10 min 30 sec (| tor 5 only on, 40 sec off | Test Date Test Time |) | 2/4/88 0420 |
|---------------------|--------------|---------|----------|------------|----------------|---------|----------|---------|------------------------|------------------------------|------------------------|--------------------|----------------|
| 10 MIN | IUTES DUR | ING TES | T PERIOD | | | RANGE (| neters> | | | | | | · • |
| Trace | .0 | -2 | 2 | :-4 | | 1-6 | | 6-8 | | Total | CHI-SQUAR FOR 2 TES | RE F-HA ST PERI | T ODS |
| Tupe | Rau | HF | Rass | HF | Ran | HF | Ras | HF | Rau | uf | Rau | HF | • |
| LS | 0 | 0 | 0 | 0 | 9 | 23 | 11 | 21 | 20 | 44 | 19 | 42 | • |
| SL. | 0 | 0 | ٥ | 0 | 2 | . 5 | • | 0 | 2 | | 2 | ., 4 | |
| +C | 1 | | 0 | ٥ | . 0 | 0 | 1 | 2 | . 2 | 10 | . 1 | 5 | |
| нн | 0 | 0 | 0 | | . 1 | > | 0 | 8 | 1 . | 3 | 1 | . 2 | |
| Total | 1 | 9 | 0 | o | 12 | 31 | 12 | 23 | 25 | 62 | 22 | 53 | - |
| 10 HI | NUTES AF | TED TES | r ereinn | | | | - ' | | | • | | | • |
| | | | | | | RANGE (| meters) | | - | | : | | |
| Trace | 0 | -2 | 2 | -4 | | 1-6 | | 6-9 | | Total | CHI-SQUAS | E VALU | E |
| Type | Rau | ИF | Rau | HF | Rass | MF | Rau | HF | Raw | HF | FOR & IES | | |
| .s | ō | 0 | 1 | 4 | 6 | 15 | 11 | 21 | 18 | 40 | | Rau | HF |
| il. | ٥ | 0 | 0 | 0 | 1 | , > | 0 | 0 | 1 | 3 | LS | 0.105 | 0.1 |
| KC | 0 | 0 | 0 | 0 | . 0 | 0 | . 0 | . 0 | . 0 | o . | SL | 0.333 | 0.5 |
| 114 | . 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | | 0 | NC | 2.000 | 10.0 |
| rotal | 0 | 0 | 1 | 4 | 7 | , 16 | 11 | 21 | 19 | 43 | ш | 1.000 | 3.0 |
| | | | | | | | | | = | | TOTAL | 0.818 | 3.43 |
| CHI—SQUA F—HAT | 0-2 | | 2- | -4 | 4 | -6 | 6 | ~8 | | | CHI-SQUAR | i> | 841 |
| | Rau | HF | Rau | MF | Ram | WF | Rau | | | • | (alpha = | .05/ | |
| LS SL NC | Ş | ģ | 0 | 2 | . 2 | 19 | 11 | 21 0 | | • • | | | |
| 414 | 1 | 4 6 | 0. | 0 | 0 | 0 2 | . 0 | 1 | | | | | |
| TOTAL | 1 | 4 | . 1 | 2 | 10 | 25 | 12. | 22 | | | | | |
| CHI —SQUA VALUES | 0-2 | | 2- | · 4 | * | -6 | 6 | -8 | | | | | |
| _ | Rau | HF | Rau | ИF | Rau | HF | Rau | HF | | • | | | |
| LS SL | | | 1.000 | 4.000 | 0.600 4.333 | 1.684 | 0.000 | 0.000 | | | | | |
| NC | | 8.000 | <u> </u> | | | | 1.000 | 2.000 | | | | | |
| NU TOTAL | 1.000 | 8.000 | 1.000 | 4.000 | 1.000 1.316 | 3.000 | 0.043 | 0.091 | | | | | |

Table C12. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

1) Numbers presented are a minimum estimation for test periods.

| 10 HIN | UTES BEF | ORE TES | T PERIOD | | 9 | ANGE (| neters) | | | | | | | |
|--|--|----------------------------------|---|--|-----------------------------------|-------------------------------------|--|---|-----------------|--------------------------------|------------------|------------------------|------------------------|----------|
| _ | 0 | -2 | . 2 | -4 . | 4 | -6 | 6- | -8 | | Total | 1 | CHI-SQU FUR 3 T | ARE F~HAI EST PERIO | r 005 |
| race Type | Rau | WF | Rau | UF | Rau | ИF | Rau | HF | Rau | HF | | Rau | WF | |
| LS | 6 | 46 | 8 | 30 | 42 | 105 | 14 | 27 | 70 | 208 | | 69 | 211 | |
| SL | 1 | 8 | ٥ | a | 0 | 0 | .0 | 0 : | 1 | 8 | | . 0 | 3 | |
| 40 | 0 | · o | . 0 | ٥ | 1 | 3 | 0 | 0 | 1 | 3 | | 0 | 1 | - |
| 410 | 0 ' | 0 | a | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | |
| rotal | 7 | 54 | 8 | 30 | 43 | 108 | 14 | 27 | 72 | 219 | | . 69 | 215 | |
| 10 MINE | UTES DUR | ING TES | T PERIOD | | · • | ANGE (| neters) | : | | | | | | |
| , | 0 | -2 | 2 | ~4 | | -6 | | -8 | | Total | 1 | CHI - SQU | RRE VALU | E |
| frace Type | Rau | MF | Raui | HF | Rau | uf . | Rau | HF | RaH | ИF | | FUR 3 T | EST PERI | |
| .s | . 3 | 2,3 | 23 | 87 | 29 | 73 | 10 | 19 | 65 | 202 | | | Rau | UF |
| SL. | 0 | 0 | O : | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | rz | 1.478 | 7.90 |
| NC | Ò | 0 | ٥ | G | 0 | Q | 0 | 0 | 0 | 0 | | SL. | | 13.33 |
| | | | | | | | | | | | | NC | | 6.00 |
| MM | 0. | 0 | 0 | o | 0 | 0 | 0 | 0 | 0 | ٥ | | | | |
| Total | 3 | 23 | 23 ST PERIOD | 87 | 29 | 73 | 10 | 19 | 65 65 | 202 | - - , | HH TOFAL | 3.594 | 6.77 |
| Total | 3 NUTES AF | 23 TER TES | 23 T PERIOD | 87 | 29 | 73 RANGE < | 10 meters> | | | 202 | 1 | HH TOFAL CHI-SQU | APE = 5.4 | 6.177 |
| Total 10 MII Trace Type | NUTES AF | TER TES | 23 T PERIOD 2 Raiu | 87 -4 HF | 29 Ran | 73 RANGE (| 10 meters> | 19 -8 | 65 Rau | 202 Total | 1 | ии Tofal | APE = 5.4 | 6.77 |
| 10 MII Trace Type | NUTES AF | 23 TER TES -2 WF 61 | 23 ST PERIOD 2 Raw 10 | 87 -4 HF | 29 F Ran 42 | 73 RANGE 4 | 10 Meters> 6- Rau 13 | 19 46 46 25 | 65 Rau 73 | 202 Fotal HF 229 | 1 | HH TOFAL CHI-SQU | APE = 5.4 | 6.177 |
| Total 10 MII Trace Type LS | NUTES AF | 23 TER TES 0-2 MF 61 | 23 ST PERIOD 2 Ram 10 | 87 -4 -4 -38 | 29 Rau 42 0 | 73 RNGE (4) 1-6 LIF 105 | 10 Meters> 6- Raw 13 | 19 4F 25 | 8au 73 | 202 Total NF 229 | 1 | HH TOFAL CHI-SQU | APE = 5.4 | 6.77 |
| Total 10 MYI Frace Type LS SL NC | RAH RODE | 23 TER TES 0-2 WF 61 0 | 23 ST PERIOD 2 Rain 10 0 | 87 -4 -4 -38 0 | 29 Rah 42 0 | 73 ANGE C | 10 meters> 6- Raw 13 0 | 19 4F 25 | Rau 73 0 | 202 Fotal UF 229 0 | 1 | HH TOFAL CHI-SQU | APE = 5.4 | 6.177 |
| Total 10 MYI Frace Type LS SL NC | RUTES AF | 25 TER TES 0-2 HF 61 0 | 23 ST PERIOD 2 Rain 10 0 | 97 4 NF 38 0 | 29 Rah 42 0 0 | 73 RANGE C | 10 meters> 6- Ram 13 0 | 19 4F 25 0 | Ran 73 0 | 202 Fotal NF 229 0 | 1 | HH TOFAL CHI-SQU | APE = 5.4 | 6.77 |
| Total 10 MII Frace Type LS SL NC | NUTES AF | 23 TER TES 0-2 WF 61 0 | 23 ST PERIOD 2 Rain 10 0 | 87 -4 -4 -38 0 | 29 Rah 42 0 | 73 ANGE C | 10 meters> 6- Raw 13 0 | 19 4F 25 | Rau 73 0 | 202 Fotal UF 229 0 | 1 | HH TOFAL CHI-SQU | APE = 5.4 | 6.177 |
| Total 10 MYI Frace Type LS SL NC | NUTES AF | 25 TER TES 0-2 HF 61 0 | 23 ST PERIOD 2 Rain 10 0 | 97 4 HF 38 0 0 | 29 Rah 42 0 0 | 73 RANGE 4 | 10 meters> 6- Ram 13 0 | 19 18 18 25 0 0 | Ran 73 0 | 202 Fotal NF 229 0 | 1 | HH TOFAL CHI-SQU | APE = 5.4 | 6.77 |
| Total 10 MYI Frace Type LS SL NC NC HH Fatal CNY—SQUAR | RAH RE RE RE RE RE RE | 25 TER TES 0-2 MF 61 0 0 | 23 ST PERIOD 2 Rain 10 0 0 | 97 4 HF 38 0 0 | 29 Rah 42 0 0 | 73 RANGE C | 10 meters> 6- Raw 13 0 0 | 19 18 18 25 0 0 | Ran 73 0 | 202 Fotal NF 229 0 | 1 | HH TOFAL CHI-SQU | APE = 5.4 | 617 |
| Total 10 MYI Frace Type LS SL NC HH Fatal CHY—SQUAR F—HAT LS SL | 8 0 0 0 0 8 RE 0-2 Rau 6 0 0 | 25 TER TES 0-2 MF 61 0 0 61 45 | 23 ST PERIOD 2 Rain 10 0 0 10 2- Rain 14 0 0 0 0 | 97 4 NF 0 0 38 0 0 38 4 NF 52 0 0 52 | 29 Rah 42 0 0 42 4- Rah 38 0 0 0 | 73 RANGE C | 10 Heters> 6-Ram 13 0 0 13 6-1 Ram 12 0 0 | 19 MF 25 0 0 25 WF 24 0 0 0 24 | Ran 73 0 | 202 Fotal NF 229 0 | 1 | HH TOFAL CHI-SQU | APE = 5.4 | 617 |

Table C13. Indian Point hanner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

1) Numbers presented are minimum estimates for test periods.

| | | | Tidel Pi | | 3 hrs bed low tide | 1 | | t Type: | t: 10 min 10 sec | | ec off | Test Da Test Ti | | 2/13/87 1107 |
|----------------------|--------------------|--------------------|---------------------|--------------------------|-----------------------|---------------|----------------------|--------------|---------------------|-------|--------|--------------------|-----------|-----------------|
| 10 MIN | HUTES DURI | NG TES | T PERIO | | | RANGE (| meters> | | | | 1 | CHI -59U | ARE F-HA | г |
| Trace | 0~: | 2 | | 2-4 | | 4-6 | 1 | 6-8 | | Total | | FOR 2 T | EST PERI | 205 |
| Tupe | Rate | HF. | Rau | HF | Rau | ME | Rau | MF | Ran | WF | | Rau | ЦF | |
| .\$ | 0 | ρ | 5-4 | 204 | 54 | 136 | 45 | 86 | 153 | 426 | | 167 | 478 | |
| SL. | ٥ | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | Q | | 0 | a | |
| (C | 0 | 0 | 1 | 4 | 0 | . 0 | 0 | 0 | 1 | • 4 | | 3 | 2 | |
| 414 | 0 | ۵ | 0 | 0 | 0 | 0 | 0 | O | . 0 | 0 | | 0 | 0 | |
| rotal | 0 | ٥ | 55 | 208 | 54 | 136 | 45 | 86 | 154 | 430 | _ | 167 | 480 | |
| 10 HTM | IUTES AFTE | R TEST | PERIOD | | (| RANGE (| notors) | | • | • | 1 | | | |
| Trace | 0~ | 2 | | 2-4 | | 4-6 | | 6-8 | | Total | • . | CHI-SQU | ARE VALUE | E nos |
| Type | Rau | HF | Ran | HF | Ran | uf | Rau | HF | Rau | HF | | , on 2 , | | HF |
| .s | 5 | 38 | 66 | 249 | 59 | 148 | 50 | 95 | 180 | 530 | | | Rau | |
| 5L. | O | 0 | 0 | ٥ | O | 0 | 0 | • | 0 | 0 | - | LS | 2.199 | 11.5 |
| 4C | . 0 | 0 | 0 | a | 0 | 0 | . 0 | 0 | | 0 | | SL | | - |
| 414 | 0 | 0 | o | • | 0 | 0 | 0 | 0 | 0 | 0 | _ | NC | 1.000 | 4.00 |
| Total | 5 | 38 | 66 | 249 | 59 | 148 | 50 | 95 | 180 | \$30 | - | TOTAL | 2.024 | 10.4 |
| CHI-SQUA F-HAT | 0-2 | | 2 | -4 | 4 | -6 | 6 | | • | | | | ARE - 3. | |
| LS SL NC MM | Rau 3 0 0 | HF 19 0 0 | Rau 60 0 1 | HF 227 0 2 0 | Rau S7 G G | 142 0 0 | Rass 48 0 0 | 91 0 0 | · | | | | | |
| TOTAL | | 13 | 61 | 229 | \$7 | 142 | 49 | 91 | | | • | | | |
| CHI —SQUA VALUES | 1RE 0-2 | | 2. | -4 | 4 | -6 | 6 | -8 | | | | | | |
| L S SL | | .000 | 1.200 | 4.470 | 0.221 | NF 0.507 | 0.263 | UF 0.448 | | | | | | |
| HC HH TOTAL | 5.000 38 | .000 | 1.000 | 4.000 3.678 | 0.221 | 0.507 | 0.263 | 0.448 | | , | | | | |

Table C14. Indian Point hanner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 min | IUTES DU | RING TE | ST PERIO | D | | RANGE < | (noters) | • | | | 1. | CHT - E011 | RRE F -HA | |
|-----------------|--------------|-------------|----------|----------------|-------|-------------|----------|-------------|-----|-------|-------------|------------|----------------------|----------|
| Tace | | 0-2 | | 2-4 | | 1-6 | | -8 | | Total | • . | | EST PERI | |
| upe | Rau | ИF | Rau | HF | Rau | uf | Rau | μF | Rau | ИF | | Rau | HF | |
| .\$ | 24 | 183 | 82 | 309 | 110 | 276 | 95 | 181 | 311 | 949 | | 318 | 956 | • |
| iL | 0 | ٥ | 0 | . 0 | 0 | 0 | 0 | 0 | | 0 | | . 0 | 0 | • |
| C | 0 | 0 | ٥ | 0 | O | 0 | Ď | 0 | | 0 | | 0 | 0 | |
| IM | 0 | 0 | 0 | 0 | 9 | a | Q. | 0 | : 0 | 0 | | 0 | 0 | |
| ot#1 | 24 | 183 | 82 | 309 | 110 | 276 | 96 | 191 | 311 | 949 | • | 316 | 956 | |
| 10 MIN | WTES AF | TER TEST | r PERIOD | | | | | | • | | | | • | |
| | | | | , | ş | RANGE (| (noters) | | 1 | | 1 | | | |
| race | · (| D-5 | | 2-4 | | I-6 | | i-9 | | Total | | CHI -SQU | ARE VALU EST PERI | E nos |
| 4b4 | Ran | HF. | Řан | HF | Rau | uF | Rau | HF | Rau | HF | | | Ram | HF |
| .s | 23 | 175 | 79 | 298 | 112 | 281 | 110 | 503 | 324 | 963 | | LS | - | |
| SL. | O | . 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | • | | 0.266 | 0-10 |
| IC | 0 | 0 | 0 | a | ` 0 | 0 | ٥ | 0 | . 0 | 0 | | SL. | | |
| tri | 0 | ۵ | 0 | 0 | ٥ | 0 | ۵ | 0 | : 0 | . a | | NC | | - |
| otal | 23 | 175 | 79 | 298 | 112 | 281 | 110 | 209 | 324 | 963 | - | IM | | |
| = | | | · · | • | , | | | | : | | | TOTAL | 0.266 | 0.10 |
| HY-SQUA -HAY | 0-3 IKE | | 2. | -4 | 4- | • | 6- | -8 | | | | (d.f | | 841 |
| _ | Ray | NF. | Rau | | Ray | µF_ | Rau | HF | | | | (al pha | 05> | |
| .s :L | 24 | 179 0 | 81 0 | 304 | 111 | 2 79 | 103 | 195 | | | | | | |
| iC | Ō | Ò | Q | Õ | Õ | Ŏ | Õ | Õ | | | | | | |
| M TOTAL | 24 | 179 | 0 81 | 304 | 111 | 279 | 103 | 195 | | | | | | |
| HI -SQUA | | | | | | | | | | | | | | |
| MLUES | 0-2 | | 2 | - - | 4- | 6 | 6- | -8 | | | | | | |
| .s | Rau 0.021 | UF 9-179 | 0.056 | ИF 0.199 | 0.018 | uF 0-045 | 1-098 | MF 2.010 | | | | 5 | ς, | |
| iL. | | | | | | | | | | | | | | |
| NC HM | | | == | | | | | | | | | | | |
| <u>Fütal</u> | 0.021 | 0.179 | 0.056 | 0.199 | 0.018 | 0.045 | 1.098 | 2.010 | | | • | | | |

Table C15. Indian Point hanner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | ****** | | Tidal P | hase: | 2 hrs bed low tide | | Treatment | t Type: | | hers 3&5 on, 20 sec off | Test Da Test Ti | He: | 2/13/88 1147 |
|--------------------|--------------|-------------|--------------|------------|-----------------------|-------------|--------------|-------------|-----|----------------------------|--------------------|-----------------------|-----------------|
| | NUTES DUI | | ST PERIO | D | | | neters> | | | 1 | | ARE F-HA | |
| | | D-2 | ; | 2-4 | • | 4-6 | 2 (| S-8 | | Total | | EST PERI | |
| Trace Type | Ran | ИF | Ran | uf . | Rau | ИF | Rau | ИF | Rau | WF | Rau | HF. | |
| | 36 | 274 | 84 | 317 | 110 | 276 | 100 | 190 | 330 | 1057 | 360 | 1145 | |
| SL | 0 | . 0 | 0 | 0 | · o | 0 | O | 0 | . 0 | 0 | 0 | 8 | |
| NC | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | . 0 | ٥ | o | ٥ | |
| uu. | 0 | 0 | . 0 |) 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | , |
| Total | 36 | 274 | 84 | 317 | 110 | 276 | 100 | 190 | >>0 | 1057 | 360 | 1145 | |
| 10 MI | NUTES AFT | TER TES | T PERIOD | | | | | | • | | | | |
| | | | | | | RANGE (| neters) | | | 1 | | | |
| Trace | | D-2 | | 2-4 | | 4-6 | | 5- 8 | | Total | | IARE VALU EST PERI | |
| Tupe | Ran | uF | Rau | HF. | Кан | MF | Ran | uF | Raw | HF. | | Rau | HF |
| LS | 28 | 290 | 108 | 407 | 120 | 301 | .125 | 234 | 389 | 1232 | LS | 4.841 | 13.37 |
| SL | 0 | ٥ | 0 | 0 | 0 | 0 | . 0 | .0 | 0 | o " | SL · | | |
| NC | 0 | . 0 | ٥ | 0 | 0. | 0 | 0 | 0 | • | ٥ | NC NC | | |
| ин | 0 | o | 0 | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | MU. | | |
| Total | 38 | 290 | 108 | 407 | 120 | 301 | 123 | 234 | 389 | 1232 | | 4.841 | 13.37 |
| | | | | | | | | | I . | | TOTAL | 4.641 ARE - 3. | |
| CHI -5QUI F-HAT | 0-5 HKE | | 2 | -4 | 4 | -6 | 6- | -8 | | | (d.f. = | 1) | 641 |
| LS | Ray 37 | иF 282 | ₽ан 96 | 362 | Rau 115 | 289 | Rau 112 | 212 | | | Calpha | 027 | • |
| SL NC | 0 | . 0 | 0 | 0 | - O | 0 | . 0 | 0 | | | | | |
| TOTAL | Q 7E | 0 282 | 96 | 362 | 0 115 | 289 | 112 | 0 212 | | | | | |
| CHI-SQU | | | 2 | -4 | : 4 | | | -8 | - | | | | |
| LS | Rau 0.054 | NF 0.454 | RaH 3.000 | | Rau 0.435 | KF 1.083 | Rau 2.372 | ИF 4.566 | | | | | |
| SL | | | | ~~ | | | | | | | | • | |
| иu | | | | | | | ~~ | 4 556 | | | | | |
| SL NC | 0.054 | 0.454 | 3.000 | | | == | 2.372 | 4.566 | | | | • | |

Numbers presented are minimum estimations for test periods.

Table C16. Indian Point hanner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 HIN | IUTES DUI | RING TES | ST PERIOD | • | | RANGE (| neters> | | | • | | RE F-HAT | |
|-------------------------------|---------------------|---------------------|---------------------|---------------------------------|-----------------------------|--------------------------|----------------------------|--------------------------|-----|---------|--|-----------|------|
| P | |)-2 | 2 | 1 -4 | • | 4-6 | | 6-8 | | Total 1 | | EST PERIO | |
| race Tupe | Ran | UF | Rau | HF | Rau | uf. | Ran | HF | Rau | MF | Rau | ИF | |
| LS | 42 | 320 | 95 | 358 | 120 | 301 | 125 | 238 | 382 | 1217 | 389 | 1214 | |
| 5L | 0 | a | 0 | 0 | 0 | 0 | . 0 | 0 | G. | 0 | 0 | o | |
| HC | 0 | . 0 | 0 | ۵ | 0 | . 0 | 0 | o | . 0 | 0 | 0 | | |
| 44 | 0. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | . 0 | |
| Total | 42 | 320 | 95 | 358 | 120 | 301 | 125 | 238 | 382 | 1217 | 389 | 1214 | |
| 10 HI | NUTES AFI | FER TEST | r PERIOD | | | RANGE (| neters> | | | 1 | | | |
| . | |)-2 | 2 | 2-4 | | 4-6 | (| 6-9 | | Total | CHI - SQU | RRE VALUE | |
| Trace Type | Ran | HF | Rau | uF | Rau | ИF | Rau | HF | Rau | HF | FUR 2, 11 | EST PERIO | |
| LS | 37 | 282 | 90 | 339 | 131 | 329 | 137 | 260 | 395 | 1210 | | Rau | HF |
| SL. | · 0 | 0 | 0 | ٥ | 0 | o | 0 | 0 | 0 | 0 | · LS | 0.218 | 0.02 |
| NC | 0 | 0 | ٥ | 0 | 0 | o. | 0 | 0 | . 0 | | SL | | |
| ИИ | 0 | 0 | 0 | 0 | G | G | 0 | a | 0, | 0 | NC | | - |
| Tatal | 37 | 282 | 90 | 339 | 131 | 329 | 137 | 260 | 395 | 1210 | TOTAL | 0.219 | 0.02 |
| CHI —SQUI F—HAT | ARE 0-2 | | 2- | - -4 | 4 | -6 | 6 | -0 | | | <d.f. =<="" td=""><td>ARE - 3.6</td><td></td></d.f.> | ARE - 3.6 | |
| LS SL NC HU TOTAL | Rau 40 0 0 | MF 301 0 0 | 844 93 0 0 | UF 349 0 0 0 349 | Rau 126 0 0 126 | 4F 315 0 0 0 | Ra-1 131 0 0 0 | UF 249 0 0 0 | | | (alpha (| - 1057 | |
| CHI-SQUI | • | | 2 | | | -6 | | -8 | | | • | | |
| , | RaH | MF | Rau | | Rau | NF. | Rau | HF | | | • | - | |
| LS SL | 0.316 | 2.399 | 0.135 | 0.518 | 0.482 | 1.244 | 0.550 | 0.972 | | | | | |
| NÇ UU | | | | | | | | | | | | | |
| TOTAL | 0.316 | 2.399 | 0.135 | 0.518 | 0.482 | 1-244 | 0.550 | 0.972 | | | | | |

Table C17. Indian Point hanner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidal P | hase: | 1.5 hrs t lou tide | | Treatment | t Type: | : 10 min 20 sec c | m, 40 sec off | Test Da Test Ti | | 2/13/88 1227 |
|-------------------------------|--------------------------------|---------------------------------|-------------------------------|---------------------------------|----------------------------------|--------------------------|---------------------------|---------------------------------|----------------------|------------------|--------------------|--------------------------|-----------------|
| 10 HINU | TES DU | RING T | EST PERIO | D | | | neters) | | | **************** | | | ****** |
| Trace | | 0-2 | | 2-4 | • | 1-6 | • | 5-8 | | Total . | FOR 2 T | JARE F-HA' TEST PERIO | 0DS |
| Tupe | Rau | HF | Rah | НF | Rau | ИF | Rau | ИF | RaH | HF | Rau | HF | |
| LS | 45 | 343 | 82 | . 309 | 124 | 311 | 130 | 247 | 381 | 1210 | 364 | 1219 | |
| 5L | 0 | 0 | Ò | 0 | . 0 | 0 | ۵ | 0 | 0 | , o | . 0 | 0 | |
| NC ' | . 0 | . 0 | 0 | 0 | . 0 | 0 | Q | 0 | ٥ | o | . 0 | 0 | |
| ии | 0 | 0 | Q | o | ٠ . | 0 | Ò | 0 | . 0 | O | 0 | o | |
| Total | 45 | 343 | 62 | 209 | 124 | 311 | 130 | 247 | 381 | 1210 | 384 | 1219 | |
| 10 MINU | | TER TE: 0-2 | ST PERIOD | 2-4 | | RANGE (| neters> | i-a | : | 1 Total | CWT S.OU | JARE VALU | · • |
| Trace Yupe | Rau | | Rass | | Rau | HF | Rau | HF | Rau | ur ur | FOR 2 T | TEST PERI | Oos |
| LS | 42 | 320 | 96 | 362 | 120 | 301 | 129 | 245 | 367 | 1228 | | Rau | WF |
| SL | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | - 0 | 0 | 0 | LS | 0.047 | 0.13 |
| NC | 0 | . 0 | 0 | o | 0 | 0 | 0 | 0 | | Δ, | SL | | |
| HH | 0 | ` Q | 0 | ٥ | ä | G | 0 | 0 | | a | NC | | |
| Total | 42 | 320 | 96 | 362 | 120 | 301 | 129 | 245 | 387 | 1228 | ын | | |
| | | | | | | - | | | : | | TOTAL | 0.047 | 0.13 |
| CHT-SQUAR F-HAT | 0~3 E | | 2 | -4 | 4 | -6 | 6- | -8 | - | • | (d.f. = | | B41 |
| LS SL NC NU TOTAL | Rau 44 0 0 0 44 | UF 332 0 0 0 332 | Rau 69 0 0 0 0 | HF 336 0 0 0 536 | Rau 122 0 0 0 122 | UF 306 0 0 0 | Rau 130 0 0 0 | HF 246 0 0 0 246 | | | (alpha | US) | |
| CHI~SQUAR VALUES | 0-2 E | | 2 | -4 | 4- | -6 | 6- | - 8 | | | | | |
| LS | Rau 0.103 | NF 0.798 | Rau 1.101 | | Rau 0.066 | иF 0.163 | Rau 0.004 | HF 0-008 | | | | | |

0.066

1.101

¹⁾ Numbers presented are minimum estimates for test periods.

Table C18. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidal P | | 30 min be low tide | | Treatmen | t Tupe: | 10 min 30 sec o | hurs 365 on, 20 sec off | Test Da Test Ti | MO: | 2/13/86 1247 |
|------------------|-------------|-----------------|----------|-----------|-----------------------|---------|----------|-----------|--------------------|----------------------------|--------------------|--------------------|-----------------|
| to ut | NUTES DU | RING TE | ST PERIO | | | | (neters) | ******* | | | | | ******* |
| _ | | 0-2 | ; | 2-4 | | 4-6 | | 6~8 | | Total 1 | | ARE F-HATEST PERIO | |
| upe race | Rau | ИF | Rau | uf. | Rau | ИF | Rau | WF | Rau | 'UF | Rau | ЧF | |
| \$ | 37 | 282 | 96 | 362 | 121 | 304 | 110 | 209 | 364 | 1157 | 376 | 1201 | |
| L . | 0 | 0 | Q | 0 | 0 | 0 | 0 | 0 - | | 0 | . 0 | ٥ | |
| C | .0 | 0 | 0 | 0 | 0 | ٥ | n | 0 | 0 | 0 | 0 | 0 | |
| 14 | O | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | |
| otal | 37 | 202 | 96 | 362 | 121 | 304 | 110 | 209 | 364 | 1157 | 376 | 1201 | |
| 10 MI | NUTES AF | r er tes | T PERIOD | | (| RANGE (| (neters) | | | | | | |
| | | 0-2 | : | 2-4 | | 4-6 | • | 6~8 | : | Total | | ARE VALU | |
| upe race | Rau | ИF | Ran | uf) | Rau | иF | Ran | HF | Rau | ИF | FOR 2 T | EST PERIC | |
| s | 42 | 320 | 100 | 377 | 134 | 336 | 111 | 211 | 367 | 1244 | | Rau | WF |
| L . | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | · · | 0 | 0 | LS | 0.704 | 3.1 |
| c . | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | a | 0 | 0 | SL | | _ |
| 4 | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | NC | | _ |
| otal | 42 | 320 | 100 | 377 | 134 | 336 | 111 | 211 | 387 | 1244 | HH TOTAL | 0.704 | 5.1 |
| HY-SQU -HAT | IARE 0-2 | | 2 | ~4 | 4 | -6 | · 6 | -e | | | | ARE - 3.4 | |
| | Rau | ЦF | Rau | | Rau | | Rau | | | | (al pha | 05) | |
| S L | 40. | 301 | 98 | 370 | 128 | 350 | 111 | 210 | | | | | |
| Č | o o | 0 | Ŏ | 0 | Ö | · ŏ | Ď. | Ŏ | | | | | |
| öraL | 40 | 301 | 98 | 370 | 128 | 320 | 111 | 210 | | | | | |
| HI —SQU HLUES | ARE 0-2 | | 2 | -4 | 4 | -6 | . 6 | -8 | | | | | |
| s | Rau | uf | Ran | | Ran | | Rau | | | | | | |
| L | 0.316 | 2.599 | 0.082 | 0.304 | 0.663 | 1.600 | 0.005 | 0.010 | | • | | | |
| C H | | | | | | | | | | | | | |
| TOTAL | 0.516 | 2.399 | 0.093 | 0.304 | 0.663 | 1.600 | 0.005 | 0.010 | | | | | |

Table C19. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidal P | hase: | 30 min b low tide | efore | | | 10 min 30 sec o | hmrs 345 n, 30 sec off | Test Da Test Ti | | 2/13/88 1307 |
|---------------------|--------------|-------------|--------------|-------------|----------------------|-------------------|-----------|-------------|--------------------|---------------------------|--------------------|--------------------|-----------------|
| 10 HI | UTES DU | RING TE | ST PERIO | 0 | | RANGE (| (neters) | | | | | | |
| | | 0-2 | : | 2-4 | | 4-6 | | 6-8 | _ | Total ' | | ARE F-HATEST PERIO | |
| Trace Tupe | Rau | uf | Rau | uf | Rau | ИF | Ran | ИF | RAM | иF | Rau | HF | |
| LS | 32 | 244 | 82 | 309 | 90 | 226 | 95 | 181 | 299 | 960 | 298 | 932 | |
| SL | 0 | 0 | 0 | ٥ | 0 | o | 0 | ٥ | | 0 | 0 | 0 | |
| NC | 0 | . 0 | 0 | • | . 0 | 0 | 0 | 0 | . 0 | . 0 | Q | 0 | • |
| ни | 0 | 0 | 0 | 0 | 0 | 0 | 0 | a | . 0 | 0 | 0 | 0 | |
| Total | 32 | 244 | 92 | 309 | 90 | 226 | 95 | 161 | 299 | 960 | 298 | 932 | |
| 10 HI | NUTES AF | TER YES | r PERIOD | | | RANGE (| (neters) | ٠ | | | | | |
| | | 0-2 | ; | 2-4 | | 4-6 | | 6-8 | • | Total 1 | ĆHI -SQU | RRE VALU | Ε |
| Trace Tupe | Ran | | Rau | HF | Rau | uf | Rau | uf | RaH | WF | FOR 2 T | EST PERI | 200 |
| LS | 24 | 183 | 74 | 279 | 106 | 265 | 92 | 175 | 296 | 903 | | Rau | ИĘ |
| SL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o | . 0 | o · | . LS | 0.015 | 1.74 |
| HC | 0 | 0 | 0 | o | 0. | o | a | 0 | : 0 | 0 | SL | | |
| LL | 0 | 0 | ٥ | 0 | ٥ | 0 | | 0 | . 0 | 0 | MC | | |
| Total | 24 | 183 | 74 | 279 | 106 | 266 | 92 | 175 | 296 | 903 | МИ | | |
| | | | | | | • | | | • | | TOTAL | 0.015 | 1.744 |
| CHI — SQUI F—HAT | ARE 0-2 | | 2 | -4 | 4 | -6 | 6 | -8 | • | | (d.f. = | | 341 |
| LS | Rau 28 | HF 21∢ | Кан 76 | HF 294 | | NF 246 | Rau 94 | UF 178 | | | (al pha | 053 | |
| SL NC | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | | | | | |
| HH TOTAL | 0 28 | 0 214 | 0 78 | 0 294 | | 0 2 4 6 | 0 94 | 0 178 | | | | | |
| CHI —SQUI VALUES | ARE 0-2 | ! | 2 | -4 | 4 | -6 | 6 | -a | | | | | |
| LS SL | Rau 1.143 | NF 8-714 | RAH 0.410 | иғ 1.531 | Ran 1.306 | ИF 3.252 | 0.048 | 4F 0.101 | | | | | |
| NC HH | | | | | | | | | | • | | | |
| TOTAL : | 1.143 | 8.714 | 0.410 | 1.531 | 1.306 | 3.252 | 0-048 | 0.101 | | | | | |

Table C20. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | UTES BEF | ORE TES | T PERIOD | | | | | **** | | | F4 20 24 81 | | | 25000 |
|---|--|------------------------------|---|--|--|---|--|---------------------------------------|----------------|--------------------------|-------------|------------------|-----------|-------|
| | | _ | | | | | neters) | | | | 1 | CHI-SQL | JARE F-HA | T |
| Trace | | -2 | | 2-4 | | 1-6 | | 6-8 | : | Total | | FOR 3 1 | EST PERI | 005 |
| Tupe | RaH | | Rau | | RAM | HF | Rau | | : Rau | HF. | | Rau | uf | • |
| LS | . 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 6 | 16 | |
| SL | 0 | ۵ | 0 | 0 | . 0 | . 0 | O | 0 | 0 | ٥. | | 0 | Q | |
| NC | 0 | 0 | 9 | 34 | 8 | 20 | 31 | ′59 | 48 | 113 | | 55 | 129 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | _ | 0 | 0 | |
| Total | 0 | 0 | 9 | 34 | 8 | 20 | 31 | 59 | 49 | 113 | | 61 | 145 | |
| to MIN | UTES DUR | ING TES | T PERIOD |) | | - | meters) | | | | | | | |
| _ | 0 | -2 | 2 | :-4 | • | 1-6 | | 6-8 | 1 1 | Total | 1 | CHI –SQL | IARE VALU | E |
| Trace Type | Rau | HF | Rau | HF | Rau | HF | Rau | uf | : ——— : Кан | uf. | | FOR 3 1 | EST PERI | ō0S |
| LS | 0 | 0 | ō | • | 19 | 48 | 0 | 0 | 19 | 48 | | | Rau | , HF |
| SL | 0 | . 0 | ٥ | 0 | D | 0 | | 0 | . 0 | 0 | | LS | 41.167 | 96.00 |
| NC | 0 | 0 | 8 | 30 | 0 | 0 | - 42 | 80 | 50 | 110 | • | ' SL | | • • |
| ш | 0 | 0 | o | o · | 0 | ٥ | 0 | a | . 0 | 0 | | MC | 6.909 | 22.18 |
| Total | 0 | 0 | 8 | 30 | 19 | 46 | 42 | 80 | 69 | 158 | - | - 144 | | |
| | | | | | | | | | • | | | TOTAL | 7.869 | 17.20 |
| 10 HI | | | | | • | | | | | | | 70.11 | 1.003 | 11.20 |
| | NUTES AF | TER TES | T PERIOD | • | · \$1 | RANGE (| (neters) | | | | | | | |
| | | TER TES | |) ?-4 | | RANGE (| | 6~8 | | Total | 1 | CHI- 50 L | IARE = 5. | |
| Trace | | | | | | | | | Rass | Total UF | 1 | CHI—SQL | IARE = 5. | |
| Trace Tupe | 0 | -2 | | ?-4 | | 1-6 | | | Rau | Total | 1 | CHI- 50 L | IARE = 5. | |
| Trace Tupe | О Raн | -2 UF | Rau | 1-4 HF | Rau | 1-6 HF | Rau | иF | : | Total HF | 1 | CHI- 50 L | IARE = 5. | |
| Trace Tupe LS | Ran G | -2 UF 0 | Rau O | 1-4 UF 0 | Rau | 1-6 HF O | Rau | uf 0 | 0 | HF 0 | 1 | CHI- 50 L | IARE = 5. | |
| Trace Tupe LS SL NC | О | -2 uF 0 | Rau Q O | 14 UF 0 | Raw O | #F 0 | Rau 0 0 | иғ 0 | 0 | Votal NF 0 | 1 | CHI- 50 L | IARE = 5. | |
| Trace Tupe LS SL NC NU Total | Rah G G | -2 UF Q O | Rau Q 0 13 | 0 0 49 | Ran 0 0 22 | 6-6 UF 0 0 55 | Rau 0 0 | UF 0 0 65 | 0 | Votal HF 0 0 169 | 1 | CHI- 50 L | IARE = 5. | |
| Trace Tupe LS SL NC NU Total CNI -SQUAR | RAH G G O O O | -2 UF 0 0 | Rau 0 0 13 0 | 2-4 UF 0 0 49 0 | Rau 0 0 22 0 | 4-6 HF 0 0 55 0 | Rau 0 0 34 0 | иғ 0 0 65 0 | 0 69 | HF 0 0 0 169 | 1 | CHI- 50 L | IARE = 5. | |
| Trace Tupe LS SL NC | 0 Rah 0 0 0 0 0 | -2 UF 0 0 | Rau 0 0 13 0 13 | 2-4 HF 0 49 0 49 | Rau 0 0 22 0 22 | 4-6 MF 0 0 55 0 55 | Rau 0 0 34 0 34 | 0 0 65 0 65 | 0 69 | HF 0 0 0 169 | 1 | CHI- 50 L | IARE = 5. | |
| Trace Type LS SL NC UIII Total CHI—SQUAI | 0 RaH 0 0 0 0 0 | 0 0 0 0 | Rau 0 0 13 0 13 2- Rau | HF 0 49 49 49 | Ran 0 0 22 0 22 4- Ran 6 | 0 0 55 0 55 | Rau 0 0 34 0 34 | 0 0 65 0 65 -8 UF 0 | 0 69 | HF 0 0 0 169 | 1 | CHI- 50 L | IARE = 5. | |
| Trace Type LS SL NC UH Tetal CHI—SQUAR F~HAT LS SL | 0 0 0 0 0 0 RE 0-2 Rah | -2 UF 0 0 0 0 | Rau 0 0 13 0 13 2- Rau 0 16 | HF 0 49 49 49 49 56 60 5 | Ran 0 0 22 0 22 4- Ran 6 | 6-6 UF 0 0 55 0 55 -6 UF 16 0 25 | Rau 0 0 34 0 34 6 Rau 0 0 36 | 4F 0 65 0 65 -8 | 0 69 | HF 0 0 0 169 | 1 | CHI- 50 L | IARE = 5. | |
| Trace Tupe LS SL NC NH Total CHI—SQUAI F~HAT LS SL NC | 0 Rah 0 0 0 0 0 0 RE 0-2 Rah | 0 0 0 0 0 | Rau 0 0 13 0 13 0 13 | 0 0 49 0 49 | Ran 0 0 22 0 22 4- Ran 6 | 6-6 UF 0 55 0 55 | Rau 0 0 34 0 34 6 Rau 0 | 4F 0 65 0 65 -8 | 0 69 | HF 0 0 0 169 | 1 | CHI- 50 L | IARE = 5. | |
| Trace Tupe LS SL NC WW Total CHI—SQURI F~HAT LS SL NC WW TUTAL CHI—SQURI | RaH 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | -2 UF 0 0 0 0 | Rau 0 0 13 0 13 0 13 2- Rau 0 0 16 0 | 0 0 49 0 49 49 49 0 38 0 38 | Ram 0 22 0 22 4- Ram 6 0 10 0 16 | 0 0 55 0 55 6 UF 16 0 25 0 41 | Rau 0 0 34 0 34 6 Rau 0 36 0 36 | 65 65 0 65 65 68 | 0 69 | HF 0 0 0 169 | 1 | CHI- 50 L | IARE = 5. | |
| Trace Type LS SL NC HH Total CHI — SQUAI F — HAT LS SL HC HC HC HC HC HC HC HC HC HC HC HC HC | 0 Rah 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 | Rau 0 0 13 0 13 2- Rau 0 16 0 10 | 0 0 49 0 49 49 49 49 44 44 44 | Rau 0 0 22 0 22 4- Rau 6 0 10 0 | 0 0 55 0 55 6 WF 16 0 25 0 41 | Rau 0 0 34 0 34 6 Rau 0 0 36 0 36 | 65 65 65 65 66 68 | 0 69 | HF 0 0 0 169 | 1 | CHI- 50 L | IARE = 5. | |
| Trace Tupe LS SL NC UH Total CHI-SQUAI F~HAT LS SL NC HC HH TUTAL CHI-SQUAI | 0 Rah 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | -2 UF 0 0 0 0 | Ram 0 0 13 0 13 2 Ram 0 10 10 | 0 49 0 49 49 44 WF 0 38 38 44 WF | Ram 0 22 0 22 4- Ram 6 0 10 0 16 | 0 0 55 0 55 -6 WF 16 0 25 0 41 | Rau 0 0 34 0 34 6 Rau 0 36 0 36 | 65 65 65 65 66 68 | 0 69 | HF 0 0 0 169 | 1 | CHI- 50 L | IARE = 5. | |
| Trace Tupe LS SL NC NU Total CNI -SQUAR | RaH 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 | Rau 0 0 13 0 13 2- Rau 0 10 10 | 0 0 49 0 49 4 | Ram 0 22 0 22 4- Ram 6 0 16 | 0 0 55 0 55 6 WF 16 0 0 25 0 41 | Rau 0 0 34 0 34 6 Rau 0 36 0 36 0 8 | UF 0 65 0 65 0 65 0 65 0 68 0 68 0 68 | 0 69 | HF 0 0 0 169 | 1 | CHI- 50 L | IARE = 5. | |

¹⁾ Numbers presented are a minimum estimation for test periods.2) Range bins obscured by echogram noise.

Table C21. Indian Point hanner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 HIN | ITES OURI | NG TES | ST PERIO | • | 1 | RANGE G | neters) | | | | | | | - |
|----------------------|-----------|--------|--------------|-------------|----------|-------------|-----------|--------------|----------|-------------|----------|-----------------------------------|------------|--------------|
| _ | G-: | 2 | 2 | 2-4 | | 1-6 | | 6-8 | | Total 1 | • | CHI-SQUA FUR 2 TE | | |
| Frace Type | Rau 1 | 4F | Rau | HF | Rau | μF | Rau | HF | Rau | ЦF | | Rau | uғ | • |
| s | 0 | 0 | 4 | 15 | 3 | 8 | | 6 | 10 | 29 | | 8 | 22 | |
| iL. | 0 | G | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | ٥ | | o | 0 | |
| IC | 0 | 0 | 0 | 0 | 11 | 20 | 22 | 42 | 53 | 70 | | 29 | 63 | |
| 44 | 0 | 0 | 0 | 0 | 0 | ٥ | | 0 | 0 | 0 | | . 0 | a | |
| rotal | 0 | 0 | 4 | 15 | 14 | 36 | 25 | 48 | 43 | 99 | | 37 | 25 | |
| 10 HIN | JTES AFTE | R TES | r PERIOD | | ٠. | 10110F 4 | neters) | | <u>:</u> | | | | | |
| | 0-2 | • | | 24 | | 4-6 | MG CGF S7 | 8 - 8 | . | T-4-1 | | | SE 1101 11 | |
| race Tupe | | 4F | Rau | HF | Rau | HF | Ran | | E Raw | Total HF | <u>-</u> | CHI- SQ UA FOR 2 TE | ST PERIO | ios |
| . <u></u> .S | 0 | 0 | 3 | 11 | 0 | 0 | 2 | 4 | 5 | 15 | - | | Rau | HF |
| iL . | 0 | . 0 | 0 | o | 0 | o | 0 | 0 | . 0 | 0 | • | LS | 1.667 | 4.45 |
| ıc | 0 | 0 | 0 | 0 | 14 | 35 | 11 | 21 | 25 | 56 | | SL | · | _ |
| tH . | . 0 | 0 | 0 | o | 0 | 0 | 0 | . 0 | 0 | 0 | | NC NC | 1.103 | 1.55 |
| otal | 0 | 0 | 3 | 11 | 14 | 35 | 13 | 25 | 30 | 71 | | 1461 | | |
| | | | | | | | | | = | | | TOTAL | 2.315 | 4.61 |
| CHI —SQUAI F—HAT | 0-2 | | 2- | -4 | 4- | -6 | | | | • | | CHI-SQUA | 1) | 41 |
| _s | Rau I | AF O | Rau 4 | HF 13 | Rau 2 | uf _ | Rass | HF S | | | | Calpha = | | |
| <u> </u> | ŏ | ö | 70 | 70 | 13 | 32 | 17 | õ | | | | | | |
| 111 | Ō | Ō | ů. | Ō | • | Ō | 0 | 32 0 | - | | | | | |
| TOTAL | 0 | ٥ | 4 | 13 | 14 | >6 | 19 | 37 | | | | | | • |
| CHI —SQUAI VALUES | 0-2 | | 2- | -4 | 4 | -6 | | -8 | | • | | | | |
| <u>.</u> 5 | Ran | AF_ | Rau 0.143 | WF 0.615 | 3.000 | NF 8.000 | 0.200 | 0.400 | | | | | | ŕ |
| SL NC | | | | == | 0.360 | 0.778 | 3.667 | 7.000 | | | | | | |
| HH TOTAL | == | | 0-143 | 0.615 | 0.000 | 0.014 | 3.769 | 7.247 | | | | | | |

^{.1)} Numbers presented are minimum estimates for test periods.
2) Range bins obscured by echogram noise.

Table C22. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 2422202 | ******** | | Tidel Phe | | 4 hrs before low tide | | Duration o Treatment messesses | Tupe: | 10 Sec on | , 20 se | coff | Test Da Test Ti | me? (| 2/18/88 0153 |
|---------------------|------------|-------|-----------------|------|--------------------------|---------------|--------------------------------------|----------|-----------|---------|------|---|-----------------------|-----------------|
| 10 HIM | AUTES BEFO | PE TE | ST PERIOD | | RANG | BE (| neters> | | | | | | | _ |
| - | 0- | -2 | 2- | 4 | 4-6 | | 6- | 8 | | Total | | FOR 3 T | ARE F-HA' EST PERI | 200 |
| Trace Tupe | Ran | HF | Kau | HF | Rau HF | - | Ran | μF | Kau | HF | | Rass | HF | |
| LS | 0 | .0 | 0 | 0 | 6 | 15 | 5 | 10 | 11 | 25 | | 6 | 15 | |
| SL | 0 | a | 0 | 0 | ۵ | 0 | , , 0 | 0 | 0 | 0 | | ٥ | ٥ | |
| NC | 0 | φ. | 0 | 0 | 3 | 8 | s | 10 | 8 | 18 | | 5 | 1.1 | |
| нн | ٥ | ۵ | ٥ | o | 1 | 3 | 0 | 0 | 1 . | . 3 | , | 0 | 1 | 1 |
| Total | o o | 0 | 0 | 0 | 10 | 26 | 10 | 20 | 20 | 46 | | 11 | 27 | |
| 10 MIN | HUTES DURI | NG TE | ST PERIOD | | RANG | SE C | neters) | • | | | | | | • |
| | 0- | -2 | 2- | 4 | 4-6 | | 6- | | | Total | | CHT ~SQU | ARE VALU | E . |
| Trace Tupe | Rau | иF | RAH | uf | Ray H | . | Rau | uf : | Rau | иF | | FOR 3 T | EST PERI | |
| LS | 0 | ō | 2 | 8 | 2 | 5 | 2 | 4 | 6 | 17 | | | Rau | ИF |
| SL | Q | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o | 0 | | LS c. | 8.333 | 16.533 |
| NC | 0 | 0 | ٥ | 0 | 1 | 3 | 1 | 2 | 2 | 5 | | SL. | | |
| ш | 0 | 0 | 0 | 0 | • | • | G | 0 | 0 | . • | | NC | 2.800 | 8.727 |
| Total | 0 | 0 | 2 | 8 | 3 | 8 | 2 | 6 | 8 | 22 | | HH TOTAL | 11.456 | 6.000 21.556 |
| | INUTES AFI | | ST PERIOD 2- | 4 | rang 4–6 | iE (| meters> | 8 : | | Total | | <d. f="=</th"><th>ARE = 5.</th><th>991</th></d.> | ARE = 5. | 991 |
| Trace Type | Ran | uF | Rau | KF . | Rau H | | Rau | uf : | Rau | uF | | Calpha | 05 > | |
| LS | 0 | 0 | 0 | 0 | 1 | 3 | 0 | | 1 | 3 | | | | |
| SL | 0 | ۵ | 0 | .0 | 0 | 0 | 0 | o i | 0 | ٥ | | | | |
| NC | 0 | . 0 | 1 | 4 | 2 | 5 | 1 | 2 | 4 | 11 | | | | |
| ин | ٥ | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| Total | 0 | a | 1 | 4 | 3 | 8 | 1 | 2 : | 5 | 14 | • | • | | |
| CHI -SQUE F-HHT | ARE 0-2 | , | 2-4 | | 4-6 | | 6-0 | : | | • | | | | |
| | Rau | MF | Ran | uF | Rau M | | Ran | нF | | | | | | |
| LS SL | 0 | 8 | 1 0 | . 2 | 3 | 8 | 2 | S | | | | | | |
| HC HH | . 0 | ง | 0 | 1 | 2 0 | 5 | 2 0 | 5 · 0 | | | | | | |
| TOTAL | . 0 | G | 1 | 4 | 5 | 14 | 5 | 9 | | | | | | |
| CHI-SQUE VELLUES | 0-2 | | 2-4 | | 4-6 | ٠, | 6-8 | · | | | | | | |
| . ~ | Rau | HF | | HF | Rau H | , | Ran | HF | | | | | | |
| LS SL | | | 2.000 13 | | 4.667 9.3 | | . | .200 | | | | | | |
| SL NC NH | | == | | .000 | 1.000 3.0 | 000 | | -600 | | | | | • | |
| TOTAL | | | 2.000 8 | -000 | 7.600 15.4 | 129 | 0.000 20 | .889 | | | | | | |

Table C23. Indian Point hanner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 MIN | NTES DURIN | | | • | | RANGE (| | | | • | | JARE F-HAT | |
|-------------------------------|--------------------------------|-------------------------|---------------------------------|-------------------------------|----------------------------------|-------------------------|------------------------------|-----------------------------|----------|-------|---------|------------|-------|
| Trace | 0-2 | | 2 | !-4 | ********* | 4-6 | | 6-8 | : | Total | FOR 2 1 | EST PERIO | DS |
| Tupe | Ray H | if | Ran | HF | Rau | HF | Rau | uf | E Rau | uf | Rau | uf | |
| LS ' | 0 | ٥ | ů | 0 | O | 0 | 1 | 2 | 1 | . 2 | 3 | 6 | |
| SL | ű. | : , ù | . 0 | 0 | , Đ | 0 | . 0 | D. | 0 | o | 1 | 2 | - |
| NC | O | 0 | 2 | 8 | 4 | 10 | 0 | o o | 6 | 18 | 5 | 14 | |
| uu | • 0 | 0 | 0 | 0 | 0 | . 0 | 0 | Ü | 0 | 0 | 1 | 3 | |
| Total | ŭ | 0 | 2 | 8 | 4 | 10 | 1 | 2 | 7 | 20 | 9 | 24 | |
| 10 MIN | IUTES AFTER | TEST | PERIOD | • | | RANGE < | neters> | | | | | ٠., | |
| Trace | 0-2 | | 2 | -4 | | 4-6 | | 6~8 | <u> </u> | Total | | JARE VALUE | |
| Tupe | Rau H | lF | Rau | HF | Rau | HF | Rau | HF | Ran | uf | | Rest | иF |
| LS | 0 | 0 | Ó | ٥ | 2 | 5 | 2 | 4 | | 9 | LS | 1,800 | 4.455 |
| SL | D | a | 1 | 4 | . 0 | 0 | O | 0 | 1 | 4 | SL | 1.000 | 4,000 |
| HC | 0 | 0 | 1 | 4 | 2 | 5 | 0 | ů | | 9 | HC | 1,000 | 3.000 |
| MM | ٥ | 0 | . 0 | G | 2 | 5 | 0 | 0 | 2 | . 5 | ни | 2,000 | 5.000 |
| Total | U | 0 | 2 | 8 | 6 | 15 | 2 | 4 | - 10 | 27 | rotal | 0.529 | 1.043 |
| CHI—SQUF F—HAT | 0-2 | | 2- | ·4 | 4 | -6 | 6 | -8 | • | | | HRE - 3.8 | |
| LS SL NC NH TOTAL | Rau 1 0 0 0 0 0 | # 0 0 0 0 0 | Rái 0 1 2 0 2 | HF 0 2 6 0 . 8 | Rau 1 0 3 1 5 | HF 0 8 3 13 | Rau 2 0 0 0 2 | HF 0 0 0 0 3 | | · | · | | |
| CHI-SQUA VALUES | 0+2 | | 2- | -4 | 4 | -6 | 6 | -8 | | | | | |
| LS SL NG NM TOTAL | | 4F | _Rau 1.000 0.333 0.000 | 4.000 1.232 | 2.000 0.667 2.000 0.400 | 1.667 5.000 1.000 | 0.335 | 0.667 | | | | | |

Table C24. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidel Pt | | 3 hrs before low tide | · ! | Duration of Tex Treatment Type: | 10 s+ | C 0 | hers 1,243 on, 40 sec off | Test Day | | 2/19/88 0235 |
|-------------------------------|----------|------------------------|------------------------------|--|--------------------------------------|-----------------------|--|--------------|------------|------------------------------|---|----------------------|-----------------|
| 10 MINU | TES DURI | NG TE | ST PERIOD |) : 25 11 12 14 14 14 14 14 14 14 14 14 14 14 14 14 | RANE | iE (| c====e=== neters> | | === | , 工作主义工作的 2000年 | | ARE F-HA | :423EE3 |
| | 0- | -2 | 2 | 2-4 | 4-6 | | 6-8 | | ; | Total | FOR 2 T | EST PERI | 200 |
| Trace Type | Rau | MF | Rau | HF | Rau HF | | Rau MF | R | - | UF | Ran | WF | • • |
| LS | 0 | o | 0 | ō | 0 | 0. | 0 0 | | ٥ | 0 | 1 | 2 | • |
| SL | Ð | ٥ | o | o | 0 | • • | 0 0 | | 0 | G. | · 3 . | 7 | |
| NC ' | 0 | 0 | ٥ | o o | 0 | 0 | 1 2 | • | 1 | 2 | 3 | 9 | |
| ни | 0 . | . 0 | . 1 | 4 | o | ø | o d | : | 1 | 4 | 2 | 4 | |
| Fotal | o | 0 | 1 | | 0 | ۵ | 1 2 | ~ : - | ż | 6 | 8 | 21 | |
| 10 HINU | TES AFTE | R TES | F PERIOD | | Deno | | neters) | | | • | | | |
| • | 0- | - 0 | | 2-4 | 4-6 | | 6-8 | | | | Cut cou | 665 1161 1 | |
| Trace | | | | uF | | | | | | Total MF | FOR 2 T | ARE VALU EST PERI | ODS |
| Tupe | Rau | | Ran | | | | | - <u>:</u> | | | | Ran | WF |
| LS | O D- | 0 | 1 | 4 | 0 | 0. 5 | . 0 , 0 | | 1 | 4 | LS | 1.000 | 4.0 |
| si. NC | _ | a | 0 | 0. 8 | 2 | 5 | 1 2 | 1 | 6 S | 1) 15 | SL | 6.000 | 15.0 |
| NC. UU | o o | _ | . 2 | • • | 0 | » 0 | | Ē | 3 2 | 4 | NG | 2.667 | 9.9 |
| MM Total | | 0 0 | 3 | 12 | | 10 | | -: - | | 36 | MM | 0.333 | 0.0 |
| TOCAL | , • | u | 3 | . 12 | | 10 | 7 14 | • | 4 | | TOTAL | 9.000 | 21.4 |
| CHI-SQUARI F-HAT | 0-3 E | | 2- | -4 | 4-6 | | 6-8 | • | | | CHT-SQUI <d.f. =<br=""><alpha :<="" td=""><td></td><td>841</td></alpha></d.f.> | | 841 |
| LS SL NC NN TOTAL | R & M | HF 0 0 0 0 | Rau 1 0 1 1 2 | UF 2 0 4 2 8 | Rau MF 0 1 1 0 2 | 0 3 3 0 5 | Rau HF 0 0 2 4 1 2 1 2 4 8 | | | | | | |
| CHI-SQUARI VALUES | 0-2 | | 2- | -4 | 4-6 | | 6-8 | | | • , | | | |
| LS SL NC NH TOTAL | RaH | HF | 2.000 1.000 1.000 | 4.000 4.000 4.000 4.000 | 2.000 5.0 2.000 5.0 4.000 10.0 | 000 | Raw HF 4.000 8.000 0.000 0.000 2.000 4.000 4.500 9.000 | | , | | | | • |

Table C25. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidal Pr | | 2.5 hrs b low tide | | Treatmen | t Type: | 20 sec | : Of | wers 1,263 1, 20 sec off | Test Da | M&: | 2/19/98 0255 |
|-----------------------|-----------|---------|-----------|--------|-----------------------|----------------|----------------------|----------------|--------|--------|-----------------------------|------------------------------|----------------------|-----------------|
| 10 MIM | UTES DURI | NG TES | ST PERIOD | | | | immanumu (neters) | | | :# # C | 1 自己 《 | · | | |
| _ | 0- | 2 | 2 | 2-4 | 4 | 1-6 | | 6~8 | | | Total | CHI-SQU FOR 2 T | ARE F-HA EST PERI | r DDS |
| Trace Type | Ran (| HF | Rau | ИF | Rau | HF | Rau | NF | . Ra | ш | HF | Rau | UF | |
| LS | 0 | 0 | 2 | 8 | 1 | 3 | 1 | 2 | 4 | 1 | 13 | · s | 13 | |
| SL. | 0 | a | 0 | O | 3 | 8 | 0 | o | | | 8 | 2 | 4 | |
| NC | 0 | 0 | . 2 | 8 | 2 | 5 | 4 | 8 | 9 |) | 21 | 6 | 16 | |
| MM | o | O | 0 | 0 | 0 | O | 0 | O | | - | 0 | 1 | 3 | |
| Total | ٥ | 0 | 4 | 16 | 6 | 16 | s | 10 | 15 | | 42 | 13 | 35 | |
| 10 NIM | UYES AFTE | R TESI | F PERIOD | | | ANGE | (neters) | | | | | | | |
| | 0- | 2 | 2 | 2-4 | | 1-6 | | 6~8 | • | | Total | CHI - SQU | ARE VALU | E |
| Trace Tupe | | WF | Rau | uF | Rau | NF. | Rau | | R | | HF | | EST PERI | 200 |
| LS | 0 | 0 | 1 | 4 | | 3 | 3 | 6 | 5 | | 13 | | Raise | HF |
| SL | 0 | o | 0 | 0 | ٥ | 0 | o | 0 | |) | ` 0 | LS . | . 0.111 | 0.000 |
| NC | ٥ | ٥ | 0 | o | 3 | 8 | 1 | 2 | : 4 | 1 | 10 | SL | 3.000 | 8.000 |
| ни | 0 | Q | ٥ | o | 1 | > | 1 | 2 | : 2 | Ł | 5 | NC | 1.555 | 3.903 |
| Total | 0 | | 1 | 4 | <u></u> 5 | 14 | 5 | 10 | 11 | ı | 28 | 1414 | 2.000 | 5.000 |
| | | | | | | | | | = | | | FOTAL | 0.615 | 2.600 |
| CHI—SQUR! F—HRT | 0-2 E | | 2- | -4 | 4- | .6 | | -8 | | | | CHI-SQU (d.f. = (alpha | | 941 |
| | Rau | uF O | Ran | uf | Rau | HF _ | Rak | MF | | | | (arpna | 057 | |
| LS SL | õ | ö | 2 0 | 6 0 | | 3 | õ | 3 | | | | | | |
| NC HH | 8 | 8 | 1 0 | 4 | | 7 | 3 | S | | | | | | |
| TOTAL | ŏ | ŏ | Š | 10 | | 2 15 | 5 | 10 | | | | | | |
| CHI — SQUAI VALUES | 0-2 | | 2- | -4 | . 4- | | 6 | -8 | | | | | | |
| | | uF | R#4 | WF | Ran | ИF | Ras | | | | | | | |
| LS SL | | | 0.333 | 1-333 | 0.000 3.000 | 0.000 | 1.000 | 2.000 | | | | | | |
| NC | | | 2.000 | 8.000 | 0.200 | 0.692 | 1,800 | 3.600 | | | | | | |
| HH TOTAL | | | 1.800 | 7.200 | 1.000 | 3.000 0.133 | 1.000 0.000 | 2.000 0.000 | • | | | | | |

Table C26. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| ***** | ****** | | | | lou tide | | i reatnen spakeen | t (ype: : | ZU S&C Of Ratestates | 30 sec o | ff Test T | |)3 15 :p===== |
|---------------------|-----------|---------|--------|----|----------------|----------------|----------------------|----------------|-------------------------|----------|--|----------------|------------------|
| 10 HINU | TES GURII | 48 TEST | PERIOD | | P | ANGE < | neters> | | | - | CHI —SQ | UARE F-HA1 | r |
| Trace | 0-2 | 2 | 2~ | 4 | 4 | -6 | | 6~8 | | Total | | TEST PERIC | |
| Type | Rau 1 | 4F | . Rau | HF | Rau | uf | Rau | uF . | Rau | HF. | Rau | HF | |
| .s | 0 | 0 | 0 | 0 | 4 | 10 | 1 | 2 | 5 | 12 | 4 | 9 | |
| iL, | 0 | 0 | 0 | 0 | . 6 | ů | 3 | 6 | 3 | 6 | 4 | 8 | |
| IC | 0 | Q | o | 0 | 5 | 13 | 3 | 6 | 8 | 19 | 7 | 16 | |
| ин | O | ٥ | o | 0 | 1 | 3 | 3 | 6 | 4 | 9 | 3 | 6 | |
| Total | 0 | 0 | 0 | 0 | 10 | 26 | 10 | 20 | 20 | 46 | 17 | 39 | |
| 10 HTHU | TES AFTEI | R TEST | PERIOD | | | RNGE (| neters> | : | | | • | | |
| _ | 0-2 | 2 | 2- | 4 | 4 | 1-6 | 1 | 6-8 | | [otal | | UARE VALU | |
| Trace Type | Rau | HF | Rau | HF | Rau | ИF | Ran | uf : | Rau | HF | FUR 2 | TEST PERI | |
| _S | 0 | 0 | 0 | 0 | | a | 3 | 6 | 3 | 6 . | | Rau | HF |
| 5L | 0 | Q | 0 | 0 | · 3 | 8 | • • | 2 | 4 | 10 | LS . | 0.500 | 2.0 |
| 4C | ٥ | 0 | 0 | ٠. | 3 | 8 | 2 | 4 | . 5 | 12 | SL | 0.143 | 1.0 |
| 414 | o | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 1 | . 3 | NC | 0,692 | 1.5 |
| otal | 0 | Ó | 0 | 0 | 7 | 19 | 6 | 12 | 13 | 31 | HH | 1.800 1.485 | 3.0 |
| | _ | | | | | | | - | | | TOTAL | | 2.9 |
| CHI-SQUAR F-HAT | 0~2 | | 2-4 |) | 4- | ·6 | 6 | -8 | | | <d.f.< td=""><td></td><td>941</td></d.f.<> | | 941 |
| | | HF | | HF | Rau | HF_ | Rau | HF | | | carpna | 05> | |
| .S | ů | 0 | 0 | 0 | 2 ` | 54 | 2 2 3 | 4 | | | | | |
| NC HH | Ō | Ō | Ö | Ō | 4 | 11 | 3 | 5 | | | | | |
| rotal | 0 | 0 | ŏ | ŏ | 9 | 23 23 | 2 | 16 | | | | | |
| CHI-SQUAR VALUES | 0-2 | | 2-4 | , | 4- | ·6 | 6 | - & | | | | • | |
| | | HF | Rau | uf | Rau | WF | Ran | uF | | | | | |
| ĻS | | | | | 4.000 | 0.000 | 1.000 | 2.000 | | | | | |
| SL KC | | | | | 3.000 0.500 | 6.000 1,190 | 1.000 0.200 | 2.000 0.400 | | | | | |
| RC WW | | | | | 0.000 | 0.000 | 3.000 | €.000 | | | | | |
| TÖTAL | | | ~- | | 0.529 | 1.089 | 1.000 | 2,000 | | | | | |

Table C27. Indian Point hanner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| ****** | | | Tidal Phas | | 30 min after high tide | Duration o Treatment ======= | Tupe: | 20 sec or | 1. 40 sec off | eO test Test Ti | He : | 2/18/86 1155 ****** |
|--------------------------|------------|--------|------------------------|----------|--|------------------------------------|----------------------|-----------|---------------|--------------------|----------|---------------------------|
| 10 MIN | WIES BEFO | RE TES | T PERIOD | | RANGE < | | | | | | ARE F-HA | r |
| - | 0- | 2 | 2-4 | ŀ | 4-6 | 6- | 8 | | Total | FOR 3 Y | EST PEKI | oos |
| race Type | Rau | UF | Rau H | IF | Rau HF | Rau | HF | Kau | ИF | Rau | ЧF | |
| LS | 0 | 0 | ٥ | 0 | 1 3 | 2 | 4 | 3 | 7 | 4 | 11 | • • |
| 5L | O | ٥ | ٥ | 0 | 0 0 | o | 0 | 0 , | o | 1 | 2 | |
| 4C | 0 | Q | 1 | 4 | 1 . 3 | 2 | 4 | 4 | 11 | 7 | 20 | |
| HH | 0 | 0 | 0 | 0 | 1 3 | 0 | 0 | 1 | 3 | 4 | 9 | |
| [otal | Q | 0 | 1 | 4 | 3 9 | 4 | 8 | 8 | 21 | 16 | 42 | |
| 10 HIH | CUTES DURI | NO TES | T PERIOD | | | | | | | | | |
| | 0- | -2 | 2-4 | | RANGE (| Heters> 6~ | | · · | Total | CHT-SQU | ARE VALU | F |
| Trace Tupe | | HF | Rau H | | Rau HF | | HF . | Rau | WF. | | EST PERI | |
| LS | 0 | | 1 | | 3 8 | | | 4 | 12 | | Rau | ИF |
| SL | 0 | 0 | - o . | ٥ | 0 0 | 0 | 0 | 0 | 0 | LS | 0.500 | 0.9 |
| NC | 0 | 0 | 1 | 4 | 1 3 | 5 | 10 | . 7 | 17 | SL | 2.000 | 7.5 |
| Н | 0 | 0 | 0 | 0 | 3 8 | 3 | 6 | 6 | 14 | NC | 4.571 | 16.30 |
| Total | 0 | | 2 | 8 | 7 19 | | 16 | 17 | 43 | ни | 3.500 | 8.2 |
| | NUTES AFT | | 2-4 | | RANGE (4-6 | neters) 6~ | 8 | • | Total | (d.f. = | ARE = 5. | 991 |
| Trace Tupe | Rau | UF | Кам и | IF | Ran HF | Rau | MF : | Rau | uf | Calpha | 05> | |
| LS | 0 | 0 | 1 | 4 | 2 5 | 2 | 4 | 5 | 13 | • | 4- | |
| SL | . 0 | Q | • | 0 | 2 . 5 | O | 0 | 2 | \$ | | | |
| NC | 0 | . 0 | 5 | 19 | 5 15 | . 1 | 2 | 11 | 34 | | | ` |
| нн | 0 | 0 | 0 | 0 | 2 5 | | 6 | 5 | 11 | ~ | | |
| Total | 0 | O | 6 | 23 | 11 20 | 6 . | 12 | 23 | 63 | | | |
| CHI —SQUA F—HAT | 0-2 | | 2-4 | | 4-6 | 6-8 | | | | | | |
| | Rau | HF | Rau H | IF | RAM HF | Rau | HF. | | | | | |
| L S SL | 0 | 8 | 1 | 3 | 2 5 | 1 0 | 3 | | | | | |
| NC HU | ŭ o | č | 2 | 9 | 2 6 | 3 | 5 | | | | | |
| TOTAL | ŭ | ŏ | 9 | 12 | 2 5 7 19 | 2 6 | 12 | | | | | |
| CHI -SQUA VALUES | RE 0-2 | • | 2-4 | | 4-6 | 6-8 | | • | | | | |
| L S 5 L | Raн | MF | Rau M 0.000 2. | F 667 | Rau NF 1.000 3.600 2.000 7.500 | | UF .667 | | - , | | | |
| NC HH TOTAL | ==. | | 6.500 16. 4.667 15. | | 6.500 12.167 1.000 3.600 4.571 8.526 | 3.000 6 | 000. 000. 733. | | | : | | |

Table C28. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | ***** | #20#E | | e dance | **** | | ****** | | 242 O€ | | | | M61 Stabber | E2#12### |
|------------------|-----------|----------|-------------|--------------|-----------------|----------------|---------|--------------|--------|----------|---|---------|----------------|----------|
| | | | | | 15 DEG | REE OBI | TONE | | | | | • | | <u> </u> |
| 10 HINL | JTES DURI | NG TES | ST PERIOD | | R | ANGE (| neters> | | • | | | CHT SOU | ARÉ F-HAI | T . |
| • | 0~ | 2 | 2 | -4 | < 4 | -6 | 6 | ~8 | | Total | | | EST PERT | |
| irace Type | Raw | ИF | Rau | WF | Rau | UF | Ran | HF | Rasa | ИF | | Rau | , HF | • |
| .s - | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | | 5 | 7 | |
| L ' | ` o | 0 | . 0 | Q | O | 0 | 1 | . 2 | 1 | 2 | | 3 | 6 | |
| iC . | 0 | o | 2 | . 8 | 7 | 18 | 6 | 11 | 15 | 37 | | 10 | 26 | |
| I H | ٥ | 0 | · . | 4 | 1 1 | Š | 1 | 2 | 3 | 9 | | 2 | • | |
| otal | 0 | <u>-</u> | | 12 | 8 | 21 | | 17 | 20 | 50 | • | 17 | 44 | |
| • | | | | | | | | : | | • | | | | |
| 10 MIN | JTES AFTE | R TESI | PERIOD | | | ANGE (| neters> | | | | | • | | |
| | 0- | 2 | 2 | -4 | | -6 | 4 | e | | Total | | CHY-SQU | ARE VALU | E |
| race | | uf | Rau | HF | Rau | uf | Rau | WF | Rau | HF | | | EST PERI | |
| . <u></u> .s | 0 | | 1 | | 1 | | 2 | 4 | 4 | 11 | | | Rate | MF |
| | 0 | 0 | o . | o | 3 | 8 | 1 | 2 | 4 | 10 | | LS | 1.800 | 6.2 |
| c | Q. | 0 | 1 | ٠.4 | 3 | 8 | 1 | 2 | 5 | 14 | | SL, | 1.800 | 5.3 |
| iu: | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | | HC | 5.000 | 10.3 |
| otal | | | 2 | <u>-</u> | - | 19 | | 10 | 14 | <u>-</u> | - | uu | 1.000 | . 4.4 |
| | | | - | . • | • | | _ | | | | | TOTAL | 1.059 | 1.9 |
| HT-SQUAI -HAT | 0-2 RE | | 2- | 4 | 4- | 6 . | 6- | 8 | | | • | (d.f. = | ARE = 3.4 | 941 |
| _ | | WF | Rass | HF | Rau | uf _ | Rau | uF _ | | | | (al pha | us/ | |
| . s | 0 | Q Q | o O | õ | 2 | 2 | 2 | 3 | | * | | • | | |
| IC IN OTRL | 0 | 000 | 2 1 3 | 6 2 10 | - 5 - 1 A | 13 2 20 | 1 7 | 7 2 14 | | | | • | | - |
| :HI —SQUA | _ | • | | | | | , , | . •• | | • | * | | | |
| ALUES | 0-2 | | 2- | 4 | 4- | 6 | 6- | 8 | | | | | | |
| _ | | HF | Rau | HF | Rau | HF | Rau | HF | • | | | | | |
| .s L | ~~ | | ~- | 4.000 | 3.000 | 3.000 8.000 | 0.000 | 0.667 | | | | • | | |
| ic in | | | 0.333 | 4,000 | | 3.846 3.000 | 3.571 | 6.231 | | | | | | |

Table C29. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidal Pha | | 1.5 hrs a | fter | Duration Treatmen | of t | est: | 10 min to 30 sec on | er = 1,243 , 30 sec off | Test Da Test Ti | | 2/18/86 1235 |
|---------------------|-----------|--------|-----------|------|-----------|---------------|----------------------|------|------|------------------------|----------------------------|--------------------|-----------|-----------------|
| 10 HINU | TES DURII | G TESI | PERIOD | | | LAMGE (| neters) | | | | | | ARE F-KAI | |
| Trace | 0-2 | 2 | 2~ | 4 | | 1-6 | | 6-8 | | | Total | FOR 2 T | EST PERL | กร |
| Type | Rau I | 4F | Rau | KF | Řан | WF | Rau | HF | | Rau | HF | Rau | HF | |
| LS | ó | 0 | 0 | 0 | 0 | Ģ | 0 | | 0 | 0 | Ŏ | 1 | . 1 | |
| 5L | o · | ٥ | 0 | 0 | 0 | . 0 | . 0 | | 0 | , o | 0 | ٥ | ٥ | |
| łC | 0 | 0 | 1 | 4 | 0 | 0 | 3 | | 6 | 4 | 10 | 2 | 5 | |
| ии | 0 | 0 | 0 | 0 | G | o | . 0 | ٠. | 0 | 0 | . | 0 | 0 | |
| Total | 0 | 0 | 1 | 4 | 0 | 0 | 3 | | 6 | 4 | 10 | 3 | 6 | |
| | | | | | | | | | 3 | | | | | |
| 10 HINU | TES AFTE | RTEST | PERI OD | | | RANGE (| neters) | | : | | _ | | | |
| | 0-2 | 2 | 2~ | 4 | | 1-6 | | 6~8 | : | | Total | CHI-SQU | ARE VALUE | E |
| race Tupe | Rau | | Rau | A | Rau | HF | Sau | UF | | Rau | uf | FOR 2 T | EST PERI | ักร |
| .s | <u>-</u> | 0 | 0 | | 0 | _ | 1 | | 2 | 1 | 2 | | Rau | uf |
| 5L | ο . | 0 | 0 | 0 | 0 | ۵ | 0 | | 0 | 0 | 0 | LS | 1.000 | 2.00 |
| NC | 0 | 0 | Δ. | . 0 | 0 | , o | 0 | | | 0 | · a | SL | · | |
| นัน | a | a | 0 | a | 0 | 0 | 0 | | | | _ | NC | 4.000 | 10.00 |
| | | | | | | | | | 0 - | 0 | 0 | ын | | |
| Total | 0 | 0. | 0 | ŭ | 0 | 0 | 1 | | 2 | 1 | 2 | TOTAL | 1.800 | 5.33 |
| CHI —SQUAR F—HAT | 6E 0~2 | | 2-4 | | 4. | -6 | 6 | -8 | | | • | (d.f | ARE = 3.0 | 84 L |
| | | MF | | HF _ | Ran | WF | Ran | HF | | | | (alpha | 05> | |
| LS SL | O . | 0 | ů | 0 | ô | 0 | 0 | | 0 | | | | | |
| NC Mu | 0 | 0 | 1 | 2 | 0 | 0 | 2 0 | | 2 | | | | | |
| TOTAL | ŏ | ŏ | ĭ | 2 | ŏ | ŏ | ž | | 4 | | | • | | |
| CHI-SQUAR VALUES | E 0-2 | · | 2-4 | | 4- | -6 | 6 | -8 | | | . , | | | |
| LS | | HF | | HF | Rau | ИF | | HF | | | | | | |
| SL | | | | | | ~- | 1.000 | 2.0 | - | | | | | |
| NC HH | | | 1.000 4 | .000 | | | 3.000 | 6.0 | 00 | | | | | |
| TOTAL | | | | .000 | == | | 1.000 | 2.00 | 00 | • | • | | | |

Table C30. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 MEN | UTES BEF | ORE TEST | PERI OD | | RA | | neters> | | | | | JARE F-HA | : T |
|----------------------|-----------|----------|-------------|----------|------------|--------|---------|----------------|-----|------------|-------------------|-----------|--------|
| • | ٥ | -2 | 2 | -4 | 4- | 6 | • | -8 | | Total | FOR 3 1 | EST PERI | ons |
| Trace Type | Ran | HF | Rau | HF | Rau | HF | Rau | uf . | Rau | ИF | Rau | HF | |
| .s | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 2 | 5 | 2 | 8 | • • • |
| ŠL. | ů | o | 0 | 0 | 1 | 3 | 0 | 0 | 1 , | 3 | 1 | S | |
| HC | 0 | ٥. | a | Û | 4 | 10 | 4 | 8 | 9 | 18 | 5 | 11 | |
| ни | 0 | O | 0 | 0 | 0 | Q | 1 | 2 | 1 | 2 | 1 | . 1 | |
| Total | 0 | 0 | 0 | 0 | 6 | 16 | 6 | 12 | 12 | 28 | 9 | 25 | |
| 10 HIN | UTES DUR | ING TEST | PERI OD | | RA | NGE (| neters> | | | | | | |
| | ٥ | -2 | 2 | -4 | 4- | 6 | • | 8 : | | Total | CHI-SQL | IRRE VALU | E |
| Trace Type | Rau | ЦF | Rau | UF | Rau | WF. | Ran | uf : | Ran | ИF | FOR 3 1 | EST PERI | |
| LS | 0 | 0 | | <u>-</u> | 1 | | 1 | 2 : | 2 | 5 . | | Rasi | HF |
| SL | 1 | 8 | 0 | 0 | 1 | 3 | 0 | 0 | 2 | 11 | LS | 0.000 | 4.37 |
| NC | o | Q | 0 | 0 | > | 8 | 3 | 6 | 6 | 14 | SL | 2.000 | 12.00 |
| ии | 0 | . 0 | 0 | 0 | ٥. | 0 | 1 | 2 | 1 | 2 | NC | 5.200 | 13.63 |
| Total | 1 | 8 | 0 | o | | 14 | 5 | 10 | 11 | 32 | MM | 0.000 | 4.00 |
| 10 HI | MITES OF | TER TEST | BEDTAN | | | | | • | | | TOTAL | 4.222 | 6.32 |
| 10 111 | MOILS IN | TER IESI | LEXTOR | | RA | NGE (| meters> | | | | CHT-501 | JARE - 5. | 991 |
| Trace | 0 | -2 | 2 | ~4 | 4- | 6 | | i-8 | | Total | Cd.f. (Calpha | 2> | |
| Tupe | Ram | HF | Rau | uF | Rais | uf | Rah | uf . | Ran | uf | | | |
| LS . | 1 | 8 | o | 0 | . 1 | 3 | 1, | 2 | 2 | 13 | | | |
| SL | 0 | 0 | 0 | o ' | Δ | 0 | 0 | 0 | ٥ | G | | | |
| NC | Đ | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | | | |
| | 0 | 0 | 0 | 0 | 0 | 0_ | | | 0 | 0 | | • | |
| Total | 1 - | . 8 | 0 | ٥ | 1 | 3 | 2 | 4 : | 4 | 15 | | | |
| CHT-SQUA F-HAT | RE 0-2 | | 2- | 4 . | 4~6 | | 6- | -8 | | | | | |
| | Rau | ИF | Rau | ИF | | HF_ | Rau | HF | | | | c | |
| L S SL | 0 | 3 | 0 | 0 | 1 | 2 6 | 1 0 | 2 0 | | | | | |
| NC HU | o o | 0 | Õ | 0 | 2 | . 6 | 3 | 5 | | | | | |
| TOTAL | ĭ | 5 | ő | ŏ | ă | 11 | å | . 9 | | | | | |
| CHI — SQUA VALUES | RE 0-2 | | 2- | 4 | 4~6 | | 6- | -8 | | | • • | | |
| | Rau | HF | . Rau | WF | Rau . | HF | Ran | HF | | | | | |
| LS SL | | 3.333 | | | 0.000 0 | -000 | 0.000 | 0.000 | | | | | |
| NC | | | | | | -333 | 0.667 | 4.800 4.000 | | | | ٠. | |
| HH | | | | | | | | | | | | | |

Table C31. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 HINUT | ES DURI | ING TE | ST PERIOD |) | | ANGE (| neters) | | | | CHT —EQII | ARE F-HAT | |
|-------------------------------|-------------------------|--------------|--------------------|--------------|-------------------------|-------------------------|---|---|-----|-------|--|-----------|------|
| _ | 0- | -2 | 2 | ?-4 | . 4 | 1-6 | I | 6~8 | | Total | | EST PERIO | |
| Trace Tupe | Ram | HF. | Rau | MF | Rau | HF | RaH | HF | Rau | NF | Rau | ИF | |
| LS | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 3 | 2 | 6 | |
| SL, | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 2 | 4 | 2 | 5 | |
| NC | ٥ | 0 | 0 | 0 | 4 | 10 | 0 | 0 | 4 | 10 | 4 | 9 | |
| нн | ο ΄ | 0 | 0 | 0 | ٥ | 0 | 0 | | O | 0 | ,1 | 1 | |
| Total | 0 | ō | 0 | 0 | 5 | 13 | 2 | 4 | 7 | 17 | • . | 20 | |
| 10 HINU | | ER TES -2 | r PERIOD | 2-4 | | RAMBE (1 | meters> | 6-8 | | Total | CHI-SQU | ARE VALUE | Ē |
| Trace Tupe | Ran | WF | Ran | WF | Rau | WF | Ran | | Rau | HF | | EST PERIO | |
| LS | | | | | | | 2 | 4 | 3 | | | Rau | HF |
| SL | 0 | ٥ | • | 0 | 2 | 5 | 0 | | 2 | 5 | LS | 1.000 | 2.2 |
| NC | o o | | 0 | 0 | 1 | 3 | 2 | 4 | 3 | 7 | SL | 0.000 | 0.1 |
| HH | a | 0 | . 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | NC | 0.143 | 0.5 |
| Total | <u>-</u> | | | | | 8 | <u>-</u> - | 10 | 9 | 22 | HH | 1.000 | 2.0 |
| | | _ | _ | | | | | : | | | TOTAL | 0.250 | 0.64 |
| CHI —SQUARI F—HAT | 0-2 | | 2. | -4 | 4- | -6 | 6 | -8 | | | CHI-50U <d.f. =<br=""><alpha< td=""><td></td><td>141</td></alpha<></d.f.> | | 141 |
| LS SL NC NH TOTAL | Raw 0 0 0 0 | HF 0 | Rau 1 0 0 | HF 2 0 0 0 2 | Ran 1 1 3 0 | WF 2 3 7 0 11 | Reid | UF 2 2 2 1 7 | | | (a) prio | | |
| CHI -SQUARI VALUES | 0-2 | | 2. | -4 | 4- | -6 | 6 | -8 | | | | | |
| LS SL NC HH TOTAL | Rau | uf | 1.000 | 4-000 | 1.000 2.000 1.800 | 3.000 5.000 3.769 | 2.000 2.000 2.000 1.000 1.266 | 4.000 4.000 4.000 2.000 2.571 | | | | | |

Table C32. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 MY NUT | res dur | ING TE | ST PERIO | 0 | | ****** | ireathen mannamh (meters) | | FSSSE: | ##### | n, 40 sec off Bessessessess | Test Ti | | 1700 |
|-------------------------------|-------------------------|------------------------|--------------------------|--------------------------|-------------------------|---------|---------------------------------|-------------------------|------------|-------|--------------------------------|---|--------------------------|------------|
| _ | o | -2 | | 2-4 | | 4-6 | ı | 6-8 | | | Total | | IARE F-HAT 'EST PERIC | |
| Trace Type | Rau | μF | Rass | HF | Rau | HF | Rau | ИF | | Rau | KF | Rau | uf | |
| LS | 0 | 0 | 1 | 4 | 0 | ō | 2 | 4 | | 3 | 8 | 2 | 4 | |
| 5L | 0 | 0 | 0 | 0 | - 0 | 0 | 0 | 0 | į | . 0 | a | 0 | 0 | |
| NC | 0 | 0 | 1, | 4 | 0 | • | 0 | 0 | • | 1 | 4 | 1 | 3 | |
| HH | 0 | 0 | 0 | . 0 | 0 | • | 0 | 0 | Ĭ | 0 | 0 | 0 | . 0 | |
| Total | 0 | 0 | 2 | 8 | 0 | ō | 2 | 4 | -: · | 4 | 12 | 3 | . 7 | |
| 10 HINU | res aft | ER YES | T PERIOD | 1 | . (| RANGE (| (neters) | | | | | | | |
| Trace | 0 | -2 | | 2-4 | | 4-6 | | 6-8 | | | Total | CHI-SOU | IARE VALUE | E nne |
| Tupe | Rau | ИF | Ran | HF | Ran | ИF | Rau | HF | _ | Rau | UF | run z . | Rau | uf Uf |
| LS | ٥ | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | O | ٥ | LS | 3.000 | 8.00 |
| SL | 0 | 0 | 0 | 0 | 0 | . 0 | . 0 | 0 | i | 0 | 0 | SL | | 0.00 |
| NC | 0 | - 0 | 0 | 0 | 0 | ٥ | 1 | 2 | i | 1 | 2 | · NC | 0.900 | 0.66 |
| MH | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | _: | 0 | 0 . | HL. | | 0.0 |
| Total | 0 | . 0 | ٥ | 0 | 0 | 0 | 1 | 2 | : | 1 | 2 | TOTAL | 1.800 | 7.14 |
| CHI - SQUARI F-HAT | 0-2 | | 2 | :4 | 4 | -6 | | -8 | <u>-</u> . | | | CHI-50U | MRE - 3.6 | |
| LS SL NC HH TOTAL | Rau 0 0 0 0 | MF 0 0 0 0 | Raid 0 1 0 1 | NF 2 0 2 0 4 | Rau 0 0 0 0 | MF 0 | Rais 1 0 1 0 2 | HF 2 0 1 0 3 | | | | <alpha< td=""><td></td><td></td></alpha<> | | |
| CHI —SQUARI VALUES | 0-2 | | 2 | -4 | . 4 | -6 | 6 | -8 | | | | | | |
| LS SL NC HU TOTAL | RaH | MF | 1.000 1.000 | 4.000 4.000 8.000 | Rass | HF | 2.000 1.000 0.333 | 4.000 2.000 0.667 | | | | | | |

Table C33. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| LS (C) SL (C) NC (C) WH (C) Total (C) Total (C) SL (C) NC (C) HU (C) Total (C) SL (C) NC (C) HU (C) Total (C) LS (C) NC (C) HU (C) Total (C) HU (C) Total (C) HU (C | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | O O O O O O O O O O O O O O O O O O O | Rass O O O O PERIOD 2 Rass O O O O O O PERIOD | 0 0 0 0 | 4- Rau 2 1 0 1 -4 Rau 1 0 4 0 5 | 5 3 0 3 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | Rau 1 0 1 3 5 | -8 0 2 6 10 | Ram 3 1 1 4 9 | Fotal UF 7 3 2 9 21 Total UF 9 0 14 6 29 | FOR 5 TI RAM 4 1 5 2 12 | 9 2 11 5 27 MRE VALUE EST PERIOR RAW 0.500 0.000 5.200 5.500 1.167 | DS HF 0.88: 3.000 13.630 8.400 |
|--|---|--|---|-----------------------------|--|--|--|--|--|---|--|--|---|
| Type Ra LS () SL () NC () WU () Total () Total () Total () Total () Total () In HINUTES Trace Ra Type Ra Type Ra LS () NC () WH () Total () NC () WH () Total () CHI-SQUARE | 0-2 0-2 0-2 0-2 0-2 0-2 0-2 | O O O O O O O O O O O O O O O O O O O | Rass O O O O PERIOD 2 Rass O O O O O O PERIOD | 0 0 0 0 0 | 2 1 0 1 4 Rs 4- Rau 1 0 4 0 | \$ 3 0 3 11 11 11 11 11 11 11 11 11 11 11 11 1 | 1 0 1 3 6 Rau 3 0 2 | 2 0 2 6 10 | 3 1 1 4 9 | UF 7 3 2 9 21 Total UF 9 0 14 | RAM 4 1 5 2 12 CHI-SQUIFOR 3 TI LS SL NC | 9 2 11 5 27 MRE VALUE EST PERIO Rau 0.500 0.000 5.200 5.200 | DS HF 0.88 3.00 13.53 8.40 |
| LS (C) SL (C) MC (C) MH (C) Total (C) Trace Type R: LS (C) MC (C) MH (C) Total (C) SL (C) MC (C) MH (C) Total (C) MH (C) Total (C) MH (C) Total (C) MH (C) Total (C) MH (C) Total (C) MH (C) Total (C) MH (C) Total (C) MH (C) Total (C) MH (C) Total (C) MH (C) Total (C) MH (C) Total (C) CHI-SQUARE | 0-2 0-2 0-2 0-2 0-2 0-2 | O O O O O O O O O O O O O O O O O O O | O O O O O O O O O O O O O O O O O O O | 0 0 0 0 us | 1 0 1 4 Rau 1 0 4 0 | 3 0 3 11 11 0 10 0 | 0 1 3 5 neters) 6 Rau 3 0 2 | 0 2 6 10 | 1 1 4 9 Rau 4 0 6 | 3 2 9 21 Total UF 9 0 | 1 5 2 12 CHI-SQU FOR 3 TI LS SL NC | 2 11 5 27 SARE VALUE EST PERIO Rau 0.500 0.000 5.200 5.200 | DS HF 0.88 3.00 13.63 8.40 |
| Trace | OURING O-2 | O O O O O O O O O O O O O O O O O O O | Q O O O O O O O O O O O O O O O O O O O | 0 0 0 ur 0 0 | 0 1 4 Rss 4- Rass 1 0 4 0 | 0 3 11 2000E Co -6 HF 3 0 10 | 1 3 6 neters) 6 Rau 3 0 2 | 2 6 10 10 4 6 | 1 4 9 Rau 4 0 6 | 2 9 21 Total HF 9 0 14 | S 2 12 CHI - SQUI FOR 3 TI LS SL NC | 11 5 27 SARE VALUE EST PERIO Rau 0.500 0.000 5.200 5.500 | DS HF 0.889 3.000 13.630 8.400 |
| Trace Trace Type R: CHIC IO MINUTES (Trace Type R: IO MINUTES Trace Type R: IO MINUTES Trace Type R: IO MINUTES Trace Type R: IO MINUTES Trace Type R: IO MINUTES Trace Type R: IO MINUTES Trace Type R: IO MINUTES Trace Type R: IO MINUTES Trace Type R: IO MINUTES Trace Type R: IO MINUTES Trace Type R: IO MINUTES Trace Type R: IO MINUTES Trace Type R: IO MINUTES Type R: IO MINU | 0-2 0-2 0-2 0-0 0 | O O O O O O O O O O O O O O O O O O O | O O O O O O O O O O O O O O O O O O O | 0 0 UF 0 0 | 1 4 Rf 4-Rau 1 0 4 0 5 | 3 11 NAME Co-6 MF 3 0 10 | 3 6 neters) 6 Rau 3 0 2 | 6 10 -8 -8 -8 -0 4 6 | Rau 4 0 6 3 | 9 21 Fotel UF 9 0 14 | 2 12 CHI - SQU FOR 3 TI LS SL NC | 5 27 27 27 27 27 27 27 27 27 27 27 27 27 | DS HF 0.889 3.000 13.630 8.400 |
| Total (10 MINUTES (Trace Ri LS (NC (NU (Total (Total (NC (| 0-2 0-2 0-0 0 0 0 | O TEST | PERIOD 2 Rah 0 0 0 0 PERIOD | 0 0 0 0 | 4 Rs 4- Rau 1 0 4 0 | 11 11 11 11 11 11 11 11 11 11 11 11 11 | 5 neters) 6 Rau 3 0 2 | 10 -8 -8 -8 -8 -0 -4 -6 | 9 Rau 4 0 6 | 21 Vif 9 0 14 | CHI-SQUIFOR 3 TO LS SL NC | 27 RAFE VALUE EST PERIO RAFF 0.500 0.000 5.200 5.500 | DS HF 0.881 3.000 13.536 |
| Trace Type R Typ | 0-2 0-2 0-2 0 0 0 0 | UF O O O O O O O O O O O O O O O O O O O | PERIOD 2 Rah 0 0 0 0 PERIOD | 0 0 0 0 | Rs 4- Rau 1 0 4 0 | 9 0 10 0 | Rau 3 0 2 | -8 UF 6 0 | Rau 4 0 6 | Total UF 9 0 14 | CHI-SQU FOR 3 T LS SL NC MM | O.500 5.200 5.500 | DS HF 0.889 3.000 13.630 8.400 |
| Trace Type Ri Type Ri SL () NC () HU () Total () Total () SL () NG () HINUTES Trace Ri Typ | 0-2 | O O O O O O O O O O O O O O O O O O O | Rau O O O O O | 0 0 0 0 | 4- Rau 1 0 4 0 | 9 0 10 0 | 6 Rau 3 0 2 | иғ 6 0 4 | 4 0 6 3 | UF 9 0 14 | FOR S TI LS SL NC MM | Rau 0.500 0.000 5.200 5.500 | DS HF 0.889 3.000 13.630 8.400 |
| Type Ra LS () SL () NC () HU () Total () 10 HINUTES Trace Type Ra LS () SL () NC () HU () Total () CHI-SQUARE | 0 0 0 0 0 0 0 | O O O O O | Rati O O O O O PERIOD | 0 0 0 0 | Rau 1 0 4 0 | 9 0 10 0 | Rau 3 0 2 3 | иғ 6 0 4 | 4 0 6 3 | UF 9 0 14 | FOR S TI LS SL NC MM | Rau 0.500 0.000 5.200 5.500 | DS . |
| Type Ra LS () SL () NG () UN () Total () 10 MINUTES Trace Ra Type Ra LS () NG () NG () NG () NG () Total () CHI-SQUARE | 0 0 0 0 0 AFTE | O O O O | O O O O PERIOD | 0 0 0 | 1 0 4 0 | 3 0 10 0 | 3 0 2 3 | 6 | 4 0 6 3 | 9 0 14 | LS SL NC MM | RaH 0.500 0.000 5.200 5.500 | HF 0.889 3.000 13.536 8.400 |
| SL (CHI-SQUARE | 0 0 0 0 AFTE | O O O R TEST | O O O PERIOD | 0 0 0 | 0 4 0 5 | 10 0 | 0 2 3 | 0 | 0 6 3 | 0 14 6 | SL NC MM | 0.500 0.000 5.200 5.500 | 0.889 3.000 13.536 8.400 |
| HC (CHI-SQUARE | 0 AFTE | O O R TEST | O O PERIOD | 0 | 4 0 5 | 10 0 13 | 2 | 4 | 6 | 14 | SL NC MM | 0.000 5.200 5.500 | 3.000 13.636 8.400 |
| Trace Trace Tupe Ro SL NG O Total CHI-square | 0 AFTE | O O CR TEST | O O PERIOD | 0 | o s | 13 | 3 | 6 | 3 | . 6 | NC HH | 5.200 5.500 | 13.536 8.400 |
| Total (10 MINUTES Trace Tupe Ro LS (SL (MG (MH (Total (CHI-square | 0-2 | O R TEST | PERIOD | 0 | 5 | 13 | | | | | 6484 | 5.500 | 8.400 |
| 10 HINUTES Trace Tupe Ri LS () NC () WH () Total () CHI-SQUARE | 0-2 | R TEST | PERIOD | | _ | | 8 | 16 | 13 | 29 | | | |
| Trace Tupe Ri LS (SL (NG (NH (Total (CHI-square | 0-2 | | | | Rf | NGE /- | | : | · | | TOTAL | 1.167 | 3,407 |
| Trace Tupe Ri SL () NC () HH () Total () CHI-square | 0-2 | | | | . Rf | WAC - | | | • | | | | |
| Tupe Ri LS () SL () NC () WH () Total () CHI-square | | 2 | - | | | 140E () | neters> | | | | CHT-SOH | ARE - 5.9 | 91 |
| Tupe Ri LS () SL () NC () MM () Total () CHI-square | hes L | | | -4 | 4- | -6 | 6 | -8 : | | Total | <d.f. <alpha<="" =="" td=""><td>2)</td><td>-</td></d.f.> | 2) | - |
| SL (C) NC (C) WH (C) Total (C) CHI-square | | بة | Raw | uf | Rau | uf | Rau | HF : | Rau | ME. | 422,000 | - 1027 | |
| NC (WH (Total (CHI-SQUARE | 0 | 0 | 0 , | . 0 | 1 | 3 | 4 | 8 | 5 | 11 | | | |
| Total (| 0 | 0 | ٥ | 0 | 1 | 3 | o | a | 1 | 3 | | | • |
| Total (| 0 | 0 | 1 | 4 | 1 | _ 3 | 6 | 11 | 8 | 18 | | | |
| CHI-SQUARE | 0 | | <u>o</u> | 0 | 0 | 0 | <u> </u> | 0 | 0 | 0 | | • | |
| CHI-SQUARE | 3 | 0 | 1 | 4 | 3 | 9 | 10 | 19 ; | 14 | 32 | | | |
| F-HAT 0- | -2 | | 2- | 4 | 4-6 | i. | 6~ | • | | | | | |
| Pau | l | iF | Rau | HF | Ran | HF | Rau | WF | | | | | |
| | 0 | 0 | 0 | 0 | 1 | 4 2 | 3 | 5 0 | | | | | |
| NC UU | Ō | Ô | 0 | 1 | 2 | 4 | 3 | 6. | | | | | |
| | ů O | ă | ö | 0 | 4 | 11 | 2 8 | 4 15 | | | | | |
| CHI-SQUARE VALUES 0- | -2 | | 2- | | 4-6 | | 5 | | • | | | | |
| | | 4F | | HF | | | Rau | HF | | • | | | |
| LS Rau | | 4 r | Ran | MF | 2.000 -0 | 250 | | 4.800 | • | | | | |
| LS SL NC | - | | | 2.000 | 0.000 1 3.500 1 | 3_000 | | 6.500 | | | | | |
| HH | _ | - | | 2.000 | 0.500 | .000 | 3.000 | 6.000 | | | | | * |

Table C34. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidal Pr | 1050; | 2.5 hrs high tid | before | Duration Treatment | of Test | t: 10 mi: 10 sec | n he | rs 345 30 sec off | Test Da Test Ti | | 2/18/88 2115 |
|---------------------|--------------|-------------|-----------|--------|-----------------------|---------|-----------------------|------------|---------------------|------|----------------------|--------------------|----------------|---------------------|
| 10 HIN | UTES DU | RING TE | ST PERIOD |) | | RANGE (| neters) | | | | | CHI -SQU | IARE F~HA | Г |
| Trace | <u> </u> | 0-2 | 2 | 2-4 | | 4-6 | | 5-8 | | ۲ | otal | FOR 2 T | EST PERI | oos |
| Type | Rau | HF | Rau | HF | Rau | ИF | Rau | ИF | Ra | H | ИF | Rau | MF | |
| LS | 0 | 0 | 0 | 0 | 0 | . 0 | Q | 0 | - | | 0 | 1 | 4 | |
| SL. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | o ` | 0 | 0 | |
| NC · | 1 | 8 | 0 | 0 | 3 | 8 | 2 | 4 | 6 | | 20 | 6 | 18 | |
| нн | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | · G | ٥ | | • | 0 | o | |
| Total | 1 | 8 | 0 | 0 | 3 | 8 | 2 | 4 | 6 | | 20 | 7 | 22 | |
| 10 MIN | IUTES AF | TER TES | T PERIOD | | | RANGE « | neters> | • | : | | | | | |
| | · | 0-2 | | 2-4 | | 4-6 | | 5-8 | | Г | otal | CHI-SOU | MARE VALUE | E Oos |
| Trace Type | Rau | HF | Rau | ИF | Ran | HF | Rau | ИF | Ra | 44 | MF | FOR 2 1 | | uf uf |
| LS | 1 | 8 | 0 | 0 | 0 | 9 | 0 | 0 | 1 | | 0 | LS | · Rau 1.000 | 8.00 |
| SL | 0 | 0 | . 0 | 0 | 0 | 0 | a | 0 | 0 | | 0 | SL | 1.000 | 6.50 |
| HC | 0 | 0 | 1 | - 4 | 1 | 3 | 4 | . 8 | . 6 | | 15 | | | |
| ни | ٥ | 0 | 0 | 0 | 0 | ٥ | 0 | 0 | . 0 | | ٥ | NC | 0.000 | 0.71 |
| Total | 1 | 8 | 1 | 4 | 1 | | 4 | 8 | 7 | | 23 | TOTAL | 0.077 | |
| | | | | | | | | | = | | , | | | 0.20 |
| CHI —SQUA F—HAT | 1RE 0-2 | | 2- | -4 | . 4 | -6 | 6 | -8 | | | | (d.f. = | MRE = 3. | 841 |
| | Ran | UF | Rau | HF | Rau | | Rau | | | | | Calpha | 05/ | |
| LS SL | 1. | 4 | 8 | 0 | | . 0 | . 0 | 0 | | | | | | |
| NC | 1 | ă | 1 | 2 | Ž | ě | چ | 6 | | | | | | |
| HH TOTAL | 0 | 8 | 0 | 0 2 | 0 2 | 6 | . 3 | 6 | | | | | | |
| CHI —SQUA VALUES | RE 0-2 | | 2- | -4 | 4 | -6 | 6 | -8 | | | | | | |
| L S SL | Rau 1.000 | MF 8.000 | Rau | HF | Rau | WF | Ran | WF | | | | . * | | |
| NC | 1.000 | 8.000 | 1.000 | 4.000 | 1.000 | 2.273 | 0.667 | 1.333 | | | | | | |
| UU TOTAL | 0.000 | 0.000 | 1.000 | 4.000 | 1.000 | 2.273 | 0.667 | 1.333 | | | | | | |

Table C35. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | | | 1 hr befor high ti <i>de</i> | T | reatment | Tupe: | 10 min h 10 sec or | , 20 sec | off | Test Da Test Ti | H4: | 2/1 9/0 2225 |
|--|--|--|---|--|---|---|---|------------------------------|--------------------------|------------------------------|------------------|--------------------|-------------------|----------------------------|
| 10 MTHU | ITES BEFO | | | | | NGE (H | | | | | | | ARE F-HA | |
| frace | 0-: | 2 | 2 | -4 | 4- | -6 | 6- | ·8 : | | Total | | FOR 3 T | EST PERI | ODS |
| Tupe | Rasi | HF | Rau | NF | RaH | NF | Rau | HF : | Rau | HF | | Ran | HF | |
| ĻŞ | 0 | 0 | .0 | 0 | 5 | 13 | 0 | 0 | 5 | 13 | ·- | 5 | 14 | • |
| SL | 8 | ٥ | 0 | 0 | Ò | o | ٥ | 0 | 0 | 0 | | 1 | 2 | , . |
| NC | 1 | 8 | 4 | 15 | 2 | 5 | . 1 | 2 : | 8 | 30 | | . 10 | 32 | |
| ш | 0 | ٠. | 0 | 0 | 0 | 0 | 0 | 0 : | 0 | 0 | | 2 | 5 | |
| Total | 1 | 8 | . 4 | 15 | 7 | 10 | 1 | 2 | 13 | 43 | | · 18 | 52 | |
| 10 HINU | ITES DURI | NG TEST | T PERIOD | ı | 96 | ANGE < | | : | | | | | | |
| | · 0~: | 2 | 2 | -4 | | -6 | 6- | -A | | Total | | CHT ~50U | ARE VALU | Œ |
| Trace Tupe | | - uf | | LIF | Rau | HF | | HF . | Rau | HF. | | | EST PERI | |
| LS | | ~ | | -= | | | 1 | | 5 | 14 | | | Rasi | MF |
| 5L | a | 0 | 0 | 0 | 1 | . 3 | | 0 | 1 | 3 | | LS | 1.200 | -0. |
| | Ω | 0 | 8 | 30 | 4 | 10 | 2 | 4 | 14 | 44 | | SL. | 0.000 | . 3. |
| NC. | | | • | | • | | _ | | 2 | 8 | | NC | 2,400 | ٠. |
| | - | ^ | | 0 | 2 | E | • | 0 . | | | | | | |
| Yotal | O O NUTES AFTI | er tes | 0 9 T PERIOD | 34 | 10 | 26 | 3 | 6 | 22 | . 66 | | HH TOTAL | 4.000 2.333 | |
| • | 0 | er tes | 9 T PERIOD | 34 | 10 | | 3 | 6 | | | | TOTAL CHI-SQU | 2.333 ARE = 5. | 7.9 |
| Total 10 MIN | O O NUTES AFT | er tes | 9 T PERIOD | 34 | 10 | 26 RNGE (| 3 neters> | 6 | | , 66 | - - - | TOTAL CHI-SQU | 2.333 ARE = 5. | 7.4 7.9 991 |
| MH Total | O O NUTES AFT | ER TES | 9 T PERIOD | 34 | 10 Ri | 26 RNGE () | 3 neters> | -8 | 22 | , 66 Total | | TOTAL CHI-SQU | 2.333 ARE = 5. | 7.1 |
| 10 MIN | O O NUTES AFTI O-: Ray | ER TES | 9 F PERIOD | 34 4 4 | 20 Ri | 26 RNGE (| seters> | -8 MF | 22 Ran | Fotal | - t- | TOTAL CHI-SQU | 2.333 ARE = 5. | 7.1 |
| 10 MIN Trace Trace Tupe LS | O O NUTES AFTI O-: Raw | ER TES | PERIOD 2 Rau 0 | 34 HF | 10 Ri -4- Rau | 26 RNGE <-6 HF 8 | S neters> 6- Rau 3 | -8 -WF | 22 Rau 6 | Fotal UF | | TOTAL CHI-SQU | 2.333 ARE = 5. | 7.1 |
| 10 MIN Trace Type -5 5L | O O | ER TES 2 UF 0 | 9 T PERIOD 2 Rem 0 | 34 HF 0 | 10 Ri -4- Rau 3 | 26 RNGE <6 HF 8 | Sectors 6-Rau | -8 -WF -6 | 22 Rau 6 | Fotal UF 14 | | TOTAL CHI-SQU | 2.333 ARE = 5. | 7. |
| Trace Trace Type LS SL NG | O O O O O O | ER TES 2 UF 0 0 | 9 T PERIOD 2 Ram 0 0 | 34 4 | 10 Ri 44 Rass 3 | 26 RNGE <-6 -6 -8 3 | Snotors> 6- Ran 3 0 | -8 -4F -6 -0 | 22 Rau 6 | Fotal UF 14 3 23 | | TOTAL CHI-SQU | 2.333 ARE = 5. | 7.9 |
| Trace Type LS SL NC MH Total CHI-SQUAR | O O O O O O O O O O O O O O O O O O O | ER TES 2 UF 0 0 0 | 9 T PERIOD 2 Ram 0 0 3 | 34 MF 0 0 11 0 | 10 Ri 44 Rasu 3 1 4 1 | 26 RMGE <-6 UF 8 3 10 3 24 | 3 0 1 3 | -8 MF -6 0 2 6 | 22 Rau 6 1 8 | Fotal UF 14 3 23 | | TOTAL CHI-SQU | 2.333 ARE = 5. | 7.1 |
| Trace Trace Tupe LS SL NG MH Total CHI-SQUAR | 0 0 NUTES AFT 0 .Ram 0 0 0 0 | O ER TES 2 UF O O O | 9 T PERIOD 2 Rain 0 0 3 0 3 2- | 34 WF 0 0 11 0 | 10 Rt 44 Rass 1 4 1 9 4-1 | 26 RMGE < | 3 Q 1 3 | -8 -8 -6 -14 | 22 Rau 6 1 8 | Fotal UF 14 3 23 | - - - | TOTAL CHI-SQU | 2.333 ARE = 5. | 7. |
| Trace Trace Tupe LS SL NC MM Total CHI-SQUAR F-HAT | O O O O O O O O O O O O O O O O O O O | O C C C C C C C C C C C C C C C C C C C | PERIOD 2 Ram 0 3 0 3 2- Ram | 34 HF 0 0 11 0 11 4 HF 1 | 10 Ri 4 Rau 3 1 4 1 9 4 4 4 | 26 RNGE <-6 UF 8 3 10 3 24 6 UF 10 | 3 0 1 3 7 6-8 Rau | -8 MF 2 14 1 | 22 Rau 6 1 8 | Fotal UF 14 3 23 | - | TOTAL CHI-SQU | 2.333 ARE = 5. | 7.1 |
| Trace Trace Type LS SL NC MM Total CHI-SQUAR F-HAT LS SL NC | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | O ER TES 2 UF O O O O UF O O O | 9 T PERIOD 2 Rain 0 3 0 3 0 7 Rain 0 | 34 NF 0 0 11 0 11 4 NF 10 | 10 Ri 4-1 Rau 4-1 3 | 26 RMGE <-6 HF 8 3 10 3 24 6 HF 10 28 | 3 Q 1 3 | 8 MF 0 2 6 14 | 22 Rau 6 1 8 | Fotal UF 14 3 23 | - | TOTAL CHI-SQU | 2.333 ARE = 5. | 7. |
| Trace Trace Tupe LS SL NG MH Total CHI-SQUAR F-HAT LS SL NC | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | O ER TES 2 UF O O O | PERIOD 2 Ram 0 3 0 3 2- Ram | 34 HF 0 11 0 11 4 HF | 10 Ri 44 Rasu 3 1 4 1 9 4-4 Rasu 4 1 1 | 26 RMGE < 6 WF 8 3 10 3 24 6 WF 10 2 | 5 6-6 Rau 3 7 6-6 Rau 1 0 0 | 8 HF 2 0 14 : | 22 Rau 6 1 8 | Fotal UF 14 3 23 | | TOTAL CHI-SQU | 2.333 ARE = 5. | 7.1 |
| Total 10 MIN Trace Tupe | 0 0 NUTES AFT | O ER TES 2 UF O O O O O | 9 T PERIOD 2 Ram 0 0 3 0 3 0 7 Ram 0 0 5 0 5 | 34 WF 0 11 0 11 4 WF 12 20 | 10 Ri 44 Rasu 3 1 4 1 9 4-4 Rasu 4 1 3 1 3 1 | 26 RNOE <-6 HF 8 3 10 3 24 6 HF 10 2 8 3 23 | 5 6-8 Raw 3 7 6-8 Raw 1 0 1 1 1 | 8 HF 2 14 : | 22 Rau 6 1 8 | Fotal UF 14 3 23 | - | TOTAL CHI-SQU | 2.333 ARE = 5. | 7. |
| Trace Trace Tupe LS SL NC WW Total CHI-SQUAR F-HAT LS SL NC WG TOTAL CHI-SQUAR TOTAL CHI-SQUAR | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | O ER TES 2 UF O O O O O O O O O O O O O | 9 T PERIOD 2 Ram 0 0 3 0 2- Ram 0 5 0 5 | 34 WF 0 0 11 0 11 1 1 1 1 1 1 1 1 1 1 1 1 1 | 10 Ri 44 Rasu 3 1 4 1 9 4 4 1 3 1 9 4 4 4 1 9 4 4 4 1 9 9 4 4 4 1 9 9 1 9 1 | 26 RMGE <-6 WF 8 3 10 3 24 6 WF 10 23 24 | 5 neters) 6-8au 3 0 1 3 7 6-8 Rau 1 0 1 1 4 | 8 HF 2 14 : | 22 Rau 6 1 8 | Fotal UF 14 3 23 | | TOTAL CHI-SQU | 2.333 ARE = 5. | 7.9 |
| Trace Trace Tupe LS SL NC WW Total CHI-SQUAR F-HAT LS SL NC WG TOTAL CHI-SQUAR TOTAL CHI-SQUAR | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | O ER TES 2 0 0 0 0 HF 0 3 | 9 T PERIOD 2 Ram 0 0 3 0 2- Ram 0 5 2- Ram 1 | 34 WF 0 0 11 0 11 4 HF 10 20 4 | 10 Ri 4- Rain 3 1 4 1 9 4 Rain 4 1 3 1 9 | 26 RMGE <6 -6 -8 -9 -10 -3 -24 -6 | 5 (6-6) (8au 3 (7 (6-6) (8au 4 (6-6) (8au 6 (6) (8au 6 | 8 HF 2 14 : | 22 Rau 6 1 8 | Fotal UF 14 3 23 | | TOTAL CHI-SQU | 2.333 ARE = 5. | 7.1 |
| Trace Trace Type LS SL NG WW Total CHI-SQUAR F-HRT LS SL NC UW TOTAL CHI-SQUAR | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | O ER TES 2 UF O O O O HF O O O NHF O O O NHF O O O NHF O O O O O O O O O O O O O | 9 T PERIOD 2 Ram 0 3 0 3 0 7 Ram 0 0 5 2- Ram | 34 UF 0 0 11 0 11 4 HF 10 20 | 10 Ri 4-1 Rah 1 1 1 Rah 4-1 1 2 4-1 Rah -0.250 0.000 2.000 | 26 RMOE < 6 HF 8 3 10 3 24 6 HF 10 28 3 23 | Sectors) 6-Rau 3 0 1 3 7 6-6 Rau 1 0 1 1 4 6-6 Rau 6-000 ! | -8 -0 -2 | 22 Rau 6 1 8 | Fotal UF 14 3 23 | | TOTAL CHI-SQU | 2.333 ARE = 5. | 7. |

Table C36. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 HI | NUTES DU | RING TE | ST PERIOD | 3 | | RANGE < | meters) | | | | | | | |
|---------------|----------|----------------|-----------|--------|----------------|-------------|---------|-------------|---|------|-------|---|------------------------|----------|
| _ | • | 0-2 | • • | 2~4 | | 4-6 | | 6-8 | | | Total | CHI-SQU FOR 2 T | ARE F-HAY | r Dos |
| Trace Tupe | Rau | ИF | RAH | HF | Rau | WF | Rau | HF | • | Rass | ИF | Raw | нF | |
| LS | 0 | 0 | 0 | ō | 0 | <u> </u> | 0 | 0 | : | 0 | 0 | 2 | 4 | |
| SL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | 0 | . 0 | ٥ | 0 | |
| NC | ů | 0 | 3 | 11 | 1 | 3 | . 2 | 4 | į | 6 | 19 | 7 | 22 | |
| И И | 0 | 0 | 0 | 0 | 4 | 10 | 2 | 4 | • | 6 | 14 | 4 | 9 | |
| Total | 0 | 0 | 3 | 11 | 5 | 13 | 4 | 8 | | 12 | 32 | 12 | 34 | |
| 10 HI | NUTES AF | TER TEST | | 2-4 | | RANGE (| neters> | c 0 | | | | | | _ |
| Trace Tupe | Rau | | Rau | uF | | | | 6-8 | į | | Total | FOR 2 T | RRE VALUE EST PERIC | DOS |
| LS | | | | | Rau | | Rase | | : | Rau | HF | | Rass | uf |
| SL. | a | 0 | 0 | 0 | • | | 0 | - | i | 0 | 0 | LS | 3.000 | 7.00 |
| NC | 1 | 8 | 1 | . 4 | 5 | 13 . | 0 | 0 | • | 7 | 25 | SL | | |
| нн | . 0 | 0 | 0 | . 0 | 1 | 3 | 0 | 0 | • | 1 | 3 | NC | 0.077 | 1.1 |
| [otal | 1 | 8 | 1 | 4 | 7 | 19 | 2 | 4 | : | 11 | 35 | ни | 3.571 | 7.1 |
| CHI –SQU | | | | | | | | | E | | | TOTAL | 0.043 | 0.13 |
| F-HAT | 0-2 | | 2. | -4 | 4 | -6 | 6 | -8 | | | , | <d.f. =<="" td=""><td>ARE - 3.6</td><td>341</td></d.f.> | ARE - 3.6 | 341 |
| L S | RaH | HF 0 | . Rau | HF : | Rais 1 | - | Ray | NF 2 | | | | Calpha | 05> | |
| ŠĹ. NC | . Ŏ | ŏ | 0 2 | Č | å " 3 | | ą | ä | | | • | | • | |
| HH TOTAL | Ŏ 1 | 4 | 2 | Ŏ B | 3 | 7 16 | i | 2 2 6 | | | | | | |
| CHI -50U | | | _ | | | | _ | _ | | | | • | | |
| VALUES | 0-2 | | | | | -6 | | | | | | | ÷ | |
| LS SL | Rau | и F | Rau | WF. | 1.000 | 3.000 | 2.000 | 4.000 | | | | | | |
| NC NC | 1.000 | 8.000 | 1.000 | 3.267 | 2.667 1.800 | 6.250 | 2.000 | 4.000 | | | | | • | |

Table C37. Indian Point hanner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidal Pi | hasei | 30 min be high tide | efore | Duration Treatment | of Test t Type: | : 10 min 10 sec o | hurs 3 k 5 n, 40 sec off | Test Dat | | 2/18/88 2305 |
|-------------------------|---------------|-------------------|---------------------|-------------|--|-------------------------|----------------------------|--------------------|----------------------|---|--|---------|-----------------|
| 10 HI | NUTES DU | RING TES | ST PERIO | | : # 12 # 14 # 15 # 15 # 15 # 15 # 15 # 15 # 15 | RANGE (| neters> | 3 E & C P = 1 h f | | 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | CHI-SQUA | : # C | |
| _ | • | 0-2 | : | 2-4 | | 4-6 | | 6-8 | | Total | FOR 2 TE | ST PERI | ops |
| Trace Tupe | Rau | ЫF | Ran | ИF | Rau | HF | Rau | ИF | Rau | uf | RaH | HF | |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | |
| SL, | a | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Q | o | 0 | |
| NC | 0 | 0 | 0 | 0 | 4 | 10 | 1 | 2 | 5 | 12 | 7 | 19 | |
| ни | 0 | 0 | 0. | 0 | 0 | 0 | 0. | 0 | 0 | 0 | 1 | 2 | |
| Total | 0 | 0 | 0 | 0 | 4 | 10 | 1 | 2 | 5 | 12 | 9 | 26 | |
| 10 mI | NUTES AFI | rep tesi | r pepton | | | | | | : | | | | |
| | | / L | , , _ , _ , | | 1 | RANGE (| (apters | | • | | | | |
| Trace | | 0-2 | | 2-4 | | 4-6 | | 6-8 | | Total | CHT-SQUA | | |
| Tupe | Rau | UF | Rau | ИF | Rau | ИF | Rau | uf | Ran | MF. | | Rau | ME |
| LS | 1 | 8 | 1 | 4 | ٥ | 0 | 1 | 2 | 3 | 14 | LS | 3.000 | 14.0 |
| SL | 0 | 0 | 0 | 0 | 0 | a | ٥ | 0 | 1 0 | 0 | SL | | |
| NC | 1 | Ð | 1 | 4 | 3 | 8 | 3 | 6 | 8 | 26 | NC | 0.692 | 5.19 |
| HH Theres | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | <u> </u> | 3 | HH | 1.000 | 3.0 |
| Total | 2 | 16 | 2 | 8 | 4 | 11 | 4 | 8 | 12 | 43 | TOTAL | 2.882 | 17.4 |
| CHI -SQU | ARE | | | | | | | | | | CHI -SQUA | _ | 841 |
| F-HAT | 0-2 | | 2 | -4 | 4 | -6 | 6· | -8 | | | <d.f. ≈<br=""><alpha =<="" td=""><td>12</td><td></td></alpha></d.f.> | 12 | |
| LS SL NC | Rau 1 0 | ИF 4 0 4 | Rass 1 0 1 | 2 0 2 | Ra ы 0 0 4 | HF 0 0 9 | Ra н 1 0 2 | 1 0 4 | • | • | | | |
| HH TOTAL | 0 1 | 0 8 | 0 1 | 0 4 | 1 | 11 | 9 | 0 5 | | | | | |
| CHI —SQU VALUES | ARE 0-2 | | 2 | -4 | 4 | -6 | 6 | -8 | | | | | |
| LS Si | Rau 1.000 | иF 8.000 | 1.000 | HF 4.000 | Rau | HF | 1.000 | uF 2.000 | | | | | |
| SL NC NU TOTAL | 1.000 | 9.000 | 2.000 | 4.000 | 0.143 1.000 0.000 | 0.222 3.000 0.048 | 1.000 | 2.000 | • | | | | |

Table C38. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidal P | hase: | 1.0 hr a high tid | | | | : 10 min 20 sec o | hers 3&5 n, 20 sec off | Test Da Test Ti | | 2/18/8 0 2345 |
|------------------------|------------------|----------|------------------|-------------------|----------------------|-------------------|-------------------|------------------|----------------------|---------------------------|--------------------|----------------------|-----------------------------|
| 10 MT | NUTES DU | RING TE | ST PERIO | 0 | ******** | RANGE | <meters></meters> | | | ***** | | | = 2-0 # # # # # # |
| | | 0-2 | | 2~4 | | 4-6 | | 6-8 | | Total | | ARE F-HA EST PERI | |
| Trace Type | Rau | UF | Rau | WF | Rau | ИF | Ran | UF | Rau | иF | RaH | HF | |
| _S | O | 0 | 0 | 0 | 1 | 3 | 4 | 8 | 5 | 11 | 5 | 7 | |
| 5 <u>L</u> | 0 | 0 | Ú | 0 | 0 | . 0 | 1 | 2 | 1 | 2 | 1 | 3 | - |
| €C, | 1 | 8 | 3 | 11 | . 4 | 10 | 2 | 4 | 10 | 33 | 11 | 34 | |
| ш | 0 | 0 | O | 0 | 0 | | 2 | 4 | 2 | 4 | > | 7 | |
| Total | 1 | 9 | 3 | 11 | 5 | 13 | 9 | 18 | 18 | 50 | 18 | 50 | |
| 10 HI | NUTES AF | TER TES | T PERIOD | | | RANGE | (neters) | | : : | | | | |
| _ | | 0-2 | | 2~4 | | 4-6 | | 6-9 | | Total | CHI-SQU | RE VALU | Ę |
| Trace Type | Ran | MF | Ram | ЫF | Rau | WF | Rau | uf | : Rau | ИF | FOR 2 TI | EST PERI | - |
| LS | 0 | 0 | 0 | 0 | 0 | ā | | 2 | 1 | 2 | | Rau | HF |
| 5L | . 0 | 0 | 1 | 4 | ı a | 0 | • | 0 | 1 | 4 | LS | 2.667 | 6.23 |
| NC | 0 | o | S | 19 | 5 | 13 | . 1 | 2 | 11 | 34 | SL. | 0.000 | 0.66 |
| шы | 0 | 0 | ` 0 | O | 2 | 5 | 2 | 4 | 4 | 9 | NC | 0.048 | 0.01 |
| Total | 0 | 0 | 6 | 23 | 7 | 18 | 4 | 8 | 17 | 49 | HH TOTAL | 0.667 | 1.92 |
| CHI — SQUI F — HAT | APE 0-2 | ! | 2 | -4 | | -6 | . 6 | . -a | • | | | ARE - J. | |
| | Rau | uf | Ran | | Rau | | Rau | | | | Calipha | | |
| LS SL NC - HH | 0 0 1 0 | 90 | 0 1 4 0 | 0 2 15 0 | 1 0 5 1 | 2 0 12 3 | 3 1 2 2 | 5 1 3 4 | | | | | |
| TOTAL | 1 | 4 | . 5 | 17 | 6 | 16 | 7 | 13 | | | | | |
| CHI – SQUI VALVES | 0 ~2 | ! | 2 | -4 | 4 | -6 | 6 | -8 | | | | | |
| LS SL | Rau | uf | Ran | | Ran | | 1.000 | UF 2.000 | | | | | |
| HC HH | 1.000 | 8.000 | 1.000 | 4.000 | 2.000 | 0.391 5.000 | | 0.667 | | | | | |
| I'OTNL | 1.000 | 8.000 | 1.000 | 4.235 | 0.333 | 0.806 | 1.923 | 3.846 | | | | | |

Table C39. Indian Point hanner test monitoring using 15 degree oblique transducer located at unit 5, inhake 35.

| | | | T PERIOD | | | ######## | - 九次公司公司集日 | # = 65 # # 6 t | ********* | , 30 sec of | 2002m= | | |
|--|--|---------------------------------------|---|--------------------------------|--|---|---|--|---------------------------|-----------------------------|---------------|-----------------------|-------------|
| | | | .9 | -4 | | ANCE (* -6 | | -8 | | Total | CHI - Sau | ARE F-HA EST PERIO | r one |
| race | | -2 | Rau | ue | | | Rate | HF : | | UF | Rau | LSI (FERI) | JUS |
| ype | R 6H | | | | | | | | £!ан | | | | |
| .S | ů - | ŭ | 0 | o | 2 | 5 | 2, | 4 | 4 | 9 - | 6 | 13 | |
| šL | 0 | 0 | - 1 | 4 | . 1 | 3 | 0 | O | 2 | 7 | 1 | 3 | |
| (C | , a | 0 | 1 | . 4 | 2 | s | 5 | 10 | 8 | 19 | 10 | 27 | |
| | D | | 0 | 9 | 1 | | <u>u</u> | | 1 | 3 | . 2 | 4 | |
| ctal | O | . 0 | * | 8: | ь | 16 | r | 14 | 15 | 36 | 18 | 47 | |
| 10 HIN | RITES DUR | ING TE | T PERLOD | • | R | ANGE (+ | ···ters> | | | • | | | |
| | . 0 | -2 | 2 | -4 | 4 | -£ | 6 | -8 | | Total | CHI -SQU | ARE VALU | E |
| race 'upe | Rau | HF | R 244 | | | HF | | uг | Ран | HF | | EST PERI | ODS |
| . <u>===</u> .s | a | -= | · | 0. | | 10 | 5 | 10 | 9 | 20 | | Pau | ₩. |
| iL | ο. | 0 | 0 | 0 | | 3 | o - | u | 1 | • | LS | 1.055 | 5.2 |
| (C | 0 | ı) | 3 | 11 | 11 | 23 | 2 | 4 | 16 | 43 | SI. | 2.000 | 9.3 |
| • | • | - | | | | | _ | | • | | NIC . | 5.900 | 14.6 |
| M. S | ^ | | | | • | E . | • | | | 7 | | | |
| | <u> </u> | o | 0 3 | 11 | 2 19 | 5 46 | <u>1</u> | 2 16 | _3 29 | 73 | HH | 0.500 | |
| rotel | | | | <u>-</u> - | | | | | | ~~~~~ | HH TOTAL | 0.500 11.222 | 3.5 22.6 |
| rotal | 0 | 0 | | 11 | 19 | | e | | | ~~~~~ | TOTAL | 11.222 | 22.5 |
| rotel 10 mm | G HUTES AF | 0 | ST PERIOD | 11 | 16 R | 46 | e neters> | | | ~~~~~ | TOTAL CHI-SQU | 11.222 PARE = 5. | 22.5 |
| retel 10 MI | G HUTES AF | O TER TE | ST PERIOD | 11 | 16 R | 46 FINUE < | e neters> | 16 | 29 f:au | 73 | TISTAL. | 11.222 PARE = 5. | 22.5 |
| fotal 10 MI frace (ype | MUTES AF | O TER TE | ST PERIOD | 11 | 19 R | 46 ANGE <1 | Autors> | -8 -8 | 29 | 73 | TOTAL CHI-SQU | 11.222 PARE = 5. | 22.5 |
| io mi race upo | G MUTES AF | TER TE | 3 ST PERIOD | 11) !-4 | 18 R | 46 FINGE <i< td=""><td>e eters></td><td>-8 -4F</td><td>29 flau</td><td>73 Total</td><td>TOTAL CHI-SQU</td><td>11.222 PARE = 5.</td><td>22.5</td></i<> | e eters> | -8 -4F | 29 flau | 73 Total | TOTAL CHI-SQU | 11.222 PARE = 5. | 22.5 |
| fotal 10 MI Frace Type SS | MUTES AF | O TER TE | ST PERIOD Ram O | 11 0 2-4 WF | R and | 46 FINGE CI | e e e e e e e e e e e e e e e e e e e | -8 8 | 29 Flau 4 | 73 Total NF | TOTAL CHI-SQU | 11.222 PARE = 5. | 22.5 |
| rotal | MUTES AF | O TER TE | ST PERIOD Ram O | 11 0 2-4 WF 0 | 16 R 4 R 6M 1 | 46 FINGE C: H-6 HF 3 | G Raw S | -8 -HF -0 | 29 Flau 4 0 | Total NF 9 | TOTAL CHI-SQU | 11.222 PARE = 5. | 22.5 |
| TO MI | G NUTES AF O Rah | O TER TE | 3 Raw 0 0 2 | 11 0 2-4 UF 0 0 | 16 R 4 R 24 1 C) | 46 FINGE <1 1-6 MF 3 | 6 Raw 5 0 | -8 -8 -8 -8 -4 | 29 Flau 4 0 7 | 73 Total MF 9 0 | TOTAL CHI-SQU | 11.222 PARE = 5. | 22.5 |
| otal race up+ S SL IC | RaH O C O | OFFER TE | ST PERIOD Ress O C C | 11 0 UF 0 8 | 18 R 4 R 24 1 C 1 C 1 C 1 C 1 C 1 C 1 C 1 C 1 C 1 | 46 FMGE <1 +6 -MF 3 1) 13 | 6 Raw 3 0 2 | 16 8 | 29 Flau 4 0 7 | 73 Total NF 9 0 20 2 | TOTAL CHI-SQU | 11.222 PARE = 5. | 22.5 |
| rotel 10 ml frace fupe LS SL NC | RaH O C O | OFFER TE | ST PERIOD Ress O C C | 11 0 ur 0 8 | 18 R 4 R 24 1 C 1 C 1 C 1 C 1 C 1 C 1 C 1 C 1 C 1 | 46 FINGE Co H=6 MF 3 D B U | 6 Raw 3 0 2 | 16 -8 -8 -9 -9 -9 -9 -9 -9 -9 -9 -9 -9 -9 -9 -9 | 29 Flau 4 0 7 | 73 Total NF 9 0 20 2 | TOTAL CHI-SQU | 11.222 PARE = 5. | 22.5 |
| TO MI TO MI TO MI SE SE SE SE SE SE SE SE SE S | NUTES AF | O TER TE | ST PERIOD Ram 0 0 2 0 2- Ram | 11 0 UP 0 8 0 | R am 1 0 4 4 - R am R am | 46 FINGE <0 H-6 MF 3 I) B U | 6 Raw 5 0 2 1 6 6- | 16 -8 -8 -8 0 4 2 12 | 29 Flau 4 0 7 | 73 Total NF 9 0 20 2 | TOTAL CHI-SQU | 11.222 PARE = 5. | 22. |
| race upo S S S S S S S S S S S S S S S S S S S | Ray 0 | O O O O O O O O O O O O O O O O O O O | ST PERIOD Ram 0 0 2 0 2- Ram 0 0 | 11 0 0 8 0 8 | 19 R A A R A A A A A A A A A A A A A A A | 46 FINUE CO 1-6 MF 3 1) 8 U 11 | 6 Raw 5 6 6 6 6 6 6 7 0 0 | 16 -8 -8 -8 0 4 2 12 8 WF 0 | 29 Flau 4 0 7 | 73 Total NF 9 0 20 2 | TOTAL CHI-SQU | 11.222 PARE = 5. | 22. |
| io mi race ype S S S S S C G G G G G H I — SHUR — HRT S S S I L | 0 Raw 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | OFFER TESTON | ST PERIOD Ram 0 0 2 0 2- Ram 0 0 | 11 WF 0 8 0 8 | R am 1 0 3 0 4 | 46 6 MF 3 0 8 11 | 6 Ram 5 0 2 1 6 6 6 6 6 7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 16 -8 -8 -8 -8 -8 -8 -9 -9 -9 -9 | 29 Flau 4 0 7 | 73 Total NF 9 0 20 2 | TOTAL CHI-SQU | 11.222 PARE = 5. | 22. |
| otal rece ype S SL G HI -SHUR -HI SI GC HI HI GC | Ray 0 | O O O O O O O O O O O O O O O O O O O | ST PERIOD Rem 0 0 2 2- Rem Rem | 11 0 0 8 0 8 | 19 R A A R A A A A A A A A A A A A A A A | 46 FINUE CO 1-6 MF 3 1) 8 U 11 | 6 Raw 5 6 6 6 6 6 6 7 0 0 | 16 -8 -8 -8 0 4 2 12 8 WF 0 | 29 Flau 4 0 7 | 73 Total NF 9 0 20 2 | TOTAL CHI-SQU | 11.222 PARE = 5. | 22.5 |
| 10 MI 10 MI 10 MI SS. SS. SS. SS. SS. SS. SS. SS. SS. S | G NUTES AF O O O O O O O O O O O O O O O O O O | OF TER TER | 3 Ram 0 0 2 0 2 | 11 0 0 8 0 8 | 18 R A A R A A A A A A A A A A A A A A A | #6 #F 3 11 16 #F 6 12 14 15 15 15 15 15 15 15 15 15 15 15 15 15 | 6 Ram 5 0 2 1 6 6 6 6 6 7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 16 -8 -8 -8 0 4 2 12 6 WF 7 0 6 1 | 29 Flau 4 0 7 | 73 Total NF 9 0 20 2 | TOTAL CHI-SQU | 11.222 PARE = 5. | 22.5 |
| TO MI TO MI TO MI S S S H TOTAL CHI - SHUA TOTAL CHI - SHUA TOTAL CHI - SHUA TOTAL CHI - SHUA TOTAL | G NUTES AF O O O O O O O O O O O O O O O O O O | OF TER TER | 3 Ram 0 0 2 0 2 | 11 0 0 8 0 8 | 18 R A A R A A A A A A A A A A A A A A A | #6 HF 3 11 11 16 HF 15 12 14 15 15 12 14 15 12 14 15 12 14 15 12 14 15 12 14 15 12 14 15 15 15 15 15 15 15 15 15 15 15 15 15 | 6 Ram 5 0 2 1 6 6 6 6 6 7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 16 -8 -8 -8 0 4 2 12 8 | 29 Flau 4 0 7 | 73 Total NF 9 0 20 2 | TOTAL CHI-SQU | 11.222 PARE = 5. | 22.5 |
| 10 MI 10 MI 10 MI SS SI 10 10 10 11 SS SI SS SS SS SS SS SS SS | 0 NUTES AF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | O O O O O O O O O O O O O O O O O O O | 3 Ram 0 0 2 0 2 | 11 0 0 8 0 8 | Ram 1 0 3 0 4 - Ram 2 1 5 1 9 | #6 #6 #6 #6 #6 #6 #6 #6 #6 #6 #6 #6 #6 # | 6 Ram 5 0 2 1 6 6 8 8 8 1 7 6 8 8 1 7 8 1 7 8 1 8 1 7 8 1 8 1 7 8 1 8 1 | 16 -8 -8 -8 0 4 2 12 8 WF 7 6 11 14 | 29 Flau 4 0 7 | 73 Total NF 9 0 20 2 | TOTAL CHI-SQU | 11.222 PARE = 5. | 22. |
| 10 MI 10 MI 10 MI SS SI 10 10 10 11 SS SI SS SS SS SS SS SS SS | G NUTES AF O RAH O O O O O O O O O O O O O O O O O O O | 0 TEP TE | 3 Rama 0 0 2 0 2- Rama 0 2- 2- Rama 0 2- 2- 2- 2- 2- 2- 2- 2- 2- 2- 2- 2- 2- | 11 0 0 8 0 8 | Ram 1 0 4- Ram 2 1 3 0 4- Ram 2 1 5 1 3 | #6 #6 #6 #6 #6 #6 #6 #6 #6 #6 #6 #6 #6 # | 6 Ram 5 0 2 1 6 6 - Ram 7 0 5 1 7 6 - 6 - 6 - 6 - 6 - 6 - 6 - 6 - 6 - 6 | 16 -8 -8 -8 -0 4 2 12 -8 -11 | 29 Flau 4 0 7 | 73 Total NF 9 0 20 2 | TOTAL CHI-SQU | 11.222 PARE = 5. | 22. |
| 10 MI 10 MI Frace Fupe SL NC NC NC NC NC NC NC NC NC NC | G NUTES AF O O O O O O O O O O O O O O O O O O | OFFER TESTON | 3 Rama 0 0 2 0 2- Rama 0 2- 2- Rama 0 2- 2- 2- 2- 2- 2- 2- 2- 2- 2- 2- 2- 2- | 11 0 0 8 0 8 | Ram 1 0 3 0 4- Ram 2 1 3 5 1 9 4- Ram 3.500 0.000 10.000 | #6 #6 #6 #6 #6 #6 #6 #6 #6 #6 #6 #6 #6 # | 6 Raw 5 0 2 1 6 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | 16 -8 -8 -8 -8 0 4 2 12 8 WF 7 0 14 6 UF 17 17 | 29 Flau 4 0 7 | 73 Total NF 9 0 20 2 | TOTAL CHI-SQU | 11.222 PARE = 5. | 22. |

Table C40. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | utes bef | | | | high tide | | | | #===================================== | , 20 Sec of | Test Til | | 0125 |
|---|---|---|--|---|--|--|---|--|--|-----------------------------|-------------------------------------|---------------------|--------------|
| 70 11114 | W163 6EF | OPE TES | I PERLU | • | Rf | ANGE CH | eters) | | • | | 647 . 604 | ARE F-HA | _ |
| Trace | | -2 | . 2 | 2-4 | | -6 | , 6- | 8 | | Total | FUR 3 T | EST PERI | 200 |
| Type | | uF | Rau | ИF | Rau | MF | RaH | HF | Rau | HF | Rase | HF | |
| LS | . 1 | 3 | 0 | 0 | G | 0 | 5 | 10 | 6 | 18 | 6 | 15 | |
| SL | · a | . 0 | ,o | 0 | 0 | 0 | 1 | 2 | 1 | 2 | Q | 1 | |
| NC | 0 | ٥ | 1 | 4 | 1 | 3 | 3 | 6 | 5 | 13 | 3 | 11 | |
| ни | 0 | 0 | 0 | 0 | . 0 | υ | 0 | 0 | 0 | 0 | . 0 | . 0 | |
| Total | 1 | 9 | 1 | 4 | 1 | > | 9 | 18 | 12 | 22 | 9 | 26 | |
| 46 | | | | _ | | | | | | | ā | | |
| 10 HIN | UTES DUR | THO IES | I LEKTOR | , | . Rí | ANGE CH | eters) | | | | | | |
| - | 0 | -2 | 2 | 2-4 | 4- | -6 | 6- | 8 | | Total | CHI-FAU | ARE VALU | E |
| Trace Tupe | Ram | HF | Ran | MF | Rass | NF | RaH | HF | Rau | HF | FIR 3 T | EST PERI | UUS UF |
| LS | ō | v | 1 | 4 | 2 | 5 | 5 | 10 | 6 | 19 | | Reu | |
| SL , | O | . 13 | 0 | . 0 | o | 0 | 0 | 0 | o | o . | LS SL | 1.167 | 4.93 2.00 |
| NC | 1 | 0 | 1 | · 4 | 1 | . 3 | 1 | 2 | 4 | 17 | | | 10.00 |
| | | | _ | _ | _ | • | _ | o i | 0 - | 0 | NC | 4.000 | 10.00 |
| MH | 0 | 0 | | 0 | 0 | 0 | 0 | U : | - | | | | |
| Total | NUTES AF | 9 | 2 | 9 | 3 | 8 | 6 | 12 | 12 | 36 | TOTAL | 5.778 | |
| Total 10 HI | 1 NUTES AF | 9 | 2 ST PERIO | 9 | . RI | | 6 | 12 | | | TOTAL CHI- SQU (d.f. = | 5.778 FIRE = 5.1 | 16.57 |
| Total | 1 NUTES AF | TER TES | 2 ST PERIO | 9 | 3 R/ | ANGE C | 6 eters> | 12 | | 36 | TOTAL CHI-SQU | 5.778 FIRE = 5.1 | 16.57 |
| Total 10 HI Trace | NUTES AF | 1 TER TES | PERIO | 8 | 3 R/ | ANGE C | 6 eters> | 12 | 12 | 36 Total | TOTAL CHI- SQU (d.f. = | 5.778 FIRE = 5.1 | 16.57 |
| Total 10 HI Trace Type | NUTES AF | TER TES | 2 ST PERIOL | 9 2-4 UF | Ram | ANGE C | 6 Heters> | 12 8 UF | 12 Rau | 36 Fotel | TOTAL CHI- SQU (d.f. = | 5.778 FIRE = 5.1 | 16.57 |
| Total 10 MI Trace Tupe | NUTES AF | TER TES | PERIO | 8 2-4 WF | Ran Q | ANGE CA | 6 eters> ReH | 12 8 WF | Rau 3 | J6 Total UF | TOTAL CHI- SQU (d.f. = | 5.778 FIRE = 5.1 | |
| Total 10 HI Trace Tupe LS | NUTES AF | TER TES | 2 ST PERIOI Rass | 8 2-4 4 U | Rass Q Q | ANGE CA | 6 eters) 6- Rau 2 | 12 8 WF 4 | 12 Rau 3 | Totel UF 8 | TOTAL CHI- SQU (d.f. = | 5.778 FIRE = 5.1 | 16.57 |
| Total 10 HI Trace Tupe LS SL NC | NUTES AF | TER TES | 2 ST PERIOI Ram 1 0 | 9 D 2-4 UF -4 U | Ram Q Q | ANGE G | 6-ReH | 12 8 4 0 | Ram 3 0 | 36 Fotel UF 8 0 | TOTAL CHI- SQU (d.f. = | 5.778 FIRE = 5.1 | 16.57 |
| Total 10 HI Trace Tupe LS SL NC NM Total CHI-SQUA | NUTES AF | TER TES | 2 ST PERIOD | 9 0 2-4 UF -4 0 0 | Risks Q Q Q Q Q | ANGE CA | 6 ReH 2 0 1 | 12 8 WF 4 0 | Rau 3 0 1 0 | 36 Fotel UF 8 0 2 | TOTAL CHI- SQU (d.f. = | 5.778 FIRE = 5.1 | 16.57 |
| Total 10 HI Trace Tupe LS SL NC HM Total | 1 NUTES AF 0 Reh 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | TER TES | 2 ST PERIOI Rass 1 0 0 | 9 D 2-4 UF -4 U | 3 R/ Ram 0 0 0 0 | ANGE CA | 6 ReH 2 0 1 | 12 8 WF 4 0 | Rau 3 0 1 0 | 36 Fotel UF 8 0 2 | TOTAL CHI- SQU (d.f. = | 5.778 FIRE = 5.1 | 16.57 |
| Trace Tupe LS SL NC HM Total CHI-SQUAF-HAT LS | NUTES AF O Reh O O O O Ref O O O Ref O O O O O O O O O O O O O O O O O O | TER TES | Rass 1 0 0 1 2 Rass | 9 D 2-4 UF -4 U 0 0 4 | 3 Ri A-1 Ram O O O O O O O Ram 1 1 | ANGE CA | 6 -6 Rau | 12 8 UF 4 0 | Rau 3 0 1 0 | 36 Fotel UF 8 0 2 | TOTAL CHI- SQU (d.f. = | 5.778 FIRE = 5.1 | 16.57 |
| Total 10 HI Trace Tupe LS SL HC HM Total CHI-SQUAR F-HAT LS SL HC | NUTES AF O RAH O O O O O REP O O REP O O REP O O REP O O REP O O REP O O REP O O REP O O REP O O O O O O O O O O O O O O O O O O | TER TES | 2 Rau | 9 D 2-4 UF U U U U U U U U U U U U U U U U U U | Rass Rass Q Q Q Q Q | ANGE CA | 6 Rail 4 O | 12 8 4 0 | Rau 3 0 1 0 | 36 Fotel UF 8 0 2 | TOTAL CHI- SQU (d.f. = | 5.778 FIRE = 5.1 | 16.57 |
| Trace | NUTES AF O ReH O O O O REF O O O O O O O O O O O O O O O O O O | TER TES | 2 ST PERIOI 1 0 0 0 1 1 2 Rate 1 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 0 1 0 0 0 0 1 0 | 9 0 2-4 UF -4 0 0 | 3 R/s 4-1 Rass 1 C 1 C 1 C 1 C 1 C 1 C 1 C 1 C 1 C 1 | ANGE CA | 6 ReH 2 0 1 0 3 | 12 8 WF 4 0 | Rau 3 0 1 0 | 36 Fotel UF 8 0 2 | TOTAL CHI- SQU (d.f. = | 5.778 FIRE = 5.1 | 16.57 |
| Trace Tupe LS SL NC HM Total CHI-SQUAF-HAT LS SL HC HC HC HC HC HC HC HC HC HC HC HC HC | NUTES AF O Rem O O O O O RE O O O O O O O O O O O O | TER TES | 2 ST PERIOR 2 Ross 1 0 0 0 1 | 9 D 2-4 UF U U U U U U U U U U U U U U U U U U | 3 Ri 4-Ram O O O O O O O O O O O O O O O O O O O | ANGE CA | 6 ReH 2 0 1 0 3 | 12 8 WF 0 2 0 | Rau 3 0 1 0 | 36 Fotel UF 8 0 2 | TOTAL CHI- SQU (d.f. = | 5.778 FIRE = 5.1 | 16.57 |
| Trace | NUTES AF O Rem O O O O O RE O O O O O O O O O O O O | TER TES | 2 Francis | 9 0 2-4 UF -4 0 0 | 3 R/s 4-1 Rass 1 C 1 C 1 C 1 C 1 C 1 C 1 C 1 C 1 C 1 | 8 ANGE CA | 6 ReH 2 0 1 0 3 | 12 8 WF 0 2 0 6 | Rau 3 0 1 0 | 36 Fotel UF 8 0 2 | TOTAL CHI- SQU (d.f. = | 5.778 FIRE = 5.1 | 16.57 |
| Total 10 HI Trace Type LS SL NC HM Total CHI-SQUR F-MAT LS SL NC HC HC HC HC HC HC HC HC HC HC HC HC HC | 1 NUTES AF 0 Rah 0 0 0 0 0 0 0 1 REE 0-2 RAH 0 0 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH | TER TES V O O O S HF S S S HF | 2 | 9 0 2-4 UF 0 0 4 -4 UF 5 0 5 | 3 Ri Rass 1 C C C C C C C C C C C C C C C C C C | ANGE CA-6-WF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 6 Pan Ran C C C C C C C C C C C C C C C C C C C | 12 8 4 0 2 0 6 | Rau 3 0 1 0 | 36 Fotel UF 8 0 2 | TOTAL CHI- SQU (d.f. = | 5.778 FIRE = 5.1 | 16.57 |
| Trace Tupe LS SL NC HM Total CHI-SQUAF-HAT LS SL NC HM TOTAL CHI-SQUAF TOTAL CHI-SQUAF TOTAL CHI-SQUAF TOTAL CHI-SQUAF TOTAL CHI-SQUAF TOTAL LS SL NC NC NC NC NC NC NC NC NC NC NC NC NC | 1 NUTES AF 0 Rah 0 0 0 0 0 0 0 1 REE 0-2 RAH 0 0 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH 0 RAH | 9 TER TES -2 WF 0 0 0 0 0 5 | 2 Fast 1 0 0 0 1 1 0 1 0 1 0 1 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 | 9 D 2-4 UF -4 U O O O O O O O O O O O O O O O O O O | 3 Ri Rass 1 C C C C C C C C C C C C C C C C C C | 8 ANGE CF | 6 -6 -6 -6 -6 -6 -6 -6 -6 -6 -6 -6 -6 -6 | 12 8 WF 4 0 2 0 6 | Rau 3 0 1 0 | 36 Fotel UF 8 0 2 | TOTAL CHI- SQU (d.f. = | 5.778 FIRE = 5.1 | 16.57 |
| Total 10 HI Trace Type LS SL NC NM Total CHI-SQUR F-MAT LS SL NC NM TOTAL CHI-SQUR UNI TOTAL CHI-SQUR UNI CHI-SQUR | 1 NUTES AF 0 Reh 0 0 0 0 0 0 1 RE 0-2 Reh 0 0 1 RE 0-2 Reh 0 0 0 1 | TER TES V O O O S HF S S S HF | 2 | 9 0 2-4 UF 0 0 4 -4 UF 5 0 5 | 3 Ri A-1 Ram O O O O O O O O O O O O O O O O O O O | ANGE CA-6-WF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 6 -6 -6 -6 -6 -6 -6 -6 -6 -6 -6 -6 -6 -6 | 12 8 4 0 2 0 6 | Rau 3 0 1 0 | 36 Fotel UF 8 0 2 | TOTAL CHI- SQU (d.f. = | 5.778 FIRE = 5.1 | 16.57 |

Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 MIH | JTES BEF | ORE TES | r PERIOD | ŀ | ę. | ANGE CH | eters> | | | | | | | |
|---|---|--|--|---|--|--|---|--|-------------------------|--------------------|---|--------------------|--------------------|-------------|
| _ | 0 | -2 | 2 | -4 | 4 | 1-6 | 6- | 8 . | - | Total | - | CHI-SQU FOR 3 T | ARE F-HATEST PERIO | r ops |
| Trace Tupe | Ran | HF | Rau | μF | Raw | HF | Rass | WF : | Pau | MF | | Rau | HF | |
| .s | Ú | 0 | 1 | 4 | Ů | 0 | 1 | 2 | 2 | € | | 1. | 2 | |
| SL. | Ú | O | ۵ | 0 | 1 | . 3 | 1 | 2 | .2 | 5 | | 1 | 3 | |
| IC | o. | o | 1 | 4 | 1 | 3 | 1 - | . 2 | 3 | 9 | | 5 | 12 | |
| 14 | 0 | 0 | ٥ | 0 | 0 | ņ | 0 | 0 | G | 0 | | 0 | 0 | |
| otal . | 0 | Ü | 2 | 8 | 2 | 6 | > | 6 | 7 | 30 | • | • | 17 | |
| 10 HEN | UTES DUR | ING TES | T PERIOD | | F | ANGE CH | eters) | : | | | : | | | |
| | | -2 | 2 | -4 | 4 | 1-6 | 6- | . : | | Total | | | ARÈ VALU | |
| frace Tupe | Rau | WF | RaH | HF | Ran | ИF | Rau | HF : | Flau | HF | | FOR 3 T | EST PERI | |
| LS | o | 0 | 0 | 0 | 0 | 0 | 0 | : | 0 | Ū | | • | Rau | HF. |
| šL. | 0 | 0 | 0 | 0 | 1 | 3 | o | 0 | 1 | 3 | | LS | 2.000 | 12.00 |
| 4C | . 0 | 0 | 0 | 0 | 3 | 8 | 3 | 6 : | 6 | 14 | | SL | 2.000 | 3.33 |
| ш | Ď. | o | O | o | 0 | . o | 2 | _ : | 0 | _ | | NC | 0.000 | 2.4 |
| | _ | • | . • | ••• | U | . 0 | 0 | 0 : | | 0 | | | | |
| rotal | 0 | | 0 | 0 | 4 | 11 | > | 6 | | 17 | • | HH TOTPL | 1.500 | |
| rotel IG MII | O NUTES AF | | O T PERIOD | 0 | 4 | | > | 6 | | | | CHI-SQU | 1.500 ARE = 5.4 | 1.05 |
| fetel 10 MI: Frace | O NUTES AF | TER TES | O T PERIOD | 0 | 4 | 11 | eters> | 6 | | 17 | | TOTAL CHI -SQU | 1.500 ARE = 5.4 | 1.05 |
| id Mi Id Mi Trace Type | O RUTES AF | TER TES | 0 T PER100 | 0 | 4 | 11 | eters> | 6 | 7 | 17 Total | | CHI-SQU | 1.500 ARE = 5.4 | 1.0 |
| fotel IG MI: Face Tupe | O RUTES AF | TER TES | PERIOD | -4 4F | Rau | 11 ANGE G | eters) | 6 HF | Rau | 17 Total | | CHI-SQU | 1.500 ARE = 5.4 | 1.05 |
| fetel IG MI Frace Fupe LS | O RUTES AF | TER TES | T PERIOD | 0 HF | Rau O | 11 RANGE CH | eters) 6- Ram 0 | 8 HF | Rau 0 | Total UF | | CHI-SQU | 1.500 ARE = 5.4 | 1.05 |
| Total 10 MI Trace Type LS SL NC | Q PRUTES AF | TEP TES -2 MF 0 | PERIOD Rau O | 0 HF 0 | Rau | 11 tange (# 1-6 #F | Seters> 6- Rau 0 | 8 MF 0 | 7 Rau 0 | Total UF 0 | | CHI-SQU | 1.500 ARE = 5.4 | 1.05 |
| Total IC HII Trace Tupe LS SL NC | RUTES AF | TER TES | PERIOD Resu G O | 0 HF 0 | Ran O U | ANGE CHIPS | 3 meters> 6- Rau 0 0 | 6 MF 0 | Rau 0 0 | 17 Total UF 0 0 14 | | CHI-SQU | 1.500 ARE = 5.4 | 1.09 |
| Total ICI MII Trace Tup# LS SL NC HH Total CHI-SHURN | RUTES AF | O TER TES -2 -2 -3 -2 -4 0 0 0 | PERIOD Ram G O 1 | 0 9 0 4 | Ran 0 0 0 3 0 | ANGE CHIPS | 3 meters> 6- Rau 0 0 | 9 WF 0 2 | ? Кан 0 0 5 | 17 Total UF 0 14 | | CHI-SQU | 1.500 ARE = 5.4 | 1.09 |
| Total ICI MII Trace Tup# LS SL NC HH Total CHI-SHURN | 0 RUTES AF 0 RAH 0 0 0 0 0 0 PR 0 - 2 | OFFER TES | 0 T PERIOD 2 Raw 0 0 1 0 1 2 | 0 HF 0 4 | Ran 0 0 0 3 0 | 11 RANGE CH -6 -6 -7 -6 -6 | 3 | 9 WF 0 2 | ? Кан 0 0 5 | 17 Total UF 0 14 | | CHI-SQU | 1.500 ARE = 5.4 | 1.05 |
| Total ICI MII Trace Tupe LS SL NC WH Total CHI-SAURI F-HAT | 0 RUTES AF 0 Ram () 0 0 0 0 RE 0-2 Ram 0-2 | OFFER TES -2 -2 -2 -2 -0 0 0 WF | 0 T PERIOD 2 Raw 0 1 1 2 - Raw 0 | 0 HF 0 4 0 | Ren 0 0 3 0 3 4- | ANGE CA | 3 | 8 MF 0 2 2 | ? Кан 0 0 5 | 17 Total UF 0 14 | | CHI-SQU | 1.500 ARE = 5.4 | 1.09 |
| Trace Trace Type LS SL NC HH Total CHI-SAURI F-HAT LS SL | 0 RUTES AF 0 RAM 0 0 0 0 0 0 RE 0 0 2 RAM 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | OF TER TES -2 -2 -2 -0 0 0 0 -0 0 0 0 0 0 0 0 0 0 | 2 Ram 0 0 1 2 Ram 0 0 1 | 0 4 0 4 4 4 4 1 0 3 | Ran 0 0 3 0 3 4- | 11 RANGE CH | 0 0 0 1 0 1 6-8 Rau 0 0 | 8 WF 0 2 2 2 4 4 1 1 1 1 1 1 1 1 | ? Кан 0 0 5 | 17 Total UF 0 14 | | CHI-SQU | 1.500 ARE = 5.4 | 1.09 |
| Trace Type SSL NC HH Fotal CHI-SHUPH F-HAT SSL NC | 0 RUTES AF 0 RAM 0 0 0 0 0 0 RE 0-2 RAM 0 | OF TER TES -2 -2 -2 -2 -0 0 0 0 WF 0 0 | 0 T PERIOD 2 Ram 0 1 2 Ram 0 1 0 | 0 4 0 4 | Rand O O O O O O Rand O | 11 RANGE CH 1-6 UF 0 0 0 0 8 0 R | 0 0 0 1 0 1 6-8 Rau 0 0 | 9 WF 0 2 0 | ? Кан 0 0 5 | 17 Total UF 0 14 | | CHI-SQU | 1.500 ARE = 5.4 | 1.09 |
| Trace Tupe LS SL NC HH Total CHI-SHURI F-HHT LS SL NC | 0 RUTES AF 0 RAH 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | OF TER TES -2 MF 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 Ram 0 0 1 2 Ram 0 0 1 | 0 4 0 4 4 4 4 1 0 3 | Ran 0 0 3 0 3 4- | 11 RANGE CH | 3 | 8 WF 0 2 2 2 4 4 1 1 1 1 1 1 1 1 | ? Кан 0 0 5 | 17 Total UF 0 14 | | CHI-SQU | 1.500 ARE = 5.4 | 1.05 991 |
| Total ICI MII Trace Type LS St. NC WM Total CHI-SNUR F-HAT LS SL NC NC NC NC NC NC NC NC NC NC NC NC NC | 0 RUTES AF 0 RAH 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | OF TER TES -2 MF 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 T PERIOD 2 Ram 0 1 2 Ram 0 1 0 | 0 0 4 0 4 | Ran 0 0 3 0 3 4- Ran 0 1 20 3 | 11 RANGE CH 1-6 UF 0 0 0 0 8 0 R | 0 0 0 1 0 1 6-8 Rau 0 0 | 9 WF 0 2 0 | ? Кан 0 0 5 | 17 Total UF 0 14 | | CHI-SQU | 1.500 ARE = 5.4 | 1.09 |
| Trace Trace Trupe LS SL NG WW Total CHI-SAURI F-HAT LS SL NC WW TOTAL CHI-SQUAR | 0 RUTES AF (1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | OF TER TES 2 MF 0 0 0 0 U WF | 9 PERIOD 2 Ram 9 0 1 1 0 1 2 - Ram 9 1 0 1 1 2 - Ram 9 1 1 0 1 1 2 - Ram 9 1 1 0 1 1 2 - Ram 9 1 1 0 1 1 1 2 - Ram 9 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 0 0 4 0 4 4 4 4 4 4 4 4 | Ran 0 0 3 0 3 4- Ran 0 1 20 3 | 11 RANGE CH | \$ 6-6 Rau 0 0 1 0 1 6-6 Rau 0 0 2 0 2 6-6 | 9 WF 1 1 2 2 1 2 5 5 WF WF | ? Кан 0 0 5 | 17 Total UF 0 14 | | CHI-SQU | 1.500 ARE = 5.4 | 1.09 |
| Trace Trace Type LS SL NC WW Total CHI-SAURI F-HAT LS SL NC WW TOTAL CHY-SQUAR VALUES | 0 RUTES AF 0 RAM 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 TER TES -2 WF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 9 PERIOD 2 Ram 9 0 1 1 0 1 2 - Ram 9 1 0 1 1 2 - Ram 9 1 1 0 1 1 2 - Ram 9 1 1 0 1 1 2 - Ram 9 1 1 0 1 1 1 2 - Ram 9 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 0 0 4 0 4 | Ran O O O O O O O O O O O O O O O O O O O | 11 RANGE CH 1-6 HF 0 0 8 0 8 -6 HF 0 2 6 0 8 | 3 enters) 6- Raid 0 1 0 1 6-8 Raid 0 2 2 2 6-6 Raid 2 | 9 WF 0 2 0 2 1 1 1 3 5 5 | ? Кан 0 0 5 | 17 Total UF 0 14 | | CHI-SQU | 1.500 ARE = 5.4 | 1.05 |
| Trace Trace Type LS SL NC WH Total CHI—SAURI F-HAT LS SL NC UN CHI—SQUAI VALUES | 0 RUTES AF 0 RAH 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | OF TER TES -2 -2 -2 -2 -0 0 0 0 U HF U 0 0 0 U HF | O T PERIOD 2 Raw O 1 1 2- Raw O 1 0 1 2- Raw - 1 | 0 4 0 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | Ran 0 0 3 0 4- | 11 RANGE CH 1-6 HF 0 0 6 0 8 0 8 | 3 eters) 6- Rau 0 1 0 1 6-8 Rau 0 2 0 2 6-8 | 9 WF 1 1 2 2 1 2 5 5 WF WF | ? Кан 0 0 5 | 17 Total UF 0 14 | | CHI-SQU | 1.500 ARE = 5.4 | 1.05 |

Table C42. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| ****** | iessosuni | | Tidal Ph | hse:] | 3.5 hrs bed low tide | fore (| Buration Treatment sussesses | t Typ+: | : 10 min h 30 sec en mananamen | , 40 \$e¢ | off | Test Dat Test Tid | n#: O | /19/88 355 |
|-----------------------|-----------|---------------|-----------------------|----------------|-------------------------|----------------|------------------------------------|----------------|--------------------------------------|--------------|-------------|----------------------|-----------|---------------|
| 10 MINUT | ES DURI | 46 TES | T PERIOD | | 60 | HOE C | meters) | | | | | | | |
| | ρ-: | > | . 3. | -4 | 4-(| | | 5-8 | | Fotal | | CITY-SQU | ARE F-HAT | ne. |
| Frace | | | | uf | | | | : | | HF | | | | w.⇒ |
| Type | | uf | R 814 | | | 4F | Rau | | Rau | | | RAM | HF | |
| .s | Ú | U | û | 0 | 1 | 3 | 0 | 0 | 1 | .3 | | 2 | 4 | |
| SL. | o | O | 1 | - 4 . | 1 . | 3 | 0 | 0 | 2 | . 7 | | 2 | 5 | |
| ic . | 0 | υ | .3 | 11 | 7 | 10 | 1 | 2 | 11 | 31 | | • | 21 | ٠ |
| 44 | 0 | Q | 1 | 4 | 1 | 3 | 0 | v | 2 | 7 | | , 2 | 6 | |
| otel | 0 | 0 | 5 | 19 | 10 | 27 | 1 | 2 | 16 | -18 | | 13 | 35 | |
| | | | | | | | | | : : | | | | | |
| 10 HINUT | res aftei | R. TESI | PERIOD | | RAI | NGE (| noters) | | : | | | | | |
| • | 0-: | 2 | 2 | -4 | 4~1 | 6. | | 5~ 8 | : : | Total | | CHI -SQU | RRE VALUE | |
| Trace 💉 | Rest | HF | Rau | HF | Rate | uf | Rau | WF | ; Rah | uf | | FOR 2 TI | EST PERIO | DS |
| . <u>57</u> .S | 0 | | 0 | 0 | | a | 2 | 4 | : | 4 | | | Rau | HF |
| 54_ | a | 0 | á | 0 | 1 | 3 | 0 | 0 | | 3 | | LS | 0.333 | 0.14 |
| IC | 0 | 0 | 1 | | 2 | 5 | 1 | 2 | | 11 | | SL | 0.333 | 1.60 |
| HU. | 0 | 0 | | . 7 | | 0 | 2 | 4 | 2 | 4 | | NC | 3.267 | 9.52 |
| | | | | - | | - - | <u>-</u> - | 10 | | 22 | | ии 🕝 | 0.000 | 0.81 |
| Total | U | " | 1 | 9 | 9 | 19 | 30 | 10 | , , | 22 | | TOTAL | 1.960 | 9.45 |
| CHI -SQUAFI | | | | • | | | | | | | | | ARE = 3.6 | 141 |
| F-HAT | 0-2 | | 2- | 4 | 4-6 | ~~~ | 6 | -8 | | v | | Cit.f. = Cal pha | | |
| LS . | Rau | HF D | ₽ a н O | HF O | Rau 1 | HF 2 | Reu | HF 2 | | | | | | |
| SL NC | á | õ | 1 2 | 2 | <u>1</u> | 3 | Õ | 0 | | | | | | |
| ни | Ò | ů n | 1 . | 2 | 1 | 12 2 18 | 1 | 2 2 6 | | | | | | • |
| TOTAL. | o - | 13 | 3 | 12 | • | 10 | 3 | • | | | | | | |
| CHI —SQUARI VALUES | E 0−2 | | 2- | 4 | 4-6 | | 6 | -8 | • | | | | | |
| • | Rau | uf | Rau | HF. | Rau | MF | Rass | | | | | | | |
| LS · SL | | . | | 4.000 | 1,000 3 | 000. | 2.000 | 4.000 | | | | | | |
| NC | | | 1.000 | 3.267 | 2.778 7 | . 348 | 0.000 | 0.000 | | | | | | |
| NH TOTAL | | | | 4.000 9.783 | 1.000 3 | .000 .314 | 2.000 2.667 | 4.000 5.533 | | | | | | |

Table C43. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 MIN | NUTES DUR | | i hekton | , | . 6 | ANGE (| utors) | | • | | | ARE F-HAT | |
|-------------------------------|-------------|----------------|-------------------------|-------------------------------|--|--|---|-------------------------------|----------|----------|-----------|--------------|----------|
| Trace | |)-2 | 2 | -4 | | 1-6 | | 6-8 | : | Total | | EST PERIO | DS |
| yp+ | Rasi | uf | Ran | HF | Reu | HF. | Rau | иF | : Rau | HF | Rau | HF | |
| .5 | 0 | ø | 1 | 4 | 7 | 10 | 3 | 6 | - 11 | 28 | 9 | 23 | |
| iL. | 0 | υ | 0 | 0 | O | D) | O | Q | 0 | 0 | 1 | 3 | |
| IC | 0 | υ | . 2 | B | 6 | 15 | 1 | 2 | . , | 25 | 10 | 30 | |
| 44 | 0 | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | 1 | > | |
| rotal | o | ij | 3 | 12 | 13 | 33 | 4 | 6 | 50 | 53 | 20 | 58 | |
| 10 M11 | NUTES AFT | TER TEST | PERIOD | | • | RANGE < | eters> | | : | | | | |
| _ | ć |)-2 | . 2 | !-4 | | 1-6 | | 6-8 | <u>:</u> | Total | CHI-SOU | ARE VALUE | , ine |
| lace Labe | Rasi | HF | Resi | MF | Rau | NF | Rass | HF | Ран | HF | F130; 2 1 | | us HF |
| .s | <u>-</u> | <u>-</u> | 3 | 11 | 1 | 3 | 2 | 4 | 6 | 18 | LS | Rau 1.471 | 2.17 |
| iL. | Ci | . 0 | a | 0 | 1 | 3 | | 2 | 2 | S | SL | 2.000 | 5.00 |
| (C | 1 | 8 | 4 | 15 | 3 | 8 | 2 | 4 | 10 | 35 | NC | 0.053 | 1.6 |
| 414 | 0 | 0 | 0 | 0 | 2 | 5 | 0 | 0_ | 2 | 5 | MM | 2.000 | 5.0 |
| fotel | 1 | Э | 7 | 26 | 7 | 19 | S | 10 | 50 | 63 | TOTAL | 0.000 | 0.66 |
| CHI —SQUI F—HAT | ARE 0-2 | | 2- | -4 . | 4 | -6 | . 6 | -8 | · . | <u>.</u> | CHI-SQU | ARE = 3.8 | H1 |
| _ | Rau | HF | Ran | HF _ | Rint | HF | Rau | | | | (al pha | 057 | |
| LS SL | 8 | 9 | o S | 9 | 4 1 | 11 | 3 | 5 | | | | | • |
| NC HH TOTAL | 1 0 1 | 4 1) 4 | 3 0 5 | 12 0 19 | 5 1 10 | 12 3 26 | 2 0 5 | 3 0 9 | | | | | |
| CHI-SAU VALUES | ARE 0-2 | | 2. | - - | 4 | -6 | - | -8 | | | | | |
| LS SL NC NM TOTAL | 1.000 | 8.000 8.000 | 2.000 2.000 0.667 | WF 3.267 2.130 5.150 | Rau 4.500 1.000 1.000 2.000 1.600 | UF 10.714 3.000 2.130 5.000 5.763 | Raw 0,200 1,000 0,333 0,111 | NF 0.400 2.000 0.667 | | | | | |

Table C44. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, incake 35.

| 10 HING | | | TE5 | T PERIOE | • | | | neters) | | | | ÇHI -SQU | ARE F-HAT | |
|----------------------|-----------|--------|-----|----------|-------|-------|----------|----------|--------|-----|----------|------------------------------|-----------|------|
| Trace | | -2 | | | 2-4 | | 1-6 | - | 5-8 | : | Total | | EST PERIO | DS |
| Tupe | Rын | HF | | Rau | HF | Ram | HF | Rass | | Rau | UF | Rau | WF | |
| LS | a | | Ü | 1 | 4 | \$: | 5 | 1 | 2 | . 4 | 11 | 5 | 0 | |
| šL | 0 | | D) | 0 | ø | 0 | Ð. | 0 | O | . 0 | 0 | ٥ | ٥ | |
| 4C | 0 | | O | 2 | 0 | \$ | 5 | 3 | 6 | 7 | 19 | 5 | 13 | |
| 4H | 0 | | ø | <u> </u> | 0 | Q | 0 | 0 | აა | 0 | <u> </u> | O ·. | 0 | |
| Total | O | | U | 3 | 12 | 4 | 10) | 4 | 8 | 11 | 30 | ê | 21 | |
| 10 MINU | ITES AFT | ER T | EST | PERIOD | | . 6 | RANGE (| meturs> | | : | | | | |
| | o | -2 | | : | 2-4 | . • | 4-6 | | 6-8 | | Total | CHI-SOU | ARE VALUE | |
| Trace. Type | Rau | ИF | | Ran | HF | Riss | MF | Rate | HF | Ран | иF | FOR 2 I | EST PERIO | |
| 1.5 | 0 | | o - | 1 | | Çi | i) | 0 | 0 | 1 | 4 | _ | Rau | HF . |
| 3L | 0 | | o | 0 | ø | 0 | o | 0 | 0 | . 0 | 0 | LS | 1.000 | 3.26 |
| NC | ٥ | | 0 | o | a | 1 | 5 | 2 | 4 | : > | t | SL | | |
| | 0 | | 0 | o · | • | ú | U | a | 0 | : 0 | o | NC | 1.600 | 5.53 |
| | 0 | | ,,, | 1 | 4 | 1 | <u>-</u> | :: 2: | 4 | : | 11 | MH | | |
| | | | | | | | | | | • | | TOTAL. | 3.267 | 8.60 |
| CHI –SNUAF F –HAT | °E 0−2 | | | 2. | -4 | 4- | -e | 15- | -0 | | | CHI-SQU Cd.f. = Calpha | | 141 |
| | Raw | HF | _ | Rau | HF | Rass | WF _ | Rina | HF | | | Cat pria | 05/ | |
| LS SL | . 6 | | 8 | 0 | 4 | Q. | 3 | 0 | 0 | | | | | |
| NC NC | . Q | | ย | 0 | 4 0 | å | ન .D | 3 | 5 0 | | | | | |
| TOTAL | ŏ | | ŏ | . 2 | ä | 3 | 7 | 3 | 6 | | | | | |
| CHI-SQUAF VALUES | E 0−2 | | | 2. | -4 | 4- | -£ | 6 | -8 | | | | | |
| LS | Rau | HF | | Ran | UF. | Ran | MF | Rass | | | | | | |
| SL. | | | | 0.000 | 0.000 | 2.000 | 5.000 | 1.000 | 2.000 | | | | | |
| NČ HH | | | | 2.000 | 8.000 | 0.333 | 0.500 | 0.200 | 0.400 | | | | | |
| TOTAL | | | | 1.000 | 4.000 | 1.800 | 3.764 | 0.567 | 1.333 | | | | | |

Table C45. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 22000PE | | | TiJ4l PI | | 30 min aft high tide | ter (| Buration Treatment | of Test t Type: | 10 min 1 10 sec o | ners 1,203 | Test Dat Test Tie | | /19/80 1235 |
|-------------------------------|------------|-----------|----------------|----------------|-------------------------|---|--------------------------------|-------------------------------|----------------------|------------|---------------------------------|-----------|----------------|
| | | | ST PERIDI |) | | | | | | | | | |
| | | _ | , | | | | neters) | | | | CHI -SQUI | ARE F-HAT | [|
| Trace | | -2 | | 2-4 | | -E | | 6-8 | : | Total | | EST PERI | צענ |
| rype | Rau | HF | Rан | uf | Rass | uf | Rau | NF. | : Rau | HF. | Rau | uf | |
| LS | o | , o | 5 | 8 | 3 | Ħ | 4 | 3 . | 9 | 34 | 7 | 18 | |
| 5L | Ō | Q | Q | 0 | 1 | 3 | 0 | Q | 1 | 3 | 1 | 3 | |
| HC . | O | υ | O | 0 | 1 | 3 | 1.9 | 2.1 | 10 | 20 | 9 | 21 | |
| ии | 0 | u | , a | ٥ | 3 | 13 | 0 | 0 | | 8 | 2 | 4 | |
| Total | o | o | 2, | 9 | 9 | 23 | 13 | 25 | 23 | 55 | 19 | 45 | |
| 10 HTN | UTES AFT | ER TES | T PERIOD | | R | ANGE (| neters> | | | • | | | |
| | 0 | -2 | , | 2-4 | | -6 | | 6-8 | | Total | CHI -SQU | ARE VALU | <u>.</u> |
| Trace Type | Rau | uF | Ran | HF | Rana | uF | Rau | | Ран | UF | FUR 2 TI | EST PERI | 005 |
| LS | 0 | 0 | G G | 0 | 1 | 3 | 4 | 9 | 5 | 11 | | Rau | WF |
| S L | à | . 0 | ٥ | 0 | o | 0 | . 1 | 3 | 1 | 2 . | LS | 1.143 | 4.03 |
| NC | ٥ | 0 | 1 | . 4 | 5 | 13 | 2 | 4 | . 8 | 21 | 5 t. | 0.000 | 0.20 |
| HH | a | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | . 0 | Ó | MC | 0.222 | 0.02 |
| rotal | <u>-</u> | | 1 | | 6 | 16 | | 14 | 14 | 34 | HM | 2.000 | 0.00 |
| | • | • | • | • | • | | • | | | | TOTAL | 2.169 | 4.95 |
| CHI –SNUAI F–HAT | P.E 0-2 | | 2 | -4 | 4 | 6 | 6 | -8 | | • | CHI-SQUI (d.f. = (alpha : | | 141 |
| | Rau | HF _ | Rau | HF | Rau | HF | Ran | HF | | • | (4) bile | 03/ | |
| LS SL | o o | O U | 1 0 | 4 0 | 2 | 6 2 | 4 | 8 1 | | | | | |
| NC | Ú | Ų | ì | 2 | . 3 | 8 | 6 | 11 | | | | | |
| HH TOTAL | ä | 0 | 5 | 6 | 7 | 19 | 10 | 20 | | | | | |
| CHI –SQUAI VALUES | P.E 0-2 | | 2 | - 4 | 4- | 6 | 6 | -8 | | • | | | |
| LS SL NC NN TOTAL | Rah | MF | 2.000 1.000 | 9.000 4.000 | 1.000 2.667 3.000 | NF 2.273 3.000 6.250 6.000 0.947 | Ram 0.000 1.000 4.455 | NF 0.000 2.000 8.048 | ٠. | | | | |

Table C46. Indian Point hanner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 HINU | TES DURI | NG TES | T PERIOD | | | RANGE (| | 4 = = = = = = = = = = = = = = = = = = = | 3中央 医三二异 动 配 | | | | 10 ± = # ± # |
|----------------------|-----------|---------------|----------|------------|--------|---------------|---------|---|--------------|------------|--------------------|------------------------|--------------|
| _ | 0- | 2 , | 2 | -4 | | -1-6 | | 6-8 | | Total | CHI-SQU FUR 2 T | ARE F-HAT EST PERIO |)DS |
| Trace Type | R-au | HF | Rase | HF | Rau | uf' | Rau | μF | Ray | HF | Rau | ИF | |
| .s | 0 | <u>-</u> | Ù | 0 | G | 0 | 2 | 4 | 2 | 4 | 2 | 3 | • |
| SL . | o | 6 | 0 | 0 | O | 0 | 0 | υ | 0 | 0 | G | . 0 | |
| 4C | 0 | 0 | 1 | 4 | 5 | 13 | 4 | 8 | 10 | 25 | 9 | 22 | |
| 414 | O | O | 0 | 0 | 2 | 5 | 1 | 2 | 3 | 7 | 3 | 6 | |
| Total | 0 | υ | 1 | 4 | 7 | - 18 | 7 | 14 | 15 | 36 | 13 | 31 | |
| 10 HINU | ITES AFTE | R TEST | PERIOD | | | RANGE (| neters) | | | | | | |
| Trace | 0- | 2 | 2 | -4 | | 4-6 | | 6-8 | | Total | CHI -SQU | ARE VALUE | 105 |
| Type | RaH | WF. | Reu | WF" | Rass | NF | Ran | uf . | Ray | HF | FOR 4 1 | Rau | MF |
| LS | Q | ů | Ú | 0 | D | 0 | 1 | 2 | 1 | 2 | LS | 0.333 | 0.66 |
| 5L | 0 | o | Q. | 0 | 0 | 0 | 0 | 0 | . 0 | O . | SL. | | |
| NC | 0 | a | 0 | 0 | 4 | 10 | 4 | . 8 | 6 | 18 | NC NC | 0.222 | 1-14 |
| HM | 0 | 0 | 0 | 0 | 2 | S | 0 | 0 | 2 | \$ | HH | 0.200 | 0.33 |
| Total | Ö | 0 | 0 | υ | 6 | 15 | 5 | 10 | 11 | 25 | TOTAL | 0.615 | 1.95 |
| CHI —SQUAR F—HAT | E 0~2 | | 2- | · 4 | 4 | -6 | | - a | • | ٠, | | ARE - 3.6 | |
| | | uf | Rau | UF | Rass | HF | Rau | | | | Cal pha | ~ .05> | |
| LS SL | 0 | ີ ບູ | o O | - o | Ö | | 2 | 7 3 | | | • | | |
| NC | 8 | i) | 1 | 2 | Š | 12 | 4 | ij | | • | • | | |
| uu Totri | Ö | 0 | 1 | 0 2 | 2 7 | 12 5 17 | 6 | 12 | | | | | |
| CHI -SQUAR VALUES | ?€ 0-2 | | 2- | - 4 | . 4 | -6 | 6 | -8 | | • | | • | |
| | Rau | WF | Rau | HF | Ran | UF | Ray | | | • | | | |
| LS . SL | | | | | | | 0.333 | 0.667 | | | | | |
| NC | | | 1.000 | 4.000 | | 0.391 | 0.000 | 0.000 | | | | | |

Table C47. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 HINUT | | 1 NG -2 | TES | |) !4 | _ | IANGE (+ I-6 | | 5-B | | Total | CHI -SQL FOR 2 1 | JARE F-HAT EST PERIO | เกร |
|-------------------------------|-------------------------|------------|-------|------------------------------|--------------------------|------------------------------|-------------------------|------------------------------|---------------|-----------------|------------|---------------------|--------------------------|------|
| Trace Tupe | Rau | HF | | Ran | MF | R-less | HF | Ran | | : ———— : Кан | uf | Rau | MF | |
| LS | 0 | | | o c | 0 | 0 | 0 | 2 | 4 | 2 | 4 | 2 | 3 | |
| SL | o | | n | 0 | 0 | ū | 0 | 0 | o | 0 | 0 | | 0 - | |
| NC | O | | 0 | 3 | 11 | 10 | 25 | 3 | 6 | : : 16 | 42 | 12 | 32 | |
| ын | 0. | | o | 0 | 0 | 1 | 3 | , 1 | 2 | : : 2 | 5 · | 2 | 4 | |
| Total | 0 | | o | 3 | 11 | 11 | 20 | 6 | 12 | 20 | 51 | 15 | 29 | |
| TO HINUT | • | ER T | EST | PERIOD | 2 ~4 | | RANGE () 4-6 | | 6 ~8 | | Total | CHI ~SQI | JARE VALUE | |
| Trace Type | Rau: | HF | | Rau | uF | Rau | HF | Rau | | Rau | HF | | FEST PERIO | |
| LS | <u></u> . | | | | | | | 1 | | 1 | 2 | , | Rau | HF |
| SL. | ο. | | 0 | . 0 | 0 | 0 | 0 | - 0 | · 0 | | <u> </u> | LS | 0.333 | 0.66 |
| NC | 0 | | 0 | 2 | 9 | 3 | а | 3 | 6 | . 8 | 22 | \$L | | |
| ни | o | | 0 | 0 | 0 | 1 | 3 | , 0 | 0 | 1 | 3 | NC | 2.667 | 6.25 |
| Total | 0 | | 0 | 2 | 8 | 4 | 11 | 4 | | 10 | 27 | HH | 0.333 | 0.50 |
| | | | | | | | | | | : | | TOTAL | 3.333 | 7.38 |
| CHI-SQUARE F-HAT | 0-2 | | | 2 | -4 | 4 | -6 | 6 | -8 | | • | <1.f. | JARE = 3.6 =_1> 1> | 141 |
| LS SL NC NU TOTAL | Rau 0 0 0 0 | ¥F | 00000 | Rан 0 0 0 3 0 | иF 0 10 0 10 | Ran 0 0 7 1 8 | UF 0 17 20 | Ван 2 0 3 1 5 | NF 3 0 6 1 10 | | | (si pna | - (20. | |
| CHI-SQUARE VALUES | 0-2 | | | 2 | -4 | 4 | -6 | 5 | -8 | | | | | |
| r's | Rau | MF | | Rau | uf | ReH | uf == | 0.333 | UP 0.667 | | | | | |
| SL NG HH TOTAL | | == | | 0.200 | 0.474 | 3.769 0.000 3.267 | 8.758 0.660 7.410 | 0.000 1.000 0.400 | 0.000 | | | | | |

Table C48. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | ALITES DU | | ST PERIOD | | ********* | | | 02 F 33 A E | | 35000 | | Test Til | 5 E 21 S 4 C 2 T 1 | |
|----------------------|-------------|-------------|-----------|----------------|-----------|---------------|---------------|----------------|----------|---------|-------------|------------------------------|--------------------|-------|
| • | | | | | | RANGE (| | | | | | CHI-SQU | ARE F-HAT | r |
| Trace Tupe | Rau | 0-2 HF | | 1-4 | Rau | 4+6 HF | Rau | 6-8 HF | : | Kau | Total UF | FOR 2 TO | EST PERIO | ρĠΣ |
| .s | 0 | | 3 | | 2 | 5 | 1 | | - | 6 | 18 | | 19 | |
| iL | 9 | 0 | | a | 0 | | 0 | 0 | • | 0 | 0 | - | | |
| _ | - | ~ | - | - | _ | - | • | - | : | _ | - | 1 | 2 | |
| NC. | 1 | . 8 | 3 | 11 | 2 | 5 | 5 | 4 | : | Ð | 28 | 6 | 18 | |
| WW. | 0 | <u> </u> | 0 | 0 | 0 | 0 | 2 | 4 | | 2 | 4 | \$10 | 2 | |
| rotal | 1 | В | 6 | 22 | 4 | 10 | 5 | 10 | į | 16 | 50 | 13 | 40 | |
| 10 MI | NUTES AF | TER TES | T PERIOD | | , | RANGE (| neters> | | • | | | | | |
| _ | | 0-2 | a | !-4 | | 4-6 | | 6~8 | : | | Total | | ARE VALU | |
| frace Type | Ran | HF | Rass | HF | Ran | NF | Rau | μF | : | RAH | ИF | FUR 2 TI | EST PERIC | · = |
| LS | 0 | o | | 11 | | . 0 | 0 | 0 | -: | 6 | 19 . | | Rau | HF |
| S L | . 0 | o | 1 | 4 | 0 | 0 | 0 | O | : | 1 | 4 | LS · | 0.000 | 0.02 |
| NC | 0 | 0 | ū | 0 | 2 | 5 | 1 | 2 | <u>.</u> | 3 | 7 | sr. | 1.000 | 4.00 |
| MUL ' | Ó | a | ٥ | 0 | _ O ' | . 0 | 0 | 0 | <u> </u> | Ω | ο . | NC | 2.273 | 12.60 |
| Fotal | | | | 15 | <u>-</u> | 13 | <u>-</u> 1 | | - | 10 | 30 | MH | 2.000 | 4.00 |
| | • | • | • | ••• | • | • | • | | • | 10 | 30 | TOTAL | 1.385 | 5.00 |
| CHI-SAUI F-HAT | AP.E 0~2 | | 2- | -4 | | ~6 | 6 | -0 | | | | CHI-SQU (d.f. = (alpha | ARE = 3.4 | 841 |
| LS | Raw | HF | Ruu | µР 11 | Ran | HF T | Rass | HF . | | | | (C. p.i.c | - ,02, | |
| SĽ NC | . 0 | ŏ | 1 | 6 | Ω | 0 | 0 | ů 3 | | | | | | |
| ни | å | 7 | 2 | U | . Ö | ບ | 2 | 2 | | | | | | |
| TOTAL | 1 | . 4 | 5 | 19 | S | 12 | . 3 | . 6 | | | | | | |
| CHI - SQUI VALUES | RP:E 0-2 | • | 2- | -4 | 4 | -6 | 6 | 0 | | | | | | |
| | Rau | UF | Rau | MF | Ran | HF | Res | HF | | | | | | |
| LS SL | | | 1,000 | 4.000 | 0.200 | 0.692 | 1.000 | 2.000 | | | | | | |
| NC NL | 1.000 | 8.000 | 3,000 | 11.000 | 0.000 | 0.000 | 2.000 | 0.667 4.000 | | | | • | • | |
| TOTAL | 1.000 | 8.000 | 0.400 | 1.324 | 0.111 | 0.391 | 2.667 | 5.533 | | | | | | |

Table C49. Indian Point hanner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidal Pi | | 1 hr bed high tid | 16 | Treatment | t Type: | 20 sec or | wers 1,203 , 30 sec off | Test Da Vest Ti | ne: 1 | /19/68 355 |
|------------------------|----------|--------|----------|--------|----------------------|---------|-----------|---------------|-----------|----------------------------|--------------------|-----------|---------------|
| , 10 HIMUI | res bur | ING FE | ST PERIO | | | | neters) | | | | C1(I - SQ) | ARE F-HAT | |
| Trace | . 0 | -2 | | 2-4 | | 1-6 | | 6-8 | | Total | FOR 2 T | EST PERLO | DS |
| Туре | Rāu | HF | Rau | ИF | Rau | ИF | Rau | HF | Pau | ИF | Rau | ЯF | |
| Li | ú | ບ | 1 | 4 | 1 | 3 | ū | 0 | 2 | 7 | 1 | 4 | |
| SL | 0 | • | 0 | 0 | D | 0 | Û | . 0 | . 0 | o | 0 | G | |
| MC | O | o | 0 | 0 | 1. | 3 | 4 | 8 | 5 | 11 | 4 | 10 | |
| Ми | 0 | 0 | 1 | 4 | a | 0 | O. | 0 | 1 | 4 , | 1 | 2 | |
| Tatal | 0 | v | 2 | 8 | 2 | 6 | 4 | 8 | 9 | 22 | 6 | 16 | |
| 10 HINUI | res Afr | ER TES | T PERIOD | | ı | RANGE (| neters> | | | | | | |
| | O | -2 | | 2-4 | | 4-6 | | 6-8 | | Total | CHI -SQU | ARE VALUE | : |
| Trace Tupe | Rau | HF | Rau | ИF | Rau | HF | Rau | MF . | Pau | HF | FOR 2 T | EST PERIO | |
| LS | 0 | ō | o | 0 | 0 | 0 | | | 0 | 0 | | Rau | HF |
| SL | . 0 | . 0 | 0 | Ð | O | 0 | o | 0 | 0 | 0. | LS | 2.000 | 7.000 |
| NC | G | a | 1 | 4 | 1 | 3 | 1 | 2 | . 3 | 9 | SL, | | |
| МЯ | ú | o | 0 | ø | o | 0 | 0 | 0 | o | 0 | , NC | 0.500 | 0.20 |
| Total | a | | 1 | 4 | 1 | 3 | 1 | 2 | 3 | 9 | ш. | 1.000 | 4.00 |
| | | | | | | | | , | = | | TOTAL | 2.273 | 5.452 |
| CHI — SQUAP! F~HAT | E 0-2 | | 2. | -4 | 4 | -6 | Ġ. | -8 | | | (d.f | ARE = 3.8 | H1 |
| - | Ran | uf | Rau | ИF | Ran | HF | Ran | | | | Call pha | 05> | |
| LS SL | ű | D D | 1 0 | 2 | 1 Ú | 2 | Ů | 0 | • | | | | |
| 14C | 0 | Ü | 1 | 2 2 | 1 | š | 3 | Š | | | | | |
| HW TOTAL | Ú | Q D | 1 2 | 2 6 | 0 2 | 0 5 | 0 3 | 9 5 | | | | | |
| CHI — SQUARI URLUES | 0-3 E | | . 2 | -4 | 4 | -6 | 6 | -8 | | | | | |
| | Ram | ИF | Rau | WF | Rau | HF | Rau | | | | | | |
| LS SL | | | 1.000 | 4.000 | 1.000 | 3.000 | . == | | | | | | |
| NC | | | 1.000 | 4.000 | 0.000 | 0.600 | 1.800 | 3.600 | | | | | |
| HK TÖTEL | | | 0.333 | 4.000 | 0.333 | 1.000 | 1.800 | 3.600 | | | • | | |

Indian Point hawner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

|)+2 | 0 0 0 | Ram O 1 O 1 PERIOD | UF 0 0 4 | Ram 0 0 1 0 | | Hèters) | 6-8 | | Fotal HF 0 0 9 | CI(I -5Q)/ | ARE F-HAT EST PERIO UF 0 0 | |
|---------|--------|----------------------------|------------------------|----------------------------|---|---|--|---|---|---|--|--------------------------------------|
| WF. | 0 0 0 | Ram O 1 O 1 PERIOD | UF O O A O | Ran 0 0 1 0 | иғ 0 0 3 | Rass G G 1 | UF 0 0 2 | 0 0 0 3 | иF 0 0 9 | Rau 0 0 2 | шғ О О € | |
| FER T | 0 | O 1 O 1 PERIOD | 0 4 0 | 0 1 0 | 0 3 0 | 0 1 0 | 2 | 0 3 0 | 9 | 0 0 2 1 | 0 6 1 | |
| TER T | 0 | O 1 PERIOD | 4 9 4 | 0 | 3 U | 1 | 2 | 0 | 9 | 2 | £ | |
| FER T | 0 | O 1 PERIOD | <u>0</u> 4 | 0 | <u>0</u> | 0 | 0 | 0 | 0 | 1 | 1 | |
| TER T | 0 | 1 PERIOD | 4 | 1 | | | | - <u>-</u> | | - | 1 | |
| FER T | - | PERIOD | | | 3 | 1 | 2 | > | 9 | 3 | | |
|)-2 | TEST | | | _ | | | | • | | | 7 | |
| | | 2 | | | RANGE (| meterso | | | | | | |
| иF | | | -4 | | 4-6 | | 6-8 : | | Total | CHI -SQI) | ARE VALUE | • |
| | 7 | Rasia | HF | Rau | ИF | Rau | WF : | Rau | WF | FOR 2 T | EST PERIO | |
| | G | 0 | 0 | 0 | ū | o | 0 | 0 | 0 | | Ран | HF |
| | 0 | 0 | . 0 | 0 | ີ ຍ | . 0 | 0 | 0 | 0 | LS | | |
| | ٥ | o | 0 | | 3 | 0 | 0 | 1 | 3 | SL. NC | 1.000 | 3.00 |
| | 0 | 0 | . 0 | 0 | 0 | 1 | 2 | 1 | 2 | HU | 1.000 | 2.00 |
| | 0 | Ú | 0 | 1 | 3 | 1 | 2 | 2 | 5 | TOTAL | 0.200 | 1.1- |
| | , | 2~ | 4 | 4 | -6 | 6 | -8 | | | CHI-590 | ARE = 3.8 | |
| | 0 0 | Raii O O | HF 0 | Ра и 0 0 1 | ИF 0 0 0 | Rass 0 0 | UF 0 1 | | | | | |
| | 9 | 0 | 0 2 | 0 | 3 | 1 | 2 | | | | | |
| | _ | 2- | -4 | 4. | -6 | 6 | -8 | | | 4 | | |
| HF | = | 1,000 | 4.000 | 0.000 | NF 0.000 | 1.000 1.000 | HF 2.000 2.000 | | | | | |
| | | • | 0 i | 0 1 2 2-4 MF Reh MF | 2-4 4 MF Ren MF Ren 1,000 4,000 0,000 | 2-4 4-6 WF Ren MF Ren MF 1,000 4.000 0.000 0.000 | 0 1 2 1 3 1 2-4 4-6 6 HF ReH HF ReH HF ReH | 2-4 4-6 6-8 HF ReH MF ReH MF REH MF 1,000 4,000 0,000 0,000 1,000 2,000 | 2-4 4-6 6-8 WF Rew WF Rew WF Rew WF 1,000 4.000 0.000 0.000 1.000 2.000 | 2-4 4-6 6-8 HF Rew MF Rew MF Rew MF 1,000 4,000 0,000 0,000 1,000 2,000 | 2-4 4-6 6-8 HF Raw MF Raw MF Raw MF | 2-4 4-6 6-9 MF Rew MF Rew MF Rew MF |

Table C51. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 MINUT | | | F PERIOD | | | | | | (1) 12 14 14 14 14 14 14 14 14 14 14 14 14 14 | | E46388 | | *** | |
|---|--|---------------------------------------|--|--|--|---|---|---|---|-----------------------------|---------------|--|-----------------------------|----------------|
| | | _ | _ | _ | | RANGE (| | | | | | | ARE F-HAT | |
| Trace | | -2 | | -4 | | 4-6 | | B | | Total | | ~~~~~ | EST PERIC | ods |
| Type | Rau | _HF | Rau | <u>н</u> г | <u>Р</u> ан | | Rau_ | HF | Rau | uf | ^ | Rau | HF | |
| LS | 0 | 0 | 1 | 4 | 2 | 5 | 0 | 0 | 3 | 3 | | 3 | . 8 | |
| SL | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 1 | 4 | | 1 | 3 | |
| NC | 0 | 0 | 3 | 11 | 2 | 5 | 4 | 8 | 9 | 24 | | 7 | 19 | |
| нн | 0 | 0 | 0 | 0 | 1 | 3 | 2 | 4 | 3 | 7 | | 2 | 5 | |
| Total | 0 | 0 | -5 | 19 | s | 13 | 6 | 12 | 16 | 44 | | . 15 | 35 | |
| 10: HINUT | ES DUR | ING TES | F PERIOD | | , | RANGE (| neters) | 1 | - | • | | | | |
| | 0 | ~2 | 2 | -4 | | 4-6 | | -9 | | Total | | CHI-5QU | ARE VALU | E |
| Trace Type | Ran | WF | Rah | UF | Rau | WF | Rau | HF : | Rau | ИF | | FOR 3 T | EST PERI | |
| LS | 0 | 0 | 1 | 4 | 2 | 5 | 1 | 2 | 4 | 11 | | | Rass | HF |
| SL | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 : | 1 | 4 | | LS | 0.667 | 3.37 |
| NC | 0 | 0 | | 0 | 2 | 5 | 1 | 2 | 3 | 7 | | \$L | 0.000 | 2.66 |
| | _ | _ | _ | _ | _ | _ | - | _ : | _ | • | | | 5.143 | 13.26 |
| uu . | a | 0 | 0 | a | a | 0 | 1 | 2 : | 1 | 2 | | NC | | |
| Total | O O OTES AF | O O TER TE: | 0 2 ST PERIOD | <u> </u> | <u>0</u> | 10 | 1 3 | 6 | 9 | <u>2</u> 24 | | HU TOTAL | 1.000 | 1.60 |
| Total 10 MTMU | O STES AF | 0 | 2 ST PERIOD | 8 | 4 | | 3 meters> | | | | | UM TOTAL CHI-SAU <d.f. =<="" th=""><th>1.000 2.000 ARE = 5.5</th><th>1.60 5.89</th></d.f.> | 1.000 2.000 ARE = 5.5 | 1.60 5.89 |
| Total | O STES AF | O FER TE: | 2 ST PERIOD | 8 | 4 | 10 | 3 meters> | 6 | | 24 | - | NM TOTAL CHI-SAU | 1.000 2.000 ARE = 5.5 | 1.60 5.89 |
| Total 10 HINU Trace Type | O STES AF | 0 FER FE: | 2 ST PERIOD 2 | -4 | | 10 RANGE < | 3 meters) | 6 | 9 | 24 | *** | UM TOTAL CHI-SAU <d.f. =<="" td=""><td>1.000 2.000 ARE = 5.5</td><td>1.60 5.89</td></d.f.> | 1.000 2.000 ARE = 5.5 | 1.60 5.89 |
| Total 10 MINU Trace Type LS | O FEE | TER TE: | 2 ST PERIOD 2 Raw | 8 -4 HF | Rase | 10 RANGE < | oneters) | -8 MF | g Rau | 24 Total | · | UM TOTAL CHI-SAU <d.f. =<="" td=""><td>1.000 2.000 ARE = 5.5</td><td>1.60 5.89</td></d.f.> | 1.000 2.000 ARE = 5.5 | 1.60 5.89 |
| Total 10 MINU Trace Type LS SL | O O Ren | OFER TES | 2 ST PERIOD 2 Raw | -4 HF | Ram | 10 RANGE < | neters) Rau 1 | -8 -WF | Reu 2 | Total MF | | UM TOTAL CHI-SAU <d.f. =<="" td=""><td>1.000 2.000 ARE = 5.5</td><td>1.60 5.89</td></d.f.> | 1.000 2.000 ARE = 5.5 | 1.60 5.89 |
| Total 10 HINU Trace Type LS SL NC | O Resi | 0 FER FE: -2 -2 -0 0 | 2 ST PERIOD 2 Ram 0 | -4 HF | Ran 1 | 10 RANGE < 4-6 MF 3 | neters) Rau 1 | 6 -8 -4 -4 -4 -4 -4 -4 -4 -4 -4 -4 -4 -4 -4 | Rau 2 | 24 Total HF 5 | · | UM TOTAL CHI-SAU <d.f. =<="" td=""><td>1.000 2.000 ARE = 5.5</td><td>1.60 5.89</td></d.f.> | 1.000 2.000 ARE = 5.5 | 1.60 5.89 |
| Total 10 HINU Frace Type LS SL NC HH | O REM | 0 FER FE: | 2 ST PERIOD 2 Ram 0 0 | -4 -4 0 0 | Ram 1 0 5 | 10 RANGE C 4-6 UF 0 13 | neters) Rau 1 0 | 6 -8 -8 -2 0 | Rau 2 0 | 24 Fotal MF 5 0 | | UM TOTAL CHI-SAU <d.f. =<="" td=""><td>1.000 2.000 ARE = 5.5</td><td>1.60 5.89</td></d.f.> | 1.000 2.000 ARE = 5.5 | 1.60 5.89 |
| Total 10 HINU Trace Type LS SL NC HH Total CHI-SQUARE | O RAM O O O O | OFER TES | 2 ST PERIOD 2 Ram 0 0 2 | 8 UF 0 0 | Rate 1 0 5 2 | 10 RANGE < 4-6 UF 3 0 13 5 | 3 neters) 6 Rau 1 0 3 | 6 MF 2 0 | Rau 2 0 10 2 | 24 Total MF 5 0 27 | | UM TOTAL CHI-SAU <d.f. =<="" td=""><td>1.000 2.000 ARE = 5.5</td><td>1.60 5.89</td></d.f.> | 1.000 2.000 ARE = 5.5 | 1.60 5.89 |
| Total 10 HINU Trace Type LS SL NC HH Total CHI-SQUARE | 0 Resu 0 0 0 0 | OFER TES | PERIOD Ram O O 2 C C C C C C C C C C C C | 8 Wr 0 0 | Ran 1 0 5 2 | 10 RANGE < 4-6 UF 9 13 5 21 | 3 meters) 6 Rau 1 0 3 0 4 | 6 MF 2 0 6 | Rau 2 0 10 2 | 24 Total MF 5 0 27 | | UM TOTAL CHI-SAU <d.f. =<="" td=""><td>1.000 2.000 ARE = 5.5</td><td>1.60 5.89</td></d.f.> | 1.000 2.000 ARE = 5.5 | 1.60 5.89 |
| Total 10 MINU Trace Type LS SL NG HH Total CHI-SQUARE F-HAT | O Resu O O O O C C C C C C C C C C C C C C C | OFER TES | 2 Raw 0 0 2 Raw 1 | 9 0 8 4 UF 3 | Ram 1 0 5 2 8 | 10 RANGE < 4-6 UF 3 0 13 5 21 | 3 neters> 6 Rau 1 0 3 0 4 6- Rau 1 1 | 6 MF 2 0 6 0 8 | Rau 2 0 10 2 | 24 Total MF 5 0 27 | | UM TOTAL CHI-SAU <d.f. =<="" td=""><td>1.000 2.000 ARE = 5.5</td><td>1.60 5.89</td></d.f.> | 1.000 2.000 ARE = 5.5 | 1.60 5.89 |
| Total 10 MINU Trace Type L\$ SL NG HH Total CHI-SQUARE F-HAT LS SL | O ATES AF | OFFER TEST | 2 Ram 0 0 2 2 0 2 Ram 1 | 9 0 8 4 UF 3 | Ran 1 0 5 2 8 4 Ran 2 | 10 RANGE < 4-6 UF 3 0 13 5 21 -6 HF 4 | 3 noters) 6 Rau 1 0 3 0 4 6- Rau 1 0 | 6 WF 0 6 0 | Rau 2 0 10 2 | 24 Total MF 5 0 27 | | UM TOTAL CHI-SAU <d.f. =<="" td=""><td>1.000 2.000 ARE = 5.5</td><td>1.60 5.89</td></d.f.> | 1.000 2.000 ARE = 5.5 | 1.60 5.89 |
| Total 10 MINU Trace Type LS SL NC HH Total CHI-SQUARE F-HAT LS SL NC | 0 Raw 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 FER TE: | 2 Ram 0 0 2 0 2 Ram 1 1 2 0 | 8 0 0 8 4 HF 33 60 | Ran 1 0 5 2 8 4 Ran 2 0 3 | 10 RANGE < 4-6 UF 9 13 5 21 -6 HF 4 0 8 3 | 3 noters) 6 Rau 1 0 3 4 6- Rau 1 0 3 1 | 6 WF 1 0 5 2 | Rau 2 0 10 2 | 24 Total MF 5 0 27 | | UM TOTAL CHI-SAU <d.f. =<="" td=""><td>1.000 2.000 ARE = 5.5</td><td>1.60 5.89</td></d.f.> | 1.000 2.000 ARE = 5.5 | 1.60 5.89 |
| Total 10 HINU Trace Type LS SL NC HH Total CHI-SQUARE F-HAT LS SL NC HH CHI-SQUARE CHI-SQUARE CHI-SQUARE | 0 ATES AF | 0 FER TE: | 2 Ram 0 0 2 2 2 Ram 1 1 2 0 3 | 8 0 0 0 8 4 HF 3 6 0 12 | Ran 1 0 5 2 8 4 Ran 2 0 3 | 10 RANGE C 4-6 UF 3 0 13 5 21 -6 HF 4 0 8 3 15 | 3 neters) 6 Rau 1 0 3 4 6- Rau 1 0 3 1 4 | 6 2 2 2 3 3 4 5 5 2 3 3 5 5 2 3 5 5 5 5 5 5 5 5 5 5 5 | Rau 2 0 10 2 | 24 Total MF 5 0 27 | | UM TOTAL CHI-SAU <d.f. =<="" td=""><td>1.000 2.000 ARE = 5.5</td><td>1.60 5.89</td></d.f.> | 1.000 2.000 ARE = 5.5 | 1.60 5.89 |
| Total 10 HINU Trace Type LS SL NC HH Total CHI-SQUARE F-HAT LS SL NC HH CHI-SQUARE CHI-SQUARE CHI-SQUARE | 0 Ram 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 FER TE: | 2 PERIOD 2 Raw 0 2 2 - Raw 1 1 2 0 3 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 | 8 0 0 8 4 HF 5 6 6 12 | Ran 1 0 5 2 8 4 Ran 2 0 3 | 10 RANGE < 4-6 UF 9 13 5 21 -6 HF 4 0 8 15 | 3 noters) 6 Raw 1 0 3 0 4 6 - Raw 1 0 3 1 4 6 - 6 - 6 - 6 - 6 - 6 - 6 - 6 - 6 - 6 | 6 2 2 2 3 4 5 5 5 2 9 4 8 | Rau 2 0 10 2 | 24 Total MF 5 0 27 | | UM TOTAL CHI-SAU <d.f. =<="" td=""><td>1.000 2.000 ARE = 5.5</td><td>1.60 5.89</td></d.f.> | 1.000 2.000 ARE = 5.5 | 1.60 5.89 |
| Total 10 MINU Trace Type L\$ SL NC HH Total CHI-SQUARE F-HAT L\$ SL NC HI CHI-SQUARE HI TOTAL CHI-SQUARE UNLUES | 0 ATES AF | 0 FER TE: | 2 Rau 0 0 2 Rau 1 1 2 0 3 2- Rau 2- Rau | 8 0 0 8 4 UF 3 6 0 12 | Ram 1 0 5 2 8 4 Ram 2 0 3 1 6 | 10 RANGE < 4-6 UF 3 0 13 5 21 -6 UF 4 0 8 3 15 | 0 3 0 4 6-Rau 1 0 3 1 4 6-Rau 6-Rau Rau Rau Rau Rau Rau Rau Rau Rau Rau | 8 WF 1 0 5 2 9 9 | Rau 2 0 10 2 | 24 Total MF 5 0 27 | | UM TOTAL CHI-SAU <d.f. =<="" td=""><td>1.000 2.000 ARE = 5.5</td><td>1.600 5.800</td></d.f.> | 1.000 2.000 ARE = 5.5 | 1.600 5.800 |
| Trace Type Ls SL NC HH Total CHI-SQUARE F-HAT LS SL NC HH TOTAL CHI-SQUARE VALUES LS SL | 0 Ram 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | O O O O O O O O O O O O O O O O O O O | 2 Raw 0 0 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 8 0 0 0 8 4 WF 12 4 WF 2.667 | Ran 0 5 2 8 4 Ran 2 0 3 1 6 | 10 RANGE C 4-6 UF 3 0 13 5 21 -6 UF 4 0 8 3 15 | 3 neters) 6 Rau 1 0 3 0 4 6-Rau 1 0 3 1 4 6-Rau 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 6 | Rau 2 0 10 2 | 24 Total MF 5 0 27 | | UM TOTAL CHI-SAU <d.f. =<="" td=""><td>1.000 2.000 ARE = 5.5</td><td>1.600 5.800</td></d.f.> | 1.000 2.000 ARE = 5.5 | 1.600 5.800 |
| Total 10 MINU Trace Type L\$ SL NC HH Total CHI-SQUARE F-HAT L\$ SL NC HI CHI-SQUARE HI TOTAL CHI-SQUARE UNLUES | 0 Ram 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | OFER TES | 2 Raw 1 1 2 0 3 3 2- Raw 0.000 | 8 0 0 0 8 4 WF 12 4 WF 2.667 | Ram 1 0 5 2 8 4 Ram 2 0 3 1 6 | 10 RANGE < 4-6 UF 3 0 13 5 21 -6 UF 4 0 8 3 15 | 0 Raw 1 0 3 0 4 6- Raw 1 0 3 1 4 6- Raw 0 0 0 | 8 WF 1 0 5 2 9 9 | Rau 2 0 10 2 | 24 Total MF 5 0 27 | | UM TOTAL CHI-SAU <d.f. =<="" td=""><td>1.000 2.000 ARE = 5.5</td><td>1.60 5.89</td></d.f.> | 1.000 2.000 ARE = 5.5 | 1.60 5.89 |

Table C52. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 MINUT | res dur | ING TE | ST PERIO | D | | RANGE (| neters> | | | | CHY-SQU | JARE F-HAT | • |
|--------------------------------|----------|------------|----------|-------------|----------------|-------------|----------------|---------|-----------|-------|--|------------|------|
| Trace | . 0 | -2 | | 2-4 | | 4-6 | | 6-8 | . <u></u> | Total | FOR 2 T | EST PERIO | DS . |
| Tupe | Rau | HF | Rau | HF | Rau | ИF | Rau | UF | Rau | uf | Rau | UF | |
| L.S | Ú | 0 | 3 | 11 | 2 | 5 | 0 | 0 | 5 | 16 | 4 | 12 | • |
| SL . | • | 0 | 2 | 8 | 3 | 8 | 0 | υ | S | 16 | 3 | 8 | • |
| NC | 0 | 0 | 4 | 15 | 4 | 10 | . 8 | 15 | 16 | 40 | 12 | 32 | |
| HH | 0 | 0 | 0 | 0 | 0 | 0 | 1 1 | 2 | 1 | 2 | 2 | 4 | • |
| Total | Ú | 0 | 9 | 34 | 9 | 23 | 9 | 17 | 27 | 74 | 20 | 55 | |
| 10 MINU | res aft | ER TES | T PERIOD | | | RANGE (| neters) | | | • | | | |
| | 0 | -2 | ; | 2-4 | | 4-6 | 4 | 6-8 | | Total | CHI —SQU | JARE VALUE | |
| Trace Tupe | Ram | uF | Rau | uf | Rau | UF | Rau | HF | Rau | ИF | | EST PERIO | |
| LS | 0 | ~ <u>0</u> | 1 | 4 | 1 | | 0 | | 2 | 7 | | Rau | ИF |
| SL | o | ٥ | 0 | ٠. و | 0 | 0 | 0 | o | 0 | 0 | LS | 1.286 | 3.5 |
| NC | 0 | ٥ | 3 | 11 | 4 | 10 | 1 | 2 | . 8 | 23 | SL | 5.000 | 16.0 |
| им | ٥ | 0 | 0 | 0 | 1 | 3 | 1 | 2 | 2 | S | NC | 2.667 | 4.5 |
| Total | 0 | 0 | 4 | 15 | 6 | 16 | 2 | 4 | 12 | 35 | 1414 | 0.333 | 1.2 |
| | | | | | | | | • | • | | TOTAL. | 5.769 | 15.9 |
| CHI — SQUARI F—HAT | E 0~2 | | 2 | -4 | | -6 | 6 | -8 | | | <d.f. =<="" td=""><td></td><td>141</td></d.f.> | | 141 |
| · | Rau_ | uf _ | Rau | | Rau | MF | Rau | | | | (a) pha | 05> | |
| LS SL | 0 | 0 | 2 1 | 8 4 | 2 2 | - 1 | 0 | 0 | | | | | |
| NC | o | 0 | 4 | 15 | • | 10 | 5 | 9 | | | | | |
| HH TOTAL | 0 | 0 | 0 7 | 0 25 | 8 1 | 2 20 | 1 6 | 2 11 | | | | | |
| CHI – SQUA RI VALUES | 0~2 | | 2 | -4 | 4 | -6 | 6 | -8 | - | | | | |
| LS · | Rau | HF | 1.000 | иF 3.267 | Rau 0.333 | NF 0.500 | Rau | WF | | | | | |
| SL | | | 2.000 | 8.000 | 3.000 | 8.000 | | == | | | | | |
| HC | | | 0.143 | 0.615 | 0.000 | 0.000 | 5.444 | 9.941 | | | | | |
| HH TGTAL | | | 1.923 | 7.367 | 1.000 0.600 | 3.000 | 8.000 4.455 | 0000 | | | | | |

Table C53. Indian Point hawner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | T | ridal Pi | hase: | 30 min a high tid | fter • | Duration Treatmen | of Test t Type: | : 10 min, 20 sec o | her 3 only n, 20 sec of | Test Da Test Ti | me: | 2/20/88 0055 |
|---------------------|-----------|--------|----------------|-------|----------------------|-------------|----------------------|--------------------|-----------------------|----------------------------|--------------------|--------------------|-----------------|
| 10 HIN | ITES DURI | G TEST | PERIO | , | | RANGE < | meters) | | | 22400425 | | | |
| _ | 0-2 | 2 | | 2-4 | | 4-6 | - | 6-8 | | Total | CHI-SQL FOR 2 T | ARE F-HATEST PERIO | r DDS |
| Trace Type | Rau (| af | Rau | HF | Rau | ИF | Ran | иF | Ray | WF | Rau | ИF | |
| LS | Q | 0 | o | Ó | 3 | 8 | 0 | 0 | : | 8 | 3 | 8 | |
| SŁ | 0 | 0 | 0 | 0 | 0 | 0 | .0 | 0 | 0 | 0 | 0 | 0 | |
| HC | 1 | 8 | 2 | 8 | 1 | 3 | . 4 | . 8 | | 27 | 10 | 30 | |
| ни - | 0 | • 0 | 0 | . 0 | 0 | ٥ | 3 | 6 | : 3 | 6 . | 2 | 3 | |
| Total | 1 | 8 | 2 | 8 | 4 | 11 | 7 | 14 | 14 | 41 | 15 | 40 | |
| | LTDC 0000 | | | | • | | | • | | | | | |
| 10 MIN | JTES AFTE | C LESI | LEKI OR | | | RANGE (| neters> | | | | | | |
| _ ` | 0-2 | 2 | : | 2-4 | | 4-6 | | 6~8 | : | Total | CHI -SQL | IRRE VALU | E |
| Trace Tupe | Ran I | uF | Ran | ИF | Rau | UF | Ran | HF | Rau | ИF | FOR 2 1 | EST PERI | |
| LS | | 0 | 0 | 0 | 2 | 5 | 1 | 2 | 3 | 7 | | Raw | MF |
| SL | , o | 0 | 0 | . 0 | . 0 | 0 | 0 | 0 | a | O | LS | 0.000 | 0.06 |
| NC | 0 | 0 | · 3 | 11 | 6 | 15 | > | 6 | 12 | 32 | SL | | |
| ин | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | o | | o . | MC | 0.800 | 0.42 |
| Total | 0 | 0 | 3 | 11 | 8 | 20 | 4 | 8 | 15 | 39 . | IIII Total | 3.000 | 6.00 |
| | `- | • | | | | | | • | = | | TOTAL | 0.034 | 0.05 |
| CHI —SQUAF F—HAT | ₹E 0-2 | | 2. | -4 | 4 | -6 | 6 | -8 | | | (d.f | | 841 |
| | | 4F | Rau | HF | Rau | | Rau | uf | | | (al pha | = .05> | |
| LS SL | 0 | 8 | 0 | 0 | . 3 | 7 | 10 | 1 | | - | | | |
| NC MM | 1 | 4 0 | 3 | 10 | 4 | 9 | 4 2 | Ž | | • | | | |
| TOTAL | 1 | 4 | 3 | 10 | ě | 16 | 6 | 11 | | | | | |
| CHI -SQUA | | | _ | | _ | _ | _ | | | | | | |
| VALUES | 0-2 | | | -4 | | -6 | b | -8 | | | | | |
| ĻS | Rau I | iF | Raн —— | HF | 0.200 | UF 0.692 | Rau 1.000 | uf 2.000 | | | | | |
| SL NC | 1.000 8 | .000 | 0.200 | 0.474 | 3.571 | 8.000 | 0.143 | 9.286 | | | | | |
| TOTAL | 1.000 8 | .000 | 0.200 | 0.474 | 1.333 | 2-613 | 3.000 0.816 | 6.000 1.636 | | • | | | |

Table C54. Indian Point hawner test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 MINUT | ES BEFO | RE TES | T PERIOD | | | | | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | | | | ****** | 200-00 |
|---|---|---|---|--|---|---|--|---|-------|-----------------------------------|---------------------------------|----------------------------|--------------------|
| | 4 | | • | | RA | NGE (F | eters> | | | | CHT-50L | JARE F-HA | r . |
| Trace | 0- | 2 | 2~ | 4 | 4- | 6 | 6- | 8 | | Total | | EST PERI | |
| Tupe | Rau | HF | Rau | uf_ | Rau | HF | Rau | uf : | Rau | uf | Rau | HF | |
| .s | 0 | 0 | 0 | 0 | 0 | Q | 0 | 0 | 0 | 0 | 3 | 7 | * |
| 5L. | • | 0 | ٥ | 0 | · O | 0 | · o | 0 | 0 | o | 0 | 1 | |
| iC . | 0 | 0 | 1 | 4 | 0 | O | 0 | 0 | 1 | 4 | 3 | 7 | |
| ш. | 0 | 0 | Ö | 0 | • 0 | 0 | 0 | 0 | o ' | G | D | 0 | |
| [otal | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 1 | 4 | 6 | 15 | |
| 10 HINUT | ES DURI | NG TES | T PERIOD | | RA | INGE (| oters> | | | ٠ | | | |
| - | 0- | -2 | 2- | 4 | 4- | 6 | 6- | | | Total | | IARE VALU | |
| Trace Type | Rau | WF . | Rau | µF | Rau | WF. | Rau | HF . | Ran | uf | FOR 3 1 | 'EST PERI | |
| .s . | o | 0 | 0 | 0 | 2 | 5 | 1 | 2 | 3 | 7 | | Rass | HF |
| 5L | o | O | . 0 | 0 | 0 | . 0 | 0 | 0 | . 0 | 0 | LS | 3.333 | 11.14 |
| | Ω | 0 | a | 0 | 0 | 0 | 1 | 2 | 1 | 2 | SL | | 6.00 |
| NC | U | | • | - | _ | | | | | | | | |
| •- | 0 | 0 | 0 | 0 | 0 | _ 0 | 0 | 0 | 0 | 0 | MC | 4.667 | ***** |
| NC HH Total | _ | _ | _ | _ | | <u> </u> | <u>0</u> | | 0 | 0 | HC HH TOTAL | 9.833 | 14.00 26.53 |
| HH Total | 0 | <u>0</u> | 0 | 0 | 2 | 5 | | i | | | HH TOTAL | 9.833 | 26.53 |
| Total 10 HINU | 0 | O O TER TES | 0 | 0 | 2 | 5 MGE (| 2 | 4 | 4 | | HH TOTAL CHI—SQL (d.f. | 9. 933 JARE - 5. | 26.53 |
| Total 10 MINU | O O DTES AFT | O O TER TES | 0 0 T PERIOD | 0 | 0 2 RA 4- | 5 MGE (| 2 neters> | 4 | 4 | 9 | HH TOTAL CHI —SQL | 9. 933 JARE - 5. | 26.53 |
| HH Total 10 MINU Trace Type | O O DTES AFT | O O TER TES | 0 0 T PERIOD | 0 0 | 0 2 RA 4- | 5 MGE () | 2 neters> | 8 | 4 | 9 Total | HH TOTAL CHI—SQL (d.f. | 9. 933 JARE - 5. | 26.53 |
| Trace Type | O O OTES AFT | 0 0 FER TES | O O O O O O O O O O O O O O O O O O O | 0 0 | 0 2 Ra 4- | 5 MGE <, | 2 neters> 6- Rau | 8 HF | Rau | Total | HH TOTAL CHI—SQL (d.f. | 9. 933 JARE - 5. | 26.53 |
| HH Total | O O UTES AFT O- Rau | 0 0 FER TES | O O O O O O O O O O O O O O O O O O O | 0 0 4 UF | 0 2 RA 4- Rau 2 | S MGE () 6 MF | 2 neters> 6- Rau 2 | 8 4 4 | Ran | Total UF | HH TOTAL CHI—SQL (d.f. | 9. 933 JARE - 5. | 26.53 |
| IN TOTAL 10 MINU Trace Type LS SL NC | O O O O O O | O Q TER TES -2 -2 UF O | 0 0 T PERIOD 2- Ram | 0 0 4 | 0 2 R6 4- R84 2 | S INGE () 6 HF 5 | 2 neters> 6- Rau 2 | 8 NF 4 | Rau 5 | Total UF 13 | HH TOTAL CHI—SQL (d.f. | 9. 933 JARE - 5. | 26.53 |
| 10 MINU Total 10 MINU Trace Type LS | O O O O O O | O O O O O O O O O O O O O O O O O O O | 0 0 T PERIOD 2- Ram 1 0 | 0 0 4 HF 4 0 | 0 2 RA 4- Rau 2 1 | S MGE < 6 MF 5 3 | 2 neters> 6- Rau 2 0 | 8 NF 4 0 | Rau 5 | Total UF 13 3 | HH TOTAL CHI—SQL (d.f. | 9. 933 JARE - 5. | 26.53 |
| IN Total 10 MINU Trace Type LS SL NC NC NH Total CHI-SQUARE | O O O O O O O | O O O O O | 0 0 T PERIOD 2- Ram 1 0 1 | 0 0 4 4 0 4 0 | 0 2 RA 4- Rau 2 1 2 | 5 SMNGE Co | 2 neters> 6- Rau 2 0 3 | 8 4 0 6 | Rau 5 | 9 Total MF 13 3 15 | HH TOTAL CHI—SQL (d.f. | 9. 933 JARE - 5. | 26.53 |
| Trace Trace Type LS SL NC NC KH Total CHI-SQUARE F-HAT | 0 0 0 Raw 0 0 0 | O O O O O O O | 0 0 T PERIOD 2- Ram 1 0 1 | 0 0 4 4 0 4 0 | 0 2 RA 4- RAH 2 1 2 0 5 | 5 SMAGE 4, 66 MF 5 3 5 0 13 | 2 neters> 6- Rau 2 0 3 0 5 | 8 4 0 6 | Rau 5 | 9 Total MF 13 3 15 | HH TOTAL CHI—SQL (d.f. | 9. 933 JARE - 5. | 26.53 |
| Trace Type LS SL NC NC HH Total CHI-SQUARE F-HAT | 0 0 0 0 Raw 0 0 0 0 | O O O O O O | 0 0 T PERIOD 2- Ram 1 0 1 | 0 0 4 UF 4 0 4 0 | 0 2 Rau 2 1 2 0 5 | 5 NNGE Co | 2 Rau 2 0 3 0 5 6-8 Rau | 8 4 0 6 0 | Rau 5 | 9 Total MF 13 3 15 | HH TOTAL CHI—SQL (d.f. | 9. 933 JARE - 5. | 26.53 |
| 10 MINU Trace Type LS SL NC NH Total CHI-SQUARE F-HAT LS SL | 0 0 Raw 0 0 0 0 0 | O O O O O O O O O O O O O O O O O O O | 0 0 T PERIOD 2- Ram 1 0 1 | 0 0 4 HF 4 0 4 0 8 | 2 RAH 2 1 2 0 5 RAH 1 0 1 | 5 S S O 13 S S O 13 S S O S S O S S S O S S S S S S S S S | 2 neters> 6-Rau 2 0 3 0 5 6-8 Rau 1 0 1 | 8 4 0 6 10 | Rau 5 | 9 Total MF 13 3 15 | HH TOTAL CHI—SQL (d.f. | 9. 933 JARE - 5. | 26.53 |
| 10 MINU Frace Type LS SL NC NC HH Fotal CHI-SQUARE F-HAT LS SL | 0 0 0 0 Raw 0 0 0 0 | O O O O O O O O O O O O O O O O O O O | 0 0 T PERIOD 2- Ram 1 0 1 | 0 0 4 0 4 0 8 | 0 2 RA 4- Rau 2 1 2 0 5 | 5 NNGE Co | 2 0 3 0 5 6-8 Rau 1 0 0 | 8 4 0 10 | Rau 5 | 9 Total MF 13 3 15 | HH TOTAL CHI—SQL (d.f. | 9. 933 JARE - 5. | 26.53 |
| 10 MINU Trace Type LS SL NC SHI Total CHI-SQUARE F-HAT LS NC HU TOTAL CHI-SQUARE | 0 0 Raw 0 0 0 0 | 0 0 0 1ER TES -2 -2 -4 0 0 0 | 0 0 T PERIOD 2- Ram 1 0 1 0 2 | 0 0 4 0 4 0 8 | 0 2 R84 4- R84 2 1 2 0 5 R84 1 0 | 5 S O 13 S O 6 | 2 notors> 6- Rau 2 0 3 0 5 6-8 Rau 1 0 | 8 4 0 10 10 | Rau 5 | 9 Total MF 13 3 15 | HH TOTAL CHI—SQL (d.f. | 9. 933 JARE - 5. | 26.53 |
| 10 MINU Trace Type LS SL NC WH Total CHI-SQUARE SL NC WH TOTAL CHI-SQUARE | 0 0 0 0 Raw 0 0 0 0 0 0 0 0 0 0 | 0 0 0 1ER TES -2 -2 -4 0 0 0 | 0 0 T PERIOD 2-Ram 1 0 1 0 2 2-4 Ram 0 1 0 | 0 0 4 0 4 0 8 | 0 2 R84 4- R84 2 1 2 0 5 R84 1 0 1 0 2 | 5 S O 13 S O 6 | 2 0 6-8 Rau 1 0 1 0 2 6-8 | 8 4 0 10 10 | Rau 5 | 9 Total MF 13 3 15 | HH TOTAL CHI—SQL (d.f. | 9. 933 JARE - 5. | 26.53 |
| 10 MINU Trace Type LS SL NC WH Total CHI-SQUARE SL NC WH TOTAL CHI-SQUARE | 0 0 0 0 Raw 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 1 1 1 0 0 0 0 | 0 0 T PERIOD 2-Ram 1 0 1 0 2 2-4 Ram 0 1 0 | 0 0 4 0 4 0 8 | 0 2 Rfi 4- Rau 2 1 2 0 5 Rau 1 0 1 0 2 2 4-6 Rau 4-6 Rau 4-6 4-6 Rau 4-6 4-6 4-6 4-6 4-6 4-6 4-6 4-6 4-6 4-6 | 5 S S S S S S S S S S S S S S S S S S S | 2 neters> 6-Rau 2 0 3 0 5 6-8 Rau 1 0 1 0 2 6-8 Rau 1 0 1 0 2 | 8 4 0 10 10 10 10 10 10 10 10 10 10 10 10 1 | Rau 5 | 9 Total MF 13 3 15 | HH TOTAL CHI—SQL (d.f. | 9. 933 JARE - 5. | 26.53 |
| 10 MINU Frace Type LS SL NC NH Fotal CHI-SQUARE F-HAT LS SL NC UH LS SL NC CHI-SQUARE CHI-SQUARE FAILUES | 0 0 0 0 Raw 0 0 0 0 0 0 0 0 0 0 | O O O O O O O O O O O O O O O O O O O | 0 0 T PERIOD 2-Ram 1 0 1 0 2 2-4 Ram 0 1 | 0 0 4 0 4 0 8 | 2 RAH 2 1 2 0 5 4-6 RAH 1 0 1 0 2 2 4-6 RAH 4.000 6 | 5 NAGE < | 2 neters> 6-Rau 2 0 3 0 5 6-8 Rau 1 0 1 0 2 2 6-8 Rau 2.000 4 | 8 HF 2 0 3 0 5 HF | Rau 5 | 9 Total MF 13 3 15 | HH TOTAL CHI—SQL (d.f. | 9. 933 JARE - 5. | 26.5 |

Table CSS. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidal P | hase: | 2 hrs be low tide | fore | Duration Treatmen | of Test t Type: | 30 Sec 0 | her 3 only n, 40 sec off | Test Da Test Ti | He: | 2/20/88 0505 |
|----------------------|--------|---------|-----------|----------|----------------------|----------------|----------------------|--------------------|----------|-----------------------------|--|-----------|-----------------|
| 10 MINUT | | | | | | | meters> | | | | CHT-5QU | ARE F-HA | |
| Trace | |)-2 | | 2-4 | | 4-6 | | 6-8 | : | Total | | EST PERI | 002 |
| Tupe | Rau | HF | Rau | HF | Rau | uf | Rau | UF | : Кан | uf | Rau | HF | |
| LS | o. | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | . 2 | 5 | • |
| SL. | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | . 2 | 1 | 3 | |
| NC | ٥ | 0 | ۵ | 0 | 0 | Q | 2 | 4 | 2 | 4 | 4 | 8 | |
| MM | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 3 | 1 | 2 | |
| Total | 0 | 0 | 0 | ŭ | 1 | 3 | 4 | 8 | 5 | 11 | 7 | 16 | |
| 10 MYNUT | ES AFI | TER TES | ST PERIOD | r to the | | RANGE (| (Heters) | | | , | | | |
| · • | • |)-2 | | 2-4 | | 4-6 | | 6-8 | | Total | | ARE VALUE | |
| Trace Type | Rau | UF | Ran | HF | Rau | ИF | Rau | HF | Rau | UF | rok 2 v | Rau | MF |
| LS | 0 | 0 | ٥ | 0 | 1 | 3 | 2 | 4 | 3 | 7 | LS | 1.000 | 2.77 |
| SL | . 0 | ٥ | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 3 | | | |
| NC | 0 | o | o | 0 | 2 | 5 | 3 | 6 | 5 | 11 | SL | 0.000 | 0.20 |
| нн | 0 | a | 0 | 0 | | a | • | 0 | 0 | 0 | NC | 1.286 | 3.26 |
| Total | 0 | 0 | 6 | 0 | 4 | 11 | 5 | 10 | 9 | 21 | HH TOTAL | 1.000 | 3.00 3.12 |
| CHI -SQUARE F-HAT | 0-2 | | . 2 | :4 | 4 | - \$ | 6 | -8 | • | | CHI-50U | ARE - 3. | |
| - | Rau | MF | Ran | | Rau | uF | Rau | HF | | • | <alpha< td=""><td>057</td><td></td></alpha<> | 057 | |
| LS SL NC | 0 | 9 | 0 | 0 | 1 | 2 2 | 2 | 3 | | | | | |
| NC | ā | ū | Ò | Õ | į | 3 | 3 | Š | | | | | |
| HH TOTAL | Ö | 8 | Õ | ů | 3 | 2 7 | 0 5 | 9 | | | | | |
| CHI-SQUARE VALUES | 0-2 | - | 2 | | 4 | -6 | | -8 | | | | | , |
| - | Rau | HF | Rau | HF | Rau | HF | Ran | | | | | | • |
| LS | | | | | 1.000 | 3.000 | 0.333 | 0.667 | | | - | | |
| SL NC | | | | | 1.000 | 3.000 5.000 | 1.000 | 2.000 0.400 | | | | | |
| HH | | | | | 1.000 | 3.000 | | | | | | | |
| TOTAL | | | | | 1.800 | 4.571 | 0.111 | 0.222 | | | | | |

Table C56. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidel Pi | nase: | 1.5 hrs low tide | | Duration Treatment | t Type: | t: 10 min 40 sec | on, 20 s | only ec off | Test Date Test Time | | 2/20/6 0525 |
|---------------------|---------------|----------|----------|-----------|-----------------------|----------------|-----------------------|----------------|---------------------|----------|----------------|---|------------------|----------------|
| | ITES OUR | ING TES | T PERIO |) | | | (neters) | | | 20005-04 | | | | |
| _ | 0- | -2 | 2 | 2-4 | | 4-6 | | 6-8 | | Total | | CHI-SQUAR FOR 2 TES | E F-HA T PERI | 00S |
| race upe | Rau | ИF | Rau | ИF | Rau | ИF | Rau | HF | Rau | WF | ~~~~ | Rau | uF | • |
| .s | Ó | 0 | 0 | 0 | 1 | 3 | 1 | 2 | -: | 5 | | 4 | 10 | • |
| L | o . | ٥ | 0 | Ð | 2 | \$ | 1 | 2 | 3 | 7 | | 2 | 4 | |
| c | 0 | Ú | 1 | 4 | 0 | 0 | 2 | 4 | 3 | 8 | | 3 . | 9 | |
| u | 0 | <u> </u> | 0 | 6 | 0 | 0 | 0 | 0 | _ 0 | 0 | _ | 2 | 4 | |
| otal | 0 | ٥ | 1 | 4 | 3 | • | 4 | 8 | 8 | 20 | | 10 | 25 | |
| 10 HINL | JYES AFTI | ER TEST | PERIOD | | | | | | • | * | | | | |
| | | | | | 1 | RANGE (| (neters) | | | | | | | |
| race | 0. | -2 | 2 | <u>-4</u> | | 4-6 | (| 6-8 | <u> </u> | Total | | CHI-SQUAR FOR 2 TES | E VALL | nns E |
| UP4 | Rau | uf | Rau | HF | Rau | HF | Rass | ИF | Rau | uf | | | Rau | UF |
| S | 0 | 0 | 1 | 4 | 3 | 8 | 1 | 2 | 5 | 14 | | | | |
| L | 0 | O | . 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | | | 1.286 | 4. |
| C | O | 0 | İ | 4 | 1 | . | . 1 | 2 | 3 | 9 | | | 3.000 | 7. |
| H | 0 | 0 | 0 | 0 | 2 | 5 | 1 | 2 | 3 | 7 | | | 0.000 | 0. |
| otal | 0 | o | 2 | 8 | 6 | 16 | 3 | 6 | 11 | 30 | - | | 3.000 | 7. |
| HI –SQUAF | . | | | ~ | | | | | • | | | | 0.474 | 2. |
| -HUL -24011 | 0-2 | | 2- | -4 | | -6 | 6. | ~8 | | | | CHI-50UAR | > | 841 |
| _ | Rau | HF | Rau | WF | Rau | HF | Rau | uf _ | | | | <alpha =<="" td=""><td>.057</td><td></td></alpha> | .057 | |
| S L | 0 | 0 | 0 | 2 0 | 2 1 | 3 | 1 | 2 | | | | | | • |
| iC iH | . 0 | .0 | 1 | . 4 | 1 | 3 2 3 | 2 | 3 | | | ÷ | | | • |
| OTAL | Ö | ŏ | 2 | ě | Ś | 12 | å | 7 | | | | | | |
| HI –SQUAF PALUES | 0-2 | | 2- | -4 | 4 | -6 | 6 | -8 | | | | , | | |
| _ | Rau | HF | Rass | MF | Rau | WF | Ran | MF | | | | | | |
| .S iL | | | 1.000 | 4.000 | 1.000 2.000 | 2.273 | 0.000 | 2.000 | | | | | | |
| ic ic | · | | 0.000 | 0.000 | 1.000 | 3.000 | 0.333 | 0.667 | | | | | | |
| IH OTAL | | | 0.333 | 1.535 | 1.000 | 5.000 2.667 | 1.000 | 2.000 0.286 | | | | | | |

Table C57. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| ***** | ********** | | | ****** | lou tide comment | | ******* | | | A, 30 sec of | | |)545 |
|------------------------------|-------------|------------|-------------------------|----------------|---|--|--------------------------------|-------------------------|-----|--------------|---|----------------|------------|
| . 10 HTN | IUTES DURII | | | | | MANGE (| | | | | CHI-SQU | ARE F-HAT | r |
| Trace | 0-: | 2 | - 2 | !-4 !~ | | 1-6 | | 6-8 <u>:</u> | | Total | FOR 2 T | EST PERI |)DS |
| Tupe | Rau I | uf | Rau | MF | Rau | MF | Rau | NF : | Rau | UF | Rau | HF | |
| LS | 4 | 30 | 1 | 4 | 0 | 0 | 1 | 2 | 6 | 36 | 4 | 20 | • . |
| 5L | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | o | 0 | . 2 | 3 | |
| NC | 0 | 0 | 1 | 4 | -2 | s | 1 | 2 | 4 | 11 | 5 | 12 | |
| 414 | 0 | o | • | . 0 | 2 | 5 | 0 | 0 | ą | 5 | 1 | 3 | |
| rotal | 4 | 30 | 2 | 6 | 4 | 10 | 2 | 4 | 12 | 52 | 11 | 37 | |
| 10 HIN | WTES AFTE | R' TESI | FERIOD | | | | | | | | | | |
| | | | | | | | neters> | | | | | | |
| frace | 0-: | | 2 | 2-4 | | 1-6 | | 6-8 | | Total . | | ARE VALUE | |
| upe | Rau | µҒ | Ran | HF | Rau | HF | Rau | ИF | Rau | HF. | | Rau | HF |
| .5 | 0 | 0 | 0 - | 0 | 1 | 3 | . 0 | 0 | 1 | 3 | LS | 3.571 | 27.9 |
| iL. | ٥ | 0 | 0 | 0 | 0 | 0 | 3 | 6 | 3 | 6 | SL | 3.000 | 6.0 |
| NC O | 0 | ٥ | 1 | . 4 | 1 | . 3 | 3 | 6 | 5 | 13 | NC | | |
| 4H - | û | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | W. | 0.111 | 0.1 5.0 |
| Total | 0 | o | 1 | 4 | 2 | 6 | 6 | 12 | 9 | 22 | TOTAL | 2.000 0.429 | 12.1 |
| CHI -SQUA | | | | | | | | • | - | | | ARE = 3.4 | _ |
| F_HAT | 0-2 | | 2- | -4 | 4- | -6 | 6 | -8 | | | <d.f< td=""><td>1></td><td>341</td></d.f<> | 1> | 341 |
| | | MF | Rau | uf | Rau | MF | Rau | HF | | | <alpha< td=""><td>05)</td><td></td></alpha<> | 05) | |
| SL. | õ | 15 | 1 0 | 2 | 0 | 2 | 1 2 | 3 | | | 4 | | |
| NC HH | ů G | 0 | 1 | 4 | 2 1 | 4 | 2 | 4 0 | | | | | |
| TOTAL | 2 | 15 | 2 | 6 | 3 | . 8 | 4 | 8 | | | | | |
| CHI —SQUA VALUES | 0-2 | | 2- | -4 | 4- | -6 | 6 | -8 | | | | * | |
| S SL IC IN TOTAL | | MF .000 | 1.000 0.000 0.333 | 4.000 0.000 | Rau 1.000 0.333 2.000 0.667 | UF 3.000 0.500 5.000 1.000 | RAH 1.000 3.000 1.000 | 2.000 6.000 2.000 | • | | | | |

Table C58. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | **** | | Tidal P | | l hr befo low-tide | | Treatmen | t Type: | 40 sec o | her 3 only n, 40 sec off | | me: C | 2/20/88 3605 ====== |
|---------------------|----------|------------|----------|-----------------|-----------------------|----------|----------|---------|----------|-----------------------------|----------|-----------|---------------------------|
| TO WING | TES DUR | ING TES | ST PERIO | D | ı | RANGE 4 | (neters) | | | | CHI -SQU | ARE F-HAT | Γ |
| Trace | 0 | 1-2 | | 2-4 | | 4-6 | | 6-8 | | Total | FOR 2 T | EST PERIC |)D\$ |
| Tupe | Rau | ИF | Rau | HF | Rau | UF | Rau | HF | Rau | ИF | Rau | uf | |
| LS | 0 | o | 0 | 0 | 2 | 5 | . 0 | 0 | 2 | 5 | 3 | 7 | |
| SL, | ۵ | 0 | ٥ | 0 | ,o | 0 | 0 | ŭ | | 0 | 1 | 1 | |
| NC | 0 | o | 1 | 4 | 4 | 10 | 1 | 2 | 6 | 16 | 4 | 11 | |
| ш | 0 | o | 0 | 0 | 0 , | 0 | 0 | 0 | i o | 0 | 1 | 2 | |
| Total | 0 | 0 | 1 | 4 | 6 | 15 | 1 | 2 | 8 | 21 | • | 20 | |
| 10 MENU | TES AFT | ER TEST | F PERIOD | | i | RANGE (| (neters) | | : | | | | |
| | _ 0 |)~2 | ; | 2-4 | | 4-6 | ٠., | 6-8 | : | Total | CHI -5QU | ARE VALUE | Ē |
| Trace Tupe | R +++ | ЦF | Rau | ИF | Rau | HF | Rau | MF | : Rau | uf | FOR 2 T | EST PERIC | |
| LS | <u>-</u> | ō | 0 | 0 | 1 | <u>-</u> | 3 | 6 | -: | 9 | , | Rau | HF |
| SL | 0 | o | 0 | o | . 0 | o | . 1 | 2 | : 1 | 2 | LS | 0.667 | 1.14 |
| NC | 0 | a | e 0 | | . 2 | 5 | 0 | o | : 2 | 5 | SL | 1.000 | 2.00 |
| ш | 0 | 0 | 0 | 0 | 1 | 3 | | 0 | 1 | 3 | NC | 2.000 | 5.76 |
| Total | 0 | v | 0 | . 0 | 4 | 11 | 4 | 8 | -: 6 | 19 | MH. | 1.000 | 3.000 |
| | | | | | | | | | : | | TOTAL | 0.000 | 0.100 |
| CHI-SQUAR F-HAT | 0-3 E | | 2 | -4 | 4 | -6 | 6 | -8 | | | (d.f. = | ARE - 3.6 | 141 |
| | Rau | HF | Rau | | Rau | ИF | Rau | ИF | | | Calpha | = .05> | |
| LS SL | 0 | 0 | 0 | ` 0 | 2 | 10 | 2 1 | 3 | | | | • | |
| NC | o. | Q | 1 | 2 | ž | 8 | 1 | 1 | | | | | |
| HH TOTAL | 0 | o o | 0 | 0 2 | 1 5 | 13 | 0 3 | 0 5 | | | | | |
| CHI-SQUAR VALUES | E 0-2 | | 2 | . -∢ | 4 | -6 | • 6 | -8 | | | | | |
| • | Rau | uf. | Rau | WF | Rau | uf | Rau | иF | | | | | |
| LS | ~~~ | | 227 | | 0.333 | 0.500 | 3.000 | 6.000 | | | | | |
| SL NC | | | | 4 200 | | | 1.000 | 2.000 | | | | - | |
| NEC HM | | | 1.000 | 4.000 | 0.667 1.000 | 1.667 | 1.000 | 2.000 | | | | | |
| TOTAL | | | 1.000 | 4.000 | 0.400 | 0.615 | 1.900 | 3.600 | | | | | |

Table CS9. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 MINU | POMENTEE Yes offo | | Tidel Pho Essensia T PERIOD | | 2 hrs aft low tide | | Treatment | Tupe: | 10 sec or | her 3 onl , 20 sec | ōf f | Test Da Test Ti | HO: | 2155 |
|---|--|---|--|--|--|---|--|----------------------------|--------------------|------------------------|---|--------------------|----------------------|-------------|
| TO MINO | IES BEFU | KE IES | 1 PERIOD | | R | ANGE (| neters> | • | | | | CM7_500 | MRE F-HAI | - |
| _ | 0-: | 2 | . 2- | -4 | 4 | 1~6 | 6 | -8 | | Total | | | EST PERI | |
| race 'ype | Rau | μF | Rau | WF | Rau | ИF | Rau | uf : | Ran | иF | - ` | Rau | HF | |
| .s | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 2 | 4 | _ | 3 | 7 | • |
| L | 0 | ٥ | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 3 . | | 1 | 2 | |
| c | 0 | o | 2 | 8 | 3 | 8 | 4 | 8 | 9 | 24 | | 6 | 18 | |
| I.I. | 0 | 0 | ٥ | 0 | . 0 | 0 | . 0 | 0 | 0 | o | | .1 | 2 | |
| otal | 0 | o, | (2 | 9 | 4 | 11 | 6 | 12 | 12 | 31 | | 11 | 29 | |
| 10 HINU | TES DURI | NG TES | T PERIOD | | 6 | ANGE (| neters) | : | | | | | | |
| | 0~ | 2 | 2. | ~ 4 | | 1-6 | 6 | ~a : | | Total | | | ARE VALU | |
| upe race | Raи | HF. | Rau | HF | Rau | UF | Rau | HF | Rau | ЧF | - | FOR 3 T | EST PERIO | |
| .s | 0 | 0 | 1 | 4 | 0 | 0 | <u>-</u> | 0 | 1 | 4 | | | Rau | HF |
| L. | Q | o | 1 | 4 | . 0 | 0 | 0 | 0 | 1 | .4 | | LS | 2.000 | 7.7 |
| c . | 1 | | 1 | 4 | 4 | 10 | . 2 | 4 : | 8 | 26 | | SL | 0.000 | 5.5 |
| | | | ۵ | 0 | ۵ | '0 | 1 | 2 | 1 | 2 | | NC | 5.833 | 16.4 |
| H | 0 | 0 | u | u | • | . • | | | | | | | | |
| | <u>0</u> | <mark>8</mark> 0 | 3 | 12 | <u>-</u> | 10 | | | 11 | 36 | | HH TOTAL | 2,000 -0.545 | 7.51 5.5 |
| otal | -1 | 8 | | ~~ | 4 | 10 | | | 11 | 36 | | TOTAL | -0.545 | 5.5 |
| otel 10 MIN | -1 | ER TES | T PERIOD | ~~ | 4 | 10 | 3 neters> | | 11 | 36 Total | | TOTAL CHI-SQL | -0.545 IARE = 5.4 | 5.5 |
| otal 10 MIN | UTES AFT | ER TES | T PERIOD | 12 | 4 | 10 | Heters> | 6 | 11 | · | · . | TOTAL | -0.545 IARE = 5.4 | 5.5 |
| otal 10 MIN race upe | ures aft | ER YES | 3 T PERIOD2. | 12 | 4 | 10 RANGE (| neters> | -8 | | fotal | · . - | TOTAL CHI-SQL | -0.545 IARE = 5.4 | 5.5 |
| otal 10 MINI Pace upe | UTES AFT | ER YES | T PERIOD | 12 -4 UF | . Rau | 10 RANGE (| 3 Heters> | -8 -4F | Rau | Total UF | · . | TOTAL CHI-SQL | -0.545 IARE = 5.4 | 5.5 |
| 10 MING | UTES AFT | ER TES | T PERIOD 2- Ram | 12 -4 UF | Rau | 10 RANGE (I-6 IF | Dineters> 6 Ram 3 | -8 -4F | Rau 5 | Fotal HF | - - | TOTAL CHI-SQL | -0.545 IARE = 5.4 | 5.5 |
| 10 MINI Trace upe .5 SL | UTES AFT | ER TES | 2 Rau 1 | 12 4 4 | Rau | 10 RANGE (1-6 UF | Neters> 6 Ram 3 | -8 -4F -6 | Rau 5 0 | UF | - - - | TOTAL CHI-SQL | -0.545 IARE = 5.4 | 5.5 |
| io MINI Trace upe .5 SL | UTES AFT | 2 WF 0 | 2 Raw 1 0 | 12 UF 4 | Rau 1 0 | 10 RANGE (1-6 UF 0 | Neters> 6 Ram 3 0 | -8 -8 -8 -9 -4 | Rau 5 0 2 | UF 13 0 | - - - | TOTAL CHI-SQL | -0.545 IARE = 5.4 | 5.5 |
| in tal 10 MINI Trace Tupe S S L IC IN Total THE THE THE THE THE THE THE TH | 0- Ram 0 0 0 | 8 ER YES 2 | PERIOD 2: Raw 1 0 0 | 12 UF 4 0 | Rau 1 0 | 10 RANGE (1-6 UF) 0 0 | Directors Signature Signat | -8 -8 -0 -12 | Rau 5 0 2 | Fotal UF 13 0 4 5 | - · · · · · · · · · · · · · · · · · · · | TOTAL CHI-SQL | -0.545 IARE = 5.4 | 5.5 |
| 10 MINI Tace UPP S S IL IC ILI IC IC ILI IC ILI IC ILI IC ILI IC ILI IC ILI IC ILI IC ILI IC ILI IC | TES AFT O-Raw O O O O C Raw O C C Raw O C C C C C C C C C C C C C C C C C C | e ER TES 2 UF 0 0 0 | PERIOD 2- Ram 1 0 0 | 12 UF 4 0 | Rau 1 0 0 | 10 RANGE (1-6 UF) 0 0 | 3 Heters> 6 Ram 3 0 2 1 6 Ram | -8 -8 -0 -12 | Rau 5 0 2 | Fotal UF 13 0 4 5 | - · · · · · · · · · · · · · · · · · · · | TOTAL CHI-SQL | -0.545 IARE = 5.4 | 5.5 |
| 10 MINI Face UPP .S SL IC IL IC INI Total -HAT | 0-Rau 0 0 0 0 0 0 0 | e ER TES | 2 Raw 1 0 0 | 12 UF 4 0 0 | Rau Rau 3 0 1 2 4- Rau 0 | 10 RANGE (1-6 WF 3 0 0 5 6 | 3 neters> 6 Ram 3 0 2 1 | -8 | Rau 5 0 2 | Fotal UF 13 0 4 5 | - - - | TOTAL CHI-SQL | -0.545 IARE = 5.4 | 5.5 |
| 10 MINI Face UPP S S S S S S S S S S S S S S S S S S | 0-Ram 0 0 0 0 0 Ram 0 0 0 0 Ram 0 0 0 | ER YES 2 UF 0 0 0 0 UF 0 3 | 2 Raw 1 0 0 0 | 12 UF 0 0 4 4 MF 3 1 | Rau 1 0 0 1 2 4- Rau 0 0 | 10 RANGE (1-6 UF 3 0 0 0 3 6 | 3 neters> 6 Ram 3 0 2 1 6 Ram 2 0 3 | -8 | Rau 5 0 2 | Fotal UF 13 0 4 5 | - · · · · · · · · · · · · · · · · · · · | TOTAL CHI-SQL | -0.545 IARE = 5.4 | 5.5 |
| 10 MINI Trace upe .S SL 4C IM Total CHI-SQUAR | TAN O | e ER TES 2 UF 0 0 0 0 | 2 Ram 1 0 0 0 | 12 UF 4 0 0 4 4 MF 3 | Rau Rau 3 0 1 2 4- Rau 0 | 10 RANGE (1-6 UF 0 0 5 6 -6 UF 1 | 3 Heters> 6 Ram 3 0 2 1 6 Ram 2 0 | -8 | Rau 5 0 2 | Fotal UF 13 0 4 5 | - - - | TOTAL CHI-SQL | -0.545 IARE = 5.4 | 5.5 |
| 10 MINI Tace upe .S .L .C .L .C .H .C .HI-SQUAR .L .IL .IL .IL .IL .IL .IL .IL .IL .IL | 0 2 Raw 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | e ER TES | 2 Ram 1 0 0 | 12 UF 4 0 0 4 4 MF 3 1 4 0 8 | Вам Вам О О 1 2 Вам О О О О О О О О О О О О О | 10 RANGE (1-6 UF | 3 Ram 3 0 2 1 6 Ram 2 0 3 | -8 | Rau 5 0 2 | Fotal UF 13 0 4 5 | - - | TOTAL CHI-SQL | -0.545 IARE = 5.4 | 5.5 |
| Tace UP+ S S IL IC III Fotal CHI-SQUAR IC III COTAL CHI-SQUAR CHI-SQUAR CHI-SQUAR | 0-2 Rau 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 8 ER TES 2 UF 0 0 0 | 2 Ram 1 0 0 1 2-Ram 1 0 2-Ram 1 0 2-Ram 1 0 2-Ram 1 0 2 | 12 UF 4 0 0 4 4 WF 3 1 4 0 8 | Rau Rau 0 0 1 2 4- Rau 0 0 2 0 3 | 10 RANGE (1-6 UF 3 0 0 3 6 -6 -6 | 3 Ram 3 0 2 1 6 Ram 2 0 3 | -8 | Rau 5 0 2 | Fotal UF 13 0 4 5 | | TOTAL CHI-SQL | -0.545 IARE = 5.4 | 5.5 |
| 10 MINI Tace UPP .5 SL IC IN CHI-SQUAR -HAT -SIL IC III FOTAL CHI-SQUAR -ARLUES .5 | 0-2 Ran 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | e ER TES | 2 Raw 1 0 0 0 1 2- Raw 1 0 0 2- Raw 1 0 1 0 2- Raw 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 12 UF 0 0 4 4 MF 3 1 4 0 8 | Вам Вам О О 1 2 Вам О О О О О О О О О О О О О | 10 RANGE (1-6 UF 0 0 3 6 -6 UF 1 1 6 1 9 | 3 Rau 1.500 | -8 -12 -12 -10 -8 | Rau 5 0 2 | Fotal UF 13 0 4 5 | - - | TOTAL CHI-SQL | -0.545 IARE = 5.4 | 5.5 |
| Tace UPP S IL IC III OTAL S IL IC III OTAL S IC III OTAL S IC III OTAL S IC III OTAL S IC III OTAL | 1 UTES AFT 0-Rain 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | e ER TES 2 UF 0 0 0 WF 0 3 0 3 | 2 Raw 1 0 0 0 1 1 2 Raw 1 0 0 2 2 Raw 0 0 0 1 | 12 UF 0 0 4 WF 3 1 4 0 8 | Ram 1 0 1 2 Ram 0 0 2 0 3 4- Ram Ram | 10 RANGE (1-6 UF | 3 neters> 6 Ram 3 0 2 1 6 6 Ram 5 5 5 6 6 Ram 1.500 0.000 | -8 | Rau 5 0 2 | Fotal UF 13 0 4 5 | - - | TOTAL CHI-SQL | -0.545 IARE = 5.4 | 5.5 |

Table C60. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidal Ph | | 1.5 hrs low tide | after | Duration Treatmen | of Test t Tupe: | t: 10 min | , har 3 only on, 30 sec off | Test Da Test Ti | te: ne: | 2/20/88 2215 |
|-------------------------------|-------------------------|---|-------------------------------------|-------------------------------|--|---|----------------------------------|-------------------------|-------------------|--------------------------------|--|----------------------|-----------------|
| 10 HINU | TES DURI | NG TE | ST PERIOD |) | 190 9H2D25 | RANGE (| (neters) | 4460CAT | Pie viezze | | | | _ |
| T | 0- | 2 | 2 | -4 | | 4-6 | | 6-8 | | [Otal | | ARE F-HA EST PEKI | |
| Trace Type | Rah | HF | Rau | HF | Rau | UF | Ran | MF | Rası | ЦF | Rass | HF | • |
| LS | o | o | 0 | 0 | 3 | 8 | 3 | 6 | 6 | 14 | 6 | 14 | • |
| SL | O | ٥ | . 0 | o | O | 0 | 0 | 0 | 0 | , o | 1 | 4 | |
| NC | ٥ | O | 3 | 11 | 3 | 8 | 4 | 9 | - 10 | 27 | . 6 | 15 | |
| ни | O | 0 | . 0 | 0 | . 0 | 0 | | 2 | 1 | 2 | 2 | 4 | • |
| Total | 0 | 0 | 3 | 11 | 6 | 16 | 8 | 16 | 17 | 43 | . 14 | 36 | - |
| 10 MINU | TES AFTE | R TES | T. PERIOD | | | RANGE (| (neters) | | * | • | | • a | |
| _ | 0- | -2 | 2 | -4 | • | 4-6 | - | 6-8 | : | Total | | ARE VALU | |
| Trace Type | RaH | HF | RaH | HF | Ran | ИF | Rau | KF | Rau | UF | FOR 2 T | EST PERI | |
| LS | 0 | 0 | 1 | 4 | 0 | Ó | 5 | 10 | 6 | 14 | | Rau | HF |
| SL. | 0 | 0 | 1 | 4 | 1 | 3 | 0 | . 0 | 2 | 7 | LS | 0.000 | 0.00 |
| NC | 0 | 0 | 0 | 0 | 1 | 3 | o | 0 | : 1 | 3 | St. | 2.000 | 7.00 |
| MH | 0 | 0 | 0 | | 1 | > | 1 | 2 | 2 | . 5 | NC | 7.364 | 19.20 |
| Total | 0 | 0 | 2 | 8 | 3 | 9 | 6 | 12 | 11 | 29 | 1111 | 0.333 | 1.20 |
| CHI -SQUAR | ~ | | | | | | | | • | | TOTAL | 1.286 | 2.72 |
| F-HAT | 0-2 | | . 2- | -4 | 4 | -6 | 6 | -8 | | | (d.f | ARE - 3. | 941 |
| LS SL HC HH TOTAL | Rau O O O Ú | UF 000000000000000000000000000000000000 | Rau 1 1 2 0 | UF 2 2 6 0 10 | Rau 2 1 2 1 5 | NF 4 2 6 2 13 | Rau 4 0 2 1 | HF 8 0 4 2 | | | <el pha<="" td=""><td>057</td><td></td></el> | 057 | |
| CHI-SQUAR VALUES | • | | 2- | - | _ | -6 | | -8 | | ÷. | | | |
| LS SL NC NN TGTAL | | MF | Rau 1,000 1,000 3,000 1 | #F 4.000 4.000 1.000 | Raid 3.000 1.000 1.000 1.000 | WF 9.000 3.000 2.273 3.000 1.960 | 9.500 4.000 0.000 0.286 | 8.000 0.000 0.571 | | | | | |

Table C61. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| 10 HINU | TES DUR | ING T | EST PERIO | D D | | | menessa (neters) | ### Bir 3 = 1 | ******* | : 22 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | ****** | .c.=454375 | |
|-------------------------------|----------|-------|-----------|-------------------------|--|---|-------------------------|----------------------|---------|--|-----------|----------------|------------|
| | 0 | -2 | | 2-4 | | 1-6 | | 6~8 | • | Total | | ARE F-HAT | |
| irace Type | Rau | иF | Rau | UF | Rau | ИF | Rau | ИF | RaH | HF | Rau | ИF | |
| .s | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 6 | 3 | 6 | 4 | 9 | • |
| 5L | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 3 | 1 | 3 | |
| ic | 0 | 0 | 4 | 15 | 5 | 13 | 3 | 6 | 12 | 34 | 9 | 25 | |
| 414 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | ð | 1 | 3 | 1 | 2 | |
| rotal | ú | 0 | 4 | 15 | 7 | 19 | 6 | 12 | 17 | 46 | 14 | 30 | |
| 10 HI HU | TES AFT | ER TE | ST PERIOD | 1. | F | eange (| (neters) | | : | | | | |
| _ | 0 | -2 | | 2-4 | 4 | 1-6 | , | 5~8 | : | Total | CHI-SQU | ARE VALUE | • |
| frace Type | Rau | ЫF | Rau | UF | Rau | HF | Rau | μF | Rass | ИF | FOR 2 T | EST PERIO | |
| .s | 0 | 0 | 1 | 4 | 2 | <u>-</u> - | 1 | 2 | 4 | 11 | | Rass | HF |
| 5L | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 1 | > | LS | 0.143 | 1.4 |
| IC | 0 | 0 | 2 | 8 | 2 | S | 1 | 2 | 5 | 15 | SL. | 0.000 | 0.0 |
| 4H | 0 | 0 | . 0 | 0 | 0 | 0 | ð | 0 | 0 | 0 | NC Mu | 2.882 1.000 | 7.3 0.0 |
| Total | 0 | 0 | 3 | 12 | 5 | 13 | 2 | 4 | 10 | 29 | TOTAL | 1.815 | 3.8 |
| CHI-SQUAR F-HAT | E 0-2 | | 2 | -4 | 4- | - 6 | 6. | -8 | _ | | CHI-SQU | ARE - 3.6 | |
| | Rau | HF | Rau | | Rau | HF | Rau | HF | • | | <-li>lpha | 05) | |
| L S SL | 0 | ů | 0 | 2 | i | 3 | 0 2 | 4 0 | | | | | |
| NC HH | 0 | 0 | 3 | 12 0 | 4 | 9 | 2 0 | 4 | | | | | |
| TOTAL | ŏ | ŏ | 4 | 14 | 6 | 16 | 4 | 8 | | • | | | |
| CHÍ-SQUAR VALUES | 0~2 E | | 2 | -4 | . 4- | -6 | 6- | -8 | | | | | |
| LS SL NC MM TOTAL | Rau | MF | 0.667 | 4.000 2.130 0.333 | Rau 2.000 0.000 1.286 1.000 0.333 | HF 5.000 0.000 3.556 3.000 1.125 | 1.000 1.000 2.000 | UF 2-000 2-000 | | | | | |

Table C62. Indian Point hammer test monitoring using 15 degree oblique transducer located at unit 3, intake 35.

| | | | Tidal Pha | 501 | 2.5 hrs low tide | | Treatmen | t Type: | t: 10 мin, 10 sec o | her 3 only n, 20 sec off | Test Da Test Ti | te: . ne: | 2/20/68 2255 |
|-------------------------------|-----------------------------|----------|-------------------------------------|-------------------------------|--|---|--|--|------------------------|-----------------------------|------------------------------|--------------|---|
| 10 MI | NUTES DURING | TE: | ST PERIOD | | | | neters) | 三三年 五四日 美宝 | | p=+44#22222201 | | ARE F-HA | |
| T | 0-2 | | 2- | ٠4 | | 1-6 | | 6-8 | | Total | FOR 2 T | EST PERI | ODS |
| Trace Tupe | Rau HF | - | Rau | HF | Ran | uf | Rau | NF | Rau | UF | Rau | . HF | |
| LS | 0 | 0 | 5 | 19 | 2 | 5 | 3 | 6 | 10 | 30 | 8 | 22 | • |
| SL | ٥ | 0 | . 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 1 | > | |
| NC | o | 0 | 1 | 4 | 4 | 10 | 2 | 4 | 7 | 18 | 5 | 14 | |
| нн | 0 | 0 | 1 | 4 | 0, | 0 | 1 | 2 | 2 | 6 | 2 | 5 | |
| Total | 0 | 0 | 7 | 27 | 6 | 15 | 7 | 14 | 20 | 56 | 16 | 43 | |
| 10 HI | NUTES AFTER | TES | PERIOD | | | RANGE (| (neters) | | | | | . • | |
| - | 0~2 | | 2- | 4 | | 4-6 | | 6~8 | | Total | | ARE VALU | |
| Trace Type | Rau HF | - | Rau | HF | Ran | HF | Rau | μF | Rase | ИF | FUR 2 I | EST PERI | |
| LS | 0 | 0 | 0 | 0 | 3 | 8 | 3 | 6 | 6 | 14 | | Rau | HF |
| SL | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 3 | L\$ | 1,000 | 5.81 |
| NC | o | 0 | . 1 | 4 | 1 | > | 1 | 2 | 3 | 9 | SL | 0.000 | 0.20 |
| HM | 0 | 0 | 0 | 0 | 1 | 3 | 0 | · o | 1 | | NC NA | 0.333 | 1.00 |
| Total | 0 | 0 | 1 | 4 | 6 | 17 | 4 | 8 | 11 | 29 | TOTAL | 2.613 | 9.57 |
| CHI-SQU F-HRT | 0-2 | _ | 2-4 | l | 4 | -6 | 6 | | | | CHI-SQU (d.f. = (alpha | | 841 |
| LS SL NC HH TOTAL | Raid UF O O O O | 0 0 0 | Raн 3 0 1 1 4 | HF 10 0 4 2 16 | Rau 3 1 3 1 6 | HF 7 2 2 16 | Rass 3 1 2 1 6 | MF 6 1 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | | | | - • | |
| CHI -SQUE VALUES | ARE . 0-2 | | 2-4 | ı | 4 | - 6 | 6 | -8 | | | | | |
| LS SL NC NH TOTAL | Rau MF | <u>.</u> | 0.000 19 | -000 1-000 | Rau 0.200 1.000 1.800 1.000 0.000 | UF 0.692 3.000 3.769 3.000 0.125 | Ray 0.000 1.000 0.333 1.000 0.819 | 0.000 2.000 0.667 2.000 1.636 | | | | | |

APPENDIX D:

Hammer Tests Monitored By 6°x12° Horizontal Transducer

Table D1. Indian Point hammer test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| | ~~~~ | | | | | | | | | | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | | | | | | | |
|--|---|---|---|--|---|---|--|--|---|---|--|---|--|--|---|---|---|--|
| IM O | MUTES BE | FORE TE | EST PERI | D | | | | | RANGE (+++ | ters> | | | | | | | | 1 |
| ٠. | 0 | -5 | , | 5-10 | · 1 | 0-15 | 15 | 5-20 | 2 | 0-25 | 25 | -30 | 30 |)~ 3 5 | 31 | 5-40 | Tota | |
| 1 56 | Rau | NF | Rau | ИF | Rau | HF | Rasi | HF | Rau | HF | Rau | HF | Rau | HF | Ram | HF | : Kau | ИF |
| ; | | 0 | Ó | o o | 0 | 0 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 2 | 2 | 1 | 11 | 8 |
| | 0 | 0 | 0 | 0 | 0 | 0 | a | 0 | 0 | 0 | O | ,0 | o | • | 0 | ٥ | . 0 | Q |
| : | 214 | 798 | 336 | 632 | 458 | 550 | . 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1009 | 1981 |
| M | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | " o | Ð | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| tal | 214 | 798 | 336 | 632 | 450 | 550 | 2 | 2 | 3 | 3 | 2 | 1 | 3 | 2 | 2 | 1 | 1020 | 1989 |
| 10 HI: | MUTES DU | RING TE | EST PERI | 20 | | | | | | | | | | | | | • | |
| | _ | | | | | | | | RANGE CHE | | | | | | _ | | | . 1 |
| race | | -5 | | 5-10 | | 0-15 | | 5-20 | | 0-25 | | 5-30 | | 2-35 | | 5-40 | Tota | |
| VP* | | NF. | | HF | Rass | | | HF. | R## | HF | | uf. | ~~~~ | HF | Ran | HF | - Reu | <u>u</u> F |
| S | . 0 | 0 | 0 | . 0 | . 0 | 0 | 0 | . 0 | 0 | . 0 | 0 | 1 | 4 | 2 | 4 | 2 | : 10 | 5 0 |
| _ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | . 0 | . 0 | 0 | 0 | 0 | | 0 | 1080 | 1981 |
| | 194 | 696 | 330 | 620 | 5\$2 | 662 | 14 | 13 | 0 | _ | . 0 | a | 0 | | 0 | 0 | . 1000 | 4901 |
| | | | | | | | | | | | | | | | | | | |
| otal | 194 NUTES RF | 686 TER YES | 330 ST PERIO | 620 | 552 | 662 | 14 | 13 | 0 0 RAMQE <== | oters> | 2 | <u>Y</u> | 4 | 2 | 4 | . 2 | 1090 | 1986 |
| tel 10 MI | 194 NUTES RF | 686 | 330 ST PERIO | 620 5-10 | 552 | | 14 | 13 | O RAMOE (no | 0 | 2 | | 4 | | - | | Tota | |
| otal 10 MI: | 194 NUTES RF | GBG | 330 ST PERIO | 680 | 552 | 642 | 14 | 13 | O RAMOE (no | 0 ters> | 2 | · 1 | 4 | 2 | - | 2 | Tota | .1 |
| otal 10 MI: race | 194 NUTES RF | 686 TER YES | 330 ST PERIO | 620 5-10 | 552 | 662 | 14 | 13 | 0 RRMGE <== | 0 ters> to-25 | 2 | - 1 5-30 | 30 | 2 | 3 | 2 | Tota | 1 |
| otal 10 HI: race ype | 194 MUTES RF | TER YES | 330 ST PERIO | 620 5-10 UF | 552 Fair | 662 10-15 | 14 15 Rau | 13 5-20 UF | RAMQE (no | 0 ters> to-25 UF | 2 Rau 0 0 | -30 HF | 3(Raн | 2 0-35 NF | 4 Э Reи | 2 5-40 WF | Tota | i MF |
| race ype S L | 194 NUTES RF 0 Ram 0 0 242 | 686 TER YES | 330 ST PERIOR Read 0 0 338 | 620 5-10 WF 0 0 | Rass 0 0 538 | 662 10-15 14F 0 | 15 Rau 3 0 | 13 5-20 UF 3 0 | RRMGE <ne 2="" rass<="" td=""><td>0 20-25 UF 1 0</td><td>21 Rau 0 0</td><td>0 0</td><td>30 Rasi 1 0</td><td>2 0-35 HF</td><td>7 Rau 2 0</td><td>2 S-40 MF</td><td>Total Raw P</td><td>uf 6 0 2185</td></ne> | 0 20-25 UF 1 0 | 21 Rau 0 0 | 0 0 | 30 Rasi 1 0 | 2 0-35 HF | 7 Rau 2 0 | 2 S-40 MF | Total Raw P | uf 6 0 2185 |
| race ype S | 194 NUTES RF Raid 0 242 | 686 TER YES | 330 ST PERIOR (Reserved 0 0 338 | 620 0 6-10 UF 0 0 635 | Rass 0 0 538 0 | 662 10-15 MF 0 0 646 | 15 Rass 3 0 1 | 13 5-20 MF 3 0 | RAMGE < ree 2 Rass 1 C C C C C C C C C C C C C C C C C C | 0 -ters> -ters> -ters> -ters> -ters> -ters> -ters> -ters> -ters> -ters> -ters> -ters> -ters> -ters> -ters - -ters - -ters -ters - -ters - -ters -ters - -ters - -t | 2: Rau 0 0 | 5-30 UF 0 0 | 31 Raid 1 0 0 | 2 0-35 MF 1 0 | 2 0 0 | 2 5-40 MF 1 0 | Tot: Raw 7 | 1 1 1 1 1 1 6 0 2165 |
| otal 10 MI: race ype L C U | 204 NUTES RF 0 Rem 0 242 0 242 | 686 TER YES | 330 ST PERIOR Read 0 0 338 | 620 5-10 WF 0 0 | Rass 0 0 538 | 662 10-15 14F 0 | 15 Rau 3 0 | 13 5-20 UF 3 0 | RRMGE <ne 2="" rass<="" td=""><td>0 20-25 UF 1 0</td><td>21 Rau 0 0</td><td>0 0</td><td>30 Rasi 1 0</td><td>2 0-35 HF</td><td>7 Rau 2 0</td><td>2 5-40 MF 1 0</td><td>Tot. Ram 7 1119 1119</td><td>1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</td></ne> | 0 20-25 UF 1 0 | 21 Rau 0 0 | 0 0 | 30 Rasi 1 0 | 2 0-35 HF | 7 Rau 2 0 | 2 5-40 MF 1 0 | Tot. Ram 7 1119 1119 | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 |
| otal 10 MI: race ype S L C H otal HI-Squ | 194 NUTES RF 0 Ram 0 242 0 242 | 686 TER YES | 330 ST PERIOR 9 844 0 0 338 0 | 620 0 6-10 UF 0 0 635 | Rest 0 0 538 0 | 662 10-15 MF 0 0 646 | 15 Rau 3 0 1 | 13 5-20 MF 3 0 | RAMUS CHO | 0 -ters> -ters> -ters> -ters> -ters> -ters> -ters> -ters> -ters> -ters> -ters> -ters> -ters> -ters> -ters - -ters - -ters -ters - -ters - -ters -ters - -ters - -t | 21 Rau 0 0 0 | 5-30 UF 0 0 | 30 Rass 1 0 0 | 2 0-35 MF 1 0 | 3 Rau 2 0 0 | 2 5-40 MF 1 0 | Tot: Raw 7 | 1 UF 6 0 2185 0 2191 |
| race ype S L E HI – SQU | NUTES RF RAM O 242 O 242 RRE O RAM | 686 TER YES MF 0 903 903 | 330 ST PERIOR RAM 0 0 338 0 339 | 620 0 5-10 WF 0 0 635 0 635 5-10 | Rau Q Q S38 Q | 642 MF 0 0 646 0 646 | 15 Rau 3 0 1 0 | 13 5-20 UF 3 0 1 0 | RAMUS CHO | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 21 Ram 0 0 0 0 0 22 Ram | 0 0 0 | 30 Ram 1 0 0 0 | 2 0-35 MF 1 0 0 0 | 3 Raw 2 0 0 2 2 3 Raw | 2 UF 1 0 0 1 15-40 WF | Tot. 1 Ram 7 1 0 1 1119 1 126 CHI = Squir FOR 3 71 1 Ram | 1 1 6 0 2185 0 2191 1RE F-16:ST FEE: |
| otal race ype S L C HI otal HI-Squ | RAM O 242 O 242 RRE O RAM O O | 686 TER YES MF 0 903 903 | 330 ST PERIOR RAM 0 0 338 0 339 | 620 0 5-10 WF 0 635 0 635 5-10 | Rau Q 0 538 0 838 | 642 MF 0 0 646 0 646 0 646 0 646 | 15 Rate 3 0 1 0 | 15 5-20 WF 3 0 1 0 | RAMGE CHO | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 21 Ram 0 0 0 0 2: Ram 1 0 0 | 0 0 0 0 5-30 MF | 30 Ram 1 0 0 0 1 30 Ram 2 Ram 3 0 0 | 2 0-35 MF 1 0 0 0 | 3 Ram 2 0 0 2 3 Ram 3 0 0 | 2 05-40 WF 0 0 1 | Tot. 1 Ram 7 1 1119 1 1126 CHI - SQUIFFOR 3 71 Ram 9 | 2185 0 2187 0 2191 http://ec. |
| otal race ype S L C HI-Squ -HRT S L C | 242 0 242 0 Raw 0 0 242 | 686 TER YES MF 0 903 903 9-5 MF 0 795 | 330 ST PERIOR RAM 0 0 338 0 338 | 620 0 5-10 0 0 635 0 635 5-10 | Rau Q 0 538 0 538 | 642 MF 0 0 646 0 646 0 647 0 648 | 15 Rass 3 0 1 0 4 | 13 6-20 MF 3 0 1 0 4 5-20 MF 2 0 | RAMGE Core RAM I C C RAM I C C C C RAM I C C C C C C C C C C C C | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 21 Ram 0 0 0 22 Ram 1 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 30 Ram 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 0-35 MF 0 0 1 10-35 MF 20 0 | 2 0 0 2 2 3 Rain 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 UF 1 0 0 1 155-40 WF | Tot. 1 Ram 7 1119 1 1126 CHI SQUIFFOR 3 71 1 Ram 1 059 | 2195 0 2196 0 2197 1857 FEB: |
| race ype S L C HI | 242 0 242 6RE 0 213 | 686 YER YES WF 0 903 0 903 PS WF 0 795 | 330 ST PERIOR Rau 0 0 338 0 339 | 620 0 5-10 0 635 0 635 5-10 | Rass 0 0 538 0 538 0 538 | 642 MF 0 0 646 0 646 0 646 0 646 | 15 Rate 3 0 1 0 | 13 6-20 MF 3 0 1 6-20 MF 2 0 | RRMGE <ne 1="" 2="" g="" g<="" rais="" td=""><td>0 0 0 25 UF 1 0 0 0 1 1 00 25 UF 1 0 0 0 0 1 1 00 25 UF 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td><td>2: Ram 0 0 0 0 0</td><td>0 0 0 5-30 UF</td><td>30 Raid 1 0 0 0 1 20 Raid 20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td><td>2 0-35 4F 1 0 0 1</td><td>3 Ram 2 0 0 2 2 3 Ram 3 0 0 0</td><td>2 5-40 WF 1 0 0 1 15-40</td><td>Tot. Raw 7 10 1119 1126 CHI-SqurFOR 3 71 Raw 1 00 1 1059</td><td>1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</td></ne> | 0 0 0 25 UF 1 0 0 0 1 1 00 25 UF 1 0 0 0 0 1 1 00 25 UF 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2: Ram 0 0 0 0 0 | 0 0 0 5-30 UF | 30 Raid 1 0 0 0 1 20 Raid 20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 0-35 4F 1 0 0 1 | 3 Ram 2 0 0 2 2 3 Ram 3 0 0 0 | 2 5-40 WF 1 0 0 1 15-40 | Tot. Raw 7 10 1119 1126 CHI-SqurFOR 3 71 Raw 1 00 1 1059 | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 |
| race ype s L C HI-SQU S L C HI-SQU S L C HI-SQU | 242 0 242 0 242 0 242 0 243 0 213 | 686 TER YES MF 0 903 903 9-5 MF 0 795 | 330 ST PERIOR R444 0 0 338 0 339 R44 0 0 334 | 620 0 5-10 0 0 635 0 635 5-10 | Rass C 0 538 0 538 0 518 | 642 MF 0 0 646 0 646 0 647 0 648 | 15 Raw 3 0 1 0 4 18 Raw 2 0 5 6 0 7 7 | 13 6-20 MF 3 0 1 0 4 5-20 MF 2 0 | RAMGE < me Rass 1 0 0 1 2 Rass 1 0 0 1 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2: Ram 0 0 0 0 0 2: Ram 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 30 Raw 1 0 0 0 1 30 Raw 0 0 0 | 2 0-35 MF 0 0 1 10-35 MF 20 0 | 3 Rau | 2 5-40 WF 1 0 0 1 15-40 WF 1 0 0 0 | Tot. 1 Ram 7 1119 1119 1126 CHI-SQUE CHI-SQUE CHI-SQUE | 2185 0 2185 0 2185 0 2185 1857 FEB: |
| race ype S L C WI-Squ HI-Squ O'R C O'TR HI-Squ HI-Squ HI-Squ HI-Squ HI-Squ | 242 0 242 0 242 0 242 0 243 0 213 | 686 YER YES WF 0 903 903 9-5 WF 0 795 | 330 ST PERIOR R444 0 0 338 0 339 R44 0 0 334 | 620 0 5-10 0 635 0 635 5-10 UF 0 628 | Rass C 0 538 0 538 0 518 | 642 MF 0 0 646 0 646 0 647 0 619 | 15 Raw 3 0 1 0 4 18 Raw 2 0 5 0 7 | 13 5-20 UF 3 0 1 0 4 5-20 UF 5-20 UF 5-20 UF | 0 RRMOE Cree 2 Rain 1 0 0 1 2 Rain 1 0 0 1 1 2 Rain 1 0 0 1 1 2 Rain 1 0 0 0 0 1 1 2 Rain 1 0 0 0 0 1 1 2 Rain 1 0 0 0 0 1 1 2 Rain 1 0 0 0 0 1 1 2 Rain 1 0 0 0 0 1 1 2 Rain 1 0 0 0 0 1 1 2 Rain 1 0 0 0 0 1 1 2 Rain 1 0 0 0 0 1 1 2 Rain 1 0 0 0 0 1 1 2 Rain 1 0 0 0 0 1 1 2 Rain 1 0 0 0 0 1 1 2 Rain 1 0 0 0 0 1 1 2 Rain 1 0 0 0 0 1 1 2 Rain 1 0 0 0 0 0 1 1 2 Rain 1 0 0 0 0 0 0 1 1 2 Rain 1 0 0 0 0 0 0 0 1 1 2 Rain 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 1 0 0 0 1 1 1 0 0 0 1 | 21 Ram 0 0 0 0 0 0 2: Ram 1 0 0 1 | 5-30 UF 0 0 0 0 0 0 0 0 0 0 0 0 0 | 20 Raw 3 0 0 0 3 30 Raw 3 7 0 0 0 3 7 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 0-35 NF 1 0 0 0 1 1 2-35 NF 2 0 0 0 2 | 3 Rau 3 Rau 3 Rau Rau Rau | 2 S-40 MF 1 0 0 1 1 5-40 MF 1 1 1 1 1 1 1 1 1 1 1 1 1 | Tot: 1 Ram 1 119 11126 CHI-SQUII FOR 3 TI 1058 CHI-SQUII FOR 3 TI 1058 | 2165 0 2165 0 2191 38E F-H SST FEE: UF 0 2029 0 2035 |
| race ype S L C HI -HRT S C U OTAL HI -SQU ALUES | 242 0 242 0 242 0 242 0 243 0 2 13 | 686 YER YES WF 0 903 903 9-5 WF 0 795 | 330 ST PERIOR Rau 0 0 338 0 339 Rau 0 334 | 620 0 5-10 0 635 0 635 5-10 UF 0 628 5-10 | Rass 0 0 538 0 538 0 515 0 515 | 642 00-15 00-15 646 00-15 00-15 00-15 00-15 00-15 | 15 Raw 3 0 1 0 4 15 Raw 2 0 5 0 7 7 15 Raw 1.500 1 | 13 5-20 UF 3 0 1 5-20 UF 2 0 5-20 UF 1 5-20 UF 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | RRMGE < me Rais 1 0 0 1 2 Rais 1 0 0 1 2 Rais 2.000 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 21 Ram 0 0 0 0 0 0 2: Ram 1 0 0 1 | 0 0 0 0 5-30 UF 1 0 0 0 0 1 5-30 | 20 Raw 3 0 0 0 3 30 Raw 3 7 0 0 0 3 7 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 0-35 MF 1 0 0 0 1 1 0-35 MF 2 0 0 0 2 | 3 Rau 3 Rau 3 Rau Rau Rau | 2 5-40 MF 1 0 0 0 1 15-40 MF 1 0 0 1 | Tot: 1 Ram 1119 11126 CHI-SQUII FOR 3 TI 1058 CHI-SQUII FOR 3 TI 2.000 | 2165 0 2165 0 2191 3RE F-H: SST RES: UF 0 2029 0 2035 3RE UAL: |
| race ype S L C HI-SQU HI-SQU S L C U O'TAL HI-SQU | 242 0 242 0 242 0 242 0 243 0 2 13 | 686 YER YES WF 0 903 0 903 0 795 UF | 330 ST PERIOR Ress 0 338 0 339 Ress 0 334 | 620 0 5-10 0 635 0 635 5-10 UF 0 628 629 | Rau 0 0 538 0 539 8au 0 515 0 515 | 642 MF 0 646 0 646 0 646 0 619 0 | 15 Rau 3 0 1 0 4 18 Rau 2 0 5 0 7 | 13 5-20 UF 3 0 1 0 4 5-20 UF 5-20 UF 5-20 UF | 0 RRMGE < He 2 Rais 1 0 0 0 1 1 2 Rais 1 0 0 0 0 1 1 2 Rais 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 0 0 0 25 UF 1 0 0 0 1 1 00 25 UF 2 000 0 1 | 21 Ram 0 0 0 0 21 Ram 1 0 0 0 1 1 2 1 Ram 4 000 1 | 5-30 UF 0 0 0 5-30 UF 0 0 1 | 20 Raw 30 0 0 0 3 3 20 Raw 0.667 | 2 0-35 4F 0 0 1 1 2-35 4F 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 0 0 0 2 2 3 Raiu 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 5-40 WF 1 0 0 1 1 5-40 WF 2 0 0 1 | Tot: 1 Ram 1 119 11126 CHI-SQUII FOR 3 TI 1058 CHI-SQUII FOR 3 TI 1058 | 1 1 0 0 2165 0 0 2191 NRE F-HRST FEE: UF 0 2029 0 2035 NRE UALL SST FEE: 1.833 74.265 |

¹⁾ Numbers presented are a minimum estimation for test periods.

Table 02. Indian Point hammer test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

Tidal Phase: 2 hrs before

| | **** | | | | | low tid | * | | | ent Ty | pe: | 10 sec | on, 20 se | coff | Test Tie | 40: 10: | 2155 | *** |
|------------------|----------|------------|------------|--------------|-------|-------------|-------------|-------|-----------|--------|-------|--------|-----------|-------------------|----------|------------|--------------------|------------------|
| 10 HI | HUTES DU | RING T | EST PERIC | | | | | | RANGE (me | ters | | | | | | | •.• | |
| | | -5 | 5 | - 10 | | 10-15 | | 5~20 | 2 | to-25 | | 25-30. | | 10-35 | | 35~40 | Tot | |
| race ype | Rau | HF | Rau | MF | Rau | MF | Rau | ИF | Rau | UF | Rau | MF | Rau | MF | Rau | µF. | : Rau | HF |
| 5 | 0 | 0 | 0 | 0 | | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 0 | -: | 4 |
| _ | ٥ | 0 | . 0 | 0 | ٥ | 0 | ٥ | 0 | 1 | 1 | Q | 0 | 0 | O | 0 | 0 | : 1 | 1 |
| • | 210 | 793 | 302 | 568 | 458 | 550 | 1 | 1 | 1 | 1 | 0 | 0 | . 0 | 0 | 0 | 0 | 972 | 1903 |
| 4 | • | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | ; O | 0 |
| et a l | 210 | 783 | 302 | \$60 | 450 | \$50 | \$ | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 0 | 978 | 1900 |
| IO MI | MUTES AF | TER TE | ST PERIO | | | • | | | | | | | | | | | | |
| | | | , | | | | | | RANGE CH | ters> | | | | | | | | 1 |
| -ace | 0 | -5 | | i- 10 | | 10-15 | 1 | 5-20 | 2 | 25 | | 25-30 | | 10 -35 | | 35-40 | Tot | al _ |
| JP# | Rau | HF | Rau | WF | Rau | uf | Rau | HF | Rass | uf . | Reu | HF | Rau | HF | Rau | WF. | : Raw | UF |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 2 | 1 | 2 | 1 | 1 | 0 | 8 | 5 |
| L | 0 | Ð | . 0 | 0 | 0 | 0 | 2 | 2 | 1 | 1 | • | 0 | 0 | 0 | . 0 | . 0 | į 3 | 3 |
| ¢ | 194 | 724 | 470 | 899 | 472 | 566 | 3 | 3 | 1 | 1 | 0 | C | 0 | 0 | 0 | 0 | 1148 | 2193 |
| | Q. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | _!1 | 1 |
| otal | 194 | 724 | 478 | 899 | 472 | 566 | | 8 | 2 | 2 | ,2 | . 1 | . 3 | 2 | 1 | 0 | : 1160 | 2202 |
| II – SQU -HAT | | S | | 5-10 | | 10-15 | | 15-20 | • | b0-25 | | 25-30 | | 30-35 | | 35-40 | CHI-SQU FOR 2 T | |
| | | | Rau | UF | Rau | | Rau | LIF. | Pass | | Rau | | Rau | LIF. | Rau | | 1 Ray | |
| S | 0 | 70 | | 0 | Î | , | 3. | ž | 1 | | 2 | | 2 | 1 | 1 | Ö | 1 P | Š |
| C | 202 | 754 | 390 390 | 734 | 465 | 558 | ` \$ | ź | i | i | Ō | ŏ | 8 | 8 | Ģ | 8 | : 1060 | 204 8 |
| DTRL. | 202 | 754 | 290 | 734 | 465 | 55 8 | · | 9 | 3 | . 3 | . 0 | 0 | 2 | 1 2 | 9 | ê | : 1069 | 5022 7 |
| II – SQU | | - 5 | | 5 -10 | | 10-15 | | IS-20 | | to-25 | | 25-30 | | 30-35 | | 35-40 | CHI - SQU | |
| HLUES | | | | | | | | | | WF | | | | | | | IFOR 2 T | EST PER |
| 5 | Rau | WF | Reu | 147 | Rau | MF | 1.000 | 1.000 | | 1.000 | 0.333 | 0.000 | 0-333 | 0.000 | 0.000 | uf — | : Reu : 0.692 | 0.111 |
| L C | 0 653 | 2.310 | 39.713 | 74.684 | 0.211 | 0.229 | 1.000 | 1.000 | | 0.000 | | | | | | | : 1.000 :14.611 | 1.000 |
| | 0.634 | | | | | | | | | | | | 1.000 | 1.000 | | | : 1,000 | 1.000 |
| OTAL | 0.634 | 2.310 | 39.713 | 74.684 | 0.211 | 0.223 | 3.600 | 3.600 | 0.200 | 0.200 | 0.333 | 0-000 | 1-000 | 0.333 | 0.000 | | :15.493 | 21.031 |

^{1&}gt; Numbers presented are a minimum estimation for test periods

Table D3. Indian Point hammer test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| UIKOII | ES DU | RING T | EST. PERIC | 10 | | | | | RANGE (m | ters) | | | | | | | * | |
|------------|----------|----------|------------|-------------|---------|----------------|--------|--------|----------|-------|-------|-------|-------|-------|-----|------|--------------|--------|
| , | 0 | -5 | | - 10 | | 10~15 | | 15-20 | | 20-25 | | 5-30 | | 30-35 | 39 | 5-40 | Total | 1. |
| • | Ray | MF | Rau | 14F | Ran | u r | Ray | UF | Rau | WF | Rau | WF | Rau | WF | | HF | I Rau | LIF |
| | | <u> </u> | 0 | 0 | 0 | - | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | -:2 | 4 |
| | 0 | 0 | 0 | 0 | 0 | O | 0 | 0 | 0 | 0 | 1 | 1 | . 0 | 0 | 0 | 0. | i i | |
| : | 158 | 583 | 330 | 620 | 516 | 739 | 24 | 22 | 0 | 0 | o | 0 | 0 | o | . 0 | 0 | 1128 | 1976 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | O | . 0 | • |
| | 150 | 503 | 330 | 650 | 616 | 739 | 24 | 22 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1131 | 197 |
| ні муп | ES AF | TER TE | ST PERIO | • | | y | | ٠, | RANGE (m | | | | | | | | | |
| | 0 | -5 | • | i-10 | • | 10-15 | | 15-20 | | to-25 | 2 | 25-30 | | 30-35 | 3! | 5-40 | Total | 1. |
| • | Rau | NF | RaH | WF | Rau | uF | Rak | | Rau | WF | Rau | UF | Rau | UF | Rau | HF | | LIF |
| | | 0 | 0 | · | 0 | - | 4 | 4 | | 0 | | 1 | 1 | 1 | 0 | | -; | |
| | 0 | ' o | 0 | 0 | 0 | Ó | ő | 0 | o | 0 | o | 0 | . 0 | 0 | 0 - | . 0 | | |
| : | 146 | 545 | 136 | 259 | 208 | 250 | 2 | 2 | Q | 0 | 0 | 0 | 0 | 0 | o | 0 | 494 | 105 |
| | <u>a</u> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | |
| | 146 | 548 | 136 | 259 | 208 | 250 | 6 | | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 500 | 106 |
| QUARE | | -5 | 5 | -10 | ~ | 10-15 | | 15~20 | : | 0-25 | · 2 | 25-30 | | 30-3S | 3: | 5-40 | CHI-SQUARE | F-IN |
| | Rau | uf | R 814 | WF | Ran | HF | Ras | | RAM | HF | Rau | UF | Res | HF . | Rau | ЦF | : Ray | uf |
| - | 0 | 8 | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 10 | 1 | 1 | 1 0 | 1 0 | 0 | 0 | : 1 | • |
| | 125 | 567 O | 234 0 | 440 | 412 | 49 5 | 13 | 12 | 0 | O | Ó | 0. | . 0 | Ô | 0 | 8 | 811 | 151 |
| | 152 | 567 | 234 | 440 | 412 | 495 | 15 | 14 | ĭ | ĭ | ĭ | | ĭ | ĭ | ŏ | ŏ | 816 | 151 |
| GUARE | | -5 | 5 | i~ 10 | | 10-15 | | 15-20 | ; | 20-25 | | 25-30 | | 30-35 | 3 | 5-40 | CHI - SQURRE | E VALI |
| | Rass | WF | Rase | MF | Rate | HF | Rai | | Rau | HF_ | Rau | HF | Rau | | Rau | HF | :FOR 2 TEST | PER |
| _ | | | | | | | 4.000 | 4.000 | 1-000 | 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | | | : 1.000 | 100 |
| 0 | 474 | 1.707 | T0.769 | 148.261 | 202.019 | 241.701 | 10.615 | 16.667 | | - == | | | | | ' | | 247.015 2 | 'EO7 |
| ` ` | 474 | 1.707 | 78.769 | 148.261 | 202.019 | 241.701 | 10.800 | 9-143 | 1.000 | 1.000 | 0.000 | 0.000 | 0.000 | 0.000 | | | 244.121 | 2 |

Table D4. Indian Point hammer test monitoring using \$\text{\$\text{M12}} degree horizontal transducer located at unit 3, intake 35.

| | | | 1 | idal P | 3 | hrs b ou tid | • | | Duration Treat | ment Tur | se: 1 | O sec o | har 2 only n, 20 sec o | ff Te | st Dat | : | 1/26/88 2245 | |
|--|----------------------------------|---------------------------------|-------------------|---------------------------------|----------------------------------|---------------------------------|----------------------------------|----------------------------------|--|------------------------|-------------------------|------------------------|---------------------------|-------------------|-------------------------|-------------------|--|-----------------------------------|
| io HI | NUTES DU | RIMG T | EST PERI | | | | | | RANGE (m | | | | | | | | • | |
| | | -s | | 5-10 | | 10-15 | • | 15-20 | | 20-25 | 2 | 25-30 | 30-3 | | | 5-40 | Tota | |
| ibe The | Rau | HF | Rau | WF | Rau | WF | Rau | HF | Rau | | Rau | uF. | Rau HF | | Rau | HF | : Rau | HF |
| s | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 1 | 1 | 0 | 0 | - | 0 | 0 | 0 | 4 | 4 |
| - | 0 | a | 0 | 0 | 0 | | 0 | a | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| ; | 134 | 500 | 236 | 444 | 264 | 317 | 3 | 3 | 0 | 0 | 1 | 1 | G | 0 | 0 | ٥ | 638 | 1265 |
| • | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | . 0 | 0 | | 0 | 0 | 0 | • | 0 | 1 | 1 |
| tal | 134 | 500 | 236 | 444 | 264 | 317 | 7 | 7 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | i 644 | 1271 |
| ro HI | MUTES AF | TER TE | ST PERIO | • | | | | | RANGE (m | eters> | | | | | | | | 1 |
| race | 0 | -5 | | 5-10 | | 10-15 | | 15-20 | | 20-25 | | 25~30 | 30-2 | 5 | | 5-40 | Fot. | |
| VP* | Rau | HF | Rau | uf | Rau | uf | Ram | WF | Rau | WF | Ran | NF | Rau HF | - | Rase | UF | I Raii | uf |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | . 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | > | 2 |
| L | 0 | 0 | D | 0 | 0 | . 0 | G | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | . 0 | | 0 |
| C | 122 | 455 | 170 | 320 | 130 | 156 | . 0 | . 0 | 1 | 1 | 0 | 0 | O | 0 | 0 | 0 | 423 | 932 |
| 4 | 0 | . 0 | . 0 | 0 | 0 | , 0 | . 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | | 0 | 2 | 2 |
| otal | 122 | 455 | 170 | 320 | 130 | 156 | 3 |) | 2 | 2 | 0 | 0 | 0 | a | 1 | 0 | : 428 | 936 |
| 11 – 5 9 U - HA T | | -5 | 9 | 5-10 | : | 10-15 | : | 15-20 | : | 20-25 | 2 | 25-30 | 30-3 | 5 | 3 | 5-40 | CHI-SQU FOR 2 TO | |
| S L C H OTAL | Rau 0 0 129 0 128 | HF 0 0 478 0 478 | 203 203 203 | MF 0 0 382 0 362 | Rau 0 0 197 0 197 | 4F 0 0 237 0 237 | 8 2 3 0 2 1 5 5 | UF 3 0 2 1 | Rau 1 1 1 1 2 | µF 1 1 1 1 | Raw 0 0 1 0 | UF 0 0 1 0 | Rau 0 0 0 0 | иг 0 0 0 | Rau 1 0 0 0 | UF 0 0 0 | Reu : 4 : 1 : 531 : 2 : 536 | UF 3 1 1099 2 1104 |
| HI-SQU ALVES | 0 | ~5 | ! | 5-10 | | 10-15 | | 15-20 | : | 20-25 | | 2S-30 | 30-3 | | | S-40 | CHI-SQU :FOR 2 T | |
| S L C . H OTRL | 0.563 | HF 2,120 2,120 | 10.729 2 | UF 20.126 20.126 | Rau | HF | 9.000 9.000 0.000 1.600 | 0.200 0.200 0.000 1.500 | Res 1.000 1.000 1.000 1.000 0.000 | | 1.000 1.000 | 1.000 | Ran V | F 1 | Res .000 | WF | Rau : 0.143 : 1.000 :43.567 : 0.333 :43.522 | 0.667 1.000 50.473 0.333 |

¹⁾ Numbers presented are a minimum estimation for test periods.

Table 05. Indian Point hammer test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| 5 MINU | MES BEF | ORE TE | ST PERIO | 9 | | | | 1 | RANGE CHE | ters> | | • | | | | | | |
|---|---|---|---|--|---|--|---|---|--|---|---|--|---|--|--|--|--|--|
| _ | o | -s | • | 5-10 | 1 | 0~15 | 1 | 5-20 | 2 | 0-25 | 25 | 5~30 | 30 | 3E-C | 35- | -40 | Tota | 1 |
| Trace Tupe | Rau | ИF | Rau | UF | Rau | WF | Rau | иF | Rau | NF | Rau | WF | Rau | MF | Rau 1 | WF | : Rau | UF |
| LS | ō | 0 | . 0 | Q | 2 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | <u>a</u> | 0 | 5 | 5 |
| 5L, | 0 | 0 | 0 | , 6 | 0 | C | 0 | 0 | 0 | 0 | 0 | 0 | ũ | 0 | 0 | ٥ | | 0 |
| HC | 60 | 224 | 74 | 139 | 110 | 142 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G | 0 | 252 | 506 |
| MM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0_ | 0 | 0 | . 0 | 0 | 0 | ٥ | 0 | 0 | | . 0 |
| Total | 60 | 224 | 74 | 139 | 120 | 144 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 257 | 5 20 |
| S NIMU | ITES DUR | INO TE | ST PERIO | D | | | | | RANGE (ne | ters) | | | | | | | | |
| | Q | ∽s | • | 5-10 | 1 | 0~15 | 19 | 5-20 | | 0~25 | 25 | 5-30 | 30 | D-35 | 35 | -40 | Tote | .1 |
| frace Type | Rau | иF | Rau | WF | Ran | ¥F | Rau | NF | Rau | NF | Rau | UF | ~ | WF | ~~~~ | HF. | | |
| L\$ | ò | 0 | 0 | 0 | | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 54 <u>.</u> | 0 | o | 0 | o | 0 | O | 0 | 0 | ο. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | : 0 | 0 |
| NC | 51 | 190 | 92 | 173 | 92 | 110 | ۵ | 0 | ۵ | 0 | 0 | 0 | 0 | 0 | 0 | . a | : 235 | 473 |
| | | | | | | | | | | | | | | | | | | |
| | 0 | 0 | 0 | Q | 0 | 0 | 1 | 1 | 0 | . 0 | | a | 0 | 0 | o | 0 | 1 | 1 |
| Total | 51 | 190 | 92 T PERIOD | 173 | 92 | 110 | 2 | 2 | 0 0 RRNGE (ne | 0 | 0 | 0 | 0 | 0 | 0 | | 237 | 475 |
| Total 5 MIMU | \$1 JTES AFT | 190 ER TES | 92 T PER100 | 173 | 92 | 110 | 2 | 2 | RRMGE CHE | 0 ters> | 25 | o 5-30 | | 0 | 0 | -40 | 1 237 Tota | 475 |
| Total 5 MIMU Trace Type | 51 JTES AFT | 190 ER TES | 92 T PERIOD | 173 5-10 MF | 92 1 Rau | 110 0~15 UF | 2 Rau | 2 5-20 UF | RANGE (ne- | 0 ters> 0-25 HF | 25 Rasi | -30 HF | 0 Rau | 0)-35 ur | 0 35- Rau I | -40 ur | Tota Raw | 475 1 UF |
| Total 5 MINU Frace Type | S1 JTES AFT | 190 ER TES | 92 T PERIOD | 173 5-10 WF | 92 1 Rau 0 | 0-15 UF | 2 1: Rau | 2 S~20 HF | RRNGE <ne< td=""><td>0 ters> 0-25 WF</td><td>25 Rau 0</td><td>0 5-30 NF</td><td>O Ress</td><td>0 9-35 UF</td><td>0 35- Rau I</td><td>-40 UF</td><td>Tota</td><td>1 L L L S</td></ne<> | 0 ters> 0-25 WF | 25 Rau 0 | 0 5-30 NF | O Ress | 0 9-35 UF | 0 35- Rau I | -40 UF | Tota | 1 L L L S |
| Trace Trace Type LS | S1 UTES AFT Raw 0 | 190 ER TES HF O | 92 T PERIOD | 173 5-10 WF 0 | 92 1 Rau 0 | 0-15 UF 0 | 2 11 Rau 3 0 | 2 S~20 HF 3 | 0 RRNGE <me 20 Rau 1</me | 0 ters> 0-25 MF | 25 Raw 0 | 0 HF 0 | Q Ress 1 | 0 0-25 HF 1 0 | 35- Raw 1 | 0 HF 0 | Tota | 1 L L L L L L L L L L L L L L L L L L L |
| Trace Type LS SL | S1 JTES AFT | 190 ER TES | 92 T PERIOD | 173 5-10 WF | 92 1 Rau 0 | 0-15 UF | 2 1: Rau | 2 S~20 HF | RRNGE <ne< td=""><td>0 ters> 0-25 WF</td><td>25 Resi 0 0</td><td>0 HF 0</td><td>0 Rau 1 0</td><td>0 9-35 WF</td><td>35- Rau 1 0 0</td><td>0 -40 -40 -6 -6</td><td>Tota Rah 5 228</td><td>1 1 MF 5 0 444</td></ne<> | 0 ters> 0-25 WF | 25 Resi 0 0 | 0 HF 0 | 0 Rau 1 0 | 0 9-35 WF | 35- Rau 1 0 0 | 0 -40 -40 -6 -6 | Tota Rah 5 228 | 1 1 MF 5 0 444 |
| UIH Fotal 5 MIMU Frace Fype LS SL NC | S1 UTES AFT Raid O O 46 | 190 ER TES -5 -4 -6 0 172 | 92 T PERIOD ! Rau 0 0 | 173 5-10 UF 0 0 | 92 Rass 0 0 | 0-15 UF 0 0 | Rau Rau 3 0 | 2 S-20 UF 3 0 | RANGE < no 20 R au 1 0 0 | 0 ters> 0-25 UF 1 0 | 25 Raw 0 | 0 HF 0 | Q Ress 1 | 0 0-25 HF 1 0 | 35- Raw 1 | 0 ur 0 0 | Tota Rah 5 228 | 1 1 L L L L L L L L L L L L L L L L L L |
| HILL Total 5 HINU Trace Type | \$1 UTES AFT Q Rain Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q | 190 ER TES -5 -WF 0 172 | 92 T PERIOD | 173 5-10 9F 0 147 | 92 Raid 0 0 104 0 | 0-15 UF 0 0 125 | 2 Rau 3 0 0 | 3 0 | RRINGE (ne- 2) Rau 1 0 | 0 ters> 0-25 UF 1 0 | 25 Rand 0 0 0 | 0 HF 0 0 | 0 Rass 1 0 0 | 0 HF 1 0 | 0 Raw 1 0 0 0 | 0 WF 0 0 0 | Tota Ram 5 228 | 1 1 UF 5 0 444 0 449 RE F-H |
| Trace Type LS SL NC HH Fotal CHI-SQUA | Rate 0 46 Rate 0 Rate | 190 ER TES WF 0 172 0 172 | 92 T PERIOD Rau 0 0 78 | 173 5-10 MF 0 147 0 147 5-10 MF | 92 Raid 0 0 104 0 | 0-15 UF 0 0 125 | 2 Reu 3 0 0 0 3 | 2 UF 3 0 0 | RRINGE (ne- 2) Rau 1 0 | 0 ters) 0-25 WF 1 0 0 1 | 25 Rand 0 0 0 0 | 0 WF 0 0 0 0 0 0 WF | 0 Rass 1 0 0 | 0 0 0 0 0 1 | 0 355 Rau 1 0 0 0 0 0 0 355 Rau | 0 HF 0 0 0 | Tota Ram Ram 5 228 228 CMI = 2004 CMI = 5004 FOR 3 TE | 1 I I I I I I I I I I I I I I I I I I I |
| Trace Type LS SL NC HH Total CHI-SQUA F-HAT LS | \$1 UTES AFT Q Raid 0 0 46 0 46 Raid 0 0 Raid 0 0 | 190 ER TES WF 0 172 0 172 | 92 T PERIOD Rau 0 78 0 78 Rau 0 | 173 5-10 MF 0 147 0 147 5-10 | 92 Rais 0 0 104 0 104 | 0-15 UF 0 125 0-15 UF | 2 1: Reu 3 0 0 0 3 1: Reu 2 0 | 3 0 0 3 5-20 | RRANGE < noe 20 Raiu 1 0 0 0 1 2 Raiu 1 0 0 Raiu 1 0 0 0 1 1 C Raiu 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 | 25 Rand 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 30 Resu 1 0 0 1 1 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 0 1 1 0 0 0 0 0 0 0 1 1 0 | 0 0 0 0 0 1 0-35 | 0 355-Rau 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | -40 WF 0 0 0 0 -40 | Tota Ram Ram 5 228 228 235 CHI = SOUR FOR 3 TE Ram 4 | 1 I I I I I I I I I I I I I I I I I I I |
| Trace Type LS SL HM Total CHI-SQUA F-HMT LS LS LS LS LS LS LS LS LS LS LS LS LS | \$1 UTES AFT Q Ram 0 0 46 0 46 Ram 0 0 52 | 190 ER TES WF 0 172 0 172 | 92 T PERIOD Rau 0 78 0 78 1 Rau 0 0 78 | 173 5-10 MF 0 147 0 147 5-10 MF | 92 Rais 0 0 104 0 104 | 0-15 UF 0 125 0-15 UF 10-15 | 2 1: Reu 3 0 0 0 3 1: Reu 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 3 0 0 3 5-20 | RRRIGE (ne- 2) Rain 1 0 0 1 2: Rain 1 Rain | 0 0-25 WF 1 0 0 1 | 25 Reni 0 0 0 0 25 Reni 0 0 | 0 WF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 30 Resu 1 0 0 0 | 0 0 0 0 0 1 0-35 | 0 355 Raw 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 ur 0 0 0 | Tota Ram Ram CHI = 228 CHI = 50UA FOR 3 TE Ram Q 236 | 475 1 1 1 1 5 0 444 0 449 1 82 FER 4 0 469 0 469 0 469 |
| Trace Type LS SL NC HIMU Total CHI-SQUA F-HAT LS SL | \$1 Q Rate 0 0 46 0 46 0 Rate 0 0 52 | 190 ER TES UF 0 172 0 172 -5 UF 0 172 | 92 T PERIOD Rau 0 0 78 0 78 1 | 173 5-10 MF 0 147 0 147 5-10 MF 0 | 92 Rate 0 0 104 0 104 | 0-18 UF 0 0 125 0 125 0-15 UF 100 126 | 2 11 Rau 3 0 0 0 3 11 Rau 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 5-20 UF 3 0 0 0 3 5-20 | RRANGE (ne- 2) Rau 1 0 0 1 Rau 20 Rau 0 0 0 | 0 0-25 UF 0 0 0 1 | 25 Ram 0 0 0 0 0 | 0 WF 0 0 0 | 30 Resu 1 0 0 0 1 | 0 0 0 0 0 0 1 | 0 - 35- Raw 1 0 0 0 0 0 0 0 | 0 ur 0 0 0 | Tota Rah 5 228 228 233 CHI - SOUA FOR 3 TE Rah 4 0 236 | 1 1 1 5 0 444 0 449 KE F-1-1 ST FEF |
| Trace Type LS SL NC HH Fetal CHI—SQUA F-HAT LS LS LS LS LS LS LS LS LS LS LS LS LS | \$1 UTES AFT Q Rau Q 46 Q 46 Rau Q 52 0 52 0 52 | 190 ER TES WF 0 172 0 172 | 92 T PERIOD Rau 0 0 78 6 Rau 0 0 91 0 81 | 173 5-10 MF 0 147 0 147 5-10 MF | 1 Rate 0 0 104 0 104 1 0 105 0 105 0 105 | 0-15 UF 0 125 0-15 UF 10-15 | 2 Rau 3 0 0 0 0 3 | 3 0 0 3 5-20 | 2 Results 1 0 0 0 1 2 Results 1 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 0 1 1 0 0 0 0 0 0 1 1 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 1 1 0 | 0 0-25 WF 1 0 0 1 | 25 Ram 0 0 0 0 0 25 Ram 0 0 | 0 WF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 30 Rass 1 0 0 0 1 30 Rass 1 0 0 | 0 0 0 0 0 1 0-35 | 35- Raw 1 0 0 0 0 0 0 | 0 ur 0 0 0 | Tota Ram Ram CHI - SOUR Ram CHI - SOUR CHI - SOUR CHI - SOUR | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 |
| Trace Type LS SL HIMU Trace Type LS SL HC HI SSL HC HI SSL HC HI CHI SSL HC HC HC HC HC HC HC HC HC H | \$1 UTES AFT Q Rau Q 46 Q 46 Rau Q 52 0 52 0 52 | 190 ER TES UF 0 172 0 172 0 175 | 92 T PERIOD Rau 0 0 78 6 Rau 0 0 91 0 81 | 173 5-10 MF 0 147 0 147 5-10 MF 153 | 104 0 104 0 104 1 105 1 105 1 105 | 0-15 UF 0 125 0 125 0-15 UF 0 126 0-15 | 2 11 Rau 2 0 0 0 2 11 Rau 2 1 1 Rau 2 1 1 Rau 2 1 1 Rau 2 1 1 1 Rau 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 2 5-20 UF 3 0 0 3 5-20 UF 2 0 0 2 | RANGE (ne- 2: Rau 1 0 0 1 2: Rau 1 0 0 1 2: Rau 1 Rau 1 0 0 0 1 | 0 -25 WF 1 0 0 0 1 1 0 -25 WF | 25 Ram 0 0 0 0 0 25 Ram 0 0 | 0 0 0 0 0 0 0 0 | 30 Rass 1 0 0 0 1 30 Rass 1 0 0 0 | 0 0 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 0 0 | 35- Raw 1 0 0 0 0 0 0 | -40 -40 -40 -40 | Tota Ram Ram CHI - SOUA Ram CHI - SOUA CHI - SOUA FOR 3 TE Ram CHI - SOUA FOR 3 TE | 1 I I I I I I I I I I I I I I I I I I I |
| Trace Type LS SL NC RM Total CHI-SQUA F-HAT LS SL NC RM CHI-SQUA CHI-SQUA CHI-SQUA | \$1 UTES AFT Q Rain Q 46 Q 46 Q Rain Q 52 Q Rain Rain Q Rain Rain Q Rain Q Rain | 190 ER TES WF 0 172 0 172 0 195 | 92 T PERIOD RAM 0 0 78 0 78 RAM 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 173 5-10 9F 0 147 0 147 5-10 153 5-10 MF | 92 Raid 0 104 0 104 105 0 105 1 Raid 2,000 | 0-15 UF 0 0 125 0 125 0-15 UF 126 0 126 0-15 | 2 11 Rau 2 0 0 0 2 11 Rau 2 1 1 Rau 2 1 1 Rau 2 1 1 Rau 2 1 1 1 Rau 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 3 0 0 0 3 5-20 life 2 0 0 0 2 | RANGE (ne- 2) Rau 1 0 0 1 2: Rau 1 0 0 1 2: Rau 1 Rau 1 0 0 0 1 | 0 0-25 UF 1 0 0 0 1 0-25 UF 1 0 0 | 25 Ram 0 0 0 0 0 0 25 Ram 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 30 Rass 1 0 0 0 1 30 Rass 1 0 0 0 | 0 0 0 1 0 0 0 1 0 0 0 1 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | -40 -40 -40 -40 -40 -40 | Tota Ram Ram CHI - SOUA Ram CHI - SOUA CHI - SOUA FOR 3 TE Ram CHI - SOUA FOR 3 TE | 1 1 5 0 444 0 449 149 149 149 149 149 149 149 149 149 |

¹⁾ Numbers presented are a minimum estimation for test periods.

Table D6. Indian Point hammer test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 36.

| 10 HI | | | EST PERIC | | | | | 1 | RRNBE (m | ters) | | | | | | | *.* | 1 |
|-----------------|----------|-------------|-----------|-------|-------|-------|-------|-------------|----------------|----------------|------------|-------|--------|-------|--------|-------|--------------------|----------------------|
| race | 0 | -5 | | 5-10 | 1 | 0-15 | | 15-20 | | 20-25 | | 25-30 | | 30-35 | 3 | 5-40 | Tota | 1 |
| upe | Rau | WF | Rau | UF | Rau | HF | Rau | MF | Rass | UF | Reu | NF | Rau | HF | Ran | HF | Rass | MF |
| \$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 2 | 4 | 2 |
| L | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | . 0 | 0 |
| C | 86 | 321 | 154 | 290 | 150 | 180 | 0 | 0 | 4 | 3 | 0 | 0 | . 0 | 0 | 0 | 0 | 394 | 794 |
| M | 0 | 0 | O | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | ` 0 | ٥ | 0 | 0 | 0 | 0 | | 0 |
| otal | 96 | 321 | 154 | 290 | 150 | 190 | 0 | 0 | 4 | 3 | 0 | 0 | o | 0 | 4 | 2 | 398 | 796 |
| 10 MI | MUTES AF | TER TE | ST PERIO | · · | | | | | RANGE (m | ters> | | | | | | | | 1 |
| race | 0 | -5 | | S-10 | 1 | 0-15 | | 15-20 | | 20~25 | | 25-30 | 3 | 30-35 | 3 | 5-40 | Tot | |
| upe | Rau | ИF | Rau | HF | Rau | NF | Rase | WF | Rau | MF | Rau | UF | Rau | uF | Rau | MF | : Raw | HF |
| s | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 4 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 10 | 8 |
| iL. | 0 | 0 | 0 | o, | 0 | 0 | 0 | 0 | 2 | 2 | 0 | a | · a | 0 | · O | . 0 | 2 | 2 |
| Ю | 86 | 321 | 138 | 259 | 178 | 214 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 402 | 794 |
| М | . 0 | 0 | ,0 | 0 | 0 | 0 | . 0 | 0 | 0 | a | 0 | o | 0 | 0 | 0 | o | 0. | O |
| otal | 96 | 321 | 138 | 259 | 180 | 216 | . 2 | 2 | 6 | 5 | 2 | `1 | Ó | 0 | 0 | 0 | 414 | 804 |
| HI-SQU -HAT | a | -5 | • | 5-10 | 1 | IO-15 | | 15-20 | ; | 20-25 | : | 25-30 | | 30-35 | 3 | S-40 | | ARE F-HA EST PERI |
| _ | Rau | MF | Rau | WF | Rau | WF | Rau | ИF | Reu | HF | Rest | WF | Ran | HF | Rau | HF | : Ray | HE |
| .S IL IC | 0 | 0 | 0 | . 0 | ò | 1 | å | 0 | 2 | 2 | ò | ò | o o | 0 | 2 0 | 1 | • | 5 1 |
| ic iu | 86 | 32 1 0 | 146 | 275 | 164 | 197 | . 0 | . 0 | 2 | 2 | 9 | 8 | 8 | 0 | 0 | 0 | : 398 | 794 |
| ÕTAL. | 86 | 32 I | 146 | 275 | 165 | 198 | ī | ĭ | Š | 4 | ī | , Ā | ŏ | ŏ | ž | ĭ | 1 406 | 800 |
| HY-SQU RLUES | | -s | | S-10 | | 10-15 | | 15-20 | | 20-25 | • | 25-30 | | 30-35 | 5 | 5-40 | CHI -squ | ARF VALU |
| | <u>`</u> | LE LE | Rau | . WF | Rasa | uf | Rau | WF | | | Rau | LIF | Rau | MF | | HF | FOR 2 TI | |
| S | K 200 | | | | 2.000 | Z.000 | 2.000 | 2.000 | 4.000 | 3.000 | 2.000 | 1.000 | | | 4.000 | 2.000 | 1 2.571 | 3.600 |
| S L C | 0.000 | 0.000 | 0.877 | 1.750 | 2.390 | 2.934 | | , == | 2.000 4.000 | 2.000 3.000 | | | | == | == | | : 2.000 : 0.080 | 2.000 |
| IM FOTRL | 0.000 | 0.000 | 0.677 | 1.750 | 2.727 | 3.273 | 2.000 | 2.000 | 9.400 | 0.500 | 2.000 | 1.000 | . == | | 4-000 | 2.000 | 0.315 | 0.040 |

¹⁾ Numbers presented are a minimum estimation for test periods.

Table D7. Indian Point hammer test monitoring using 6x12 degree horizontal transducer located at unit 3, intake 35.

| | | | | | ~ # # # # # # # # # # # # # # # # # # # | tigh Tic | ********** | - | ******** | ent Type | | 54C 0 | | | | | | |
|--|---|--|--|--|--|--|--|---|--|--|--|---|--|--|---|---|--|---|
| | MUTES BEF | ORE TE | | | | | - | • | RIMBE (met | ters) | | | | | | | | |
| race | 0- | | S | -10 | | 10-15 | 15 | -20 | 20 | 0-25 | 25 | -30 | | 0-35 | | 5~40 | Tota | 1 |
| ID-6 | | MF | Rau | UF | Rasi | NF | Rau | HF | Rau | HF | Rau | WF | Rau | MF | Rau | HF | 2 Rau | HE |
| | 0 | 0 | <u> </u> | 9 | 5 | 6 | 4 | 4 | 7 | 5 | 9 | 5 | 1 | 1 | 0 | 0 | 31 | 30 |
| | 0 | 0 | ٥ | 0 | 0 | 0 | O | 0 | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | o | . 0 | 0 |
| : | 0 | ٥ | 0 | 0 | ø | ٥ | 0 | 0 | 0 | ٥ | ٥ | 0 | o | 0 | 0 | 0 | . 0 | 0 |
| 1 | ø. | 0 | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | o | 0 | 0 | o` | . 0 | 0 |
| tal | 0 | 0 | 5 5 | 9 | 5 | 6 | 4 | 4. | 7 | 5 | 9 | 5 | 1 | 1 | 0 | | 31 | 30 |
| o HI | NUTES DUR | INO TE | ST PERIO | D | | | | 1 | RANGE (not | ters) | | | • | | | | | |
| | · 0- | -5 | 5 | -10 | | 10-15 | 15 | -20 | 20 | 0-25 | 25 | ~30 | 3 | Q-3 5 | 3: | 5-40 | Tota | 1 |
| race spe | Rau | WF | Rau | WF | Rau | NOF | Rau | WF | Rau | WF | Rau | NF | Rate | HF | Rass | WF | 1 Res | M |
| | 0 | | 4 | 8 | 7 | 8 | 3 | 8 | 14 | 11 | 6 | 4 | 2 | <u>i</u> | ,, | 0 | 43 | 40 |
| L | 0 | 0 | 0 ·· | 0 | 0 | ٥ | 0 | O | 0 | 0 | 0 | 0 | 0 | 0 | . a | 0 | 0 | 0 |
| | | | | | _ | _ | 1 | 1 | 1 | 1 | 0 | 0 | o | o · | ٥ | 0 | 5 | 9 |
| : | 1 | 4 | 1 | Z | 1 | 1 | * | • | • | • | - | | | | _ | _ | · - | |
| | 0 | • | 0 | 2 | 0 | 0 | 0 | 0 | | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| tel | 0 1 | 0 4 | | 10 | _ | - | 7 | _ | - | _ | | 4 | 2 | 0 | - | 0 | • | 49 |
| i ital 10 řízi | 0 | 0 4 | 5 F PERIOD | 10 | 8 | <u> </u> | 10 | 9 | 0 15 RANGE (he) | 12 | 6 | | 2 | | 0 | 0 | 0 | 49 |
| tel | O 1 HUTES AFT | 0 4 | 5 F PERIOD | 10 | 8 | 3 | 0 10 | 9 | 0 15 RANGE (he) | 0 12 ters> | 6 | 4 | 2 | 1 | 0 | 0 | 0 48 | 49 |
| ital 10 jili | O 1 HUTES AFT | Q 4 ER YES | o 5 ST PERIOD | 10 | 8 | 9 | 0 10 | 0 9 5-20 | 0 15 RANGE (no) | 0 12 ters> | 6 | -30_ | | 0-35 | 0 1 | 0 | 0 48 | 49 |
| itel 10 fil: | O 1 MUTES AFT O-Rem | 0 4 ER TES | O 5 ST PERIOD 5 Raw | 10 10 i-10 HF | G S Rate | 0 3 10–15 | 0 10 | 0 9 20 MF | 0 15 RANGE Cook | 0 12 ters> 0-25 | 0 6 25 Raw | 4 ~30 MF | 2 3 Rate | 0-35 NF | 0 1 2: Rais | 0 0 5~40 MF | 0 1 48 | 49 |
| i ital 10 HII race ipe | O I RUTES AFT | O 4 FER TES | O S S Raw | 0 10 3-10 HF | 0 8 Rau | 0 9 10-15 HF | 0 10 15 Rana 5 | 0 9 5-20 MF | O 15 RANGE (no 20 Rau | 0 12 ters> 0-25 MF | 0 6 25 Raw 2 | 4 i~30 MF | 2 Rau | 0-35 HF | 9: Rais | 0 0 5-40 UF | Tota Rau 35 | 49 11 14 46 |
| itel 10 MI | O I RUTES AFT O-RAM | O 4 FER TES | O 5 ST PERIOD SRAW | 10 10 HF 17 | 0 8 Rau 10 | 0 3 10-15 NF 12 | 0 10 15 Raw 5 | 0 9 5-20 MF 5 | RANGE See | 0 12 ters) 0-25 MF | 25 Raw 2 | 4 i~30 MF 1 | 2 Rau . 3 | 0-35 HF 2 | 0 1 29 Raw 1 | 0 0 1-40 UF 0 | Tota Rau 35 | 49 UF 46 |
| itel 10 MI | O I I O-Rest 2 O 2 | O 4 FER YES S UF F O | 5 FRANCO | 10 10 HF 17 0 | 0 8 Rau 10 0 | 0 3 10-15 1F 12 0 | 0 10 15 Rau 5 0 | 0 9 5-20 MF 5 0 | 0 15 RANGE Cool 20 Rau 3 0 | 0 12 ters) 0-25 14F 2 0 | 25 Raw 2 0 | 4 i-30 HF 1 0 | Raid O | 0-35 WF 2 0 | 0 1 Raw 1 0 | 0 0 0 UF 0 | Tota 1 Rau 2 35 | 49 HF 46 0 |
| race | 0 1 MUTES AFT 0- Ress 2 0 2 | 0 4 FER TES 5 WF 7 0 7 | 0 5 T PERIOD 5 Raw 9 0 1 | 10 10 10 17 0 2 | 0 9 Rest 10 0 0 | 0 3 10-15 1F 12 0 | 0 10 15 Rau 5 0 0 | 0 9 5~20 MF 5 0 | 0 15 RANGE Charles 20 Rang 0 0 | 0 12 ters) 0-25 14F 2 0 0 2 | 25 Raw 2 0 1 | 4 i~30 MF 1 0 1 0 2 | 3 Ratu 3 0 0 | 0-35 NF 2 0 0 0 | 0 1 29 Ram 1 0 0 | 0 0 13~40 14F 0 0 0 | Tota # Raiu # 35 # 40 CHI-SQUAFOR 3 TE | 49 46 0 10 2 58 IRE F-HR |
| intel | O 1 MUTES AFT O-Rail 2 0 2 0 4 ARE | 0 4 FER TES 5 WF 7 0 7 | 0 5 T PERIOD S Rand 9 0 1 1 | 0 10 10 10 17 0 2 2 21 | 0 9 Rest 10 0 0 | 0 3 10–15 HF 12 0 0 | 0 10 15 Rau 5 0 0 | 0 9 5-20 MF S 0 0 | 0 15 RANGE Charles 20 Rang 0 0 | 0 12 ters) 0-25 NF 2 0 | 25 Raw 2 0 1 | 4 i~30 MF 1 0 1 | 3 Ratu 3 0 0 | 0-35 WF 2 0 0 | 0 1 29 Ram 1 0 0 | 0 0 13~40 MF 0 0 | Tota | 49 49 46 0 10 2 58 18E F-HR |
| race pe i i i i i i i i i i i i i i i i i i | O 1 MUTES AFT O-Ress 2 0 2 0 4 RRE C- | 0 4 F 2 0 | France S Rank S C C C C C C C C C C C C C C C C C C | 0 10 10 10 10 10 10 10 10 10 10 10 10 10 | 0 S Rate 10 0 0 10 Rate 7 0 | 0 3 10-15 12 0 0 12 10-15 | 0 10 15 Rau 5 0 0 0 | 0 9 1-20 MF 5 0 0 | 0 15 RANGE Chan 21 Ran 3 0 0 0 3 20 Ran 8 0 0 | 0 12 ters) 0-25 MF 2 0 0 2 | 25 Rass 2 G 1 C | 4 4 5-30 HF 1 0 1 0 2 5-30 HF 3 0 | 2 3 Raw 3 0 0 0 0 3 Raw 2 0 0 | 0-35 MF 2 0 0 2 | D 1 1 Si Rau 1 O O O I I Rau 1 O O | 0 0 0 14F 0 0 0 0 | Tota I Rau I 35 O 1 4 CHI-SQUAFFOR 3 TE IRAM I 36 I 36 I 40 I | 49 49 46 0 10 2 58 REF-HAR |
| race pe | O I I MUTES AFT O-Rest 2 O 2 O 4 ARRE O-Rest I I | 0 4 F C C C C C C C C C C C C C C C C C C | FRAME STREET PERIOD STREET STR | 0 10 10 10 10 10 10 10 10 10 10 10 10 10 | Rate 10 0 0 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 3 10-15 12 0 0 12 10-15 | 0 10 15 Rau 5 0 0 0 5 | 0 9 5-20 MF 5 0 0 5 | 0 15 RANGE Chan 2 Ran 2 C C C Ran 2 C C C C C C C C C C C C C C C C C C | 0 12 ters) 0-25 MF 2 0 0 2 | 25 Rau 2 G 1 C | 1 0 1 0 2 1-30 MF 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 | 0-35 NF 2 0 0 2 0-35 NF 1 0 0 | 0 1 1 2: Rate 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 14F 0 0 0 0 0 0 0 0 0 | Tota I Rau I 35 O 1 4 CHI-SQUAFFOR 3 TE IRAM I 36 I 30 I 3 | 49 46 0 10 2 59 REF P-H# 30 0 6 |
| race per squellers squelle | 0 1 1 NUTES AFT 0- Resu 2 0 2 0 4 4 ARRE 0- Resu 1 0 1 0 2 2 | 0 4 FER TES 5 UF 7 0 14 -5 | ST PERIOD SRand 9 0 1 1 1 5 Rand 0 1 | 0 10 10 10 10 10 10 10 10 10 10 10 10 10 | 0 9 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | 0 9 10-15 MF 12 0 0 12 10-15 | 0 10 15 Rau 5 0 0 0 | 0 9 9 6-20 MF 5 0 0 | O 15 RANGE Chee Rau 3 0 0 0 20 Rau 3 | 0 12 ters) 0-25 16 0 0 2 | 25 Raw 2 G 1 C 3 | 4 30 MF 1 0 1 0 2 5-30 MF 5 0 0 | 3 Ratu 0 0 0 3 | 0-35 MF 2 0 0 2 | 0 1 Raw 1 0 0 0 7 | 0 0 0 14F 0 0 0 0 0 0 0 0 0 | Tota Rau 1 35 1 40 CMI-SQUE FOR 3 TE RAU 2 36 3 3 | 49 46 0 10 2 59 RE F-HF ST PERI |
| race ppe i i i i i i i i i i i i i i i i i | 0 1 1 NUTES AFT 0- Resu 2 0 2 0 4 4 ARRE 0- Resu 1 0 1 0 2 2 | 0 4 FER TES 5 UF 7 0 14 -5 | ST PERIOD SRand 9 0 1 1 1 5 Rand 0 7 | 0 10 10 10 10 10 10 10 10 10 10 10 10 10 | 0 9 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 3 10-15 12 0 0 12 10-15 | 0 10 10 Rau 5 0 0 0 25 Rau 6 | 0 9 9 6-20 MF 5 0 0 | 0 15 RANGE (her 20 0 0 0 0 20 Ran 20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 12 ters) 0-25 MF 2 0 0 2 | 25 Rass 2 G 1 G 3 | 1 0 1 0 2 1-30 MF 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 Ratu 0 0 0 0 0 2 | 0-35 NF 2 0 0 2 0-35 NF 1 0 0 | 0 1 Raw 1 0 0 0 8 2 Raw 1 0 0 | 0 0 0 14F 0 0 0 0 0 0 0 0 0 | 0 | 49 49 46 0 10 2 58 REF-HAR 30 6 1 45 |
| race per interpretation of the second | 0 1 MUTES AFT 0- Rass 2 0 2 0 4 ARE 0- Rass 1 0 1 0 2 | 0 4 FER TES 5 UF 7 0 14 -5 UF 2 0 4 0 6 5 5 UF | 0 5 5 T PERIOD 5 Raw 9 0 1 1 1 1 5 Raw 6 0 1 0 7 5 Raw 7 7 5 Raw 7 7 5 Raw 7 7 5 Raw 7 7 5 Raw 7 7 5 Raw 7 7 5 Raw 7 7 5 Raw 7 7 5 Raw 7 7 5 Raw 7 7 5 Raw 7 7 5 Raw 7 7 5 Raw 7 7 5 Raw 7 7 5 Raw 7 7 7 5 Raw 7 7 7 5 Raw 7 7 7 5 Raw 7 7 7 5 Raw 7 7 7 5 Raw 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 | 0 10 10 10 10 10 10 10 10 10 10 10 10 10 | 0 8 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 3 10-15 MF 12 0 0 0 12 10-15 MF 9 0 0 | 0 10 10 15 Raw 5 0 0 0 5 8 8 8 9 0 0 6 | 0 9 1 5-20 MF 5 0 0 0 5 | 0 15 RANGE Charles 20 0 0 0 3 20 Rang 0 0 0 0 | 0 12 ters) 0-25 WF 2 0 2 0-25 WF 6 0 0 6 | 25 Rami 2 G 1 G 3 25 Rami 6 O 0 0 6 | 4 30 MF 1 0 1 0 2 5-30 MF 3 0 4 | 2 3 Raiu 2 0 0 0 2 3 Raiu 2 0 0 2 3 Raiu 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0-35 MF 2 0 0 2 0-35 MF 0 0 | 0 1 Raw 1 0 0 0 8 2 Raw 1 0 0 | 0 0 0 0 0 0 0 0 0 0 | Tota Rau 1 35 1 40 CMI-SQUE FOR 3 TE RAU 2 36 2 39 | 49 46 0 10 2 58 REF-HAR 30 6 1 45 |
| race poe i ital ital ital ital ital ital ital ital ital ital ital ital ital ital ital ital ital ital | 0 1 1 | 0 4 FER TES 5 UF 7 0 14 -5 UF 2 0 4 0 6 5 5 UF | 0 5 Ram 9 0 1 1 11 5 Ram 6 0 7 7 | 0 10 10 10 10 10 10 10 10 10 10 10 10 10 | 0 9 8 Raw | 0 3 10-15 WF 12 0 0 12 10-15 WF 3 | 0 10 10 15 Rau 5 0 0 0 6 15 Rau 6 0 0 6 | 0 9 1-20 MF 5 0 0 5 5-20 MF 6 0 0 0 0 | 0 15 RANGE (No.) Rest 3 0 0 0 0 3 20 Ratt 8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 12 ters) 0-25 WF 2 0 0 0 2 0-25 WF 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 25 Raw 2 C 1 C 3 25 Raw 6 O 0 0 6 | 4 4 5~30 MF 1 0 1 2 5~30 MF 3 0 0 4 4 5~30 MF 4 6000 | 2 3 Raid 2 0 0 2 2 3 Raid 1.000 | 0-35 MF 2 0 0 2 0-35 MF 1 0 0 1 | 0 1 2 Raw 1 0 0 0 8 1 2 1 0 0 1 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Tota 1 Raw 1 35 1 4 2 40 CHI-SQUAR FOR 3 TE RAW 1 50 2 39 CHI-SQUAR 1 30 3 15 RAW 1 30 3 16 3 17 8 18 8 18 8 18 8 18 8 18 8 18 8 18 8 | 49 49 46 46 46 47 47 48 48 48 48 48 48 48 48 48 48 48 48 48 |

Table D8. Indian Point hammer test monitoring using 6w12 degree horizontal transducer located at unit 3, intake 35.

| | | | ********* | | ; | ilgh Tic | ie · r - n = = = = | | Duration Treatmo | int Tup | •: 10 | O sec o | ber 5 onli m 20 sec | off | Test Date Test Time | • : | 2/4/98 0140 | |
|--|--|--|--|---|---------------------|---|----------------------------------|---|--|--|---|---|---|---|--|--------------------------------|--|---|
| O MI | INUTES BEI | FORE TE | EST PERIOD | | | | | . 1 | RANGE (Het | ters> | • | | | | | | | |
| | 0- | -5 | 5- | 10 | 1 | 10-15 | 19 | 5~20 | 20 |) -2 5 | 2 | 5-30 | 30 | 0-35 | 35 | 5-40 | Total | |
| ibe ece | Rau | UF | Ray | HF | Reu | WF | Rau | WF | Rass | MF | Rau | NF | Rau | uF. | Rau | NF. | Rau | H |
| : | 1 | 4 | 0 | 0 | 4 | 5 | 8 | 7 | 6 | Б | 7 | 4 | 5 | 3 | 2 | 1 | 33 | 29 |
| - | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | a . | 0. | 0 | 0 | 0 | 1. | 1 |
| c | 0 | 0 | 0 | 0 | 0 | 0 | 0 1 | 0 | 1 | 1 | 1 | 1 | . 0 | 0 | 0 | 0 | . 2 | 2 |
| 4 | | . 0 | 0 | 0 | . 0 | 0 | 0 | . 0 | 0 | 0 | 0 | G | , 0 | 0 | 0 | 0 | . 0 | 0 |
| tal | 1 | 4 | 0 | 0 | 4 | , s | 9 | 7 | 9 | 7 | 9 | 5 | 5 | 3 | 2 | 1 | 36 | 32 |
| O ME | HUTES DU | RIMO TE | EST PERIOD | | | | | | | | • | | | | | | | |
| | _ | _ | _ | | | | 4 | | RANGE (net | | _ | | _ | | | | | |
| - | Rau | -5 | | 10 UF | | 10-15 LEF | | 5-20 | |)-25 | | S-30 | | 0-3 5 | | 5-40 | Total | |
| up+ | | | | | Rau | | Rau | MF | | uf | Reu | uf | | MF | Reu | - | Raw | MF |
| 5 | 1 | 4 | 5 | 9 | | 10 | 17 | 15 | 11 | 8 | 10 | 6 | 3 | 2 | 2 | 1 | 57 . | 55 . |
| L C | 2 | 7 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 2 | 0 | 0 | | 0 | 0 | 0 | 1 | 4 |
| - | 4 | • | æ | - | 0 | 0 | 0 | 0 | 9 | 2 | 1 | , | 0 | 0. | 0 | 0 | | 14 |
| | _ | _ | _ | _ | | | | u | Q | u | U | 0 | | 0 | 0 | a | 1 | - |
| otal | 1 5 INUTES AFI | 19 TER YES | O 7 ST PERIOD | 13 | 8 | 10 | 17 | 15 | 14 | 10 | 11 | 7 | 3 | 2 | 2 | 1 | 67 | 77 |
| otal 10 MI | 5 NUTES AFT | 19 TER YES | 7 ST PERIOD | 13 | 8 | 10 | 1: | 5-20 | RANGE (H+1 | ters) 3–25 | | 5-30 | | 0-35 | _ | 5-40 | fotal | |
| race upe | 5 INUTES AFT O- | TER TES | 7 ST PERIOD S- Rau | 13 10 WF | Rau | 10 | 17 1: | 5-20 WF | RANGE (H+1 | ters))-25 UF | Rau | 5-30 W | | | _ | 1 5-40 UF | | |
| otal 10 MI race upe | S INUTES AFI O- Rass | 19 TER YES | P ST PERIOD S- Rau | 13 10 WF | Rau | 10 10-15 UF | 17 Rau 10 | 5-20 UF | 20 Rais 11 | ters))-25 UF | 2: Reu 12 | 5-30 Wf 7 | | 0-35 HF | 3: Res. 1 | HF Q | Total | |
| otal 10 MI race upe 5 | S CHUTES AFT | 19 TER TES S HF | 7 ST PERIOD S- Rau | 13 10 WF 13 | Rani | 10 10-15 UF | 17 13 Rau 10 | 5-20 MF 9 | 20 Raw 11 | ters))-25 NF 8 | 2: Rau 12 0 | 5-30 HP 7 0 | | 9-35 UF | 3: Resu 1 0 | UF Q | Total | HF 47 |
| otal 10 MI race ype 5 | S INUTES AFT | TER YES | F PERIOD S-Rau 7 0 | 13 10 10 13 0 | Ranı 7 0 | 10-15 UF | 17 Rau 10 0 | 5-20 WF 9 0 | 20 Rass 11 1 0 | ters))-25 NF 8 1 | 22 Resu 12 0 | 5-30 HF 7 0 | 30 Rau 4 0 | 0-35 HF 2 0 | 1 0 0 | HF Q Q | Fota: Ran 52 1 1 4 | HF 47 . 1 |
| otel LO MI Pace pe | S OUTES AFT O- Rau O 2 | TER YES | 7 ST PERIOD 5- Rau 7 0 | 13 10 10 13 0 2 | Rass 7 0 0 0 | 10-15 UF 0 | 17 Rau 10 0 | 5-20 UF 9 0 | RANGE (He) 20 Raid 11 1 0 | 0 0 | 22 Ress 12 0 0 | 5-30 HP 7 0 | 30 Rau 4 0 1 | 0-35 UF 2 0 1 | 3: Rest 1 0 0 | UF G G O | Fota: Rau 52 1 1 1 0 | HF 47 1 10 0 |
| otal 10 MI race upe 5 | S INUTES AFT O- Rau O 2 O 2 | TER YES | F PERIOD S-Rau 7 0 | 13 10 10 13 0 | Ranı 7 0 | 10-15 UF | 17 Rau 10 0 | 5-20 WF 9 0 | 20 Rass 11 1 0 | ters))-25 NF 8 1 | 22 Resu 12 0 | 5-30 HF 7 0 | 30 Rau 4 0 | 0-35 HF 2 0 | 1 0 0 | HF Q Q | Fotal | 47 10 0 |
| otal 10 MI race upe | S INUTES AFT O- Ram O 2 O 2 | TER YES | 7 ST PERIOD S- Rau 7 0 | 13 10 10 13 0 2 | Rasi 7 0 0 | 10-15 UF 0 | 17 11 Rau 10 0 0 | 5-20 UF 9 0 | 20 Ran 11 1 0 0 12 12 | 0 0 | 2: Rau 12 0 0 | 5-30 HP 7 0 | 7 Rau 4 0 1 0 5 | 0-35 UF 2 0 1 | 31 Rest 1 0 0 | UF G G O | Fota: Rau 52 1 1 1 0 | 10 0 58 |
| otel 10 MI race MPe 5 C M otal HI-SQL | S INUTES AFT O- Ram O 2 O 2 | TER YES | 7 ST PERIOD S- Rau 7 0 | 13 10 UF 13 0 2 0 15 | Rasi 7 0 0 | 10 15 HF 0 0 0 8 | 17 1: Rau 10 0 0 0 10 1: Rau | 5-20 MF 9 0 0 9 | 20 Ran 11 1 0 0 12 12 | ters))-25 HF 8 1 0 | 22 Resu 12 0 0 12 | 5-30 HP 7 0 0 | 7 Rau 4 0 1 0 5 | 0-35 Uf 2 0 1 0 3 0-35 | 3: Rest 1 0 0 0 | 0 0 0 0 | Total Raw 52 1 4 0 CNI-SQURIFOR 3 TE: | 47 1 10 0 58 25 F-HF |
| otal | S INUTES AFT O C Raw O C C C C C C C C C C C C C C C C C C | 19 TER YES -5 -6 0 7 0 7 | 7 ST PERIOD 5- Ram 7 0 1 | 13 10 WF 13 0 2 0 15 | Ranu 7 0 G 0 7 | 10 10 15 UF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 17 | 5-20 UF 9 0 0 | 20 Rail 1 1 0 0 12 20 20 12 20 20 12 | ters))-25 HF 8 1 0 | 22 Read 12 0 0 12 22 Read 10 | 5-30 MF 7 0 0 7 | 20 Rass 4 0 1 0 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 | 0-35 MF 2 0 1 0 3 0-35 | 3: Resu 1 0 0 0 1 3: Rasi 2 | 0 0 0 0 0 5–40 | Total Raw 52 1 57 CMI-SQUAR FOR 3 TES Raw 47 1 | 47 10 0 59 RE F-HR |
| otel LO MI Acce Pe Li Mi | S INUTES AFT O Rau O 2 O 2 INRE O- Rau 1 | 19 TER YES -5 -6 0 7 0 7 | FOR ST PERIOD STATE OF STATE O | 13 10 WF 13 0 2 0 15 | Rans 7 0 0 7 | 10 10 15 WF 0 0 0 8 10 - 15 WF | 17 Rau 10 0 0 110 110 | 5-20 MF 9 0 0 9 5-20 | 20 Rail 1 1 0 0 12 20 20 12 20 20 12 | 8 1 0 0 9 0-25 MF 7 1 | 2: Reu 12 0 0 12 12 | 5-30 MF 7 0 0 7 | 20 Rau 4 0 1 1 0 5 8 Rau 4 0 0 | 0-35 Uf 2 0 1 0 3 | 31 Result 1 Q 0 0 1 | 0 0 0 0 0 5–40 | Total Raw 52 1 57 CHI-SQURIFOR 3 TE: Raw 47 1 1 5 5 | 10 0 58 EF PERI |
| otal Otal Face IPPE | S INUTES AFT O Rau O 2 O 2 IMRE O Rau O 3 | 19 TER YES -5 -6 7 0 7 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 | FERIOD ST PERIOD ST | 13 10 17 13 0 2 0 15 | Rans 7 0 G 0 7 | 10 10 15 UF 8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 17 11 Rass 10 0 0 11 12 0 0 0 12 | 5-20 WF 9 0 0 9 5-20 WF 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 20 Raw 11 1 0 0 12 20 Raw 11 1 0 11 1 | 0 0 0 0 0 0 0 0 0 0 0 0 | 2: Resu 12 0 0 12 2: Resu 10 0 10 | 5-30 MF 7 0 0 7 | 70 1 0 5 20 Rehi | 0-35 MF 2 0 1 0 3 0-35 MF 2 0 0 | 31 Remi 1 0 0 0 1 31 Remi 2 0 0 0 | 0 0 0 0 0 5-40 | Total Raw 52 1 57 CMI-SQUAR FOR 3 TE: 47 1 1 5 5 | 47 10 0 59 82 F-MA 17 PERI 43 29 15 |
| otal IO HI Face MPC S L C H otal HI-SQL | S (NUTES AFT O-Rau O Rau O Rau O Rau O Rau O O Rau O O Rau O O Rau O O Rau O O O O O O O O O O O O O | 19 TER YES -5 MF 0 7 0 7 -5 11 10 | 7 PERIOD 5-Ram 7 0 1 0 5-Ram 4 0 1 0 5 5-Ram 5.500 13 | 13 10 WF 13 0 2 0 15 16 WF 7 0 2 0 | Rans 7 0 G 0 7 | 10 10 15 WF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 17 | 5-20 UF 9 0 0 9 5-20 UF 10 0 0 | RANGE CHE 1 20 Rau 11 1 0 0 12 Rau 9 11 10 11 20 Rau 2.889 0.000 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 22 Resu 0 0 12 22 Resu 10 0 10 | 5-30 MF 7 0 0 7 5-30 MF 6 | 20 Rau 4 0 0 0 0 0 4 2 0 0 0 0 0 0 0 0 0 0 0 0 | 0-35 Uf 2 0 1 0 -35 UF 2 0 0 | 31 R cos 1 0 0 0 0 1 31 R cos 1 2 0 0 0 2 | 0 0 0 0 5-40 UF | Total Ram 52 1 52 1 1 57 CMI-SQURIFOR 3 TE: 47 1 1 5 3 CHI-SQURIFOR 3 TE: Ram FOR 3 TE: Ram 1 7.930 11 2 0.000 2 2.800 | 10 0 58 F-HF 43 2 2 3 55 RE VALLE |

Table D9. Indian Point hammer test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| | | | | | H | Hrs at | le | | Buration Treatm | ent Tys | e: 1 | 0 500 (| Her 5 on on 30 sec | off | Test Dat Test Tim | •: | 2/4/88 0200 | |
|---------------------|----------------|----------------|-----------|----------------------------------|-------------------------|---|-----------|-------------------------|--------------------|----------------------------------|-----------|-------------------------|-----------------------|-------------------------|-------------------------|---------|---|---|
| 10 MI | NUTES DU | RING T | EST PERIO | 0 | | | | 1 | RANGE CHO | ters> | | | | | | | • | |
| | _ | -5 | 5 | -10 | 1 | 0-15 | | 5-20 | 2 | 0-25 | . 2 | 5-30 . | 3 | 0-35 | | 5-40 | Tota | 1 |
| dbe Lece | Rau | MF | Rau | WF | Rau | HF | | UF | Rau | ИF | Rau | KF. | Rau | NF | Raw | NF | Rau | MF |
| \$ | 1 | 4 | 7 | 13 | 6 | 7 | 7 | 6 | 12 | 9 | 14 | 8. | 6 | 3 | 1 | 0 | 54 | 20 |
| L | a | 0 | 0 | 0 | 2 | . 2 | 1 | 1 | 1 | 1 | 0 | 9 | 0 | 0 | 0 | • | 4 | . 4 |
| E | 2 | 7 | 0 | ` 0 | 0 | 0 | G | 0 | 1 | 1 | 3 | 2 | 1 . | 1 | 0 | 0 | 7 | 11 |
| 1 | . 0 | . 0 | 1 | 2 | . 2 | 2 | 0 | o · | 0 | 0 | 0 | 0 | OO | g. | 0 | 0 | | 4 |
| stal | 3 | 11 | | 15 | 10 | 11 | 6 | 7 | 14 | 11 | 17 | 10 | 7 | 4 | 1 | o | 60 | 69 |
| to MI | MUTES AF | TER TE | ST PERIOD | • | | | | 1 | RANGE (me | ters) | | | | | | | | |
| .ace | 0 | -5 | 5 | -10 | | 0-15 | | 5-20 | 2 | 0-25 | | 5~30 | | 0-35 | 3 | 5-40 | Tota | 1 |
| pě | Rass | ИF | Rau | WF | Rau | UF | Rau | HF | Rau | uf | Rau | uf' | Rau | MF | Rau | HF | E Ran | ur |
| S | 3 | 11 | 6 | 21 | 11 | 13 | 19 | 17 | 18 | 14 | 12 | 7 | 6 | 3 | 0 | 0 | 75 | 76 |
| , , | 0 | 0 | 2 | 4 | 0 | G | 0 | . 0 | • | 0 | 0 | ٥ | 0 | 0 | . 0 | . 0 | 2 | 4 |
| c | 2 | 7 | 0. | 0 | 2 | 2 | 0 | 0 | 1 | 1. | 1 | 1 | . 0 | 0 | 1 | 0 | 7 | 11 |
| * | 0 | . 0 | 1 | 2 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 . | 0 | 0 | o | 11_ | 2 |
| ital | 5 | 10 | 9 | 17 | 13 | 15 | 19 | 17 | 19 | 15 | 15 | 8 | 6 | 3 | 1 | 0 | : 05 | 93 |
| II —SQU HAT | | -5 | 5 | -10 | 1 | 015 | 1 | 5-20 | 2 | | 2 | 5-30 | 3 | 0-35 | 3 | 5~40 | CHI-SQU FOR 2 F | |
| \$ | Rau | HF B | Rau | HF 12 | Rau | ₩F 10 | Rau 13 | иF 12 | Rau 15 | UF 12 | Rau 13 | WF | Rau | HĘ | Rau | WF O | : Rau | ИF 63 |
| | ē | ğ | i | 2 | i | 1 | 1 | 1 | - 1 | -1 | 0 | Ž | ě | ő | į | ě | : 3 | . 11 |
| i ITAL | ő | , 15 | 1 | 16 | 12 | 13 | 14 | 0 12 | 10 17 | 13 | 15 | Ó | ģ | ģ | Ô | ě | 77 | |
| II – SQU IL IJES | | -5 | 5 | i-10 | 1 | 0-15 | 1! | 5~20 | | 0-25 | 2 | S-30 | | io-35 | 3 | 5-40 | CHI -Squ | |
| s L C Fral | 1.000 0.000 | 3.267 0.000 | 5.000 | 0.167 4,000 0.000 0,125 | 2.000 2.000 2.000 | UF 1.800 2.000 2.000 2.000 0.615 | 1.000 | 5.261 1.000 4.167 | | 1.087 1.000 0.000 0.615 | 1-000 | 0.067 0.333 0.222 | 1.000 | 0.000 1.000 0.143 | 1.000 1.000 0.000 | | :FOR 2 TI : Rau : 3.419 : 0.667 : 0.000 : 1.000 : 1.889 | 5.765 0.900 0.800 0.467 3.554 |

Table DiD. Indian Point hammer test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

| 10 HI | NUTES DUE | | | | | | | | RANGE (He | | ************************************** | 144012 | | | <u> </u> | | | |
|----------------------------|-----------|------------|----------|----------------------|--------------|--------------|--------------|----------|-----------------------|----------------------|--|-------------|-------|-------------|----------|---------|-----------------------------|----------------|
| | 0- | Æ | . 5. | -10 | • | 0-15 | , | .5~20 | | 0-25 | 24 | 5-30 · | • | 0-35 | . 34 | 5-40 | Tota | .1 |
| race upe | | ur ur | Rau | WF | Rau | MF | Rau | WF | Rau | WF | | | | WF | Raw | HF | : Rau | |
| S | 1 | 4 | 1 | 2 | 12 | 14 | 12 | 11 | 14 | 11 | 14 | 8 | 10 | 5 | 4 | 2 | 68 | 57 |
| L, | 0 | e | ٥ | 0 | 0 | ٥ | 0 | . 0 | 1 | 1 | 0 | 0 | 0 | 0 | ٥ | ٥ | 1 | 1 |
| C | 1 | 4 | 0 | 0 | G | 0 | a | 0 | 0 | ٥ | 1 | 1 | . 0 | 0 | 0 | 0 | 2 | 5 |
| N.4 | 0 | 0 | 1 | 2 | 0 | 0 | O · | 0_ | 0 | 0 | ō | 0 | 0 | 0 | 0 ' | 0 | 1 | 2 |
| otal | 2 | | 2 | 4 | 12 | 14 | 12 | 11 | 15 | 12 | . 15 | 9 | 10 | \$ | 4 | 2 | 72 | 65 |
| 10 MI | MUTES AFT | ER TES | T PERIOD | | | | • | 1 | RANGE CHI | ters> | | | | | | | | |
| race | 0- | -5 | 5 | - 10 | 1 | 0-15 | | 15-20 | | 0-25 | 2! | 5-30 | | 0-35 | | 5-40 | Tota | e] |
| VP+ | Rau | NF | Rau | uf' | Rass | uf | Rau | NF | Rau | WF | Rau | uf . | Rass | HF | Rass | ИF | : Rau | W |
| S | 1 . | 4 | 3 | 6 | 9 | 11 | 11 | 10 | 11 | 0 | 5 | 3 | 4 | 2 | 3 | 1 | 47 | 45 |
| L | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | a | . 0 | 1 | . 2 |
| ¢ · | 0 | 0 | 1 | 2 | 1 | . 1 | . 0 | 0. | 0 | . 0 | 1 | 1 | ٥ | 0 | 0 | Đ | <u> </u> | 4 |
| H | 0 | 0 | 0 | 0 | <u> </u> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 00 | 0 | 0_ | 0 | 0 |
| otal | 1 | 4 | 5 | 10 | 10 | 12 | 11 | 10 | 11 | 8 | 6 | 4 | 4 | 2 | 3 | 1 | ž 5 1 | 51 |
| HI-SQU -HAT | ARE 0- | - S | 5 | -10 | | 0-15 | 1 | 15-20 | | 20-25 | 2 | 5-30 | 3 | 0-35_ | | 5-40 | CHI-SOUF FOR 2 TE | |
| s | Raw | MF | Rau | uf | Raw | UF 13 | Rau | HF 11 | Rau 13 | uf 10 | Rau 10 | ИF | Rau | HF | Rau | WF 2 | : Rau | ығ 51 |
| L | ò | 3 | į | 7 | 11 | 0 | 12 | ģ | 13 | 10 | ō | ŏ | 0 | 8 | 2 | Ö | : 3 | 2 |
| C H DTAL | 0 | 9 | į | 1 | 1 0 11 | 1 0 13 | 0 0 12 | 11 | 13 | 10 | 1 0 11 | ģ | Ď. | ğ | 9 | 0 | 1 62 | 1 50 |
| v: ra. HI — SQ U | _ | • | • | • | ** | 23 | 46 | | | 20 | •• | • | • | • | • | - | | 20 |
| NLUES | | S | 5- | -10 | 1 | 0-15 | | 15-20 | | 0-25 | 2 | 5-30 | 3 | 0-35 | | 5-40 | CHI-SQUE | |
| S | 0.000 (| WF .000 | 1.000 | NF 2.000 2.000 | 0.429 | 0.360 | 0.043 | 0.049 | 744 0.360 1.000 | UF 0.474 1.000 | 4.263 I | uF 2.275 | 2.571 | ₩F 1.294 | 0.143 | 0.333 | 1 Ram 1 3.835 1 0.000 | 1.412 0.333 |
| Č · | 1.000 | .000 | 1.000 | 2.000 | 1.000 | 1.000 | = | | 1.000 | | | 0.000 | == | == | | == | 1 0.200 | 0.111 |
| M OTAL: | 0.333 | .553 | | 2.000 2.571 | 0.192 | 0.154 | 0.043 | 0.048 | 0.615 | 0.600 | 3.857 | 1.923 | 2.571 | 1.286 | 0.143 | 0.333 | 1 3.505 | 2.00 |

Table Dil. Indian Point hammer test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

| | | | - | idal P | · · · · · · · · · | Hrs a | de | | | ent Ty | pe: 2 | LO SOC | ther 5 onl on 20 sec | coff | Test Dat | ie I | 2/4/88 0240 | |
|----------------------|---------|------------|-----------|--------|-------------------|---------|-------|-------|----------|---------------|----------------|----------------|-------------------------|---------|----------|---------|--------------------|-----------|
| | | | EST PERIO | | | | | | RANGE < | | | | | | | | • | |
| • | 0- | 5 | 5 | -10 | 1 | 10~15 | ! | 12-50 | | 25 | | 25-30 | | 30-35 | 2 | 5~40 | Tot | al |
| Ab-e LP-Ce | Rau | HF | Rau | HF | Rau | MF | Rasi | HF | Rau | WF | Rau | WF, | Rau | NF | Rau | HF | Ran | WF |
| \$ | 0 | 0 | 4 | 9 | 11 | 13 | 9 | 8 | 7 | ~ 5 | 9 | 5 | 2 | 1 | 1 | 0 | 43 | 40 |
| L | 0 | 0 | D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G | 0 | 0 | 0 | | . 0 |
| C | 0 | ٥ | 1 | . 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 1 | 2 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| etal | 0 | 0 | 5 | 10 | 11 | 13 | 9 | 0 | 7 | 5 | • | 5 | 2 | . 1 | 1 | 0 | 44 | 42 |
| 10 MINUT | res aft | ER TE | ST PERIOD | | | | | | RAMBE (M | ·ters> | | | | | | | | |
| race | 0- | · s | 5 | -10 | | 10-15 | | 15-20 | | 20~25 | 2 | 25-30 | | DO-35 | | 5-40 | Tot | al |
| Ab- | Rau | WF | Rau | HF | Rau | LUF . | Rau | NF | Rau | UF | Rau | HF | Reu | WF | Rau | HF | : Ran | uf. |
| \$ | 0 | . 0 | 4 | | 2 | 2 | 11 | 10 | 5 | 4 | 13 | • | 3 | 2 | 2 | 1 | 40 | 35 |
| L. | , o " | ` 0 | 0 | 0 | 0 | G | 0 | 0 | 0 | 0 | 1.1 | 1 | 0 | ò | . 0. | Ö | 1 | 1 |
| c | 0 | O | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o o | 0 | | 0 |
| 114 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 1 |
| otal | o | 0 | 4 | 0 | 2 | 2 | 12 | 11 | . 5 | 4 | 14 | 9 | | 2 | 2 | 1 | 42 | 37 |
| NI -SQUARI -HAT | E | -5 | 5 | -10 | | 10-15 | ; | 15-20 | | 10-25 | · | 25-30 | 3 | 30-35 | | 5~40 | CHI-SOU FOR 2 I | |
| s | Rau | MF | Rau | HF. | Rau | NF B | R44 | HF | Rau | MF | Rase 11 | MF | Rau | UF 2 | Rau 2 | HF 1 | : Rau 1 42 | HF 38 |
| Č | š | ě | 6 | Š | ģ | 9 | 8 | Š | Š | 9 | • • | 1 | ŏ | ő | ō | ģ | 1 | 1 |
| TAL | Ö | ŏ | ģ | o 9 | Ş | 9 | 11 | 10 | 9 | Š | 0 12 | Š | Š | 0 2 | 2 | 9 | 43 | 40 |
| HI SQUARI ALUES | E- 0- | ·s | S | - 10 | ; | 10-15 | ; | 15-20 | 1 | to-25 | 2 | 25-30 | | 50~3S | : | S-40 | CHI-SQU | |
| _ | Raw | HF | RaH | UF | Rau | | Rau | WF | Rau | HF | Ran | UF | Rasa | uf. | Rau | UF | FOR 2 T | WF |
| S L C . | | | | 0.000 | 6.231 | 9.067 | 0.200 | 0.222 | 0.333 | 0.111 | 0.727 1.000 | 0.692 1.000 | 0.200 | 0.333 | 0.333 | 1.000 | 1.000 | 1.000 |
| 4 | | | | 2.000 | == | | 1.000 | 1.000 | | | | | == | | | | : 1.000 : 1.000 | 2.000 |
| <u> </u> | | | D.111 | 0.222 | 6.231 | 0.067 | 0.429 | 0.474 | 0.353 | 0.111 | 1.097 | 1.143 | 0.200 | 0.333 | 0.333 | 1.000 | : 0.047 | 0.516 |

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Table Diz. Indian Point hammer test monitoring using 6w12 degree horizontal transducer located at unit 3, intake 35.

| 400000 | | | | | |) Hrs b high ti | de | - | Duratio Treat | ment Ty | pe: a | 0 sec | Hmr 5 onl on 30 sec | off | Test Dat Hit taet | 1 4 E | 2/4/88 0300 | |
|---------------------------|-------------------------|-------|------------------------------|--------------------|--------------------|------------------------------|------------------------------|---|--------------------------|-------------------------|--------------------------------|--------------------|-------------------------|--------------------|------------------------------|-------------------|---|--|
| O HINU | TES DU | INO T | EST PERIC | 00 | | | | | RANGE (n | eters) | | | | | | | •.• | |
| | 0- | 5 | | 5-10 | | 10-15 | 1 | 15~20 | ; | 20-25 | 1 | 5-30 | | 10-35 | 2 | 5~40 | Tota | 1 |
| race ype | | NF . | Rau | | Rau | WF | Rau | NF | Rau | | Rau | HF | Ram | up. | Rau | WF | 1 Rau | H |
| | 0 | ٥ | 1 | 2 | 4 | 5 | 5 | 5 | 10 | • | 12 | 7 | 1 | 1 | 3 | 1 | 36 | 29 |
| | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | o | 0 | 0 ' | 0 | | 3 |
| | 0 | ٥ | 0 | . 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 1 | . 1 |
| l | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | • |
| tal | 0 | 0 | 1 | 2 | 5 | 6 | 7 | 7 | 11 | 9 | 12 | 7 | 1 | 1 | 3 | 1 | : 40 | 33 |
| O HIXMUT | TES AFT | ER TE | ST PERIO | D | | | | | RANGE <= | eters> | | | | | , | | | |
| .ace | 0- | -5 | 9 | 5-10 | | 10-15 | | l5-20 | | 20~25 | _2 | 5~30 | | 0-35 | 3 | 15-40 | Tota | -1 |
| De | Rau | WF | . Rau | HF | Rass | WF | Rans | WF | , Rau | WF | Resu | MF | Rau | WF | Rau | UF | : Raw | ur . |
| | G | 0 | 2 | 4 | > | 4 | 6 | S | • | 6 | 17 | 10 | 1 | 1 | 1 | 0 | 30 | 30 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 1 | 1 |
| : | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 1 | 1 | 0 | ٥ | G | 0 | 0 | 0 | 1 | 1 |
| l | . 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 1 | 1 |
| tal | 0 | 0 | 2 | 4 | 2 | 4 | • | 7 | 9 | 7 | 17 | 10 | 1 | 1, | 1 | o | 41 | 23 |
| II —SQUA RI HAT | E 0- | 5 | 1 | 5-10 | | 10-15 | 1 | 15-20 | | 20-25 | · | .S-30 | 3 | 0-35 | 4 | 5-40 | CHI-SQUE FOR 2 II | |
| S I DTAL | Rau 0 0 0 0 | 0000 | Rau 2 0 0 0 2 | MF 3 0 0 | Rau 1 1 0 | MF \$ 1 0 0 5 | Rau 6 1 1 1 0 | MF 5 1 1 1 | Reu 1 1 0 10 | 1 1 0 | Rew 15 0 0 0 15 | 4 MF | Rau 1 0 0 0 | 10 0 0 | Rau 2 0 0 0 2 | HF 1 0 0 | # Rau # 37 # 2 # 1 # 1 | UF 30 2 1 1 |
| II SAUARE NLUES | E | -5 | 1 | 5-10 | | 10-15 | 1 | 15-20 | | 20-25 | | 5-30 | 3 | 0-35 | | 5-40 | CHI-SQUE | |
| TAL | Rese | | 0.333 0.333 | 0.667 0.667 | 0.143 1.000 | 0.111 1.000 | 0.000 1.000 1.000 | 0.000 0.000 1.000 1.000 0.000 | 0.222 1.000 1.000 | 0.286 1.000 1.000 | 0.862 0.862 | 0.529 0.529 | == | 0.000 0.000 | 1.000 | 1.000 | E Rau 1 0.054 1 1.000 2 0.000 2 1.000 | WF 0.817 1.900 0.800 1.800 |

Table Di3. Indian Point hammer test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| 10 M | MULES D | NKT MO .I | EST PERI: | UU | | | | | RANGE CHA | ters> | • | | | | |) | •.• | |
|-------------------|---------|-------------|-----------|--------------|-------|---------|-------|-------|-----------|-------|-----------|---------|-------|-------|-------|-------------|--------------------|------------------------|
| | |)S | | 5-10 | | 10-15 | | 15-20 | | 0-25 | 2 | 5-30 | | 30-35 | | 5-40 | Tot | :a1 |
| ype | Rau | | Rau | HF | Rau | UF | Rau | ИF | Rau | WF | Rau | uF. | Rau | WF | Rau | HF | E Rau | WF. |
| s · | 0 | 0 | 5 | 9 | 5 | 6 | 4 | 4 | 5 | 4 | 11 | 7 | 5 | 3 | 2 | 1 | 37 | 34 |
| Ł | 0 | 0 | 0 | 0 | 0 | G | 0 | 0 | 0 | 0 | Ò | 0 | 0 | 0, | 0 | 0 | . 0 | 0 |
| iC . | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | . 0 | 0 | , 0 | 0 | . 0 | Q | .1 | 1 |
| M | . 0 | 0 | 0 | 0 | O | 0_ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 |
| otal | 0 | 0 | 5 | 9 | 6 | 7 | 4 | 4 | 5 | 4 | 11 | 7 | 5 | 3 | 2 | 1 | i 30 | 35 |
| 20 HI | NUTES A | TER TE | ST PERIO | D | | | | | RANGE CH | ters) | | | | | | | | • |
| | |)-S | ! | 5 -10 | | 10 15 | . 1 | 15-20 | | 0~25 | 2 | 25-30 | | 30-35 | 3 | 5-40 | Tot | :al |
| Abe LPCe | Rau | MF | Rau | WF | Rau | WF | Rau | WF | Rau | HF | Rass | MF | Ram | HF | Ran | HF | Res | , UF |
| S | 1 | 4 | > | . 6 | 7 | • | 3 | 3 | 5 | 4 | 14 | • | 4 | 2 | 3 | 1 | 40 | 36 |
| L | 0 | . 0 | 0 | · o | 0 | e | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ,0 | 0 | 0 |
| IC . | 0 | 0 | 2 | 4 | 0 | ٥ | 0 | 0 | 0 | . 0 | 1 | 1 | ٥ | 0 | 0 | 0 | 3 | 5 |
| N | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ð | 0 | <u> </u> | 1 |
| otal | 1 | 4 | 5 | 10 | 9 | 9 | 3 | , 3 | 5 | 4 | 15 | 9 | 4 | . 2 | > | 1 | i 44 | 42 |
| HI -591 -HAT | MRE |)-S | | 5 -10 | ~ | 10-15 | | 15-20 | | 0-25 | | 25-30 | | 30-35 | 3 | S-40 | | PRRE F-HA TEST PERI |
| s | Rau | HF 2 | Rau | UF | Rass | UF 7 | Rau | HF | Reu | uf | Rau 13 | HF A | Rau | MF | Rau | HF | 1 Ray 29 | uf 35 |
| ī c | ě | Õ | o o | Ŏ | Ŏ | Ò | Ó | Ó | ē | Ó | 0 | Ŏ | Ŏ | ě | Ó | Õ | : 0 | 9 |
| Ŭ OTAL | Ŏ | Ŏ 2 | ŝ | 10 | î | ĩ | Ŏ | Š | 0 | 9 | , Ö | Õ 8 | Õ | Š | Š | Ŏ | 1 41 | 29 1 |
| HI — SQL ALUES | | 0 –5 | | 5-10 | | 10-15 | | 15-20 | | 0-25 | . 2 | 25-50 | | 30-35 | 3 | 5-40 | CHI-SOU | ARE VALU |
| s | Rau | HF | Rau | UF | Rau | | Rau | MF | Rau | MF | Rau | HF | Raw | WF | Rau | UF | 1 Raw | EST PERI |
| L L | 1.000 | 4.000 | 0.500 | 0.600 | 0.323 | 0.286 | 0.143 | 0.143 | 0.000 | 0.000 | | 0.067 | 0.111 | 0.200 | 0.200 | 0.000 | 0.117 | 0.057 |
| ii ic m | . == | | 2.000 | 4.000 | 1.000 | 1.000 | | | | | 1.000 | 1.000 | | | | | : 1.000 : 1.000 | 2.667 1.000 |

Table D14. Indian Point hammer test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| | | ***** | | ldal Pi | | .5 Hr L on Tide | • | | Puration Treatm | ent Tub | o: 34 | O sec o | imr 5 onl on 20 sec | = off | Yest Dat Fest Tim | e: | | |
|-------------------------|----------|------------|-----------|---------|-------|--------------------|-------|----------------|--------------------|---------|------------|---------|------------------------|---------------|----------------------|------------|--|-------------------------|
| 10 MI | MUTES DU | RIND TI | EST PERIO | , | | | | | RAMBE Coef | tersÿ | | | | | | | •.• | |
| | | ~5 | S | ~10 | 1 | 10-15 | 1 | 5-20 | ~ 20 | 0-25 | 2 | 5~30 | | 90-35 | 3 | 5-40 | Teta | 1 |
| upe upe | Rau | MF | Rau | HF | Rau | WF | Rau | μF | Rau | ИF | Reu | MF | Rau | | Rau | HF | Res | NF |
| | | 0 | 2 | 4 | 4 | 5 | 9 | 8 | 8 | 6 | 12 | 7 | 4 | 2 | 5 | 2 | 44 | 34 |
| L | 0 | | . 0 | . 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | O | 0 | 0 | 0 | | 0 |
| c | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 5 |
| H | 0 | 0 | . 0 | 0 | 1 | . 1 | .0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| otal | 1 | 4 | 2 | 4 | 5 | 6 | 9 | • | • | 6 | 12 | 7 | 5 | 3 | 5 | 2 | i 4 | 40 |
| io nz | MUTES OF | YER TE | ST PERIOD | | * | | | | RANGE Coo | tors> | | - | | | | | | |
| | 0 | -5 | \$ | ~ 10 | _ 1 | 10-15 | . 1 | 5-20 | . 20 | 0-25 | 2 | 5-30 | 3 | 30-35 | | 5-40 | Tet | |
| ibe | Rau | UF | Rau | WF | Rau | HF | Rau | UF | Rau | MF | Rau | HF. | Rau | MF | Ram | MF | 2 Raw | UF |
| s | 0 | 0 | 1 | 2 | 7 | • | 6 | 5 | 7 | 5 | , s | . 3 | 3 | 2 | 4 | 2 | . 39 | 27 |
| L | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | • | 0 | 0 | 0 | 0 | , o | 1 | 1 |
| C | 1 | 4 | 0 | 0 | 0 | • | 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | 0 | 1 | 4 |
| H | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 2 | 2 |
| otal | 1 | 4 | 1 | 2 | 0 | 9 | 0 | 7 | 7 | 5 | 5 | 3 | . 3 | 2 | 4 | 2 | i 37 | . 34 |
| HI-S Q U -HAT | | - S | <u></u> | ~10 | | 10-15 | 1 | 5-20 | 2 | 0-25 | 2 | 5-30 | | 30~35 | 3 | 5-40 | CHI-SAU | |
| - | Rau | HF | Rau 2 | WF | Rau | HF | Rau | HF. | ; Rau | HF. | Rau 9 | WE | Rau | HF 2 | Rau | WF 2 | : Ran | / 31 |
| s L C | ĕ | ŏ | ō | ğ | Ŏ | ġ | | į | ŏ | ě | ő | ŏ | ģ | Ŏ | , ŏ | ĕ | | 1 5 |
| L U OTAL | 0 | . 0 | 0 2 | Š | 1 | 1 | į | i | \ 0 | . 6 | Š | Š | ő | ĝ 3 | 0 5 | Ŏ 2 | 42 | 37 |
| HI – SQU ALUES | | 5 | \$ | ~10 | : | 10~15 | | 5-20 | 2 | 0-25 | 2 | 5-30 | | 30~3 <u>5</u> | | S-40 | CHI-SNU | RRE UAL |
| .s iL iC . | Rau | MF | 0.333 | 0.667 | 6.918 | 0.692 NF | 1.000 | 0.692 1.000 | 0.067 | 0.091 | 2.062 | 1.600 | 0.143 1.000 | 1.000 | 0.111 | 0.000 | 1 Raw 1 1.571 1 1.608 2 0.333 | 0.803 1.000 0.111 |
| U DTAL | 0.000 | 0.000 | 0.222 | 0.667 | 0.000 | 0.600 | | 1.000 | 0.067 | 0.091 | 2.682 | 1.600 | 0.500 | 0.200 | 0.111 | 0.000 | I 0.333 | 0.333 |

Table Di5. Indian Point hammer test monitoring using 5H12 degree horizontal transducer located at unit 3, intake 35.

| 10 HINUTE | ES DU | RINO T | EST PERI | Op | | - | | | RANGE (m | eters) | | | | | | | •.• | |
|--------------------|-------|--------|----------|-------------|--------------|-------------|--------------|-------------|-------------------|-------------|-----------|-------------|---------------|---------------|--------------|-------------|----------------------|----------|
| | 0 | -5 | | 5-10 | | 10-15 | | 15-20 | 2 | 20-25 | 2 | 25-30 | : | 30-3 5 | 2 | 5-40 | Tota | 1 |
| upe upe | Rau | HF. | Rasi | uf | Rau | HF | Rau | UF | Rau | ИF | Rau | ЧF | Rau | WF | Res | HF. | RBH | HF |
| S | o - | 0 | 5 | 9 | 16 | 19 | 13 | 12 | 9 | 7 | 12 | 7 | 7 | 4 | 2 | 1 | 64 | 59 |
| _ | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | , 0 | 0 | 0 | 0 | 0 | | 0 |
| C | 0 | 0 | 0 | 0 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | , | 4 1 |
| н | 0 | 0 | G | 0 | . 0 | · • | 0 | 0 | O | C | 0 | 0 | 0 | 0 | 0. | 0 | | 0 |
| otal | . 0 | 0 | 5 | 9 | 19 | 23 | 13 | 12 | 9 | 7 | 12 | 7 | 7 | 4 | 2 | 1 | 67 | 63 |
| TO HIMUTE | ES AF | TER TE | ST PERIO | D | | | | | RANGE CH | eters) | | | | | , | | | |
| race | 0 | -5 | | 5-10 | | 10-15 | | 15~20 | 8 | 20-25 | · | 25-30 | | 30-35 | 3 | 5-40 | Yota | 11 |
| ND4 | Rau | WF | Res | HF | Ress | HF | Rasi | HF | Rau | WF | Rau | LIF | Rau | | Reu | NF | ž ReH | HF |
| 5 | 0 | . 0 | 3 | 6 | 10 | 12 | 7. | 6 | 11 | 9 | 11 | 7 | B | 3 | 4 | 2 | 6 1 | 44 |
| L | • | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | . 0 | 0 | | 1 | 1 |
| c | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | Ó | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | į 2 | 3 |
| М | 0 | 0 | 0 | ٥ | . 0 | 0 | 0. | 0 | 0 | 0 | 0 | 0 | 0 | ø | .0 | 0 | | 0 |
| otal | 0 | 0 | 4 | • | 10 | 12 | • | 7 | 12 | • | 11 | 7 | . 5 | 3 | 4 | 2 | 54 | 48 |
| II -SQUARE -HAT | | 5 | | 5~10 | | 10-15 | | 15-20 | | 20-25 | | 25-30 | | 30-35 | 3 | 5-40 | CHI-SAUR FOR 2 TE | RE F-HAT |
| S | Rau | MF | Rau | HF A | Rau 13 | UF 16 | Rau 10 | HF | Ra и 10 | UF A | Rau 12 | HF. | Rau | HF | Raw | WF 2 | t Reu | HF 52 |
| 5 | ŏ | Ŏ | ě | ŏ | 0 2 | 0 | ŏ | ō | 1 | 1 | 9 | ò | ě | e e | ŏ | õ | 1 1 | 1 |
| TAL. | Ö | ŏ | . Ó | ĝ | 15 | 18 | 11 | 10 | 11 | ě | 0 12 | ğ | ŏ | ŏ | Š | 9 | 61 | 56 |
| II-SQUARE NLUES | | -5 | | 5-10 | | 10-15 | | 15-20 | | 20-25 | | 25-30 | | 30-35 | . 3 | 95-40 | CHI -SQUA | |
| 1 | Rau | MF | 0.500 | NF 0.600 | Rau 1.305 | иF 1.501 | Rau 1.600 | 4F 2.000 | 0.200 | UF 0.067 | 0.043 | UF 0.000 | Rass 0.333 | uF 0.143 | RAH 0.667 | UF 0.333 | FOR 2 TE | i.e. |
| | | == | | | | | | | 1.000 | 1.000 | 0.045 | | 0.355 | | 0.667 | | £ 1.000 | 2.184 |
| | | | 1.000 | 2.000 | 3.000 | 4.000 | 1.000 | 1.000 | | | | | | | | | : 0.200 | 0.143 |

Table D16. Indian Point hammer test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

| 10 HI | MUTES DUR | EX MG E | ST PERIO | | | • | | | RANGE (no | ters> | | | | | | | 8.e | |
|------------------|-----------|---------|-----------|----------------|----------------|-------|----------------|----------------|-----------|---------|-----------|-------|-------|--------------|------------|-----------|----------|-------------------------|
| | 0- | | S | -10 | 1 | 0-15 | 1 | 5-20 | | 20-25 | . 2 | 5~30 | 3 | 10-35 | 3 | 5-40 | Tota | . 1 |
| race upe | | NF | Raw | MF | Rau | MF | Rau | NF | Rau | 185 | Rau | HF | Rau | HF | Rau | MF | : Ress | μF |
| S | o | 0 | 2 | 4 | | 10 | 9 | 7 | 10 | ₿. | 11 | 7 | 8 | 4 | 2 | 1 | 45 | 41 |
| L | Q | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | ,0 | • | 0 | | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 (| | 0 | 0 | . 0 | 0 | 0 | , 0 | 0 | o | 0 | | 0 |
| Н | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | | 0 |
| otal | , • | 0. | 2 | 4 | | 10 | 0 | 7 | 10 | | 11 | 7 | • | .4 | 2 | 1 | i 49 | 41 |
| 10 MI | MUTES AFT | ER TES | ST PERIOD | | | | | 1 | RANGE (m | ters) | | | | | | | | |
| race | 0- | -5 | 5 | -10 | 1 | 10-15 | | S-20 | 1 | 20-25 | 2 | 5-30 | 3 | 0-35 | 3 | 5~40 | Tota | 1 |
| up4 | Rau | WF | Rana | WF | . Rau | MF | Rau | WF | Rau | WF | Rau | MF | Rau | HF | Rass | HF | Ress | MF |
| \$ | 2 | 7 | 0 | 0 | 3 | 4 | 4 | 4 | 11 | | • | \$ | 7 | 4 | 4 | 2 | 38 | 34 |
| L | • | 0 | 1 | * | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | į 2 | |
| C | 1 | 4 | 0 | 0 | 0 | Þ | 0 | Q | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 |
| H | 0 | 0 | 0 | 0_ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | _ • | 0 | 0 | 1 | 0 |
| stal . | > | 11 | 1 | 2 | > | 4 | 5 | 5 | 11 | • | • | S | 7 | . 4 | 4 | 2 | i 42 | . 41 |
| HI -501 ~HAT | JARE 0- | 5 | 5 | -10 | 1 | 10-15 | 1 | 5-20 | | 20-25 | 2 | 25-30 | | 10-35 | 3 | 5-40 | | RE F-HAI |
| ~ | Rau | HF | Rau | uf 2 | Rau | HF | Rau | HF | Rau | HE B | Rau 10 | WF | Rau | WF | Rau | ¥F 2 | Rau | ИF 39 |
| S L C | ō | ò | ĩ | ì | Ŏ. | ė | Ĭ | Ĭ | ő | ě | Õ | ŏ | ŏ | Ö | Ŏ | ē | | 5 |
| Ŭ OTAL | ô 2 | Õ | ŏ | Š | ŏ ´ | Š | Ŏ | ě | 11 | ă | 10 | ě | | ŏ | Š | Ŏ | 45 | 41 |
| HI —SQL RLUES | 0. | -5 | 5 | -10 | | 10-15 | | 6-20 | | 20-25 | | ts~30 | | 10-35 | · <u> </u> | 15-40 | CHI-SOUF | |
| | 2.000 T | UF | | 4.000 2.000 | 2.273 2.273 | 2.571 | 1.333 1.000 | 0.616 1.000 | 0.048 | 0.000 | 0.474 | o.553 | Rau | 0.000 | 0.667 | 0.353 | 1 Rau | 0.653 3.000 4.000 |
| U OTAL | 3.000 1 | 1-000 | 0.333 | 0.667 | 2.273 | 2.571 | 0.692 | 0.533 | 0.046 | 0-000 | | 0.353 | 0-067 | 0.000 | 0.667 | 0.333 | 0.530 | 6.000 |

Table 017. Indian Point hanner test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| | | | **** | | 10 | hrs bo | • | | Treatm | of Test: ent Type: | 10 | sec on | ers 305 , 20 sec | off | Test Date Test Time | • = | 2/13/89 1047 | 1469 |
|---|---|---|--|-------------------------|---|--|--|---|--|---------------------------------------|--|--|---|---|--|---|--|---|
| 10 KIN | UTES BEFO | RE TE | ST PERIOD | | | | | R | RNGE (net | ters> | | | | | | | | |
| | 0~9 | . | . 5~ | 10 | 10 |) 1 5 | . 15 | -20 | 20 | 0~25 | 25 | ~30 | 30 |)-35 | 35 | -40 | Fotal | l |
| upe race | Rau 1 | uf | Rau 1 | WF | Rau | MF | Rass | HF | Rau | WF | Res | uf . | Rau | HF | Rau | HF | E Rau | WF |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | 0 | D | 0 | 0 | 0 | 0 | 0 | · · · · · | ō |
| iL. | 0 | D | ٥ | 0 | 0 | a | 0 | 0 | 0 | 0 | 0 | ø. | O | 0 | 0 | 0 | . 0 | 0 |
| c | 2 | 7 | 1 | 2 | D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . • | o | | 9 |
| u . | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0. | 0 | o | . 0 | 0 |
| otal | 2 | 7 | 1 | 2 | 0 | 0 | 0 | ø | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 9 |
| 10 MIN | UTES DURI | NG TE | ST PERIOD | | | | | Ri | RNGE (net | ters) | | | • | | | | | |
| | 0-5 | 5 | 5- | 10 | 10 | - 15 | 15 | 5-20 | 20 | 0~25 | 25 | ~30 | 30 | 7-35 | 35 | ~40 | Total | ļ |
| race ype | Rau L | F | Rau | UF | Rau | HF | Rau | 14F | Rau | I | RaH | WF | Rau | WF | Rau | MF | t Rau | UF. |
| <u></u> | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | <u>-</u> | 0 | 0 | 0 | 0 | | 1 |
| iL. | 0 | 0 | 0 | 0 | 0 | a | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ıc | 2 | 4 | 0 | . 0 | 2 | 2 | 1 | 1 | ٥ | 0 | 0 | 0 | 1 | 1 | 0 | ٥ | 5 | 8 |
| ille ' | 0 | 0 | 0 | Q | 0 | 0 | o | o | ο. | o | 0 | 0 | Ð | 0 | 0 | 0 | | 0 |
| otal | 1 | 4 | 0 | 0 | 2 | 2 | 2 | 2 | 0 | 0 | D | 0 | 1 | 1 | 0 | . 0 | | 9 |
| | | | | | | | | | | | | | | | | | | |
| 10 MIN | UTES AFTE | R TES | T PERIOD | | | | | R | RMGE Cores | ters) | | | | • | | | | |
| | UTES AFTE | | -5- | | |)-15 | | 5- 20 | 20 | 0-25 | | -30 | 3 |)-35_ | | -40 | Total | |
| race ype | O~! Rau | iF | S- Reu | uf | Res | ИF | | 5-20 MF | Ram Ram | 0-25 UF | Rau | HF | Rau | HF | Rese | HF | Rau | HF |
| race ype S | C-S Rau i | <u> </u> | -5- | | | | | 5- 20 | 20 | 0-25 | | | | | | | ~~~~~ | |
| race ype S | O~! Rau | #F 0 | S- Reu | uf | Reu 2 0 | MF 2 0 | Rau | 5-20 UF 1 | 20 Ram D | 0 0 | Rau 0 0 | 0 0 | Rau O | NF O | Ress O O | HF 0 | Raw | HF 3 |
| race ype .S L | 0-5 Rass 0 0 | #F 0 0 | Rau 0 0 0 | ur 0 9 | Reu 2 0 15 | WF 2 0 | 1 0 0 | MF 1 0 | 20 Ram D O | 0-25 UF 0 0 | Rans O O O | 0 0 | Rau 0 0 | HF 0 0 | Ress O O | ИF 9 0 | Rau 3 0 | UF 3 0 49 |
| race ype S L | C-S Rau i | 4F 0 0 22 | - S Rau (0 0 5 | 0 9 | Ress 2 0 15 | HF 2 0 16 0 | Rau 1 0 0 | 1 0 0 | 20 Ram D O O | 0 0 0 0 | Rau O O O | 0 0 0 | Raw 0 0 0 | 0 0 0 | Rese O O O | 0 0 0 | Rasu 3 0 26 | HF 3 0 49 |
| race type S L C | 0-1 Rau j 0 0 6 | #F 0 0 | Rau 0 0 0 | ur 0 9 | Reu 2 0 15 | WF 2 0 | 1 0 0 | MF 1 0 | 20 Ram D O | 0-25 UF 0 0 | Rans O O O | 0 0 | Rau 0 0 | HF 0 0 | Ress O O | ИF 9 0 | Rasu 3 0 26 0 29 | UF 3 0 49 0 52 |
| race upe S L IC IH otal | 0-1 Rau j 0 0 6 | 9 0 0 22 0 | - S Rau (0 0 5 | 0 9 0 | Resid 2 0 15 0 | HF 2 0 16 0 | Rau 1 0 0 | 1 0 0 | 20 R&M 0 0 0 | 0 0 0 0 | 0 0 0 0 | 0 0 0 | Rass 0 0 0 0 0 | 0 0 0 | Ress 0 0 0 0 0 0 0 0 | 0 0 0 | Rasu 3 0 26 | UF 0 49 0 52 |
| Frace Fype S S S S S S S S S S S S S S S S S S S | 0-9 Rass 1 0 0 0 6 0 6 RE 0-9 | #F 0 0 22 0 22 UF | S | 0 9 0 9 | Resid 2 0 15 0 | MF 2 9 18 0 20 | Rau 1 0 0 | 1 0 0 | 20 Rass 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rau 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 | Ress O O O O O O O O O O O O O O O O O O | 0 0 0 0 | Reste O O O O O O | 0 0 0 0 0 | Rau 3 0 26 0 29 CHY-Squal FOR 3 YE: Rau | UF 3 0 49 0 52 RE F-1 |
| race ype S L C H Otal -HAT S | 0-9 Rass 1 0 0 6 0 6 RE 0-9 | 8F 0 0 22 0 22 | S-Raw 0 0 5 0 5 S-Raw 0 0 0 0 | 0 9 0 9 | 2 0 15 0 17 10 Raw 1 0 | UF 2 0 16 0 20 0-15 UF 1 0 | Rass 1 0 0 0 1 15 Rass | 1 0 0 0 1 5-20 | 20 Ram 0 0 0 0 0 0 20 Ram 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Raus O O O O O Z5 | 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 | Resta O O O O O O O O O O O O O O O O O O O | 0 0 0 0 0 0 0 0 | Rau 1 | 0 49 0 52 EF-1 HF 1 0 |
| race ype S L C III otal -HAT SQUA | 0-9 Rate 0 0 0 6 0 6 RE 0-9 | 5 6 0 22 0 22 23 5 HF 0 0 | 5 | 0 9 0 9 10 WF 0 | Rew 2 0 15 0 17 10 Rew 1 | 20 18 0 20 20 0-15 HF | Ram 1 0 0 1 1 15 Ram 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 1 0 0 0 1 1 5-20 HF 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 20 Ram 0 0 0 0 0 0 Ram 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rau 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 | Rau O O O O O O O O O O | 0 0 0 0 0 | Resta O O O O O O O O O O O | 0 0 0 0 0 0 0 0 0 0 | Raw 26 29 CHY-Squal FOR 3 YE: Raw 10 11 0 | 0 49 0 52 RE F-I 0 0 HF |
| race vpe S L C H otal HI-SQUA -HAT S L C U OTAL | 0-9 Rate 1 0 0 6 0 6 RE 0-9 Rate 0 0 0 3 | #F 0 0 22 0 22 UF 0 0 11 | 5 | 0 9 0 9 10 WF 0 0 4 | 2 0 15 0 17 10 Ram | 2 0 18 0 20 0-15 HF | Ram 1 0 0 1 1 15 Ram 1 0 0 | 1 0 0 0 1 5-20 | 20 Ram 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rau 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 | Rau 0 0 0 0 0 | 0 0 0 0 0 | Rass 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 | Rau 26 26 29 CHY-SQUAR FOR 3 YE: 11 11 | 0 49 0 52 RE F-1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 |
| race vpe S L C C H otal HI-SQUA -HAT S L C H OTAL HI-SQUA | 0-9 Rate 1 0 0 6 0 6 RE 0-9 Rate 0 0 0 3 | 0 0 22 0 22 0 22 5 HF 0 0 11 | 5 | 0 9 0 9 10 WF 0 9 4 9 | Raw 2 0 15 0 17 16 Raw 1 0 5 0 6 | 20 18 0 20 20 0-15 HF | Ram 1 0 0 1 1 15 Ram 1 0 0 1 | 1 0 0 0 1 1 5-20 HF 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 20 Rass 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Resi 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 | Rau 0 0 0 0 0 0 Rau 0 0 0 | 0 0 0 0 0 | R ass 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Raw 26 29 CHY-Squak FOR 3 YE: Raw 10 11 0 11 0 15 CHI-SQUAK | 49 0 49 0 52 8F F= 0 22 23 |
| race ype S L IC III Otal HI-SQUA S IIC III OTAL HI-SQUA | 0-5 Ram 0 0 0 6 0 6 RE 0-1 Ram 0 0 0 3 0 3 | 0 0 22 0 22 0 22 5 HF 0 0 11 | 5 | 9 0 9 10 MF 0 4 4 10 MF | 2 0 15 0 17 10 Ram 1 0 5 0 6 | 20 18 0 20 0-15 UF 1 0 7 7 0 15 UF | Rass 1 0 0 0 1 15 Rass 1 0 0 1 | 5-20 MF 1 0 0 1 5-20 MF 1 0 0 0 1 | 20 Rass 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rau 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rau 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | R 854 0 0 0 0 0 0 355 R 854 0 0 0 0 355 R 855 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Raw 20 20 21 29 CHI - SQUAR FOR 3 VE Raw 10 11 01 11 CHI - SQUAR FOR 3 TE Raw | 49 0 49 0 52 8F F=1 1 0 2 2 2 3 8F UPS 1 1 1 1 1 2 2 3 3 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 |
| race ype S L IC III Otal HI-SQUA -HAT S L IC III OTAL HI-SQUA HI-SQUA | 0-5 Raw 6 0 0 6 RE 0-1 Raw 0 0 3 0 7 RE 0-1 | 22 0 22 0 22 10 11 | 5-Raw 0 0 5 0 5 5-Raw 0 0 2 2 5-Raw | 9 0 9 10 MF 0 4 4 10 MF | 2 0 15 0 17 10 Ram 1 0 5 0 6 10 Ram 2.000 2 | 20 18 0 20 15 HF 1 0 7 7 15 HF 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rass 1 0 0 0 1 15 Rass 1 0 0 1 | 5-20 MF 1 0 0 1 5-20 MF 1 5-20 MF 1 5-20 | 20 Ram 0 0 0 0 20 Ram 0 0 0 20 Ram 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rau 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rau 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 | R 8614 0 0 0 0 0 335 R 8614 0 0 0 0 355 R 8614 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Raw 26 29 CHI - SQUAR FOR 3 VE: Raw 11 01 11 11 11 11 11 11 11 11 11 11 11 | 0 49 0 52 RE F-1 0 0 22 2 0 0 23 RE UNIST PET 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 |
| race ype S L IC III OTAL HI-SQUA OTAL HI-SQUA ALUES S IC III III III III III III | 0-5 Rau 6 0 0 6 0 6 RE 0-1 Rau 0 0 3 0 3 4.667 16. | 22 0 22 0 22 0 0 11 | 5-Raw 0 0 5 0 5 5-Raw 0 0 2 2 5-Raw 7.000 10 | 9 0 9 10 MF 0 4 4 10 MF | 2 0 15 0 17 10 Ram 1 0 5 0 6 | 20 18 0 20 17 10 17 10 15 15 15 15 15 15 15 15 15 15 15 15 15 | Ram 1 0 0 0 1 15 Ram 1 0 0 1 15 Ram 0 0 1 | 5-20 MF 1 0 0 1 5-20 MF 1 0 0 1 5-20 MF 1 0 0 0 1 | 20 Ram 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rau 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | NF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rass O O O O O O O O O O O O O O O O O O | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | R 864 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rau 26 26 29 CMY - SQUAR FOR 3 YE Rau 10 11 01 13 CMY - SQUAR FOR 3 TE Rau FOR 3 TE Rau FOR 3 TE | 49 0 49 52 25 F- 67 PE 47 0 23 0 23 82 F- 9 0 23 0 23 0 23 |

Table D18. Indian Point hammer test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

Tidal Phase: 3 hrs before

| | | | | | | | | • | RANGE (HE | ters> | | | | | | | • | 1 |
|-----------------|---------|------------|-----------|-------|--------|----------|-------|-------|-----------|-------|-------|-------|-------|----------|-------|--------|----------------------|----------|
| race | |)~5 | 5 | -10 | 1 | 10~15 | 1 | 15-20 | 2 | 0~25 | | 25-30 | : | 30-35 | : | 35-40 | Tota | l |
| up+ | Rau | WF | Rass | uf | Rau | WF | Rau | HF | Ram | WF | Rau | UF | RAH | WF | Rau | uf | Rau | uf |
| S | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 1 | 1 | 0 | 0 | 1 | . 1 |
| Ļ | 0 | 0 | 0 | 0 | 0 | 0 | • 0 | . 0 | .0 | 0 | · O | 0 | 0 | 0 | 0 | 0 | 0 | ٥ |
| C | . 11 | 41 | 8 | 15 | 32 | 38 | 0 | 0 | ø | . 0 | 0 | | . 0 | 0 | 0 | . 0 | 51 | 94 |
| M | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | . 0 | 0 |
| otal | 11 | 41 | • | 15 | 32 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 52 | 95 |
| 10 MI | NUTES A | TER TE | ST PERIOD |) | - | | | | RANGE (ma | ters | | | | | | | | |
| - | • |)-S | 5 | -10 | ; | 10-15 | | 15-20 | | 10-25 | | 25-30 | ; | 30-35 | | 35~40 | Tota | 1 |
| race upe | Rau | HF | Rau | WF | Rau | uf | Rau | uF | Rou | UF | Rau | uf | Rau | ИF | Ray | HF | : Rau | WF |
| s | o | | | | 0 | | 2 | 2 | 1 | 1 | 1 | 1 | 0 | <u> </u> | 2 | 1 | | 5 |
| L | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | o. | • | • | • | 0 | · o | . 0 | 0 | . 0 | į. o | o |
| C | 33 | 123 | 28 | 53 | 63 | 76 | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 124 | 252 |
| н | 0 | 0 | | 0 | 0 | o | 0 | 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | . 0 | 0 |
| otal | 33 | 123 | 29 | \$3 | 63 | 76 | 2 | 2 | . 1 | 1 | 1 | 1 | 0 | 0 | 2 | 1 | 130 | 257 |
| HI -50U -HAT | |)-S | | i 10 | . 1 | 10-15 | : | 15-20 | 2 | 20-25 | · • | 25~30 | : | 30-35 | 3 | 35~40 | CHI-SQUA FOR 2 TE | |
| _ | Rau | MF | Rau | WF | RAH | ИF | Rau | HF | Rau | MF | Rau | HF | Rau | uF. | Reu | MF | Reu | HF |
| S L | 0 | . 0 | <u> </u> | 0 | 8 | 0 | Ŏ | 0 | ò | ò | ò | Ö | 0 | ò | ŏ | 0 | : 3 | 3 |
| | 22 | 82 0 | 19 0 | 34 | 48 | 57 0 | 0 | 0 | õ | 0 | 0 | 0 | 9 | ŏ | 8 | O . | ± 88 | 173 |
| DTAL | 22 | 6 2 | 18 | . 34 | . 48 < | _ 57 | ĭ | ĭ | i | ĭ | ĭ | ĭ | ĭ | ĭ | 1 | 1 | : 91 | 176 |
| IX –SQU | |)-S | | - 10 | | 10-15 | | 15-20 | | 0-25 | ٠. | 25-30 | | 30-35 | , | 35-40 | CHI-SQUA | |
| MLUE> | | | | | | | | | | MF | | | | | | | FOR 2 FE | ST PERIO |
| 5 | Rass | HF. | Rau | MF | Rase | HF —— | 2.000 | 2.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 2.000 | 1,000 | | 2.667 |
| | 11.000 | 11.000 | 11.111 2 | 1.235 | 10.116 | 12.667 | | == | | | | | | | | | 30.451 7 | |
| u Otal | 11-000 | ==_ | 11.111 2 | | 10.116 | | 2.000 | 2.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1-000 | 1-000 | 2.000 | 1.000 | 33.429 7 | 4 557 |

2/13/88

¹⁾ Numbers presented are a minimum estimation for test periods

Table 019. Indian Point hammer test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

| | J, L, DO | RING TE | | 7 | | | | | RANGE CH | eters> | | | | | • • | | * | |
|--------------------------|---------------------------------|----------------------------|---|----------------------------|--------------------------------|--------------------------|------------------------------|------------------------|-------------------------|------------------------|--------------------------|------------------------|-------------------------|-------------------|-------------------------|-------------------|--|----------------------------|
| race | 0 | ~5 | 5 | - 10 | | 10-15 | | 15-20 | | 20-25 | 29 | 5~30 | : | 30-35 | 3 | 5-40 | Tot | al |
| ype | Rau | MF | Reu | WF | Rau | HF | Rau | | Rass | HF | Rau | ¥F | Rau | NF | Rau | WF | Rau | MF |
| s | 0 | 0 | 0 | 0 | 4 | 5 | 1 | 1 | 1 | 1 | 1 | 1 | ٥ | 0 | 1 | 0 | | B |
| | 0 | o | 0 | 0 | o | 0 | 1 | 1 | O | . 0 | 0 | 0 | . 0 | 0 | 0 | o | 1 | 1 |
| ¢ · | 46 | 172 | 60 | 113 | 54 | 65 | 0 | 0 | . 0 | . 0 | .0 | 0 | į o | 0 | ٥ | 0 | 160 | 550 |
| u | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 1 | 1 | 0 | 0 | | 1 |
| otal | 46 | 172 | 60 | 113 | 56 | 70 | 2 | 2 | . 1 | 1 | 3 | 1 | 1 | 1 | A * | 0 | 1 170 | 360 |
| 10 HTM | ITES AF | TEO TE | T PERIOD | | | | | | | | | | | | | | | |
| | | | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | | | | | | RANGE CH | eters) | • | - | | | | | | 1 |
| race | 0 | -5 | 5 | -10 | | 10-15 | | 15-20 | | 20-25 | 2: | 5-30 | | 30~35 | 3 | 5-40 | Tot | al |
| ype | Rau | ИF | Rau | uf | Rau | HF | Rau | HF | Rass | HF | Rais | UF | Rau | ИF | Rau | UF | t Raw | uF |
| 5 | 0 | 0 | G | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 6 | 4 | 0 | 0 | 0 | 0 | 10 | 8 |
| L į | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | a | 0 | 0 | • | . 0 | • | 0 |
| C, | 49 | 183 | . 73 | 137 | 40 | 48 | 0 | 0 | 0 | 0 | 0 | ٥ | a | 0 | 0 | 0 | 162 | 368 |
| 4 | 0 | G | 0 | . 0 | <u> </u> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| otal · | 49 | 183 | 73 | 137 | 40 | 48 | 2 | 2 | 2 | 2 | 6 | 4 | 0 | 0. | 0 | 0 | 112 | 376 |
| HI-SQUAI -HAT | 0 | -5 | | -10 | | l0-15 | | 15-20 | ; | 20~25 | 2: | 5-30 | * | 30-35 | | 5-40 | CHI~SQU FOR 2 T | ARE F-NA |
| S L C H DTAL | 284M 0 0 49 0 48 | HF 0 178 0 176 | Rau 0 0 67 0 | NF 0 125 0 125 | Reu 2 0 47 0 49 | MF 0 57 0 59 | Rau 2 1 0 0 2 | µF 2 1 0 0 | Rau 2 0 0 0 | WF 2 0 0 0 | Rass 4 0 0 0 | HF 3 0 0 0 | Rau 0 0 0 1 | иг 0 0 1 | Rau I G O O | 4F 0 0 0 | I Rew 9 7 1 1 161 2 171 | NF 8 1 359 369 |
| II – SQUAI LUES | | -5 | | i+10 | | lO-15 | | 15-20 | - | 20~25 | 21 | 5-30 | | 30-35 | 3 | 5-40 | CHI -SQU | ARE VALU |
| S L C | | uf 0.341 | 1.271 | UF 2.304 2.304 | 4.000 2.085 3.306 | NF 5.000 2.559 | Rau 0.333 1.000 | | 0.333 | 0.353 0.333 | Ran 3.571 | 1.800 | 1.000 | UF | 1.000 | MF | FOR 2 TO Raw 1 0.222 1 1.000 1 2 1.000 1 0.012 | |

^{1&}gt; Numbers presented are a minimum estimation for test periods.

Table D20. Indian Point hammer test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

| | | | EST PERI | - | | | | | RANGE (ne | ters> | | | | | | | *.• | |
|------------------|-----------|--------|----------|-------|-------|-------|-------|-------|-----------|-------|------|--------|-----|-------|-----|------|----------------------|--------------------|
| -40 | | -5 | ! | 5-10 | | 10-15 | | 5-20 | | 0-25 | | 25~30· | | 0-35 | | 5-40 | Tota | al 1 |
| UPO | Rau | HF | R 864 | | Rau | MF | Rau | | Rass | MF | Rau | WF. | Rau | WF | Rau | HF | : Rau | HF |
| ; | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | D | 0 | . 0 | 0 | 0 | 0 | 0 | O | 0 | 0 | 0 |
| | a | 0 | , ' o | . 0 | . 0 | 0 | ٥ | 0 | 0 | 0 | • | | 0 | 0 | 0 | 0 | 6 | 0 |
| ; | 82 | 306 | 100 | 353 | 102 | 122 | 0, | 0 | • | 0 | 0 | 0 | . 0 | Q | 0 | 0 | 372 | 781 |
| 1 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | œ | 0 | . 0 | Q | 0 | a | 0 | : 0 | 0 |
| tal | 82 | 306 | 199 | 353 | 102 | 122 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 372 | 781 |
| O MIN | | | ST PERIO | _ | • | | | | | | | | | | • | | | |
| O NIN | MIES M | TER IE | SI PERIG | | • | | | | RANGE (He | ters> | | | | | | , | | |
| | | -s | | 5-10 | | 10-15 | - 1 | 5-20 | | 0-25 | 8 | ts-30 | 3 | 10-35 | 3 | 5-40 | Tota | 1 |
| /D ◆ | Rau | WF | Rau | | Rau | | Rau | ИF | Rau | HF | Rase | HF | Rau | uF. | Rau | ИF | 1 Rau | uF |
| | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 1 |
| | 0 | 0 | 0 | 0 | 0 | · 0 | 0 | 0 | 0 | o | 0 | 0 | 0 | 0 | . 0 | . 0 | | 0 |
| ; | 56 | 209 | 174 | 327 | 98 | 118 | 0 | 0 | 0 | 0 | o | o | Ð | • | 0 | 0 | 328 | 654 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 - | o | 0 | ٥ | 0 | 0 | 0 | | ٥ |
| tel | 56 | 209 | 174 | 327 | 90 | 118 | 1 | 1 | 0 | 0 | 0 | Q | 0 | 0 | 0 | 0 | 329 | 655 |
| | | | | | | | | | | | | | | | | | | |
| II – SQUA HAT | | -5 | 9 | 5-10 | 1 | 10-15 | 1 | 5-20 | 2 | 0~25 | a | 85-30 | 3 | 30-35 | 3 | 5-40 | CHI~SQUE FOR 2 TE | RRE F-M EST PER |
| 3 | Rau | WF | Rau | MF | Rau | WF | Rau | MF | Rase | HF | Rass | HF | Rau | WF | Rau | ИF | : Rau | WF |
| | ٥ | 8 | Ō | | . 0 | ŏ | 0 | ò | ě | 0 | ê | 8 | 0 | 8 | 8 | 0 | 1 0 | 0 |
| i | 69 0 | 258 | 191 | 340 | 100 | 120 | 0 | Ŏ | Š | 0 | 0 | 8 | 0 | 0 | 9 | 8 | : 350 | 718 |
| TAL | 69 | 258 | 181 | 340 | 100 | 120 | ĭ | ĭ | ŏ | ŏ | ă | ŏ | ŏ | ŏ | ŏ | ŏ | : 3 51 | 718 |
| I-SQUA LUES | | -5 | | 5- 10 | . 1 | 10-15 | | 5-20 | . , | 0-25 | | :5-30 | | 10-35 | _ | 5-40 | CHI -SQUA | 90E 1401 (|
| | Rau | LUF | Rase | LIF | Rau | LIF | Rau | UF | Reu | UF . | Rau | HF. | Raw | UF | Rau | uf | IFOR 2 TE | |
| | | | | =- | | | 1.000 | 1.000 | | | | | | | | | | 1.000 |
| | 4-899 | 8.270 | 0.541 | 0.994 | 0.080 | 0.067 | | | | | | | | | | == | 2.766 | 11.240 |
| | 7.073 1 | | | | | | | | | | | | | | | | | |

¹⁾ Numbers presented are a minimum estimation for test periods.

Table D21. Indian Point hanner test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

| 10 HI | NUTES DU | RINB TI | EST PERIO | D | | | | | RANGE CHO | ters> | • | | | | | | • | |
|-----------------|----------|------------|-----------|----------|-------|----------|----------------|---------------|-----------|--------------|-----|------|----------|-------------------|-------|------|--------------------|-----------------|
| | _a | -5 | S | -10 | 1 | 10-1¥ | 1 | 5-20 | 1 | 0-25 | 25 | 5-30 | 2 | 10-35 | | 5-40 | Fot | al 1 |
| ype ' | Rau | ИF | Rau | NF | Rau | HF | Rau | MF | Rate | HF | Rau | MF | Rau | HF | | ИF | : Rau | HF |
| s | 0 | a | 0 | 0 | | 9 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | | 2 |
| | ۵ | 0 | 0 | 0 | ٥ | . 0 | o | 0 | ٥ | 0 | 0 | 0 | 0 | ٥ | ٥ | • | | ٥ |
| ; | 81 | 302 | 203 | 382 | 104 | 221 | 0 | o | 0 | ٥ | 0 | ۵ | . 0 | 0 | 0 | ٥ | 468 | 905 |
| 4 | ٥ | 0 | 0 | • | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | o | ۵ | 0 | ٥ | . 0 | 0 |
| otal | 81 | 302 | 203 | 382 | 194 | 221 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | o | 472 | 907 |
| io HI | NUTES AF | TER TES | ST PERIOD | | | | | 1 | RANGE Coa | ters> | | | | | | | | |
| | 0 | - 5 | | -10 | | 10-15 | í | 5-20 | | 0-25 | 2: | 5-50 | 3 | 30-3 5 | | 5-40 | Tot | al ¹ |
| race upe | Rau | HF | | WF | Rass | UF | Rau | uf . | Rau | HF | Rau | WF | Rau | HF | | MF | i Rau | HF |
| 5 | 0 | 0 | | o | o | 0 | 2 | 2 | 3 | 2 | 0 | 0 | 1 | 1 | | 0 | - | 5 |
| | . 0 | o | . 0 | 0 | 0 | o | 0 - | 0 | 0 | 0 | 0 | ٥ | ٥ | 0 | . 0 | | : . | ٥ |
| 2 | 90 | 336 | 231 | 434 | 175 | 210 | 6 | 0 | o | G | | o | a | | 0 | 0 | 496 | 980 |
| | 0 | Ð | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | o | 0 | 0 | ٥ | 0 | o · | ٥ | | o |
| otal | 90 | 336 | 231 | 434 | 175 | 210 | 2 | 2 | > | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 502 | 985 |
| HI – SQL HAT | IARE C | -5 | 6 | -10 | 1 | 10-15 | 1 | 5-20 | 2 | 0-26' | 25 | 5-30 | 3 | 10-35 | 3: | 5-40 | CHI-SQU FOR 2 T | ARE F-IA |
| | Rau | HF | Rau | HF | Ran | HF | Rau | MF | Ran | HF | Rau | ИF | Ran | HF | Rau | NF. | Ray | MF |
| 5 | 8 | 0 | ô | å | 0 | 0 | 0 | 2 0 | 9 | 0 | ò | 8 | õ | ò | | Ş | : 5 | đ |
| | 86 | 319 0 | 217 | 408 0 | 180 | 216 0 | 8 | 0 | 0 | 8 0 : | 0 | 0 | <u> </u> | . 0 | 0 | . 0 | : 492 : 0 | .943 0 |
| DYAL | 86 | 219 | 217 | 408 | 180 | 216 | 2 | 2 | 2 | -1 | 0. | 0 | . 2 | 1 | . 1 | 0 | : 497 | 946 |
| II-SQL LUES | |)-S | 5 | -10 | | 10-15 | | 5-20 | 2 | 0-25 | 21 | 5-30 | 3 | 00-35 | 3: | S-40 | CHI-SQU | ARE VALUE |
| 5 | Rau | MF | Rass | HF | Rau | 14F | . Raн 0.333 | NF 0.333 | 3.000 | 14F 2.000 | Rau | HF | 0.333 | 4F 0.000 | 1.000 | HF | 1 Rau | 1.286 |
| | 0.474 | 1.012 | 1.806 | 3.314 | 0.226 | 0.281 | === | | | | == | | | | | | 0.013 | 2.984 |
| TAL | 0.474 | 1.812 | | 3.314 | | 0.281 | 0.333 | 0.533 | 3.000 | 2.000 | | | 0.333 | 0.000 | 1.000 | | 0.924 | 3.216 |

¹⁾ Numbers presented are a minimum estimation for test periods.

Table D22. Indian Point hawner test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| | | | | | | lou tid | | | Treat | n of Temperature | >+: | 10 min, 1 20 sec o | n . 40 sec | c off | Test Date Test Time | • \$ | 2/13/ 00 1227 | |
|------------------|-----------------------|-----------|-------|-------|---------|---------|-------|---|----------|------------------|---------------|-----------------------|-------------------|--------------|------------------------|------|-------------------------|------------------------|
| 10 HI | MUTES DU | | | _ | | | | | RANGE (» | | ÷ | | | | | | i | . 1 |
| FACO | | -5 | | -10 | | 10-15 | | 15-20 | | 20-25 | | 25-30 | |)-3 5 | | -40 | Tot | |
| VP+ | Rau | NF. | Rau | uf | Rau | HF | Ray | uf | Ras | uf | Ray | I HF | Rau | HF. | Rau | HF | _ Raw | HF |
| \$ | ٥ | 0 | ú | O | 0 | 0 | 2 | 2 | 1 | 1 | 1 | 1 | 0 | ø | • . | 0 | • • | 4 |
| L | 0 | ٥ | 0 | 0 | ۵ | • | 0 | 0 | 9 | 0 | ٥ | Ð | 0 | 0 | ٥ | G | | . 0 |
| c | 102 | 380 | 281 | 528 | 216 | 259 | 0 | 0 | • | . 0 | 0 | 0 " | o | 0 | 0 | ۵ | 599 | 1167 |
| и | o | 0 | G | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | 0 | 0 | . 0 | 0 |
| otal | 102 | 380 | 291 | 528 | 216 | 259 | 2 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | : 603 | 1171 |
| 10 H | MUTES AF | ST PERIOD | | | * | | | RANGE (+ | enters) | | | | | | • | | | |
| race | | | | -10 | | 10-15 | | 15-20 | | 20-25 | | 25-30 | | 0-35 | 36 | -40 | Tot | al 1 |
| up• | 0-5 Rew MF | | Rass | HF | Rau | | Rau | uf | Rau | | Ray | HF | Rau | HF | Rau | HF | 2 Rau | MF |
| S | Raw MF Raw | G | 0 | 0 | > | . 3 | 1 | 1 | 0 | O. | 0 | 0 | . 0 | 0 | 4 | 4 | | |
| L | 0 | 0 0 0 | G | 0 | O. | 0 | . 0 | 0 | 0 | 0 | 0 | • | • | • | | 0 | | |
| C | 105 | 392 | 270 | 808 | - 214 | 257 | 0 | , 0 | 0 | ò | 0 | 0 | 0 | 0 | 0 | 0 | 589 | 1157 |
| н | 0. | o | . 0 | . 0 | . 0 | | ٥ | o ' | 0 | 0 | ٥ | 0 | 0 | 0 | | ٥ | | O |
| otal | 105 | 392 | 270 | 508 | 214 | 257 | > | 3 ; | 1 | . 1 | 0 | 0 | 0 | 0 | 0 | 0 | \$93 | 3161 |
| HI —SQI —HAT | |)S | 5 | i-10 | | 10-15 | | 15-20 | | 20-25 | | 25-30 | - 3 | 0-35 | | -40 | | ARE F-HAT EST PERIC |
| _ | Rau | MF | Rau | ИF | Rau | | Rau | | Ras | 4 HF | Rau | | Rau | .HF | Rau | HF | Ran | HF |
| S L | 8 | Ö | . 0 | 0 | - D | 0 | 3 | 3 | 0 | 0 | 0 | 0 - | ê | 0. | 8 | 8 | : 3 | . 4 |
| ដ | 104 | 386 | 276 | 519 | 215 | 250 | 0 | 0 | 9 | 9 | 9 | 0 | õ | 9 | 9 | 0 | : 594 | 1162 |
| ÖTAL | 104 | 386 | 276 | 518 | 215 | 258 | . 5 | 3 | i | 1 | ī | ĭ | ŏ | ō | ō | ō | : 596 | 1166 |
| HT —SQI RLUES | NL 104 386 -SQUARE | | | 5-10 | | 10-15 | | 15-20 | - | 20-25 | | 25-30 | 3 | 0-35 | | 5-40 | CHI-SQU | ARE VALUE |
| _ | Rau | HF | Rau | HF | Rau | MF | 9.200 | | 0.000 | 0.000 | 1.000 | 1.000 | Rass | WF | Rau | HF | 2 Rau | 0.000 |
| S L | | | | | | | 0.200 | 0.200 | D.000 | | 1.400 | | | | ~~ | | | |
| Č H | | 0. 187 | 0.220 | 0.386 | 0.009 | 0.008 | | == | == | | | | - == | | | | 0.064 | 0.043 |
| DTAL | 0.043 | 0.187 | 0.226 | 0.386 | 0.009 | 0.008 | 0.200 | 0.200 | 0.000 | 0.000 | 1.000 | 1.000 | | | | | : 0.084 | 0.045 |
| | | | | | CHI-SQU | ARE - 3 | .041 | <d.f< td=""><td>1. alph</td><td>·05</td><td>> .</td><td></td><td>,</td><td></td><td>f</td><td></td><td></td><td></td></d.f<> | 1. alph | ·05 | > . | | , | | f | | | |
| | | | | | | | | | | | | | | | | | | |

¹⁾ Numbers presented are a minimum estimation for test periods.

Table D23. Indian Point hammer test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| 10 MI | | 0-5 | EST PERI | S- 10 | | 10~15 | | 15-20 | RANGE <me< th=""><th>ters> 0-25</th><th>9</th><th>5-3Q</th><th></th><th>0-35</th><th>•</th><th>-40</th><th> Tota</th><th>1 /</th></me<> | ters> 0-25 | 9 | 5-3Q | | 0-35 | • | -40 | Tota | 1 / |
|-------------|---------------|---------|----------|----------|-----------|------------|----------|-------|--|---------------|----------|----------|----------|---------|------------|---------|--------------|-------------|
| race upe | Rass | | Rau | | Rau | | Rau | | | Tur- | Rau | HF | | MF | | uf | : Rau | |
| | | | | | | | | | D | | | | | | | | -: | |
| S · | 0 | 0 | 0 | . 0 | 0 | 0 | G | - | 0 | | 1 | 1 | 0 | • | 0 | • | 1 | 1 |
| L | 0 | | ۵ | Q | 0 | 0 | • | 0 | _ | 0 | 0 | 0 | _ | 4 | • | 0 | i 0. | 0 |
| c | 124 | 463 | 242 | 465 | 236 | 283 | 1 | 1 | 0 | 0 | 0 | ο. | 0 | • | 0 | 0 | 603 | 1202 |
| M | 0 | 0 | 0 | <u> </u> | 0 | -0 | <u> </u> | 0_ | | 0 | 0 | Q | <u> </u> | Q. | 00 | 0 | 0 | 0 |
| otal | 124 | 463 | 242 | 455 | 236 | 293 | 1 | 1 | 0 | 0 | 1 | 1 | 9 | ٥ | . 0 | 0 | 604 | 1203 |
| 10 MI | MUTES A | FTER TE | ST PERIO | D | | | | | RANGE (ma | ters) | | • | | | | | | • |
| | 0-5 Rau NF | | | 5-10 | | 10-15 | | 15-20 | | 0-25 | . 2 | 5-30 | 3 | 0-35 | 35 | -40 | Tot. | al 1 |
| race ype | Rau | | Rau | ИF | Ran | NF | Rau | WF | Rau | WF | Ran | UF | Rau | MF. | Rau | ИF | 1 Rau | WF |
| .s | 0 | 0 | | a | 0 | 0 | 0 | 0 | ٥ | 0 | 0 | ō | 0 | 0 | 0 | 0 | - | 0 |
| L | ٥ | a | ٥ | ٥ | . • | 0 | Q | 0 | 0 | 0 | 0 | o | 0 | 0 | o . | | io | ø |
| ic - | 98 | 366 | 241 | 453 | 208 | 250 | . 0 | 0 | o | 0 | . 0 | 0 | ۵ | 0 | ٥ | 0 | : : 547 | 1069 |
| M | ٥ | ٥ | ٥ | ٥ | a | a | 0 | 0 | ٥ | 0 | 0 | 0 | G | a | ٥ | • | : 0 | 0 |
| otel | 98 | 366 | 241 | 453 | 208 | 250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 547 | 1069 |
| HI-SQU | | | | | | | | | _ | | _ | | _ | | | | CHI - SQU | ARE F-MAI |
| -HAT | | 0-5 | | 5-10 | | 10-15 | | 15-20 | | 0-25 | · | 5-30 | | 0-35 | | -40 | | EST PENT |
| s | Rai | · HF | Rau | MF O | Ran | ᄣ | Rau | | Rau | HF 0 | Rau 1 | HF 1 | Rau | MF 0 | Ram O | WF Q | : Rau | HF 1 |
| ic ic | 111 | 415 | 0 242 | 0 454 | 0 222 | 267 267 | 0 | 0 | . 6 | 0 | ò | 0 | 9 | 9 | 8 | 0 | : 575 | 1136 |
| OTAL | 111 | 415 | 242 | 454 | 222 | 267 | ą | ą | Š | Ŏ | ě | Õ | ě | Ď | ě | ě | ; 0 ; 576 | 1136 |
| HI-SQU | | 712 | 272 | 707 | 222 | 201 | • | • | • | • | • | • | - | • | • | • | . 3.0 | |
| ALUES | | 0~5 | | 5-10 | | 10-15 | | 15-20 | 2 | 0-25 | 2 | S-30 | | 0-35 | | -40 | CHI-SQUE | RRE VALLA |
| .s | Ras | HF | Rau | HF | Rau | MF | Rau | MF | Rau | WF | 1.000 | HF 1.000 | Rau | HF. | Rau | WF | 1 RAH | MF 1.600 |
| L | | | | | <u></u> . | | | | ~- | | | | | | | | 3 | |
| Ċ M | 3.045 | 11.350 | 0.002 | 0.004 | 1.766 | 2.043 | 1.000 | 1.000 | | | | == | | | | | 2.727 | 7.789 |
| ÖTAL | 3.045 | 11.350 | 0.002 | 0.004 | 1.766 | 2.043 | 1.000 | 1.000 | | | 1.000 | 1.000 | | | | | : 2.023 | 7.903 |

¹⁾ Numbers presented are a minimum estimation for test periods.

Indian Point hammer test monitoring using 6m12 degree horizontal transducer located at unit 5, intake 35.

| | | | | Tidal P | | 30 nin lou tid | | | | of Testi ent Type: | | | hors 345 | | Test Date Test Time | | 2/13/88 1307 | |
|-----------------|---------|---------|----------|---------|-------|-------------------|-------|-------|-----------|-----------------------|------|------|----------|--------------|------------------------|------|-----------------|-------------|
| | | | EST PERI | OD . | | | | | RANGE (ne | ters> | | | | | | | ** | |
| | | D-S | | S-10 | : | 10-15 | : | LS-20 | | D-25 | 25 | -30 | 30 |)-3E | 2! | -40 | Tot | .1 .1 |
| pe | Ran | WF | Rau | NF | Rau | WF | Ram | HF | | UF | Rau | uF | | W. | Rau | WF | I Rau | MF |
| | 0 | 0 | 0 | 0 | | 0 | | | 0 | 9 | 0 | 0 | 0 | 0 | ۵ | ō | -: | 0 |
| | 0 | • | · o | . 0 | o | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | ٥ | ۵ | 0 | <u> </u> | ٥ |
| | 124 | 463 | 152 | 286 | 98 | 118 | . 1 | . 1 | 0 | 0 | 0 | 0 | . 0 | 0 | ٥ | ø | 375 | 869 |
| | 0 | 0 | 0 | 0 | 0 | • | ·o | 0 | ٥ | 0 | 0 | O. | 0 | o | Q | 0 | : 0 | ٠. ٥ |
| tal | 124 | 463 | 152 | 286 | 98 | 118 | 1 | 1 | 0 | . 0 | ۵ | 0 | 0 | ٥ | 9 | 0 | 376 | 884 |
| O MI | NUTES A | FTER TE | ST PERIO | 0 | | | • | | RANGE CHE | ters) | | | | | | | | |
| - | • | 0-5 | ! | 5-10 | . 1 | 10-15 | ; | 15-20 | 20 |)-25 | 25 | -30 | 30 |)-3 5 | . 34 | -40 | Tat | .1 2 |
| pe | Rau | HF | Rau | HF | Rau | UF | Rau | uf . | Rau | WF | Rau | иF | Rau | MF | Ran | HF | \$ Ray | UF |
| | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | ٥ | 0 | | 0 | 0 | 0 | | 1 |
| | . 0 | 0 | • | Q | 0 | ۰ | . 0 | ٥ | 0 | 0 | ٥ | 0 | ٥ | 0 | / 'o | . 0 | | 0 |
| ! | 110 | 410 | 124 | 233 | 142 | 170 | 0 | 0 | ٥ | o | • " | 0 | ů | ٥ | . 0 | 0 | : 376 | 813 |
| ι | a | a | 0 | Q | 0 | . • | a | q | ٥ | 0 | G | G | 0 | ۵ | ٥ | 9 | io | ٥ |
| tal | 110 | 410 | 124 | 233 | 142 | 170 | 1 | 1 | 0 | 0 | ٥ | 0 | 0 | ٥ | 9 | 0 | 377 | 814 |
| I-SQU HAT | 4 | D-S | • | 5-10 · | 1 | 10-15 | ; | 15-20 | 20 | D-25 | · 25 | i-30 | 34 | -35 | 31 | i-40 | | RE F-HAT |
| | Ran | HE | Rau | HP | Rau | WF | Reu | HF | Rau | WF | Ran | MP | Reu | HF | Rau | MF | 1 Rau | HF |
| | ŏ | ă | 0 | 0 | 0 | ā | ģ | ģ | 8 | 0 | 8 | 8 | ě | 8 | 8 | å | : . | ្នំ |
| | 117 | 437 | 138 | 260 | 120 | 144 | ģ | å | 0 | 0 | Ģ | 0 | 8 | 8 | 0 | 8 | : 376 | 841 |
| FAL. | 117 | 437 | 138 | 260 | 120 | 144 | 1 | 1 | 0 | ο , | 0 | 0 | ٥ | 0 | 0 | a | : 376 | 841 |
| I – SQU LUES | | 0-5 | | 6-10 | | 10-15 | 1 | 15-20 | . 20 |)-2S | 25 | -30 | | -35 | | -40 | | RE VALUE |
| | Ram | up | Raw | HF | Rass | HF | 1.000 | 1.000 | Rass | HF | Rau | MF | Rau | HF | Rau | HF | 1.000 | HF L.OOu |
| | 0.838 | 3.218 | 2.841 | 5.412 | 9.067 | 9.389 | 1.000 | 1.000 | | | ~~ | == | | | | | 0.001 | 1.800 |
| TAL | 0.638 | 3.218 | 2.841 | 5.412 | 9.067 | 9.589 | 0.000 | 0.000 | | | == | | | == | == | == | 0.005 | 1.734 |

Table 825. Indian Point hanner test monitoring using 6#12 degree horizontal transducer located at unit 3, intake 35.

S-10

10 MINUTES BEFORE TEST PERIOD

Tidal Phaset

3 hrs before low tide

10-15

| race | | | : | | | | | | | | | | | | | | | |
|--------------------|---------|-------------|-----------|----------|-------|---------|-----------|----------------|----------|---------|------|------|-----|---------|------|---------|-----------|-------------|
| up• | Rau | HF | Rau | HF | Rau | NF | Rau | HF | Rau | uf . | Rass | NF | Rau | UF | Rau | uf | E Raw | MF |
| \$ | 0 | 9 | 0 | 0 | Q, | 0 | ٥ | 0 | 4 | 3 | 0 | 0 | ۵ | 0 | 0 | 0 | . 4 | 3 |
| L, | | 0 | 0 | 0 | . 0 | 0. | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| ic . | 62 | 306 | 144 | 271 | 160 | 216 | 72 | 23 | • | • | 0. | . • | G | 0 | 0 | 0 | : 470 | 950 |
| ILI T | 0 | . 0 | 0 | 0 | • | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | i o | 0 |
| otal | 92 | 306 | 144 | 271 | 190 | 216 | 72 | 65 | 4 | | 0 | 0 | . 0 | 0 | 0 | 0 | 492 | 861 |
| 10 MIN | UTES DU | RING TE | ST PERI | 00 | | | | | | | | | | | | | | |
| | | | | | | | | | RANGE CH | eters) | | | • | | | : | | 1. |
| race | 0 | -5 | | 5-10 | | 0-15 | | 15-20 | | 20-25 | 25 | 5-30 | | 0-35 | 35 | 5~40 | Tota | |
| ype | Rau | HF | Rass | uf . | Rau | uf | Ram | HF | Rau | MF | Rau | NF | Rau | HF | Rass | HF | 8 Ress | HF |
| . s | 0 | 0 | 0 | 0 | . 0 | 0 | 8 | 0 | 0 | ٥ | Ó | 0 | 4 | 0 | 0 | .0 | | . 0 |
| FL. | ٥ | • | G | , 0 | e | 0 | 9 | 0 | 0 | 0 | . 6 | 0 | Q | 0 | 0 | 0 | | o o |
| ic | 110 | 410 | 165 | 310 | 172 | 206 | 68 | 61 | ٥ | a | 0 | 0 | 0 | 0 | 6 | 0 | E 15 | 987 |
| ŧu. | ۵ | 0 | 0 | | ٥ | 0 | 0 | • | 0 | Q | 0 | ٥ | 0 | 0 | ٥ | 0 | | a |
| otal | 110 | 410 | 165 | 310 | 172 | 206 | 60 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | \$15 | 987 |
| | | | | | | | | | | | | | • | | • | • | | |
| 10 UIM | WIES RF | TER IE | ST PERIO | | | | | , | RANGE (m | eters> | | : | | | | | | - |
| _ | c |)- 5 | ! | 6-10 · | 1 | 0-15 | | 15-20 | | 20-25 | 21 | G~30 | 34 | 0-36 | 36 | -40 | Tota | .1 |
| Trace Tupe | Ran | WF | Rau | WF | Rem | uf . | RAM | HF | Rau | WF | Rass | uf | Reu | MF. | Raut | MF | f Rau | WF |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | 2 | 2 | 0 | 0 | 0 | 0 | 0 | • | -:2 | 2 |
| SL, | 0 | 0 | o | a | 0 | a | 0 | 0 | . 0 | 0 | o | 0 | o | 0 | 0 | o | | a |
| (C | 34 | 351 | 145 | 273 | 135 | 162 | 59 | 52 | . 0 | • | ٥ | 0 | 0 | 9 | 0 | • | 432 | 836 |
| 4M2 | 0 | o o | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G | 0 | 0 | : 0 | · o |
| Total | 34 | 351 | 145 | 273 | 135 | 162 | 50 | 52 | 2 | 2 | 0 | 0 | 0 | | 0 | , o | 434 | 840 |
| CHI – SQUA | | | | • | | | | | | | | | | | • | | CHI-SQUA | |
| F-HAT | |)-5 | | B- 10 | | 10-15 | | 15-20 | | 20-25 | 2 | 5-30 | 3 | 0-35 | | 5-40 | FOR 3 TE | ST PE |
| LS | RAH | HE | Rau | HF O | Rau | MF O | Rau | HF | Rau | uF 2 | Rase | HF | Rau | HF D | Rau | HF O | I Rau | UF 2 |
| Si. | ŏ | ŏ | 0 | Õ | ō | , ō | Ō | _0 | Ö | ō | Ŏ | · ŏ | ā | Õ | Ō | ō | iŌ | õ |
| NC | 95 | 355 | 15 1 0 | 284 0 | 162 | 194 | 66 | 53 0 | 0 | 9 | 0 | 0 | 0 | ö | S | 0 | 1 470 | 98 5 |
| TOTAL | 95 | 35\$ | ışī | 284 | 162 | 194 | 66 | . 53 | 2 | Ž | ă | Ō. | ō | Ğ | Ō | Õ | i 472 | 887 |
| CHI-SQUA PALUES | RE | 3-E | | S-10 | , | 10~15 | | 15-20 | • | 20-25 | 2: | S-30 | 3 | 0-35 | 31 | 5-40 | CHI-SQUA | RE UR |
| | Rau | WF | Rau | | Rau | ИF | Rau | | Raw | UF. | Rau | WF | Ran | WF | Rau | HF | IFOR 3 TE | |
| | F-014 | | | | | =- | | | 4.000 | 1.500 | | | ~- | | | ~ | 1 4.000 | 1.500 |
| S | | | | | | | 4 | 2.500 | | | | | | | | | :22.517 4 | |
| SL ' | 5.158 : | 17.330 | 2.061 | 5.401 | 0.117 | 10.515 | 1.576 | 2-500 | | | | | | | | | | 13.015 |

Duration of Test: Treatment Type:

20-25

25-30

RANGE (meters)

15-20

2/13/86 2320

Total 1

10 min hurs 345 Fest Date: 10 sec on, 20 sec off Fest Time:

30-35

Numbers presented are a minimum estimation for test periods.

Table D26. Indian Point hanner test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

| | MUTES DU | | | - | | | | 1 | RANGE SHO | ters) | | | | | | | 1.0 | |
|---------------------|----------|------------------|----------|---------------|-------|---------|-----------|--------------|-----------|-------|-----|---------|-----|--------------|-----|------|---------------------|-----------------|
| | | S | | - 10 | | 10-15 | | 15-20 | | 0-25 | | 25-30 , | | 0-3 5 | | 5-40 | Fot. | a1 ' |
| upe - | RAN | 45 | Raw | WF | Rau | HF | Rau | WF | Rau | MF | Rau | up. | Rau | NF | | HF | : Rau | WF |
| S | 0 | 0 | 0 | 0 | | • | 0 | - | | 0 | 0 | 0 | 0 | G | 0 | | -i | 0 |
| L. | ۵ | 0 | 0 | 0 | 0 | 0 | ٥ | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| C | . 93 | 347 | 156 | 293 | 191 | 229 | 45 | 41 | · o . | Ò | 0 | 0 | . 0 | 0 | ٥ | 0 | : 485 | 910 |
| u | 0 | ۰ | 0 | 0 | 0 | 0 | 0 | 0 | a | o · | 0 | 0 | 0 | 0 | 0 | . 0 | : 0 | o |
| otal | 93 | 347 | 156 | 293 | 191 | 329 | 45 | 41 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 465 | 910 |
| 10 HI | MUTES AF | TER TE | ST PERIO | | | | | | RANGE CHE | ters) | | | . • | | • | | | <u>.</u> |
| | |)-S | | i~10 | | 10-15 | | 15-20 | | 0-25 | ; | 25-30 | 3 | 0-35 | | 5-40 | Tot | al ¹ |
| ype | Rau | uF | Rau | uf | Rau | Jef | Ran | HF | Rau | HF | Rau | HF | Rau | HF | | HF | E Reu | HF |
| \$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | ~~~ | 0 | 0 | 0 | 0 | | Ü |
| L . | . 0 | Q | ٥ | Ö | 0 | • | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | . 0 | . 0 | | ٥ |
| C | 45 | 317 | 160 | 316 | 182 | 218 | 62 | 56 | o | . 0 | 0 | . 0 | 0 | . 0 | D | . 0 | 497 | 907 |
| M | 0 | • | o | o | ٥ | 0 | 0 | 0 | 0 | . 8 | 0 | • | 0 | 0 | • | 0 | i o | 0 |
| otal | 85 | 317 | 160 | 316 | 182 | 210 | 62 | 56 | 0 | 0 | 0 | 0 | a | 9 | 0 | o | 497 | 907 |
| HI – SQL – HAT | |)- 5 | 5 | - 10 | | 10-15 | | 15-20 | 2 | 20-25 | | 25-30 | | 0-35 | 31 | 5-40 | CHI-SQUI | RRE F-HA! |
| s | Rau G | NF. | Rau | HF O | Rass | HF O | Rau | HF O | Rau | MF ' | Rau | MF | Rau | HF | Rau | ИF | T Rau | HF |
| Ĺ | 83 | 0 332 | 162 | 0 305 | 197 | 224 | - 0 54 | 49 | ě | Õ | Ö | õ | ŏ | Ď | Ŏ | ŏ | 491 | 909 |
| Ŭ OTRL | ő | 332 | 162 | 305 | 197 | 224 | | 49 | . 0 | ŏ | ŏ | ő | ŏ | ŏ | ŏ | ŏ | 1 0 | Ů |
| HI-SQL | | 242 | 142 | 205 | 101 | 224 | 57 | 43 | | u | v | U | U | U | U | u | : 491 | 909 |
| UT'NE 2 HI - 260 | |) - 5 | | i~ 10 | : | 10-15 | | 15-20 | | 0-25 | | 25~30 | > | 0-35 | 36 | 5-40 | CHI-SQU :FOR 2 F | RE VALU |
| s | Rau | ИF | Rau | HF | Rau | ИF | Rau | ИF | Rass | ИF | Raw | UF | RaH | μF | Rau | HF | E Rass | HF |
| Ī. | | | | _ | | | | | | | | | · | | | | = == | |
| | 0.360 | 1.355 | 0.444 | 0.869 | 0.217 | 0.271 | 2.701 | 2.320 | | ~~ | | | | == | == | == | 0.147 | 0.005 |

¹⁾ Humbers presented are a minimum estimation for test periods.

Table D27. Indian Point hanner test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

Tidal Phase:

4 hrs before low tide

| | | | ST PERIOD | | | | | | | | | | | | | | | |
|--|---|---|---|--|--|--|--|--|---|---|---|--|--|--|---|---|---|---|
| IO NIN | utes bef | OKE IE | | | - 1 | | | | RANGE (m | eters) | | | | | • | | | |
| | 0- | 5 | 5- | 10 | 1 | 0-15 | | 15-20 | ; | 20-25 | 2 | 5-30 | : | 30-35 | : | 5-40 | Tota | ı |
| ype | Rau | HF | Rau | HF | Ran | ₩F | Rau | HF | Rau | ШF | Rau | HF | Raw | HF | Rass | HF | : Rau | М |
| 5 | 1 | 4 | 1 | 2 | 2 | .5 | 3 | 3 | 7 | Б | 1 | 1 | 3 | 2 | 3 | 1 | -21 | 20 |
| L. | ۵ | 0 | 0 | | 0 | 0 | 1 | 1 | 0 | 0 | œ | 0 | | O | 0 | 0 | 1 | 1 |
| Ç · | ٥ | o | 1 | 2 | 1 | 1 | • | 0 | 2 | 2 | | ٥ | 0 | ٥ | • | 0 | 4 | 5 |
| н . | | 0 | 0 | 0 | • | . • | 0 | . 0 | Q · | | 0 | | . 0 | 0 | 0 | • | | 0 |
| otel | 1 | 4 | 2 | 4 | 3 | 3 | 4 | 4 | 9 | 7 | 1 | 1 | 3 | 2 | 3 | 1 | 26 | 26 |
| 10 NIM | 1176 C140 | TNA TE | EST PERIOD | | | | | | | | | | | | | | | |
| | | | , | | | - | | | RANGE CH | eters> | | | | | | | | |
| race | 0- | 5 | 5- | 10 | | 10-15 | | 15-20 | | 20-25 | 2 | 5-30 | | 30-35 | | 35-40 | Tota | , |
| upe | Rau | WF | Ræq | HF | Rau | uf ———————————————————————————————————— | Rau | WF | Rau | uf | Rau | WF | Ran | MF | Rau | WF | t Raw | W |
| .s | 0 | 0 | > | 6 | 4 | 5 | 9 | | 3 | 2 | 11 | 7 | 6 | > | 1 | 0 | 37 | 31 |
| iL. | 0 | ٥ | 0 | ۵ | • | 0 | 0 | 0 | 0 | 0 | 0 | , • | . • | ٥ | 0 | ٥ | • | 0 |
| iC . | 0 | 0 | 0 | o | . 0 | ٥ | 1 | . 1 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 4 | . 4 |
| u | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| | 0 | _ | _ | _ | _ | _ | | ·_ | . 2 | 4 | 12 | 8 | | 3 | 1 | | 41 | 35 |
| | _ | O ER TES | 3 ST PERIOD | | 4 | 5 | 10 | 9 | RANGE CH | • | | | | • | • | . - | | |
| 10 HIN | _ | ER TES | ST PERIOD | -10 | • | 10-15 | | 15-20 | RANBE CH | • | | 5-30 | | 30-35 | - | 15-40 | Tota | 1 |
| 10 MIN | NITES AFT | ER TES | ST PERIOD | -10 WF | Rau | 10-15 I# | Rau | 15-20 UF | RANBE CH | eters) 20-25 UF | Rau | 85-30 NF | Reu | 30-36 W | Rau | 15-40 14F | . Rau | UF. |
| 10 MIN race ype | NITES AFT | ER TES | ST PERIOD | -10 | | 10-15 18 ² | Rass 2 | 15-20 UF | RANGE CH | eters) 20-25 | Rau 9 | KF 5 | Rau 4 | 30-35 UF 2 | Rau 2 | 15-40 14F | | |
| race ype S | Rau 0- 0- 0 | ER TES | ST PERIOD S- Ran | -10 WF | 2 О | 10-15 14F 2 0 | Rau 2 0 | 15-20 UF 2 | RANGE Con Ran 4 | eters) 20-25 MF 3 | 2 Rau 8 0 | NF 5 | Rau | 30-35 UF 2 0 | Rau | 1 0 | 23 1 | 17 |
| race upe S | Rau O O O O | ER TES | ST PERIOD S- Ram 1 0 | -10 UF 2 0 2 | Reu 2 0 | 10-15 18F 2 0 | Rass 2 0 | 15-20 UF 2 0 | RANBE Con | oters) 20-25 WF 3 | Rau 8 0 | S-30 NF 5 0 | Reu 4 0 4 | 30-36 WF 2 0 | 2 0 | 1 0 | 23 1 | 17 1 |
| 10 MIN | O-Rau O 2 0 | ER TES | ST PERIOD S- Rau 1 0 1 | -10 HF 2 0 2 | Rest 2 0 0 0 | 10-15 MF 2 0 0 | 2 0 0 | 15-20 UF 2 0 | RAMBE Co. Res. 4 | 20-25 MF 3 1 0 | 2 Rau 8 0 0 | S-30 NF 5 0 | Reu 4 0 4 | 30-36 ldf 2 0 2 | 2 0 1 | 1 0 0 | 23 1 23 0 | 17 1 1 11 |
| race ype s | CO-ROW O C C C C C C C C C C C C C C C C C C | ER TES | ST PERIOD S- Ram 1 0 | -10 UF 2 0 2 | Reu 2 0 | 10-15 18F 2 0 | Rass 2 0 | 15-20 UF 2 0 | RANBE Con Rand 4 1 | oters) 20-25 WF 3 | Rau 8 0 | S-30 NF 5 0 | Reu 4 0 4 | 30-36 WF 2 0 | 2 0 | 1 0 | Rem 23 1 1 8 1 0 0 1 32 | 17 1 1 11 0 |
| 10 MIN | CO-ROW O C C C C C C C C C C C C C C C C C C | S UF 0 7 | ST PERIOD STATEMENT OF THE PERIOD OF THE PERIOD OF THE PERIOD OF THE PERIOD OF THE PERIOD OF THE PERIOD OF THE PERIOD OF THE PERIOD OF THE PERIOD OF THE PERIOD OF THE PERIOD OF THE PERIOD OF THE PERIOD OF THE PERIOD OF T | -10 HF 2 0 2 | Rau 2 0 0 | 10-15 MF 2 0 | Rau 2 0 0 | 15-20 UF 2 0 | RAMBE CHI | 20-25 MF 3 1 0 | Raw 8 0 0 | S-30 NF 5 0 | Reu 4 0 4 0 | 30-36 ldf 2 0 2 | 2 0 1 0 | 1 0 0 | 23 1 23 0 | 17 1 1 11 0 29 |
| Yaca Ypa S S S S S S S S S S S S S S S S S S S | O-ROW O 2 O REW O | S UF 0 7 0 7 5 14P | ST PERIOD S- Raw 1 0 1 0 2 | 10 18F 2 0 2 0 4 | 2 0 0 0 | 10-15 HF 2 0 0 2 10-15 | 2 0 0 0 2 Res | 15-20 14F 2 0 0 | RAMBE CHI | 0 0 4 20-25 | Raus 8 0 0 0 8 | 5 0 0 G | Reu 4 0 4 0 | 20-36 UF 2 0 2 0 4 | 2 0 1 0 3 | 1 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 23 1 2 9 2 2 3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 17 1 11 0 29 RE F-IM |
| Yaca Ypa S S S S S S S S S S S S S S S S S S S | O-RAM O O 2 O 2 RAM O RAM O O O O O O O O O O O O O O O O O O O | 5 UF 0 7 7 5 MP 10 10 10 10 10 10 10 10 10 10 10 10 10 | ST PERIOD S-Raw 1 0 1 C S-Raw 2 | -10 MF 2 0 2 0 4 -10 | 2 0 0 0 | 10-15 WF 2 0 0 2 10-15 | 2 0 0 0 2 Rate | 15-20 UF 2 0 0 0 2 15-20 UF 4 | RAMBE CHARACTER | oters) 20-25 UF 3 1 0 4 20-25 | Ram 8 0 0 0 8 8 2 Ram 7 0 | S-30 NF S 0 0 0 0 S S-30 | Resu 4 0 4 0 8 8 | 30-36 WF 2 0 2 | 2 0 1 0 3 | 1 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 23 1 2 2 3 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 17 1 1 11 0 29 RE F-IM ST PERI |
| otal 10 MIN Pace 'ype S KL IC MI STAL GTAL | O-Rau | ER TES | ST PERIOD S-Raw 1 0 2 5-Raw 2 0 1 0 | 10 HF 2 0 2 0 4 | Rau 2 0 0 0 2 2 Rau 3 0 0 0 0 0 | 10-15 MF 2 0 0 2 10-15 MF 3 0 | 2 0 0 0 2 | 15-20 16 2 0 0 0 2 15-20 | RAMBE Coo | 20-25 UF 3 1 0 0 4 20-25 | Raus 8 0 0 0 8 2 Raus 7 0 | S-30 MF 5 0 0 0 5 S-30 | Reu 4 0 4 0 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | 2 0 2 0 4 30–35 | 2 0 1 0 3 Rau 2 0 | 1 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 23 1 2 2 3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 17 1 1 11 0 29 RE F-IM ST PERI UF 22 1 7 |
| race upe .s RL IC III Cotal Co | O-Rau O 2 O Rain O 1 | S UF 7 7 7 5 14P 10 20 | ST PERIOD S-Ron 1 0 1 0 2 S-Ran 2 0 1 0 2 | 10 18F 2 0 2 0 4 | 2 0 0 0 2 2 Raw | 0 0 0 2 LO-15 | Rass 2 0 0 0 2 2 Rass 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 15-20 UF 2 0 0 2 15-20 UF 4 0 0 | RAMBE CHARACTER | 0 0 4 20-25 | Ram 8 0 0 0 0 8 2 Ram 7 0 0 0 7 7 | 5 0 0 0 5 5 30 UF | Ress 4 0 4 0 8 | 30-36 UF 2 0 2 0 4 30-35 UF 2 0 | 2 0 1 0 3 | 1 0 0 1 1 SS-40 MF | 23 1 23 1 23 21 25 26 27 27 27 27 27 27 29 20 20 20 20 20 20 20 20 20 20 20 20 20 | 17 1 11 0 29 REF F-HF ST PERI UF 22 21 7 0 |
| race ype S S S S S S S S S S S S S S S S S S S | O-Rau O 2 O Rain O 1 | S WF 0 7 0 7 5 WP 1 0 2 0 4 | ST PERIOD S-Ron 1 0 1 0 2 S-Ran 2 0 1 0 2 | 10 HF 2 0 2 0 4 10 | Rau 2 0 0 2 2 Rau 3 | 10-15 MF 2 0 0 2 10-15 MF 3 0 | Rau 2 0 0 0 2 2 Rau 5 0 0 0 0 5 5 | 15-20 UF 2 0 0 2 15-20 UF 4 0 0 | RAMBE Coo | 20-25 MF 3 1 0 0 4 20-25 MF 3 0 1 0 20-25 | Ram 8 0 0 0 0 8 2 Ram 7 0 0 0 7 7 | 5 0 0 0 S S 30 UF 4 0 0 0 S S 5 30 UF 4 0 0 0 S S 5 5 30 | Ress 4 0 4 0 8 Ress 0 1 0 5 | 30-35 MF 2 0 2 0 4 30-35 MF 2 0 1 0 3 | 2 0 1 0 3 3 Raus 2 0 0 0 2 2 | 1 0 0 0 1 1 SS-40 WF 1 1 0 0 0 1 1 SS-40 0 1 1 SS-40 | 23 1 23 1 23 21 25 26 27 27 27 27 27 27 29 20 20 20 20 20 20 20 20 20 20 20 20 20 | 17 1 11 0 29 REF F-HF ST PERI UF 22 21 7 0 |
| race upe S S S S S S S S S S S S S S S S S S S | ROW O C C C C C C C C C C C C C C C C C C | 5 UF 0 7 7 5 UP 1 0 2 0 4 | ST PERIOD S-Rah 1 0 2 5-Rah 2 0 1 Rah Rah | 10 18F 2 0 2 0 4 | Rau 2 0 0 2 2 Rau 3 | 10-15 MF 2 0 0 2 10-15 MF 2 3 | Rau 2 0 0 0 2 2 Rau 5 0 0 0 0 5 5 | 15-20 UF 2 0 0 0 2 15-20 UF 4 0 0 0 5 | RAMBE Coo | 20-25 MF 3 1 0 0 4 20-25 MF 3 0 1 0 20-25 | 2 Ram 9 0 0 0 8 8 2 Ram 7 0 0 0 7 2 Ram Ram Ram Ram Ram Ram Ram Ram Ram Ram | 5 0 0 0 5 5 30 UF | Ress 4 0 4 0 8 Ress 0 1 0 5 | 30-35 MF 2 0 2 0 4 30-35 MF 2 0 1 0 3 | 2 6 1 0 3 8au 2 0 0 2 8au 2 0 2 8au 3 8au 2 8 2 8 2 8 2 8 2 8 3 8 2 8 2 8 2 8 2 8 | 1 0 0 0 1 1 SS-40 WF 1 0 0 0 1 1 0 0 0 1 1 | 23 1 23 1 23 2 1 23 2 21 2 20 21 20 21 21 21 21 21 21 21 21 21 21 21 21 21 | 17 11 10 0 29 REF-HRST PERI HR 22 17 00 30 REF WALL SET PERI HR 7-100 |
| race ype S S S S S S S S S S S S S S S S S S S | 0- Resu 0 2 0 2 0 2 0 Resu 0 0 0 Resu 0 Resu 0 0 Resu 1 0 0 1 1 0 1 | ER TES | ST PERIOD S-Rah 1 0 2 5-Rah 2 0 2 5-Rah 0 0 2 | 10 10 2 0 2 0 4 -10 10 10 10 10 10 10 10 10 10 | Rau 2 0 0 2 2 Rau 3 0 0 0 3 | 0 0 0 2 10 15 WF 3 0 0 0 0 3 10 - 15 WF | Rau 2 0 0 0 2 Rau 5 0 0 0 0 8 8 | 15-20 UF 2 0 0 2 15-20 UF 4 0 0 0 | RAMBE Coo | 0 0 4 20-25 WF 3 0 1 0 5 5 20-25 WF | 2 Ram 8 0 0 0 8 8 2 Ram 7 7 0 0 0 7 7 2 Ram 8 | S-30 NF 5 0 0 0 5 S-30 NF 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rest 4 0 4 0 8 Rest 4 0 1 0 5 | 30-36 WF 2 0 2 0 4 30-35 WF 2 0 1 0 3 | 2 6 1 0 3 8au 2 0 0 2 8au 2 0 2 8au 3 8au 2 8 2 8 2 8 2 8 2 8 3 8 2 8 2 8 2 8 2 8 | 1 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 23 1 1 23 1 2 3 1 2 3 2 2 3 1 2 3 2 2 3 2 2 3 3 2 2 3 3 2 3 3 2 3 | 17 11 11 0 29 REF-HF 22 1 7 0 30 REF WALL ST PERI |
| race ype s t c with the second | 0- Rau 0 0 2 0 2 0 2 0 0 0 0 0 0 0 0 0 0 0 0 | 7 0 7 5 MP 1 0 2 2 4 4 5 MF 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | ST PERIOD S-Rah 1 0 1 0 2 5-Rah 0 2 5-Rah 0 0 0 0 0 0 | 10 10 2 0 2 0 4 -10 10 10 10 10 10 10 10 10 10 | Rau 2 0 0 2 2 Rau 3 0 0 0 3 | 0 0 0 2 10 15 WF 3 0 0 0 0 3 10 - 15 WF | Rau 2 0 0 2 2 Rau 5 0 0 0 0 5 | 15-20 UF 2 0 0 2 15-20 WF 4 0 0 0 5 15-20 | RAMBE Coo | 20-25 MF 3 1 0 0 4 20-25 MF 3 0 1 0 5 20-25 | Ram 8 0 0 8 8 2 Ram 7 0 0 7 2 Ram 6.571 | 5-30 0 0 0 5-30 WF 4 0 0 0 5-30 | Rew 4 0 1 0 5 5 Rew 2.250 | 30-35 MF 2 0 2 0 4 30-35 MF 2 0 1 0 3 3 30-35 | 2 0 1 0 3 8au 2 0 0 0 0 2 | 1 0 0 0 1 1 SS-40 MF 1 0 0 1 1 SS-40 MF 1 0 0 0 1 1 SS-40 MF 1 0 0 0 1 1 SS-40 MF 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 23 1 1 23 1 1 8 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 17 11 11 0 29 REF F-HF 22 1 7 0 30 REF WALL ST PER 7.800 0.100 |

Duration of Test: Treatment Type: 10 min, hers 1,243 Test Date: 10 sec on, 20 sec off Test Time: 2/10/88 0153

Table D28. Indian Point hanner test monitoring using 5w12 degree horizontal transducer located at unit 3, intake 35.

| | | | | idal P | | 3.5 hrs low tid | • | | Treat | of Test went Type | •: : | 10 sec | hurs 1,2 on, 30 se | c off | Test Dat | 10 5 | 2/19/00 0215 | |
|-----------------|----------|-------------|--------------|-------------|--------------|--------------------|-------|---------|-----------|----------------------|-------|---------|-----------------------|-------------|---|---|------------------|------------------------|
| | | | EST PERIC | | | | | | RANGE (ne | | | | | | ,,_,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | | *: | |
| | 0 | ≶ | 5 | i-10 | | 10-1 5 | | 15-20 | 2 | 20-25 | : | 25-30 | | W-35 | 3 | 5-40 | Tota | n1 |
| race Me | Rau | MF | Rau | UF | Rau | UF | Res | WF | Rau | WF | Rase | WF | Rau | W | Rau | WF | \$ Ran | WF |
| \$ | 0 | | 4 | 8 | 9 | 11 | 13 | 12 | 4 | 3 | >0 | 18 | 3 | 2 | 2 | 1 | 65 | 25 |
| _ | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | ٥ | ٠ ٥ | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | | 0 |
| : | 1 | 4 | 1 | 2 | 4 | 5 | 7 | 6 | 4 | 3 | 2 | 1 | 1 | 1 | G | 0 | 20 | 22 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | • | 0 | 0 | • | 0 | • | o | • | | 0 . |
| stal | 1 | , 4 | 5 | 10 | 13 | 16 | 20 | 10 | 8 | 6 | 32 | 19 | 4 | 3 | 2 | 1 | | 77 |
| lo MI | NUTES AF | TER TE | ST PERIOD | • | | | | i | RANGE (m | eters> | | | | | | , | • | |
| | | - -≤ | 9 | i-10 | | 10~15 | | 15-20 | | 20-25 | 8 | 25-30 | | 0-35 | 3 | 5-40 | Total | 1 |
| ibe .ece | Rau | WF | Rau | WF | Reu | uf . | Rau | WF | Rau | WF | Rau | WF | Rase | WF | Rana | UF. | 2 Rass | W |
| 5 | 1 | 4 | 7 | 13 | 12 | 14 | 12 | 11 | 9 | 7 | 12 | 7 | 4 | 2 | 0 | 0 | 57 | 58 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | a | 0 | ٥ | . 0 | 0 | ٥ | · • | 3 0 | 9 |
| - | 1 | 4, | ٥ | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | | 11 | 12 |
| н | ٥ | ٥ | • | 0 | 0 | 0 | 0 | • | 0 | 0 | ,0 | | 0 | 0 | 0 | 0 | . 0 | 0 |
| otal | 2 | 9 | 7 | 13 | 14 | 16 | 14 | 13 | 11 | 9 | 14 | 8 | 5 | 3 | 1 | 0 | 69 | 70 |
| -HAT -HAT | | ⊢ 5 | | i-10 | | 10-15 | | 15-20 | • | 20-25 | 1 | 2530 | 3 | 0-35 | , | 5-40 | | RRE F-HAT EST PERIO |
| _ | Rau | W | Rau | ur. | Rau | HF 13 | Rase | HF | Rau | HE | Rau | ИF | Rau | WF | Rau | MF | E Rau | WF |
| | ģ | 2 | 6 | 11 | 11 | <u> </u> | 13 | 12 | 6 | 5 | 21 | 13 | õ | ő | į | ò | 61 | 57 |
| 4 | ò | ą | 1 0 | ò | ٥ | 5 | 5 | 1 | ò | ğ | 2 | 1 | 1 0 | ģ | ģ | 6 | : 16 | 17 |
| TAL | 2 | 6 | 6 | 12 | 14 | 16 | 17 | 16 | 10 | 8 . | 23 | 14 | 5 | 3 | 2 | 1 | : 77 | 74 |
| ATNER 11-201 | PERFE. | -5 | | 5-10 | • | 10-15 | | 15-20 | | 20-25 | 1 | 25-30 | | 0-3£ | | 5-40 | CHI-SOU | NEE VALUE |
| E | 1.000 | 4.000 | Rau 0.818 | uF 1.190 | 8au 0.429 | 0.360 | 0_040 | 0.043 | 1.923 | UF 1.600 | 7.714 | 4.840 | Rau 0.143 | UF 0.000 | 2.000 | UF 1.000 | 1 RAN 1 0.525 | 4.180 |
| | 0.000 | 0.000 | | 2.000 | 0.667 | 1.296 | 2.770 | 2.000 | 0.667 | 0.200 | 0.000 | 0.000 | | 0.000 | 1.000 | ======================================= | 2.613 | 2.041 |
| Ŭ DYAL | 0.333 | 1.533 | | 0.391 | 0.037 | 0.000 | 1.059 | 0.006 | 0.474 | 0-600 | 7.043 | 4.491 | | 0.000 | 0.223 | 1.000 | 1.869 | 0.233 |
| | | | | | | MRE - 3 | | (d.f. = | | 06> | | . • • • | | | | | | |

Table D29. Indian Point hammer test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| | | | | | | 3 hrs b low tid | • | | | ment Typ | re: 1 | O sec | | c off | Test Oate | P 2 | 2/1 8/88 0235 ************************************ | |
|--------------------|---------|--------|------------|---------|---------------|--------------------|---------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|-----------|--------------|---|------------------------|
| O HT NU | res our | INO TE | ST PERIOD |) | | | | ~ | RANGE (m | eters) | | | | | | | | |
| | 0 | | 5~ | 10 | | 10~15 | : | 15-20 | | 20-25 | 2 | 5-30 | . 1 | 10-3S | 31 | 5~40 | Tota | 1 |
| ibe Kace | | WF | Rau | HF | Ras | · UF | Rau | uf. | Rau | WF | Rau | MF | Ran | WF | Rau | WF | i Reu | HF |
| \$ | 0 | 0 | 2 | 4 | 1 | 1 | 2 | . 5 | 4 | 3 | 9 | 5 | 5 | > | 3 | 1 | 26 | 19 |
| | 0 | 0 | 0 | o | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | 1 | 1 |
| ; | 0 | 0 | 1 | 2 | 1 | 1 | 1 | 1 | 0 | . 0 | 1 | 1 | . 1 | 1 | 1 | 0 | | 6 |
|) | 0 | o | 11 | 2 | D | 0 | . 0 | Q | 1 | 1 | 0 | . 0 | 0 | 0 | 1 | 9 | | |
| tal | ٥ | 0 | 4 | | 2 | 2 | 4 | 4 | E | | 10 | 6 | 6 | 4 | 8 | 1 | 36 | 29 |
| O MINU! | | | ST PERIOD | | | | | | RANGE (m | | | | | | • | | | |
| ac+ | | | | 10 | - | 10-15 | | 15-20 | | 50-52 | | 5-30 | | 0-35 | | 5-40 | Tota | |
| pe | | HF | | uf - | Ra- | | Rau Rau | HF. | Ran | | Rau | uf | Rew | HF | | MF | Raw | MF |
| S | 0 | 0 | 2 | 4 | 3 | 4 | 10 | .9 | 6 | 2 | 10 | 6 | 2 | . 1 | 2 | . 1 | : 36 | 30 |
| • | • | 0 | 0 | ٥ | ٥ | • | • | . 0 | 0 | ٥ | 0 | 0 | . 0 | • | 0 | . 0 | ; 0 | a |
| : | 0 | 0 | 1 | 2 | 1 | 1 | 0 | 0 | 3 | 2 - | 1 | 1 | . 0 | ٥ | 1 | ٥ | : 7 | 6 |
| <u> </u> | | | | 0 | | | | <u>-</u> | | 1 | 1 | 1 | 0 | . 0 | <u>_</u> | <u> </u> | -: 2 | 2 |
| tal | 0 | 0 | . 3 | 6 | 4 | 5 | 10 | . 9 | 10 | • | 12 | 8 | 2 | 1 | 4 | 1 | : 45 | 38 |
| I-SQUARI HAT | 0 | 5 | S~ | 10 | | 10-15 | : | 15-20 | | 20-25 | 2 | :5-30 | 3 | 26-0 | 31 | 5-4 0 | CHT-SQUA FOR 2 TE | |
| | Rau | MF | Rau | HF | Rai | HE | Rau | W | Rau | HF | Rau | MF | Rau | LIF. | Rau | М | 3 Rau | HF |
| i | 9 | ŏ | - 5 | 2 | ą | ğ | 1 | - 1 | 0 | 2 | 0 | ğ | 3 | . 5 | 3 | ò | 1 1 | 25 1 |
| 1 | ō | 8 | į | 2 | ò | ò | ġ. | ò | 1 | 1 | 1 | 1 | ò | Ŏ | 1 | 8. | (| _ 5 |
| TAL | - | 0 | 4 | 7 | . 3 | 4 | 7 | 7 | 8 | 6 | 11 | 7 | 4 | 3 | Б | 1 | : 41 | 34 |
| I — SOUARI LUES | O- | 5 | 5 ~ | -10 | | 10-15 | : | 15-20 | 2 | 20-25 | | 5-30 | 3 | O-35 | 35 | -40 | CHI -SQUA | RE VAL |
| • | Rau | WF | 0.000 B | HF | Rat | 1.800 | Ra44 5.333 | HF 4.455 | Rau 0.400 | UF 0.500 | Rau 0.053 | иF 0-091 | Rau 1.286 | UF 1.000 | 0.000 C | ME. | :FOR 2 TE : Rau : 1.613 | ST PERI HF 2.469 |
| | | | | .000 | 0.000 | 0.000 | 1.000 | 1.000 | 3.000 | 2.000 | | 0.000 | | 1.000 | 0.000 | | : 1.000 | 1.200 |
| I STAL | | | 1.000 2 | .000 | 0.567 | | 2.571 | 1.923 | 0.000 | 0.000 | 1.000 | 1.000 | | | 1.000 | | . 0.200 | 0.200 |
| | | | 0.143 0 | | | 1.286 IRRE = 3 | | _ | 1.667 | 1.333 | - | 0.286 | 5.000 | 1.800 | 0.111 | 3.000 | 1.000 | 1.209 |

Table 030. Indian Point hammer test monitoring using 6m12 degree herizontal transducer located at unit 3, intake 35.

| | | | EST PERIO | D | | low tide | | | | | | TERROPE TERROPE | erseners | | Test Tie | | 0255 | |
|------|---------|---------|-----------|-------|----------|----------|-------|-------------|----------|-------------|--------|--------------------|----------|---------------|----------|-------|----------------------|----------------|
| | | | | | | | | • | RAMBE CH | ters) | | | | | | | | |
| 160 | |)-5 | 5 | - 10 | | 10-15 | | 5-20 | | 20-25 | ~ | 25-30 | | 30-3 5 | | 5-40 | Tot4 | 1 |
| pe | Rau | HF | Rau | 145 | Rau | HF | Rau | MF | Rau | MF | Rau | . uf | Res | MF | Rase | HF. | 2 Raw | MF |
| | 0 | 0 | 1 | 2. | 10 | 12 | 7 | 6 | | 5 | 15 | 9 | 4 | 2 | 1 | ٥ | . 44 | 36 |
| | ٥ | 0 | 1 | 8 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | • | 1 | 2 |
| | 2 | 7 | 2 | 4 | 3 | 4 | 2 | 2 | 2 | 2 | 3 | 2 | . 1 | . 1 | 0 | 0 | 15 | 22 |
| | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | ٥ | 1 | | 0 | 0 | 9 | 0 | • | G | 1 | 3 |
| al | 2 | 7 | 4 | 9 | 15 | 16 | 9 | • | 9 | | 19 | 11 | 5 | > | 1 | 0 | 61 | 61 |
| o MI | NUTES A | TER TE | ST PERIOD | • | • | | | | | | - | | | | | | | |
| | | | _ | | 1 | | | | RANGE CH | | | | | | | | | _ |
| DCT. | | 0-5 | 5 | -10 | | 10-15 | | 5-20 | | 20-25 | | 25-30 | | 30-35 | | 5-40 | Tota | |
| P-0 | Raw | uf | Rau | | Rau | uf | Rau | uf | Rau | F | Rau | HF | Rau | | Rau | uf | ~} | WF |
| | 0 | 0 | 0 | ٥ | 3 | 4 | • | . 4 | 7 | 5 | 6 | 4 | 3 | 2 | 2 | . 1 | t 25 | 20 |
| | 0 | 0 | ٥ | 0 | . 1 | 3 | • | 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | . 0 | 1 | 1 |
| | 1 | 4 | 1 | 2 | 1 | 1 | 1 | 1 | 0 - | . 0 | 0 | • | 0 | 0 | 0 | • | 4 | * • \$ |
| | 0 | | 0 | | <u> </u> | 0 | 0 | 0 | 0 | 0 | 0 | <u>`0</u> | <u> </u> | 0 | <u> </u> | 0 | . 0 | 0 |
| al | 1 | 4 | 1 | 2 | 5 | 6 | 5 | 5 | 7 | 5 | 6 | 4 | 3 | 2 | 2 | . 1 | : 30 | 29 |
| -sou | MRE | D-5 | s | -10 | | 10-15 | 1 | E-20 | | 20-25 | | 25-30 | | 30-35 | | S-40 | CHI-SQUE FOR 2 TE | |
| ı | Raw | HF. | Rau | MF | Rau | HF | Rau | MF | Rau | WF | Rau | ME | Rau | HF | Rau | WF | t Rau t 35 | HF |
| | - 0 | ŏ | i | i | 1 | <u> </u> | ŏ | ō | Ģ | ą | 11 | é | 3 | Š | 2 | 0 | 2 1 | 2 0 |
| | 2 0 | ō | 2 0 | ş | 2 0 | 0 | 2 | 9 | ì | 1 | 2 0 | Õ | ò | ò | 8 | 0 | 10 | 15 |
| FAL. | 2 | 6 | 3 | Ś | 9 | 11 | 7 | 7 | | 7 | 12 | •, | 4 | 3 | 2 | 1 | 2 46 | 45 |
| -SQL | | 0-5 | | -10 | | 10-15 | 1 | 5-20 | | 20-25 | | 25->0 | | 30-35 | | 5-40 | CHI-SQUA | |
| | Ran | W | Rass | WF | Rau | WF | Rau | UF 0.400 | Rau | UF 0.000 | 2.857 | WF | Reu | UF 0.000 | 0.333 | 1.000 | I Rau | HF |
| | | | 1.000 | 2.000 | 1.000 | 1.000 | 0.016 | | 0.077 | | | 1.923 | 0.143 | | 0.333 | 1.000 | 1 0.000 | 4-571 0.333 |
| | 0.335 | 0.810 | | 0.667 | 1.000 | 1.800 | 0.333 | 0.333 | 1.000 | 1.000 | 3.000 | 2,000 | 1-000 | 1.000 | | | : 1.000 | 1.500 |
| ral. | 0.333 | 0.618 | 1.000 | 3.600 | 3.556 | 4.545 | 1.143 | 0.692 | 0.250 | 0.692 | 6-900 | 3.267 | 0.500 | 0.200 | 0.323 | 1.000 | :10.560 1 | 1.376 |

Table 031. Indian Point hanner test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

| io MI | MUTES DI | | | | | | | | | | RANGE (H | eters> | | | | | | | •.• | |
|-----------------------|----------|------|-----------------------|-------------------------|----------------------------------|-------------------|--------------------|---|--|----------------------------------|--------------------|----------------|--------------------------|------------------|-------------------------|-------------------|--------------------|--------------------|-------------------------------------|---|
| -450 | | D-6 | | 5 | 5-10 | | 1 | 0~15 | | 15-20 | | 20-25 | | 25~30 | · . | 30-35 | | 3E-40 | Tota | 1 |
| p• | Rau | HF | | Rau | HF | | Rau | ier- | Rau | H | Ras | HF | Ray | MF | Rau | MF | Rate | NF | Į Ram | MF |
| | 0 | | 0 | 0 | 0 |) | > | 4 | > | 3 | 5 | 4 | 12 | 7 | 2 | 1 | 1 | 0 | 26 | 19 |
| | 0 | | 0 | 0 | 0 | 1 | . 1 | 1 | . 1 | 1 | | 0 | 0 | 0 | 0 | 0 | 0 | o | 2 | 2 |
| | 1 | | 4 | 1 | 2 | : | 2 | 2 | • | 3 | 2 | 2 | 4 | 2 | . 0 | 0 | 0 | 0 | 1 13 | 15 |
|) | 0 | | 9 | 1 | 2 | : | 0 | 0 . | 0 | Q | • • | 0 | 0 | . 0 | | 0 | a | a | 1 1 | 2 |
| tal | 1 | | 4 | 2 | 4 | | 6 | 7 | 7 | 7 | 7 | 6, | 16 | 9 | 2 | 1 | 1 | o | -: | 36 |
| D MI | NUTES AI | FTER | TEST | PERI OC | 0 | | | | | | RANGE (| eters> | | ٠ | | | | | | |
| ace | | 0-5 | | <u> </u> | 5-10 | | 1 | 0~15 | | 15-20 | | 20-25 | | 25~30 | | 30-35 | | 5-40 | Tota | 1 |
| pe | Rau | HF | | Rau | NF | | Rau | HF | Rass | HF | Ras | UF | Rau | H F | Rau | HF | Rau | MF | : Ram | MF |
| | 0 | | 0 | 2 | 4 | 1 | 4 | 5 | 6 | S | 9 | 7 | 7 | 4 | 4 | 5 | 3 | 1 | 35 | 26 |
| | ٥ | | 0 | . 0 | 0 |) | 0 | 0 | . 0 | . 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | . 0 | | 0 |
| | 0 | | 0 | 1 1 | 2 | : | 3 | 4 | 1 | 1 | 2 | 2 | 2 | 1 | 0 | • | 0 | • | | 10 |
| | 0 | | 9 | | 0 |) . | 1 | 1 | 1 | 1 | | ٥ | ٥ | 0 | 0 | | | 0 | . 2 | 2 |
| tal | 0 | | 9 | 3 | 6 | | 8 | 10 | 0 | 7 | 11 | 9 | 9 | 5 | 4 | 5 | 3 | 1 | 46 | 40 |
| I –SQU HAT | | D-S | | | 5-10 | | 1 | 0-15 | 1 | 15-20 | | 20-25 | : | 25-30 | | 30-36 | 3 | S-40 | CHI-SQUA FOR 2 TE | RE F-H ST PER |
| · | R AN O | ; | F 0 0 2 0 | Ran 1 0 1 1 | HF 2 0 2 1 | | Rau 4 1 3 | MF 5 1 3 | Rau 5 1 2 1 | HF 1 | Rau 7 0 2 | HF 6 | Ran 10 0 3 0 | 6 0 2 0 | Ran 3 0 0 0 | 900 | Rau 2 0 0 | HF. 1 0 0 | : Rau : 31 : 1 : 11 : 2 | 115 24 1 13 2 |
| TAL II-SQU LUES | | 0-5 | 2 | | 5-10 | | 1 | 9 0 15 | | r 15–20 | , 9 | 8 20-25 | 13 | 7 25~30 | 3 | 20-3 5 | 2 | 105~40 | : 44 CHI-SQUA | |
| PAL | 1.000 | 4.00 | 0 0 | .000 | 4.000 0.000 2.000 0.400 | 0.1 1.0 0.2 | 00 | UF 0.111 1.000 0.667 1.000 0.525 | Rass 1.000 1.000 1.000 1.000 | 0.500 1.000 1.000 1.000 | 0.000 | 0.918 0.000 | 1.316 0.667 | 0.818 0.333 | 0.667 | 0.333 | 1.000 | 1.000 | : 2.000 : 0.727 : 0.333 | 1.723 2.300 1.800 0.800 0.851 |

Table 832. Indian Point hanner test monitoring using 6012 degree horizontal transducer located at unit 3, intake 35.

10 MINUTES BEFORE TEST PERIOD

Tidal Phase: 30 min after high tide

| race | 0- | 5 | 5 | -10 | | 0-15 | 1 | 5-20 | 2 | 0-25 | 2 | 5-30 | 3 | 0-35 | <i></i> | 5-40 | Tota | · |
|---|--|---|---|---|---|--|--|---|--|---|---|--|--|---|--|--|-----------------|---|
| p• | Rau | HF. | Rau. | HF | Rau | MF | Rass | WF | Rau | HF | Ran | WF | Rau | MF | Rau | MF | t Rau | MF |
| 5 | 0 | 0 | 1 | 2 | . 0 | 0 | 1 | .1 | 0 | ٥ | 0 | 0 | 1 | 1 | 0 | 0 | - 3 | 4 |
| - | 0 | 0 | 0 | 0 | ٥ | • | Ó | . 0 | ٥ | .0 | . • | 0 y | 2 | 1 | . 0 | ٥ | 2 | 1 |
| : | 2 | 7 | 2 | 4 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | 4 | 11 |
| ¥ | 0 | 0 | 0 | 0 | ۵ | 0 | 0 | ٥ | . 0 | . 0 | 0 | 0 | Œ | 0 | . 0 | 0 | ž 0 | • |
| otal | 2 | 7 | 3 | 6 | 0 | ٥ | 1 | 1 | ō | 0 | 0 | 0 | 3 | 2 | 0 | ٥ | | 16 |
| 10 HIN | NUTES DUR | ING TE | ST PERIO | 0 | | | | 1 | RANGE (no | ters> | | | • | | | | | |
| | 0- | 5 | 5 | - 10 | 1 | 0-15 | 1 | 5- 2 0 | 2 | Q-25 | 2 | :S-30 | 3 | 0-35 | 31 | 5-40 | Tota | 1 |
| race . Upe | Rau | uF. | Rau | HF | Rau | HF | Rass | WF | Rau | WF | Rass | HF | Raw | MF | Rau | uf. | I Res | WF |
| S | 0 | | 3 | | 0 | <u>-</u> | <u> </u> | 0 | <u>1</u> | 1 | 1 | 1 | 0 | 0 | 0 | | -: | 8 |
| L . | 1 | 4 | 0 | 0 | | 0 | o | Q | 1 | 1 | . 0 | 0 | 0 | 0 | 0 | ۵ | : 2 | 5 |
| c | i | 4 | 0 | 0 | 1 | 1 | o | 0 | 1 | . 1 | . • | . 0 | 1 | 1 | 0 | 0 | • 4 | ¥ |
| | | ٥ | | 2 | 0 | • | 0 | 0 | 0 | • | 0 | ۰ | ٥ | 0 | 0 | 0 | : 1 | 2 |
| ¥ | | | | | | | | | 3 | 3 | 1 | 1 | 1 | 1 | | | 1 12 | 22 |
| otal | 2 NUTES AFT | | | | 1 | . 1 | | | RANGE (110 | ters) | | | e | | _ | | | |
| otal 10 HII | NUTES AFT | ER TES | F PERIOD | ;-10 | | 0-15 | | 5-20 | RRNGE (no | ters> | | tS-30 | | 0-3S | | 5-40 | Tota | |
| otal 10 HIP Tace Upe | NUTES AFT | ER TES | F PERIOD | -10 HF | Rau | 10-15 HF | neu Reu | 5-20 HF | RANGE (ne | ters) 0-25 UF | Rau | HF | Rau | Lef | Ray | 5-40 MF | Tota 1 Ress | ur |
| otal 10 MIN race type S | NUTES AFT O- Row | ER TES | E Reu | :-10 HF | Rau 2 | HF 2 | Rau O | 5-20 WF | RRINGE (no 2 Rau | ters> 0-25 UF | Rau 1 | HF 1 | Ram £ | MF 1 | Ress C | E-40 | Tota | HF 6 |
| race upo S | NUTES AFT | ER TES | F PERIOD | -10 HF 0 | Rau 2 0 | 10-15 HF 2 | 2 Rau 0 | 5-20 HF | RRINGE (110 2 Rau 2 | ters) 0-25 UF | Rau 1 0 | HF 1 0 | Rem 1 | MF 1 0 | Ray | Б—40 MF О | Tota 1 Ress | UF 6 |
| otal 10 MIN race upo s | NUTES AFT O- Row O O O | ER TES | Reu O | -10 HF 0 0 | | MF 2 0 | Rau 0 0 | 5-20 HF 0 | RRINGE (no 2 Rau 2 0 0 | ters) :0-25 :UF 2 0 | Rau 1 0 | HF 1 0 | Ram I O | HF 1 G | Ress C | E-40 | Tota 1 Ram 1 6 | UF 6 0 2 |
| otal 10 HXI Pace Upe S L | ROTES AFT C- Row O O O | ER TES | Rose 0 | -10 HF 0 0 | 2 0 0 | 10-15 MF 2 0 | 2 Rau 0 0 0 0 0 | 5-20 HF 0 0 | 2 Rass 2 0 0 1 | 2 0 1 | Rau 1 0 0 | HF 1 0 0 0 | Ram I O | LIF L C C | 20 0 0 0 | 6-40 MF 0 0 | Total | UF 6 0 2 2 |
| otal 10 HXP race upe S L C | Resi 0 0 0 0 0 0 0 | ER TES | Reu O | -10 HF 0 0 | | MF 2 0 | 2 Rand | 5-20 HF 0 | RRNGE CHO 2 Ram 2 0 0 | ters> 0-25 UF 2 0 1 | Rau 1 0 | HF 1 0 | Raw I Q O | Lef 1 0 0 | Raw G G | 0 0 0 | Tota 1 | 4F 6 0 2 2 2 10 10 10 10 10 10 10 10 10 10 10 10 10 |
| otal 10 MIN race type S | Resi 0 0 0 0 0 0 0 | ER TES | Ran O 1 G | -10 HF 0 0 | Rass 2 0 0 | 10-15 MF 2 0 | 2 Rand | 5-20 HF 0 0 | RRNGE CHO 2 Ram 2 0 0 | 2 0 1 | Resi 1 0 0 | HF 1 0 0 0 | Raw I Q O | LIF L C C | Rass Q Q Q Q | 6-40 MF 0 0 | Total | 4F 6 0 2 2 2 10 10 10 10 10 10 10 10 10 10 10 10 10 |
| race Yace Yace Yace Yace Yace Yace Yace Y | O-Rem O O O O O O O | ER TES | Ran O 1 G | -10 HF 0 2 | Rass 2 0 0 | 0-15 WF 2 0 0 | 2 Rand | 5-20 HF 0 | RRNGE CHO 2 Ram 2 0 0 | ters> 0-25 UF 2 0 1 | Resi 1 0 0 | HF 1 0 0 0 1 1 | Raw I Q O | Lef 1 0 0 | Rass Q Q Q Q | 0 0 0 | Tota 1 | 4F 6 0 2 2 2 10 10 10 10 10 10 10 10 10 10 10 10 10 |
| race Wpa L C U utal HI-SQU HI-SQU | Resident Control of Co | 0 0 0 S WF | Rate O O 1 | 0 0 2 0 2 | Reu 2 0 0 1 3 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 | 2 0 1 2 0 1 3 | 2 | 5-20 UF 0 0 0 5-20 | RRMGE Cree Ram 2 0 1 3 | 0-25 0-25 0 0 1 3 | Resi 1 0 0 0 | HF 1 0 0 0 1 1 25-30 | 3 Ram 1 0 0 0 | 0 0 0 1 | Raw Q Q Q Q Q | 0 0 0 0 0 | Total Rem 1 | UF 6 0 2 2 10 REF F-HF |
| rece upe s L c u utal ur-squ r-HAT | O-Residence O-Resi | ER TES | Retu O 1 S Rate A 1 | 0 0 2 0 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 2 0 0 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 2 0 0 1 3 | Rass O O O O | 5-20 UF 0 0 0 5-20 UF | RRMGE < | 0 0 1 3 00-25 UF | Resi 0 0 0 1 1 Resi | NF 1 0 0 0 1 1 25-30 NF 1 0 | 3 Ram 1 0 0 0 1 1 2 3 Ram 1 1 1 | 1 0 0 1 0-35 | Raw Q Q Q Q Q Q | 5-40 MF 0 0 0 | Total Rem 1 | UF 6 0 2 2 2 10 IRE F-IN ST PERI |
| race upa s L c ui atal HI-SQUF S L c c ui atal HI-SQUF | Resi O O O O O O O O O O O O O O O O O O O | 0 0 0 0 S WF 0 14 0 S | Rando 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 | -10 0 2 0 2 -10 WF 3 0 2 1 5 | 2 0 0 1 2 3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 10-15 WF 2 0 1 3 10-15 WF 1 0 0 | 2 Rass 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 5-20 MF 0 0 0 5-20 MF | RRMGE Cree 2 Rass 2 0 0 1 3 Rass 2 0 0 2 Rass 2 0 0 1 2 0 0 0 2 | 0-25 UF 2 0 1 3 0-25 UF 1 0 0 0 2 | Resi 1 0 0 0 1 1 Resi 1 0 0 | NF 1 0 0 0 1 1 25-30 NF 1 0 0 0 1 | 7 Ram 1 0 0 0 1 1 1 1 1 1 0 0 0 2 2 | 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 29 Rau 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 6-40 | Total Ram 1 | UF 6 0 2 2 1 ST PERI UF 6 2 7 1 16 |
| receupe S L C W Hatal Sur-HAT S L C C C | Resi 0 Rasi 0 Rasi 0 Rasi 0 Rasi 0 Rasi 0 Rasi 0 O 1 | ER TES | Rate O 1 1 S Rate O 1 O 1 O 1 O 1 O 1 O 1 O 1 O 1 O 1 O | -10 -10 0 2 0 2 -10 -10 | Rau 2 0 0 1 1 3 Rau 1 0 0 0 1 1 | 2 0 0 1 3 10-15 WF | Rand | 5-20 WF 0 0 0 5-20 WF 0 0 5-20 | RRMGE Chee Rans 2 0 0 1 3 Rans 0 0 2 Rans | 0-25 UF 2 0 0 1 3 0-25 UF 1 0 0 0 2 | Ross 1 0 0 0 1 2 Ross 1 0 1 1 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | MF 1 0 0 0 1 1 25-30 MF 1 0 0 0 1 1 25-30 | 3 Ram 1 0 0 0 1 1 3 Ram 1 1 0 0 2 2 3 | 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Raw O O O O O O O O O O | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Tota Rem 1 | UF 0 2 2 10 REF-HEST PERI UF 6 2 7 116 REF UALLEST PERI |
| otel 10 HIP Pece Upe 5 L C H -tel HT-SQUE C HT-SQUE HT-SQUE HT-SQUE HT-SQUE HT-SQUE HT-SQUE | Rass O-Rass O-Rass O-Rass O-Rass O-Rass O-Rass | ER TES | Rate O C C C C C C C C C C C C C C C C C C | -10 0 2 0 2 -10 WF 3 0 2 1 5 | 2 0 0 1 2 3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 10-15 WF 2 0 1 3 10-15 WF 1 0 0 | 2 Rass 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 5-20 MF 0 0 0 5-20 MF | RRMGE (Me 2 2 Ram 2 0 0 1 3 2 Ram 1 0 0 2 2 Ram Ram Ram | 0-25 UF 2 0 1 3 0-25 UF 1 0 0 0 2 | Resi 1 0 0 0 1 1 Resi 1 0 0 | NF 1 0 0 0 1 1 25-30 NF 1 0 0 0 1 | Ram 1 0 0 0 Ram 1 1 1 0 0 2 Ram 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 29 Rau 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 6-40 | Total Rem 1 | UF O 2 2 10 REF-HEST PERI UF 6 2 7 16 REF UALL SET PERI 11 15 11 15 16 17 17 18 18 18 18 18 18 18 18 |
| race upa s L c ui atal HI-SQUF S L c c ui atal HI-SQUF | 0 - Rau 0 - Rau 0 1 0 1 0 1 0 1 0 1 0 1 - 12 | ER TES 5 WF 0 0 0 0 5 WF 0 14 0 5 | Rate 1 0 1 0 3 S | -10 WF 3 0 2 2 1 5 -10 WF | Rau 2 0 1 1 3 Rau 1 0 0 0 | 00-15 WF 2 0 1 3 10-15 WF 1 0 0 1 | Rand | 5-20 WF 0 0 0 5-20 WF 0 0 5-20 | RRMGE (Me 2 2 Ram 2 0 0 1 3 2 Ram 1 0 0 2 2 Ram Ram Ram | 0 0 1 3 0 0 2 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | Ross 0 0 0 1 1 Ross 1 0 1 Ross 1 Ross 1 Ross 1 Ross 1 | MF 1 0 0 0 1 1 25-30 MF 1 0 0 1 1 25-30 MF | Raw I O O I Raw I O Raw Raw Raw | 0 0 1 0 3 5 UF | 20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Total Rem 1 | UF 2 2 10 RRE F-MF ST PERI 16 2 7 16 RRE VALUEST PERI UF |

Duration of Test:

RANGE (notors)

10 min, hers 1,223 Test Date: 20 sec on, 40 sec off Test Time: 2/10/98 1155

Table D33. Indian Point hanner test nonitoring using 6x12 degree horizontal transducer located at unit 3, intake 35.

| | NUTES OU | | | | | high ti | | **** | | ment Typ | | | | | Test fir | | 1215 | |
|-----------------|-----------|------------|----------|----------------|-------|---------|-------|-------|----------|----------|-------|-------|-------|-------|----------|------|--------------------|-------|
| 10 111 | INGIES DO | KIRO IE | SI LEKTO | U | | | | | RANGE CH | eters> | | | | | | • | | |
| race | 0 | -s | | -10 | | 10-15 | 1 | S-20 | | 20-25 | | 25-30 | | 30-35 | | 5-40 | Tota | 1 |
| up+ | Rau | HP* | Rass | ИF | Rau | HF | Rau | WF | Rau | | Rass | ИF | Rau | MF | Rau | WF | : Rest | LAF |
| 5 | 0 | 0 | 2 | . 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Ó | 0 | 0 | ٥ | 0 | 2 | 4 |
| - | 0 | ٥ | 0 | 0 | ٥ | ٥ | . • | . 0 | 0 | Q | 0 | 0 | 0 | • | 0 | Q | | • |
| : | 2 | 7 | 1 | . 2 | 2 | 2 | 0 | 0 | 1 | 1 | 0 | ۵ | . 1 | 1 | 1 | 0 | | 13 |
| H | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| atal | 2 | 7 | 5 | 6 | . 2 | 2 | 0 | 0 | 2 | 2 | 0 | 0 | 2 | 2 | 1 | ٥ | 12 | 19 |
| 10 HJ | NUTES AF | FER TES | T PERIOD | • | | | | | RANGE (m | eters) | | | | | • | | | |
| | ٥ | -5 | 5 | -10 | | 10-15 | 1 | 5-20 | | 20-25 | | 25-30 | : | 30-35 | 3 | S-40 | Tota | 1 |
| 2C4 | Rau | WF | Rau | ИF | Rau | MF | Rau | uf | Ray | LUF* | Rau | MF | Rau | HF | Rass | WF | 2 Rass | W |
| : <u></u> - | 2 | 7 | 0 | 0 | 2 | 2 | | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | • | | 12 |
| | 0 | 0 | 1 | 2 | 0 | 0 | ٥ | | 1 | 1 | 0 | 0 | | 0 | 0 | Q | : 2 | 3 |
| : | 1 | 4 | 2 | 4 | 1 | 1 | 0 | 0 | . 0 | 0 | 0 | . 0 | ٥ | 0 | ٥ | ٥ | • 4 | 8 |
| 1 . | 0 | ٥ | . 0 | | . 1 | 1 | 1 | 1 | . 0 | 0 | 2 | 1 | 0 | 0 | . 0 | 0 | • | 3 |
| tal | 3 | 11 | 3 | 6 | 4 | 4 | 1 | 1 | 2 | 2 | | 2 | 1 | 1 | 0 | û | | 27 |
| II 5 Q L | | - 5 | _ | - 10 | | 10-15 | | S-20 | | 20-25 | | 25-30 | | 30-35 | | S-40 | CHI-SQUA | |
| -41142 | Rau | | Raw | | Ray | LIF. | Rau | LIF | Rau | | Reu | LF | Rau | | Rau | MF | I Rau | LIF |
| • | 1 0 | 4 | 1 | 2 | i i | 1 | 0 | | Kell | - | 1 | - | R I | | Ö | 76 | 5 | 8 2 |
| | ž | ĕ | 2 | ŝ | Ž | 2 | ŏ | ŏ | į | i | ŏ | · ŏ | ĭ | ĭ | 1 | ŏ | | 11 |
| TAL | 9 | 9 | 2 | 9 | 1 5 | 3 | i | i | 2 | 2 | 1 2 | 1 | 2 | ž | ĭ | 0 | : 15 | 23 |
| I-SQL | | _ | _ | | | | | | | : | | | | | _ | | | |
| LUES | | -5 | | -10 | | 10-1E | | 5-20 | | 20-25 | | 25~30 | | 30-35 | | 5-40 | CHI-SQUA | |
| 5 | 2.000 | 7.000 | | 4.000 | R-000 | 2.000 | Rau | . HE_ | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | Raw | | 2.779 | 4.800 |
| | 0.333 | 0.819 | | 2.000 0.667 | 0.333 | 0.333 | == | | 1.000 | 1.000 | | | 1.000 | 1.000 | 1.000 | | : 2.000 : 1.333 | 3.300 |
| TAL | | 0.889 | | 0.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 2.000 | 1.000 | 1.000 | 1.000 | 1.000 | | : 0.667 | 0.200 |

Table 034. Indian Point hammer test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| ومونية الأجارية | | | | idal P | · · · · · | 1.5 hrs high ti | de | | Duration Treate | ent Tupe | . 3 | D Sec 4 | heers 1,24 on, 30 se | e off | Test Dat | •: | 2/18/98 1235 | |
|----------------------|-------|------------|-----------|------------|-----------|--------------------|-------|-------|--------------------|----------|-------|---------------|-------------------------|--------------|----------|--------------|----------------------|------------------|
| | | | EST PERIC | | | | | | RANGE (na | | | | | | | | : | |
| | ۰ | -5 | S | -10 | | 10-15 | 1 | 5-20 | 2 | 20-25 | 2 | 5-30 | | 30~35 | 3 | S~40 | Tota | ı |
| race upe | Rau | NF | Rau | WF | Rau | HF | Rau | NF | Reu | WF | Rau | UF | Rau | ИF | Rau | HF | z Rau | HF |
| s | ٥ | | 0 | 0 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 0 | 0 | 7 | 6 |
| L | ٥ | ٥ | D | 0 | 0 | 0 | 1 | 1 | 0 | ٥ | 0 | Q | 0 | 0 | ٥ | 0 | 1 | 1 |
| c | 0 | G | . 0 | 0 | 0 | • | 0 | • | 0 | ٥ | . 0 | ٥ | 1 | 1 | 1 | G | 2 | 2 |
| pM | 0 | 0 | ٥ | 0 | 0 | 0 | | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | • | 1 | 1 |
| etal | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 0 | 11 | 9 |
| 10 HTMUTE | ES AF | FER TE | ST PERIOD | • | | | | | RANGE Cod | ters) | | | | | | | | |
| | 0 | - 5 | 5 | i- 10 | | 10-15 | 1 | 6-20 | 4 | to-25 | 2 | 5-30 | 2 | 30~3S | 3 | 5~40 | Tota | .1 |
| race upe | Raw | w | Rau | MF | Ray | MF | Rau | MF | Rau | uf . | Rou | LEF. | Ran | ЧF | Rau | WF | I RAM | HF |
| .s | 0 | 0 | 2 | 4 | | 1 | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | | -! | 5 |
| a. | 0 | 0 | G | 0 | 0 | 0 | ٥ | 0 | 0 | • | 0 | 0 | 0 | a | 0 | ٠. | | 0 |
| K | 0 | ٥. | . • | 0 | . 0 | ٥ | 1 | 1 | 1 | 1 | 2 | 1 | 0 | 9 | ٥ | • | 4 | , 3 |
| ni | 0 | 0 | 0 | 0 | 0 | 0 | G | 0 | 1 | 1. | 0 | 9 | 0 | 0 | ٥ | 0 | 1 | 1 |
| atel | 0 | 0 | 2 | 4 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 0 | 0 | <u>-</u> | 0 | | 9 |
| MT—SQUARE -HAT | ٥ | -5 | • | i~10 | | 10~15 | 1 | 5-20 | . 2 | 20-25 | 2 | 5 -3 0 | 3 | 10-3E | 3 | 5~4 0 | CHI-SQUA FOR 2 TE | RE F-H ST PER |
| | Rau | ИF | Rass | MF | Rau | HF | ReH | NF. | Rau | HF | Rau | ИF | Rau | ИF | Rau | ИF | I Bau | MF |
| .s iL iC | 0 | 0 | 0 | 5 | 1 0 | 100 | 1 | 1 | 10 | ò | 0 | ò | Ô | 10 | 0 | 8 | : 5 | 6 |
| K | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 10 | 1 0 | 1 | 1 | 0 | : 7 | 2 |
| TAI. | ŏ | ō | . 1 | 2 | ĭ | ĭ | 2 | 2 | ž | 2 | ž | ī | ĭ | ī | ī | ā | 10 | Š |
| NI — SQUARE ALVES | 0 | -5 | 6 | - 10 | | 10-15 | 1 | 5-20 | 2 | to-25 | 2: | 5-30 | 3 | 30-35 | > | 5~4 0 | CHT-SQUA | |
| | Rau | μF | Rau | WF | Ray | MF | Ran | WF | Rau | WF | Reu | WF | Rau | WF | Ran | WF | EFOR 2 TE | ST PER UF |
| . S iL | | = | 2.000 | 4.000 | 0.000 | 0.000 | 2.000 | 2.000 | 1.000 | 1.000 | 2.000 | 1.000 | 1.000 | 1.000 | = | | | 0.091 1.800 |
| ic m | | | | , | == | == | 1.000 | 1.000 | 1.000 | 1.000 | 2.000 | 1.000 | 1.000 | 1.000 | 1.000 | | : 0.567 | 1.000 |
| STAL | | == | 2.000 | 4-000 | 0.000 | 0.000 | 1.000 | 1.000 | 0.000 | 0.000 | 6-000 | 0.000 | 2.000 | 2.000 | 1.000 | | | 0.000 |

Table D35. Indian Point hammer test monitoring using 6m12 degree herizontal transducer located at unit 3, intake 35.

10 NIMUTES BEFORE TEST PERIOD

Tidal Phase:

1.5 hrs before low tide

| race | 0- | 5 | ! | 5-10 | | 10-15 | 11 | 5-20 | | 0~25 | 25 | 5-30 | | 30-35 | 31 | 5~40 | Total | 1 |
|---|--|--------|---|---|---|---|--|---|---|--|---|--|---|---|--|---|---|--|
| upe | Rau | HF | Rasu | HF | Rai | HF | Rau | NF | Rass | WF . | Rase | WF | Rass | MF | Rau | MF | E Rass | MF |
| \$ | 0 | ۰ | 1 | 2 | 6 | 7 | 1 | 1 | 4 | 3 | 5 | 3 | 1 | 1 | 2 | 1 | и 29 | 18 |
| L | ٥ | 0 | . 0 | 0 | 0 | ۵ | 0 | 0 | 0 | 0 | 0 | ٥ | 0 | 0 | • | 0 | | 0 |
| C | 0 | 0 | 1 | 2 | 1 | 1 | * 4 | 4 | 0 | 0 | 2 | 1 | 0 | 0 | • | ۵ | | • |
| en | 0 | .0 | . 0 | 0 | 0 | 0 | • . | 0 | 0 | 0 | G | ٥ | 0 | 0 | ٥ | ٥ | | ٥ |
| otal | 0 | 0 | . 2 | 4 | 7 | 9 | 5 | 5 | 4 | 3 | 7 | 4 | 1 | 1 | 2 | 1 | 2) | 26 |
| 10 HIN | UTES DUR | ING TE | ST PERIC | DĐ | | | | 1 | RANGE (net | ters> | | | | | • | | , | |
| | 0 | 5 | | 5-10 | • | 10-15 | 15 | 5-20 | - | 0-25 | 25 | -30 | : | 30-3S | 39 | 5~ 4 0 | Total | |
| upe upe | Rau | uf . | Ran | WF | Ras | HF | Rau | WF | Rau | MF | Rau | HF | Rau | WF | Rau | HF. | I Rau | HF. |
| .s | 0 | 0 | | 0 | 1 | 1 | 6 | 5 | Б | 4 | 2 | 1 | 2 | 1 | 2 | 1 | 18 | 15 |
| ı. | 0 | ٥ | G | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | • | 0 | 0 | 0 | G | 1 | 1 |
| IC | 2 | 7 | 1 | 2 | 0 | 0 | 1 | 1 | G | 0 | 0 | 0 | 0 | o | ٥ | 0 | • | 10 |
| | 0 | ٥ | • | • | • | . 0 | 0 | · o | • | ٥ | 0 | 0 | 0 | 0 | . 0 | ٥ | | ٥ |
| H | | | | | | | | <u>-</u> | | | 2 | 1 | 2 | | 2 | | 23 | 24 |
| otal | LITES AFT | | | | 1 | 10-15 | 7 | , | RANGE (no | ters> | _ | | _ | _ | * | , . | | |
| otal 10 MIN | NTES AFT | ER TES | ST PERIO | 5-10 | Ran | 10-15 | 11 | 5-20 | RANGE (110) | ters> | | 5-30 WF | ~~~ | - |). | 5-40 | Total | <u> </u> |
| otal 10 MIN 7450 VPO | NTES AFT | ER YES | F PERIO | 5-10 | | 10-15 | · | , | RANGE (no | ters> | | 5-30 MF | Reu | |): | , | Total | MF |
| otal 10 MIN Tace Upe | NTES AFT | ER TES | F PERIOR | 5-10 UF | Rac | 10-15 NF | Rau | 5-20 HF | RAMGE (ne- | ters> 0-25 uf | Rau | uf | ~~~ | 90-38 UF | New | i-40 ur | Total | <u> </u> |
| otal 10 MIN Tace Upe | NTES AFT | ER YES | F PERIOR | 5-10 Uf 2 | Rac | 10-15 uF | 11 Rau 3 | 5-20 HF | RANGE Cue 20 Rau | ters> 0-25 uf | Rau | ur 2 | Rau | 00-36 UF 2 | | 5-40 UF | Total | UF 13 |
| otel 10 MIN race upe S S | RAM 0- 0- 0 | ER YES | F PERIOR | 6-10 HF 2 | Rac | 10-15 uF | 3 Rau 3 0 | HF 3 | RANGE Cool Rau 1 0 | ters> 0-25 MF | R444 3 0 | иг 2 0 | Rau 4 0 | 00-36 UF 2 | | 1-40 14F | Total | 13 13 |
| otel 10 MIN Vace Vace Vace Sil | Ran O O O | ER TES | Reu 1: 0 | 5-10 UF 2 0 | Rau 2 1 | 10-15 HF 2 | 3 9 | 5-20 HF 3 0 | RANGE Coop Range 1 0 | ters> 0-25 MF 1 6 | Re | иг 2 0 | Raw 4 0 | 30-36 UF 2 0 | 2 Ren 2 Q 1 | 1 0 | Total 2 Rais 3 15 3 1 | 13 13 |
| M Total 10 MIN Trace Type -S SL SC SU Total HHI-SQUR -HAT | Ram O C Ram O O O | ER TES | PERIOR 1 O O I | 5-10 WF 2 0 0 | Ras 2 1 1 0 | 10-15 WF 2 1 1 0 | 2) Ran 3 0 0 | 5-20 HF 3 0 | RANGE Gue | ters> 0-25 4F 1 6 | Ren 3 0 1 | 2 0 0 | Resu 4 0 1 0 | 2 0 1 | 2 0 1 0 | 5-40 HF 1 0 | Total 2 Raw 1 1 2 1 2 2 | 13 1 2 2 18 RE F-H9 |
| race 10 MIN race ype .s si. sc si. sc si. ctal chr-squa | Ram O O O O O O O REE O RAM | ER TES | PERIOR 1 O O I | 2 0 0 0 | Ras 2 1 1 0 | 10-15 HF 2 1 1 0 4 | 2) Ran 3 0 0 | 1-20 HF 3 0 | 20 20 20 20 20 20 20 20 20 20 Raw | ters> 0-25 4F 1 0 1 2 0-25 | Rau 3 0 0 1 4 | 2 0 0 1 3 i-30 MF | Rasa 4 0 1 0 5 | 20-36 UF 2 0 1 | 2 g 1 0 35 Rass | 1 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | Total Raw I II I 1 I 2 CHI-SBURH FOR 3 TE: | 13 1 2 2 18 RE F-HATI |
| otal Tace ype S S III otal HI-SQUA -HAT | Ram O O O O O O O O O O O O O O O O O O O | ER TES | PERIOR 1 O O I I Rau | 0 S-10 WF 2 C C C C C C C C C C C C C C C C C C | Ran 3 0 | 10-15 10-15 10-15 | 11 Raw 9 9 0 3 | 5-20 UF 3 0 0 0 3 5-20 | 20 20 20 Rain 3 0 0 | ters> 0-25 4f 1 0 1 2 0-25 | 25 Rau | 2 0 0 1 3 i-30 MF 2 0 | Rass Q 1 0 5 Fass 2 | 20-36 | 2 G 1 O 3 S Rass 2 G G G G G G G G G G G G G G G G G G | 1 0 0 1 i-40 MF | Total # Ray # 14 # 1 # 1 # 22 CHI Saurat FOR 3 TE: # Rau # 18 # 1 | 13 1 2 2 18 RE F-HM* ST PERI |
| otal Trace Upe S S S S S S S S S S S S S S S S S S S | O-RAH | ER TES | PERIOR 1 O O O I I Rais | 0 6-10 4F 2 0 0 0 2 5-10 | Rac 2 1 1 0 4 | 10-15 HF 2 1 1 0 4 | 3 0 0 0 2 11 Rai | 5-20 UF 3 0 0 3 5-20 | 20 20 20 20 20 20 20 20 20 20 20 20 20 2 | 1 0 0 1 2 0-25 | Rest 0 0 1 4 25 | 3 3 3 3 3 3 4-30 4F 2 0 | Rass | 20-36 UF 2 0 1 0 3 30-35 UF 1 | 2 Q 1 1 Q 2 3 5 Rass 2 Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q | 1 0 0 1 i-40 MF | Total # Ran # 116 # 1 # 1 # 2 # 22 CHI - SMURI FOR 3 TE: # Ran # 18 # 1 # 5 # 1 | 13 1 2 2 2 18 RE F-HM1 5T PERII 15 15 17 |
| otel 10 MIN Pace ype S L C HI — SOUR — HAT S L C HI — SOUR S L C HI — SOUR | O-RAH OO OO OO OO OO OO OO OO OO OO OO OO OO | ER TES | Rau 1.00 0.01 | 0 5-10 UF 2 0 0 0 2 5-10 UF 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rau 2 1 1 0 4 | 10-15 10-15 10-15 10-15 | 11 Ran 0 0 0 0 11 Ran 2 0 0 5 | 5-20 UF 3 0 0 0 5-20 UF 3 | 24 Rais 24 Rais 24 Rais 20 0 0 4 4 | 0-25 MF 1 0 1 2 0-25 MF 3 0 0 | 25 Rau 0 0 1 4 25 Rau 3 0 1 | 2 0 0 1 3 i-30 MF 2 0 0 0 3 | Rass 0 0 5 8 22 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 20-36 UF 2 0 1 0 3 00-35 UF 1 0 0 | 2 0 1 0 3 8es 2 0 0 2 | 1 0 0 1 i i i i i i i i i i i i i i i i | Total 2 Raw 3 1 3 1 2 2 CHI - SBURN FOR 3 TE: 1 1 1 1 1 2 24 | 13 1 2 2 18 RE F-HATST PERITI |
| TACO YPP S IL HT-SQUA OTAL OTAL HI-SQUA | Rem 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | ER TES | Rau 1.00 0.01 1.00 1.00 1.00 1.00 1.00 1.0 | 0 6-10 2 0 0 2 5-10 UF 1 0 1 0 | Rau 2 1 1 0 4 4 2 2 2 1 1 0 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | 10-15 10-15 10-15 | 11 Rem 3 0 0 0 11 Rem 3 0 0 5 | 5-20 UF 3 0 0 0 3 5-20 UF 3 0 | 24 Resu 1 2 24 Resu 3 0 0 0 4 4 2 | ters> 0-25 WF 1 0 1 2 0-25 WF 3 0 0 0 | Rest 3 0 0 1 4 25 Rati | 2 0 0 1 3 i-30 MF 2 0 0 0 3 i-30 | Rass 0 0 5 Rass 2 0 0 0 3 3 | 20-36 HF 2 0 1 0 3 30-35 HF 1 0 0 2 | 2 0 1 0 35 Raw 2 0 0 2 35 | 1 0 0 1 i i 40 UF 1 0 0 0 1 i i 40 0 0 1 i i 40 0 0 0 1 i i 40 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Total Raw 11 12 22 CHI-SMURH FOR 3 TE: 11 12 CHI-SMURH FOR 3 TE: | 13 1 2 2 18 RE F-HA'ST PERI: 17 12 22 RE UALUIST PERI: |
| otal Yace YPP S S S H Otal H1-SOUR S IL IC IN OTAL HI-SOUR | O-RAH OO OO OO OO OO OO OO OO OO OO OO OO OO | ER TES | Rau 1.00 0.01 | 0 6-10 2 0 0 2 5-10 UF 1 0 1 0 | Rau 2 1 1 0 4 | 10-15 10-15 10-15 | 3 0 0 0 3 11 Rau 3 0 2 0 5 | 5-20 LIF 3 0 0 0 5-20 LIF 3 0 5-20 | RANGE Cook Rani 1 0 0 1 2 Rani 3 0 0 4 22 Rani 4 22 | 0-25 MF 1 0 1 2 0-25 MF 3 0 0 0 | Rest 3 0 1 1 4 25 Rest 3 0 1 0 4 | 2 0 0 1 3 i-30 MF 2 0 0 0 3 | Rass 0 0 5 8 22 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 20-36 UF 2 0 1 0 3 00-35 UF 1 0 0 | 2 Q Q 1 Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q | 1 0 0 1 i i i i i i i i i i i i i i i i | Total Raw 11 12 13 13 14 15 17 18 18 18 18 18 18 18 18 18 | 13 1 2 2 18 RE F-HA'ST PERI: 15 1 7 12 22 RE UALLUI 57 PERI: 15 1 7 12 12 12 13 15 15 16 17 18 18 18 18 18 18 18 18 18 18 18 18 18 |
| otal 10 MIN Pace ype S L C III Otal HI-SQUR C C OTRL HI-SQUR HI-SQUR | O-Rand | ER TES | Rau 1 0 0 1 Rau 1 1 Rau 1 Rau 1 Rau 1 Rau 1 Rau 1 Rau | 0 5-10 2 0 0 0 2 5-10 WF | Ras 2 1 1 0 4 1 1 0 1 1 0 1 1 1 1 1 1 1 1 1 1 | 10-15 HF 2 1 1 0 4 10-15 HF 3 0 1 10-15 | Ran 3 0 0 0 0 3 11 Ran 2 0 5 | 1-20 NF 3 0 0 0 3 5-20 NF 3 0 0 0 0 0 0 0 0 0 0 0 0 0 | 24 24 24 4.000 6 | ters> 0-25 4f 1 0 1 2 0-25 4F 3 0 0 1 2 | Rest 3 0 1 1 4 25 Rest 3 0 1 0 4 | 2 0 0 1 3 5-30 UF | Rau 2 0 0 0 3 3 3 Rau 3.500 | 30-36 MF 2 0 1 0 3 30-35 MF 1 0 0 2 2 1 0 1 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 | 1 0 0 1 1 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 | Total Raw 11 12 13 13 14 15 17 18 18 18 18 18 18 18 18 18 | 13 1 2 2 18 RE F-MM* ST PERI* 1 22 RE UALUM ST PERI* |

Duration of Test: Treatment Type: 10 win, hwrs 345 Test Date: 10 sec on, 30 sec off Test Time: 2/19/08 1620

Table D36. Indian Point hammer test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

| 10 MINUI | res du | RING | TES | T PERI | OD . | | | • | | | RANGE | (ne | ters> | | | | | | | •.• | |
|----------------------|--------|------------|------------|--------|--------------|--------------|-------|----------|------|-------------|-------|----------|-------------|-------|-------|-------|-------|-------|---------|----------------|-------------|
| | • | - 5 | | | 5 -10 | | 10-1 | , | 1 | 15-20 | | | 0-25 | | 25-30 | • | 30-35 | : | 35-40 | Tota | 1 |
| ibe .ece | Rau | ИF | | Rau | HF | Ra | u Lif | | Rau | HF. | | M | NF | Ras | . HF | Ray | HF | Rau | HF | Rau | HF |
| | 0 | | o | 1 | 2 | 1 | | 1 | 3 | . 3 | 2 | 2 | 2 | . 1 | 1 | 2 | 1 | 2 | 1 | 12 | 11 |
| . • | . 0 | | 0 | • | 0 | ò | : | 0 | 0 | 0 | | 3 | 0 | 0 | 0 | . 0 | . 0 | 0 | 0 | | 0. |
| • | ٥. | | o . | 0 | 0 | 0 |) | 8 | ۰. | . 0 | | • | 0 | 1 | . 1 | | 0 | . 0 | 0 | 1 | 1.1 |
| l | 0 | | Q | . 0 | 0 | ٥ | | 0 | 1 | 1 | | | 0 | 0 | . 0 | 0 | € 0 | . 0 | | _:1_ | 1 |
| t-1 | 0 | | 0 | 1 | 2 | 1 | | 1 | 4 | .4 | 2 | 2 | 2 | 2 | 2 | . 2 | 1 | 2 | 1 | 14 | 13 |
| IO MY NUT | rec os | TEO | YEST | PERIO | | | | | | | | | 1 | | | | | | | | |
| , 114 mg | IES M | | | FERTU | • , | | | | | | RANGE | (we | ters> | | | | | | | | |
| | | -5 | | | 5-10 | : | 10-1 | 5 | 1 | 15-20 | | 20 | 0-25 | · | 25-30 | | 30-35 | | 35-40 | Tota | 1 |
| P4 | Rau | HF | | Rau | HF | Ra | u HF | | Rau | ИF | R | 14 | HF | Ras | . HF | Ras | HF | Rau | ШF | i Rau | HF |
| i | 0 | | 0 | 0 | a | 3 | | 4 | 6 | 5 | , 4 | • | 3 | 3 | 2 | 3 | 2 | 3 | 1 | 22 | 17 |
| L | • . | | 0 | 0 | . 0 | . 0 | | 0 | 0 | 0 | | • | . 0 | 1. | 1 | 0 | • | 0. | . 0 | 1 | 1 |
| e | 0 | | 0 | 1 | : 2 | .0 | | 0 | 0 | | . : | k · | 1 | 0 | ٥ | | 1 | 0 | 0 | | .4 |
| 4 | Ö | | • | . 0 | 0 | ٥ | | 0 | ۵ | . 0 | |) | 0 | 0 | 0 | 0 | 0 | | 0 | | . 0 |
| etal . | 0 | | • | 1 | 2 | 3 | | 4 | 6 | 5 | i | 5 | . 4 | . 4 | 3 | 4 | > | > | 1 | 1 26 | 22 |
| I -SQUARI | | | | | | | | · . | | | | | _ | | | | | , | | CHI -SQU | MF F-H4 |
| HAT | | -5 | | | S-10 | | 10-1 | <u> </u> | : | 15-20 | | 2 | 0-25 | | 26-30 | | 30-35 | | 35-40 | FOR 2 TE | EST PERI |
| | Rau | H | F | Reu | HF | Ra 2 | | # | Rass | HF | R | 44 | HĘ. | Ran | 4 HF | Ray | HF | Rau | HF 1 | E Rau | ₩ 1-4 |
| | ŏ | | ĕ | ģ | ĝ | ā | - | ő | ğ | Ö | į | | é | į | ī | ō | Ģ | Õ | Õ | 1 1 | " <u>i</u> |
| TAL | · ŏ | | ě | å | Ô | i a | | ě | ĭ | 1 | Ġ | 5 | ģ | ġ | ġ | é | و ، | ě | ŏ | 1 20 | 1 |
| ii ra. (I —SQUAR) | - | | U | | - | | i • | • | - | | • | • | - | , · | | • | | • | • | : | |
| LUES | |)S | | | 5-10 | · <u>-</u> _ | 10-1 | <u> </u> | | 15-20 | | 2 | 0-25 | · | 25-30 | | 30-35 | | 35-40 | CHI-SQUA | ME UALL |
| | Raw | HF | | 1-000 | 2.000 | 1.000 | | | Rau | NF 0.500 | | 14 | uf 9.200 | 1.000 | 0.333 | 0-200 | Q.333 | 0.200 | 0.000 | 2 Rau 2:341 | uF 1.286 |
| | == | == | | | | 1.000 | | | | 0.500 | 1.00 | _ | 1.000 | 1.000 | 1.000 | | 1.000 | | | 1.000 | 1.100 |
| i ′ | | == | : | 1.000 | 2.000 | . == | | 1-1 | 000 | 1.000 | 4.00 | - | ***** | 1.000 | 1.000 | 0.667 | 1.000 | | | 1.000 | 1.800 |

Table D37. Indian Point hanner test monitoring using 6x12 degree horizontal transducer located at unit 3, intake 35.

| | | | | del Pi | | 1 hr bed low tide | • | | Treat | n of Tes went Typ | e: 1 | iO sec o | hers 34 on, 40 s | ec off | Test Dat Test Tim | ide I | 2/18/44 1700 | |
|-------------------------------------|----------|---------|------------|-------------|----------|----------------------|--------------|-------|---------------|----------------------|-------------|-------------|---------------------|--------------|----------------------|--------------|----------------------|-------------|
| | | | EST PERIOD | | | | | | RANGE (m | | | | | | | | •.• | |
| | 0- | 5 | · 5- | -10 | | 10~15 | | 15-20 | | 20-25 | 2 | :5-30 | | 30-35 | 3 | 5-40 | Tota | 1 |
| race ype | | HF | Ran | WF | Rai | uF | Rau | HF | Rau | WF | RaH | WF | Rau | HF | Rau | HF | 5 Rau | HF |
| S | 0 | 0 | 3 . | 6 | 5 | 2 | 8 | 7 | 2 | 2 | 5 | 3 | 1 | 1 | 1 | 0 | 22 | 21 |
| L . | 0 | ٥ | Ģ | 9 | 0 | ۵ | a | • | 0 | ٥ | 1 | 1 | 0 | o | • | • | 1 | 1 |
| C | 0 | ۵ | 2 | 4 | 1 | 2 | o | ٥ | ø | 0 | 0 | 0 | · 0 | 0 | o | c | 3 | 5 |
| ч | . 0 | 0 | ø | 0 | 0 | 0 | 0 | a | 0 | G | 0 | ٥ | 0 | 0 | O | 0 | 0 | o |
| otal | 0 | ۵ | 5 | 10 | > | 3 | 9 | 7 | 2 | 2 | 6 | 4 | 1 | 1 | 1 | 0 | 26 | 27 |
| 10 HIM | ITES AFT | ER TE | ST PERIOD | | | | | | RANGE CH | eters) | | | | | | | | |
| | 0- | 5 | 5- | -10 | | 10-15 | | 15-20 | ; | 20~25 | . 2 | :5-30 | | 30-35 | 3 | 5-40 | Tota | 1 |
| NDO LTCO | Res | uf | Raw | HF | Ras | uF | Ran | WF | Rau | ИF | Rau | UF | Rev | HF | Rau | HF | I Rau | μF |
| <u> </u> | ō | ō | 3 | 6 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 2 | 0 | 0 | 2 | 1 | 13 | .13 |
| L, | 0 | ٥ | 0 | 0 | 0 | . 0 | 0 | ٥ | 0 | 6 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 |
| C | ٥ | ٥ | ٥ | 0 | 0 | Q | 1 | 1 | 0 | 0 | 1 | 1 | , 0 | 0 | . > | 1 | 2 | 3 |
| 4 | 0 | ٥ | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | | 0 | 1 | 1 |
| otel | 0 | 0 | 3 | 6 | 1 | 1 | 2 | 2 | 2 | 2 | 5 | 3 | 1 | 1 | 5 | 2 | 19 | 17 |
| HI ~SQUAI -HAT | eE0- | 5 | E - | -10 | | 10-15 | | 15-20 | · | 20-25 | 2 | 15-30 | | 30-35 | 3 | 5-40 | CHI-SQUE FOR 2 TE | RE F-HA |
| s L C | RaH | WF O | Rau 3 | HF 6 | Rai 2 | 4 HF | Rau | - HF | Rau 2 0 | WF 2 0 | Rau | HF 3 | Ray | MF 1 | Rau 2 0 | MF 1 | 1 Rem 1 18 | 11F |
| | 0 | Õ | 1 | 2 | 1 | . 1 | 1 | į | ŏ | ě | i | i | ě | ŏ | ž | 1 | 4 | 4 |
| OTAL. | ŏ | ŏ | 4 | ě | 2 | 2 | 5 | š | 2 | 2 | ě | 4 | i | i | ٠ 5 | ĭ | i 23 | 22 |
| HI —S QUA F RLUE S | RE 0- | 5 | 5- | -10 | | 10-15 | | 15-20 | | 20-25 | | 15-30 | | 30-35 | 3 | 5-40 | CHI-SQUA | |
| 5 | Rass | 147 | 0.000 | uf 0.000 | 0.333 | 0.223 | Rau 5.444 | 4.500 | 0.000 | 0.000 | 0.111 | uf 0.200 | 1.000 | 1-000 | 0.333 | UF. 1.000 | 2 Rau 2.314 | UF 1.882 |
| <u> </u> | == | | | 4.000 | 1,000 | 1.000 | 1.000 | 1.000 | | | 1.000 | 1.000 | | | | 1.000 | 1.000 | 1.800 |
| Ú DTAL | | | - | 1.000 | 1.000 | 1.000 | 3.600 | 2.778 | 0.000 | 0.000 | | 0.143 | 1.000 | 1.000 | | 2.000 | : 1.000 | 1.000 |
| | | | 3.200 | | | MRE - 3 | | | 1, alph | | ~~~~ | | | | | | - | |

Table D38. Indian Point hanner test monitoring using 6w12 degree horizontal transducer located at unit 3, intake 35. .

| 10 MIN | WTES BEI | FORE TES | T PERIOD | | * | | | | RANGE CHO | tors) | | | | | | | | |
|---|---|--------------------------------|--|--|---|---|--|--|--|--|--|---|---|---|--|--|---|--|
| | ٥ | - 5 | 5- | 10 | 1 | 0~15 | 1 | 5-20 | 21 | 0-25 | 25 | -30 | . 3 | 0~ 3 5 | 36 | 5~40 | Total | 1 |
| race upe | Rau | NF | Rau | kF | Rau | ИF | Ran | uf . | Rau | HF | Rass | HF | Rau | WF | Rass | MF. | E Rau | ur |
| \$ | 2 | 7 | 1 | 2 | o | a | 9 | 0 | 1 | 1 | 3 | 2 | 1 | 1 | 2 | 1 | . 10 | 14 |
| • | 0 | 0 | • | 0 | O _. | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | G | 0 | 0 | | 0 |
| 2 | 0 | 0 | ٥. | 0 | 0 | 0 | a | 0 | Ö | 0 | 1 | . 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| | 0 | 0 | . 0 | 0 | o o | 0 | 0 | 0 | 0 | 0 ' | 0 | 0 | 0 | 0 | O | 0 | <u> </u> | 0 |
| etal | 2 | 7 | 1 | 2 | . 0 | 0 | 0 | ٥ | 1 | 1 | 4 | 3 | 1 | 1 | 2 | 1 | 11 | 15 |
| MIN O | IUTES DU | RING TES | ST PERIOD | | | | | | RRNGE (ne | ters> | • | . • | | | . * | | | |
| | G- | -5 | · 5~ | 10 | 1 | 0-15 | 1 | E-20 | 20 | 0-25 | 25 | -30 | 34 | 0-35. ~ | 35 | 5-40 | Total | ı |
| race race | Rau | UF | Rau | WF | Rau | HF | Rau | UF | Rau | uf . | Rau | HF | Rau | NF | Rau | WF | \$ Rest | WF |
| s | 0 | 0 | 0 | 0 | ò | 0 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | · | 3 |
| L | 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | ٥ | ٥ | . 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| _ | 1 | . 4 | 0 | 0 | 0 | 0 | 0 | 0 | ٠ ۵ | ٥ | 0 | g | o | 0 | 0 | 0 | 1 . | 4 |
| 5 | _ | | | | | | | | | | | | | | | | 1 | |
| • | | ٥ | . 0 | • | 0 | | o | 0 | 0_ | . 0 | 1 . | 1 | 0 | 0 | 0 | 0 | 1 1 | 1 |
| H etal | 0 1 NUTES AFT | 4 | 0 | <u></u> | 0 | 0 | 2 | 2 | 0 1 | 1 | 1 | 1 | 0 | <u>0</u> | <u> </u> | 0 | i i | <u>1</u> |
| n etal 30 MIM | 1 IUTES AF | TER TEST | PERIOD | 10 | 0 | 0-15 | 2 | 2 5-20 | 1 RANGE <net< td=""><td>1 ters> 0-25</td><td>1</td><td>1</td><td></td><td>0>6</td><td>Q </td><td>0</td><td>Fotal</td><td></td></net<> | 1 ters> 0-25 | 1 | 1 | | 0>6 | Q | 0 | Fotal | |
| ntel 10 HIM | UTES AFT | FER TEST | O PERIOD | 10 | Q Rass | 0-15 W/ | 2 1 Rou | 2 5-20 UF | RANGE Cned | 1 0-25 MF | 1 25 Ress | 1 | G Sau | 0 0-36 4F | Q Si Reu | 0 i-40 MF | Total | W |
| N ntal 10 MIN 7ace | UTES AF | TER TEST | PERIOD S- Raid (| 10 UF | Raw O | 0 0-15 W | 2 Rau | 2 8-20 HF | RANGE Cree 20 Rans | 1 ters> 0-25 MF | 1 Ress | 1 -50 UF | S Ray O | 0 0-36 UF | Q Se Ress | 0 I-40 MF | rotal | |
| n etel 10 MIM race 400 | D Raw | 4 FER TEST -S -S -S 0 0 | PERIOD S- Rau 0 | 0 0 0 | Ram O | 0-15 HF 0 | 2 Rest 0 | 2 S-20 HF 0 | RAMGE Cnet | 1 0-25 MF 0 | Rau Q O | 1 -30 -4F 0 | 0 Reu 0 | 0 ->5 UF 0 | Q Resu Q Q | 0 MF 0 | Total | W 0 |
| ntel 30 HIN 100 HIN | UTES AF | TER TEST | PERIOD S-Raw | 10 UF | Rass O O | 0 0-15 UF 0 0 | 2 Rau | 8-20 UF 0 | RANGE Creet 21 Rand 0 0 | 1 0-25 0 0 0 | Rass C O | 1 -30 -4F 0 0 | Rau 0 0 0 | 0 >s ur 0 0 | 35 Rau 0 0 | 0 HF 0 | rotal Rau | Wf 0 0 |
| H otol 10 MIM Face Upo S L C | D Raw O O O 2 | 4 TER TEST -S -UF -0 -0 -0 -7 | PERIOD S- Rau 0 | 0 0 0 | Ram O | 0 0 0 0 0 1 | 2 Reu 0 0 | 2 S-20 HF 0 | RANGE Check | 1 0-25 MF 0 | Rass C O | 1 G O 1 | 0 Reu 0 | 0 ->5 UF 0 | Q Resu Q Q | 0 MF 0 0 | rotal Rau | W 0 0 9 |
| race ype L c iii iii iii iii iii iii i | DEFE | 4 FER YEST S O O O O | PERIOD S-Raid I O O 2 | 0 0 0 0 | 0 0 0 1 1 | 0 0-15 UF 0 0 | 2 Resu 0 0 0 | 8-20 HF 0 0 | RANGE Cine (| 1 0-25 MF 0 0 | Rass C O 1 | 1 -30 -4F 0 0 | 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 0 0-36 UF 0 0 | 0 Rest 0 0 | 0 HF 0 | Fotal Rau 1 0 1 0 1 4 | 0 0 9 5 14 |
| M otal 10 HIM race upe S L C M otal MI-SQUA | DEFE | 4 FER YEST | PERIOD S- Raw 0 0 0 2 2 | 0 0 0 0 | Rease O O 1 I | 0 0 0 0 0 0 1 1 0 1 5 WF | 2 Resu 0 0 0 | 2 S-20 UF 0 0 | RANGE Cine (| 1 ters) 0-25 MF 0 1 1 0-25 MF | Rass C O 1 | 1 HF 0 0 1 | Rasu 0 0 0 0 0 Rasu Rasu Rasu | 0-36 MF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 Rest 0 0 | 0 WF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Total Resi | O O 9 5 14 RE F-Hr |
| H otal 10 MIM race upe S L C N otal MX-SQUA THAT | DEFENDENCE OF THE PROPERTY OF | 4 FER YEST O O 7 O 7 | PERIOD S-Raw O O 2 2 S-Raw | 0 0 0 0 4 | 0 PRess | 0 0 15 W 0 0 1 1 1 0 - 15 W 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 Rest 0 0 0 | S-20 UF 0 0 0 0 | RANGE Chee 21 Ran 0 0 1 | 1 ters> 0-25 iff 0 0 1 0 1 0 -25 | 28 Rate 0 0 1 26 Rate 1 0 0 | 1 -30 -30 -30 -30 | Rass O O O Rass O O O O Rass O Rass | 0 -35 ur 0 0 0 | 36 Rest 0 0 0 | 0 WF 0 WF 0 0 | For 3 TES | O O 9 S 14 SE F-Hr F F F F F F F F F F F F F F F F F F F |
| otal O MIM Pace I I I I I I I I I I I I I | DEREN | 4 FER TEST 0 0 7 0 7 | PERIOD S-Raw 0 0 2 2 2 S-Raw 0 0 | 0 0 0 4 10 MF | Read O O 1 1 PROME O O O O O O O O O O O O O O O O O O | 0 0 15 W 0 0 1 1 1 0 - 15 W 0 | Resid | 5-20 WF 0 0 0 5-20 WF | RAMOE CHECK | 1 ters) 0-25 HF 1 0 0 1 1 0 -25 HF 1 0 0 | Ress C C 1 C 1 | 1 -30 -4F 0 0 1 1 -30 -4F 1 0 0 1 1 0 0 0 1 1 0 0 0 0 0 0 0 0 0 | Rass G G G G G G G G G G G G G G G G G G | 0-36 MF 0 0 0 | 25 Rest 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 MF 0 0 0 | Fotal Rass 1 0 1 0 1 0 1 7 CHE SQUARE FOR 5 TES Rass 4 4 5 0 | O O 9 S 14 RE F-HAST PERI |
| TAL | DES AFT | 4 IER YEST 0 0 7 0 7 -5: | PERIOD S-Raw 0 0 2 2 2 S-Raw 0 0 | 0 0 0 4 4 10 | 1 Read 0 0 1 1 1 Read 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 15 WF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 Rest | 5-20 WF 0 0 0 0 0 0 0 0 0 | RANGE Check Rang 0 1 6 1 2a Rang 0 1 0 1 | 1 ters) 0-25 | 25 Rass 0 0 1 0 1 25 Rass 1 0 0 1 0 2 2 5 Rass 2 0 0 1 0 0 2 2 0 0 0 0 0 0 0 0 0 0 0 0 | 1 -30 -4F 0 0 1 1 -50 -4F 1 0 1 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 | 30 Rease 0 0 0 0 0 0 0 0 | 0-36 MF 0 0 0 | 36 Rest 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 WF 0 0 WF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Total Rass 1 0 1 0 1 4 2 7 CHI -SQUAR CHI -SQUAR | O O 9 5 14 RE F-HET PER: |
| Tace pe | Raw O C C C C C C C C C C C C C C C C C C | F WF | PERIOD S-Raw 0 0 2 2 S-Raw 0 0 1 1 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 1 Read 0 0 1 1 1 Read 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 15 W 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Residence of the second | 5-20 WF 0 0 0 5-20 WF 1 5-20 WF | 20 Raw G G G G G G G G G G G G G G G G G G G | 1 ters) 0-25 IdF 0 1 0-25 IdF 1 0-25 IdF 1 0 0 1 | 25 Rau | 1 -30 -4F 0 0 1 1 -30 -4F 1 0 2 2 -30 -4F | 30 Rease 0 0 0 0 0 0 0 0 | 0 -35 ur 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 256 Rest 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 HF 0 0 0 0 | Fotal Rass 1 0 1 0 1 0 1 7 CHI - SQUAN FOR 3 TE: 0 2 1 1 0 0 CHI - SQUAN FOR 3 TE: Rass FOR 3 TE: | O O 9 5 14 KE F-HIST PER! UF 6 0 5 2 12 KE URLLET PER! UF HE F HE F HE F HE F HE F HE F HE F H |
| H otal 10 MIM race 100 11 C H otal NX-SOUR L C H HIT-SOUR RLUES | 1 BUTES AFT Q Q Q Q Q 2 Q Q Rah 1 Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q | F WF | PERIOD S-Raw 0 0 2 2 S-Raw 0 0 1 1 | 0 0 0 0 4 4 10 MF | 0 0 1 1 1 Rate 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 15 W 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Resid O O O O I I Resid | S-20 UF 0 0 0 5-20 UF 1 | 20 Raw G G G G G G G G G G G G G G G G G G G | 1 ters) 0-25 isF 0 0 1 0 -25 isF 1 0 0 0 0 1 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 1 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 0 | 25 Rau 0 1 0 1 26 Rau 1 0 1 27 Rau 1 0 1 0 2 | 1 | 20 Rate 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 -3% ur 0 0 0 -3% ur 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 25 Rest 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 HF 0 0 0 0 | Total 7 | O O 9 5 14 RE F-HET PER! HF 6 0 0 5 2 12 RE URLEST PER! |

Table D39. Indian Point hawner test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

| ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | | | EST PERI | | | | | | RANGE CH | eters) | | | | | | | •• | |
|--------------------------------------|-------------------------|------------------------|--------------------------------|-------------------------|--|-----------------------------|-------------------------|-------------------------|-----------|------------------|------------------------------|------------------------|------------------------------|--------------------|------------------------------|--------|----------------------------|------------------------------|
| race | 0 | -5 | | 5-10 | | 10-15 | | 15-20 | | 20-25 | | 25-30 | 3 | 20-35 | 3 | 5-40 | Tota | 1 |
| ype | Rau | MF. | Rau | uf | Rau | MF | Raw | MF | Rau | uf | Ran | UF | Rau | uf_ | Rau | WF | i Rau | ш |
| S | 0 | 0 | 1 | 2 | ٥ | 0 | 0 | a | • | 0 | 0 | 0 | . 0 | • | 0 | ٥ | 1 1 | 2 |
| L | 0 | ٥ | ٥ | . 0 | 0 | ٥ | 0 | 0 | • | 0 | 0 | 0 | 0 | 0 | ٥ | 0 | . 0 | 0 |
| C | 0 | 0 | 2 | 4 | 1 | 1 | 1 | 1 | | , 0 | 0 | ٥ | . 0 | 0 | • | 0 | • | 6 |
| u | 0 | 0 | . 0 | 0 | 0. | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | <u> </u> |
| otal | 0 | 0 |) | 6 | 1 | . 1 | 1. | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ø | : 5 | 8 |
| 10 HINUT | ES RF | TER TE | ST PERIO | ۵ | | | | | RAMBE (no | rtors) | | | | | | | | |
| race | | -5 | | 5-10 | | 10-15 | | 15-20 | | 20-25 | | 25-30 | : | 30-35 | 3 | S-40 | Tota | 1 |
| UP+ | Rau | HF | Rau | HF | Rau | HF | Rau | HF | Rass | HF | Rau | NF | Rau | WF | Rau | uf . | 2 Rau | MF |
| 5 | 0 | 0 | 1 | 2 | <u>, </u> | 1 | 2 | 2 | 0 | 0 | ٥ | 0 | 2 | 1 | 0 | • 0 | - | 6 |
| L. | 0 | 0 | | 2 | 0 | 0 | 1 | . 1 | | 0 | . • | . 0 | . 0 | 0 | 0 | . 4 | 2 | 3 |
| c | .0 | Q | 0 | 0 | 2 | 2 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | Ò | ٥ | • 4 | 4 |
| М | 0. | ٥ | . • | 0 | • | 0 | ٥ | 0 | • • | . • | 0 | o. | 0 | Q | Q | 0 | 0 | ۰ |
| otel | 0 | 0 | 2 | 4 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 0 | 0 | 12 | 15 |
| HI —SQUARE —HAT | |)÷5 | | 5-10 | | 10-15 | | 15-20 | | 20~25 | | 25-30 | | 00-35 | | 5-40 | CHI-SQUA FOR 2 TE | |
| S L C H OTAL | Ван 0 0 0 0 | UF 0 0 0 0 | ### 1 1 1 0 3 | UF 2 1 2 0 S | Rau 1 0 2 0 2 | HF 1 0 2 0 2 | Rau 1 1 0 2 |) WF | 0 | 0 0 1 0 | Rau 0 0 1 0 1 | UF 0 0 1 0 | Rau 1 0 0 0 1 | WF 1 0 0 | Rau 0 0 0 0 0 | Hooodo | : Rau : 4 : 4 : 0 | 14 4 2 5 0 11 |
| HI — SQUARE ALUES | |)S | | 5-10 | | 10-15 | | 15-20 | ` | to-25 | | 25-30 | | 10-36 | 3 | 540 | CHI-SQUA | RE VAL |
| S C M OTAL | Rau | | Rau 0.000 1.000 2.000 | 0.000 2.000 4.000 | 1.000 9.333 | 1.000 0.333 | 2.000 1.000 1.000 | 2.000 1.000 1.000 | 1.000 | 1.000 1.000 | 1.000 | 1.000 | 2.000 2.000 | 1.000 1.000 | Rau | HF | 2.000 2.000 2.000 | 2.900 3.900 6.400 |

Table D40. Indian Point hammer test monitoring using 6x12 degree horizontal transducer located at unit 3, intake 35.

10 MINUTES BEFORE TEST PERIOD

Tidal Phase:

1 hr before high tide

| frace | 0-! | 5 | 5- | -10 | | 10~15 | 1 | 5-20 | | 0-25 | 21 | 5-30 | 3 | 0-35 | | 5-40 | Tota | |
|--|--|--|---|---|--|--|--|---|---|---|---|---|--|---|---|--|--|---|
| up+ | Rass | uf. | Rau | HF | Rau | up . | Rau | HF | Rau | HF | Rau | NF | Rau | MF | Rass | KF | E RAM | HF |
| \$ | 1 | . 4 | . 0 | ø | 3 | 4 | 1 | - 1 | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | Q. | 5 | 9 |
| L | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | , o | 0 | Ο, | ٥ | o | 0 | ۵ | 0 | 0 |
| c | 0 | 0 | . 0 | ٥ | 1 | 1 | 0 | ٥ | 1 | 1 | 0 | O | 0 | 0 | 0 | 0 | 2 | 2 |
| M | 0 | 0 | 0 | 0 | 1 | 1 | 0 | ٥ | O | 0 | . 0 | 0 | 0 | 0 | . 0 | ٥ | 1 | 1 |
| otel | 1 | 4 | 0 | 0 | 5 | 6 | 1 | 1 | 1 | 1 | ٥ | 0 | 0 | 0 | o | 0 | | 12 |
| 10 HIN | NUTES DUR | ING TE | ST PERIO | D | | | | | RANGE (No | tors> | | | • | | | | | |
| | 0-9 | 5 | \$ | -10 | ; | 10-15 | 1 | 5-20 | 2 | 9-25 | 21 | S-30 | 3 | 0-35 | 5 | 5~40 | Tota | 1 |
| TACO WD-0 | Rau | NIF | Rau | HF | Rau | WF | Rau | HF | Rau | NF | Rau | MF | Reu | WF | Rau | LIF | z Rau | UF |
| . <u></u> | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | | |
| L | 0 | ō | . 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 1 | 1 |
| c | 1 | 4 | 2 | 4 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 5 | 10 |
| 149 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 |
| | | | | | | | | | | | 1 | 1 | 1 | 1 | 0 | 0 | -: | 14 |
| otal 10 MI) | ,1 NUTES AFT | | | -10 | . | 2 10-15 | 1 | 1 5-20 | 1 RANGE CHO 2 | _ | - | S-30 | _ | 0-3S | _ | . u 5~40 | Tota | |
| otal 10 MI) Trace | NUTES AFT | ER TES | T PERIOD | | | 10-15 | | - | RANGE CHO | ters) | - | | _ | - | _ | • | Tota | |
| otal 10 MI) Tace up+ | NUTES AFT | ER TES | T PERIOD | -10 | | 10-15 | 1 | 5-20 | RANGE CHE | ters) 0-25 | 2: | S-30 | | 0-35 | | 5-40 | Tota | 1 |
| otal 10 HII Pace upe | NUTES AFT | ER TES | F PERIOD | -10 HF | Rau | 10-15 UF | Rau | 5-20 WF | RANGE CHO | tors) 0-25 Uf | Z: Rau | 5-30 MF | Rau | 0-35 UF | Rau | 5-40 uf | Tota : Ran | NF |
| otal 10 HI) Tace Upe | NUTES AFT | ER TES | E Rau | -10 HF | Rau | 10-15 шғ | Rau 0 | 5-20 WF | RANGE CHE 2 RAN | ters> 0-25 UF | Rau O | 5-30 AF 0 | Rass G | 0-35 HF | Rass | 5-40 uf | Tota : Ran | uF Q |
| race up+ | Rau G | ER TES | E Raw O | -10 HF 0 | Rau 0 0 | 10-15 UF 0 | Rau 0 | 5-20 HF | RANGE CHO 2 Rau 0 | ters> 0-25 UF 0 | 25 Rau 0 0 | 5-30 MF 0 | Rau G G | 0-35 UF 0 | Rau O | 5-40 UF 0 | Tota : Ram O | 9 0 |
| race upe S | Rau 0 | ER TES | B Raw O G | -10 HF 0 0 | Rau O O | 0 0 | 0 0 | 5-20 HF 0 | RANGE CHO 2 Rau 0 0 | 0 0 0 | 2: Rau 0 0 | 5-30 UF O O | Rass O O | 0-35 UF 0 0 | 8 au 0 0 0 | 5-40 ur 0 | Tota Ram O O Tota | 9 9 |
| otal | Rass 0 0 3 0 3 | 0 0 11 0 | E Raw O O 1 | -10 HF 0 0 | Rass 0 0 1 1 0 1 | 0 0 0 | 0 0 1 1 2 | 5-20 UF 0 0 | RANGE CHE 2 RAM 0 0 0 0 | 0 0 0 0 0 | 2: Rau 0 0 0 | 5-30 UF 0 0 | 30 Rass G G O O | 0-35 WF 0 0 0 | 9 0 0 | 5-40 UF 0 0 | Tota Rem O F C C C C C C C C C C C C C C C C C C | 0 0 13 16 |
| race ype s s s s s s s s s s s s s s s s s s s | Rau O | 0 0 11 0 | Rese G G G G G G G G G G G G G G G G G G | -10 MF 0 0 2 2 | Rass 0 0 1 1 0 1 | 0 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | Rais G G I I I Z Rais Rais G | 5-20 MF 0 0 1 1 2 5-20 MF | RANGE CHE 2 RAM 0 0 0 0 2 RAM | 0-25 0-25 0-25 0 0 0 | 21 Rau 0 0 0 0 | 6-30 UF 0 0 0 0 | 20 0 0 0 0 | 0-35 WF 0 0 0 0 | Rass O O O O | 5~40 UF 0 0 0 0 8-40 | Tota | 0 0 13 16 |
| race ype s s s s s s s s s s s s s s s s s s s | Rau O O O O O O O O O O O O O O O O O O O | 0 0 11 0 11 S UF 1 | B Ram O O I I I S | -16 MF 0 0 2 2 | Rate 0 | 0 0 1 0 | 0 0 1 1 2 | 5-20 WF 0 0 1 1 | RANGE CHO | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 21 Rau 0 0 0 0 | 6-30 0 0 0 0 | 20 0 0 0 0 0 | 0-35 UF 0 0 0 0 0 | Rass O O O O Rass | 5-40 uF 0 0 0 0 4 40 iuF | Total Rem O I O I FOR 3 TE | O O I O I O I O I O I O I O I O I O I O |
| otal 10 HIP Pace Upe S L C IM otal HI-SOM HAT IL IC | Rau 0 0 3 0 0 1 0 0 1 0 0 1 0 0 | 0 0 11 0 11 S UF 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Reserved to the | -16 MF 0 0 2 2 -10 MF 0 0 | Rate 0 0 1 1 0 1 1 0 1 0 1 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 | 0 0 1 0 1 1 10 15 WF 2 0 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | Rais 0 0 1 Rais 0 0 1 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 | 5-20 WF 0 0 1 1 2 5-20 WF | RANGE CHE RAM O O O RAM | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 21 Rau O O O O | 6-30 0 0 0 0 | 20 0 0 0 0 0 0 0 0 0 0 | 0-35 UF 0 0 0 0 0 | Ram | 5-40 | Total Ram O G G G CHI - SQUA FOR 3 TA Ram G G G G G G G G G G G G G G G G G G G | UF |
| race up+ S S S S S S S S S S S S S S S S S S S | Rau G G G G G G G G G G G G G G G G G G G | 0 0 11 0 11 S UF | B Rass O O 1 1 S Rass O O 1 1 | -10 -10 -0 -0 -2 -10 | Rate 0 0 1 1 Rate 1 0 1 1 | 0 0 1 0 1 1 10 1 1 | 1 0 0 1 1 2 Rand 0 0 0 1 1 1 Rand 0 0 0 1 1 | 5-20 WF 0 0 1 1 2 S-20 WF 0 0 | RANGE < Ne | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 21 Rau 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 5-30 UF 0 0 0 0 0 0 0 0 | Rass G G G G G G | 0-35 UF 0 0 0 0 | Rau | 5-40 ur 0 0 0 | Total Ram O S TE S TE S TE S TE S TE S TE S TE S | O O I O I O I O I O I O I O I O I O I O |
| Tace | Rass O | 0 0 11 0 11 S UF 1 0 6 6 | Rau O O 1 1 1 2 Rau O O 1 1 O 1 1 O 1 1 O 1 1 O 1 1 O 1 1 O 1 1 O 1 1 O 1 1 O 1 1 O 1 1 O | -16 MF 0 0 2 2 -10 MF 0 0 | Rate 0 0 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 | 0 0 1 0 1 1 10 15 WF 2 0 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 1 0 0 1 1 2 2 1 Rand 0 0 1 0 1 0 1 0 1 1 | 5-20 WF 0 0 1 1 2 S-20 WF 0 0 | RANGE < Ne 2 Ram 0 0 0 0 2 Ram 0 0 1 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2: Rau 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 6-30 0 0 0 0 | 20 0 0 0 0 0 0 0 0 0 0 0 | 0-35 UF 0 0 0 0 0 | Rau | 5-40 | Tota Ram O O FOR 3 TE Ram O CHI - SQUAR O CHI - SQUAR CHI - SQUAR | O O I O O O O O O O O O O O O O O O O O |
| otal race up+ S i i i i i i i i i i i i i i i i i i | Rau O O O O O O O O O O O O O O O O O O O | ER TES 5 WF 0 11 0 11 5 WF 5 6 | Raid G G G G 1 1 S Raid O 1 C Raid Raid Raid Raid Raid Raid Raid Raid Raid Raid | -10 MF 0 0 2 2 -10 MF 0 0 1 1 2 | Rate O O 1 O 1 Rate 1 O 2 Rate 2 O 3 | 10-15 WF 0 0 1 10-15 WF 2 0 1 | 1 0 0 1 1 2 2 1 Rand 0 0 1 0 1 0 1 0 1 1 | 5-20 MF 0 0 1 1 2 S-20 MF 0 0 1 1 2 S-20 | RANGE < Ne 2 Ram 0 0 0 0 2 Ram 0 0 1 | 0-25 MF 0 0 0 0 0 0 0 0 0 0 0 | 21 Rest 0 0 0 0 0 2 Rest 0 0 | 5-30 UF 0 0 0 0 0 0 0 0 0 0 | 20 0 0 0 0 0 0 0 0 0 0 0 | 0-35 UF 0 0 0 0 0-35 | Rau | 5-40 UF 0 0 0 0 8-40 | Total Ram O O O O O O O O O O O O O O O O O O O | O O O O O O O O O O O O O O O O O O O |
| race up+ S iL ic im otal cHI-Sour -HAY S iL ic ic in HI-Sour race HI-Sour RL ic HI-Sour RL ic HI-Sour RL | Ram O O O O O O O O O O O O O O O O O O O | ER TES | Raid G G G G C Raid C C Raid Raid C Raid Raid Raid Raid Raid Raid Raid Raid Raid Raid Raid | -10 MF 0 0 2 2 -10 MF 0 0 1 1 2 -10 MF ERR | Rate 0 0 1 1 0 1 0 1 0 1 0 0 1 0 0 0 1 0 | 10-15 WF 0 1 10-15 WF 2 0 1 10-15 | Rais 0 0 1 1 2 Rais 0 0 1 1 0 1 1 Rais 1 0 0 1 1 Rais 1 0 0 1 1 Rais 1 R | 5-20 MF 0 0 1 1 2 5-20 MF 0 0 1 1 5-20 MF | RAMGE CMO 2 RAM 0 0 0 2 RAM 0 0 1 2 RAM 0 1 | 0-25 WF 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rest O O O O O O O O O O O O O O O O O O O | 5-30 UF 0 0 0 0 0 0 0 0 0 0 0 0 0 | 20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0-35 0 0 0 0 0-35 MF 0 | Ramo O O O O Ramo O O O O O O O O O O O O O O O O O O O | 5-40 UF 0 0 0 0 18-40 UF | Total Ram O O FOR 3 TE RAM FOR 3 TE RAM O CHI-SQUAR FOR 3 TE RAM STOR 3 TE RAM STOR 3 TE RAM STOR 3 TE RAM STOR 3 TE | O O O O O O O O O O O O O O O O O O O |
| Tace Type S L C III Total CHI-SQUI | Ration O O O O O O O O O O O O O O O O O O O | 0 0 11 0 11 S WF 1 0 6 6 | Raid O O O O O O O O O O O O O O O O O O O | -10 MF 0 0 2 2 2 -10 MF 0 0 1 1 2 2 -10 MF ERR | Rate O O 1 O 1 Rate 1 O 2 Rate 2 O 3 | 10-15 WF 0 0 1 10-15 WF 2 0 1 | Rana 0 0 1 1 2 2 1 Rana 0 0 1 1 0 1 1 Rana 0 0 1 1 0 0 1 1 Rana 0 0 0 1 1 0 0 1 1 0 0 1 1 1 1 1 1 1 1 | 5-20 MF 0 1 1 2 5-20 MF 9 9 1 1 5-20 MF | RAMGE CMO 2 RAM 0 0 0 2 RAM 0 0 1 2 RAM 0 1 | 0-25 MF 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rest O O O O O O O O O O O O O O O O O O O | 5-30 UF 0 0 0 0 0 0 0 0 0 0 0 0 0 | 20 0 0 0 0 0 0 0 0 0 0 | 0-35 0 0 0 0 0-35 MF 0 | Ramo O O O O Ramo O O | 5-40 UF 0 0 0 0 18-40 UF | Total Ram O 1 | O O O O O O O O O O O O O O O O O O O |

Duration of Test: Treatment Type:

RANGE (meters)

10 min, hers 385 Test Date: 10 sec on, 20 sec off Test Time: 2/18/**99** 2225

Table D4: Indian Point hammer test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| | | | | 20 | | | | 1 | RANGE < | ters> | | | | | | | | |
|-------------------------------------|-------------------------|------------------------|------------------------------|-------------------------------|-------------------------|------------------------|--------------------|-------------------|-------------------------------|-----------------------------|--------------------|-------------------|--------------------|---------------|--------------------|--------------|---|----------------------------------|
| race | 0- | 5 | | - 10 | | 10-15 | | 5-20 | | 0-25 | 2 | 5~30 | | 0-22 | | 5-40 | Tota | 1 |
| UP+ | Rau | MF | Rau | HF | Rau | WF | Rau | HF | Rau | HF | Rau | NF | Rau | NF | Rass | MF | : Reu | HF |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 |
| L | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | . 0 | 0 | 1 | 1 |
| c | 1 | 4 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 3 | 7 |
| M | 0 | 0 | 1 | 2 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | 1 | 2 |
| otel | 1 | 4 | 2 | 4 | 1 | 1 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | | 13 |
| 10 MIN | UTES AFT | ER TES | T PERIOC | | | • | | 1 | RANGE (m | ters> | | | | • | | | | |
| race | 0- | -S | 5 | 10 | | 10-15 | 1 | 5~20 | | 20-25 | | 5-30 | | 0-35 | 3 | 5-40 | Tota | 1 |
| up- | Rau | MF. | Rau | MF | Rau | HF | Rau | HF | Rau | HF. | Rau | HF | Res | MF | Rau | HF | I Rau | WF |
| S | 0 | 0 | 0 | 0 | 1 | 1 | 0 | ø | 2 | 2 | 1 | 1 | . 0 | 0 | 0 | 0 | 4 | 4 |
| L | • | • | 0 | 0 | 0 | 0 | 0 | G | 0 | 0 | • | 9 | Ô | o | ø | . 0 | | 0 |
| C | 0 | 0 | 1 | 2 | . 0 | 0 | 0 | 0 | 1 | 1 | , 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 |
| W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| otal | 0 | 0 | 1 | 2 | 1 | 1 | 0. | 0 | > | 3. | 1 | 1 | 0 | 0 | 0 | 0 | ; 6 | 7 |
| KI –SQUAI –HAT | RE O- | ·\$ | | i-10 | | 10-15 | 1 | 5-20 | | :0-25 | | :5-30 | 3 | 10-3 5 | | 5-40 | CHI-SQUA FOR 2 TE | RE F-H |
| .s il ic ic in iotal | Rau G G 1 G | HF 0 2 0 2 | Rau 0 0 1 1 2 | UF 0 0 2 1 | Rau 1 0 1 0 | MF 1 0 1 0 | Rau 1 0 0 | UF 1 0 0 | Rate 2 1 1 0 3 | WF 2 1 1 0 3 | Rau 1 0 0 | иF 1 0 0 | Rau O O O | 0 0 | Rau 0 0 0 | #F 0 0 | 2 Rate 2 4 2 1 2 3 2 1 2 7 | #F 4 1 5 1 |
| HI — SQUAI PALUES | RE 0- | -5 | | j-10 | | 10-15 | 1 | 5-20 | | 20-25 | 2 | 5-30 | 3 | 0-35 | 3 | 5-40 | CHI-SQUA | RE VAL |
| S L C M OTAL | | MF 1.000 | 1.000 | UF 0.000 2.000 0.667 | 1.000 1.000 | 1.000 1.000 | == | 2.000 | 0.333 1.000 1.000 | 0.333 1.000 1.000 | 1.000 | 1.000 | Rau | WF | Ram | MF | Rau 2 0.143 2 1.000 2 0.200 2 1.000 | 0.143 1.800 1.800 2.800 |

Table D42. Indian Point hanner test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

| | | | | del P | h | 0 min be igh tide | • | | Duration Treat | ent fu | pe: 1 | 10 sec 6 | hers 345 n, 40 se | coff | Test Dat Test Tim | •: | 2/10/60 2305 | · |
|------------------------|----------|--------|------------|-------|-----|----------------------|-----|------|-------------------|-------------------|----------|----------|----------------------|-----------|----------------------|------|-----------------|----------|
| | | | ST PERIOD | | | | | | RANGE Con | | | | | | | | ••• | |
| | 0- | 5 | 5- | - 10 | 1 | 0-15 | 1 | 5-20 | 3 | 10 -25 | 2 | 5-30 | 34 | 0-35 | 3: | 5~40 | Tota | -1 |
| race upe | | WF | Raco | WF | Rau | WF | Rau | ИF | Ran | HF | Rau | ИF | Rau | UF | Rau | WF . | : Res | |
| .s | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 9 | 1 | 1 | 1 | . 1 | o | 0 | 0 | 0 | | 4 |
| L, | 0 | ٥ | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | Ò | G | 0 | 0 | 0 | . 0 | - O |
| ¢ | 0 | • | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | . 0 | . 0 | . 0 | 0 , | 0 | 2 | > |
| # | 0 | 0 | 0 | 0 | 2 | 2 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 00 | 0 | | 2 |
| otal | 0 | 0 | 2 | 4 | 3 | 3 | 0 | ō | 1 | 1 | 1 | 1 | 0 | 0 | . 0 | 0 | ; P | 9 |
| 10 HZ H | UTES AFT | ER TES | T PERIOD | | | | | ı | RANGE (m | ters> | | | | | , | | | |
| race | 0- | 5 | 5- | -10 | 1 | 0-15 | 1 | 5-20 | | 0-25 | 2 | 25-30 | | 0-35 | 3: | 5-40 | Tot | 1 |
| yp+ | Rau | UF | Rau | HF | Rau | ИF | Rau | NF | Rau | UF | Rau | | Rau | HF | Rau | HF | 2 Rau | HF |
| S | 0 | . 0 | 0 | a | 0 | . 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | | 1 | 1 |
| iL. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | 0 | . • | 0 | 0 | 0 | O | 0 | . 0 | | 0 |
| ic . | 0 | 0 | 0 ' | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | a |
| # | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | a | 0 | 0 | 0 | 0 | Q | . 0 | • • |
| etal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| HI —SQURI —HAT | RÉ | 5 | S- | -10 | 1 | 0-15 | 1 | 5-20 | | to-25 | . 2 | 25-30_ | | D-35 | 3 | 5~40 | CHI -59U | |
| • | Rau | HE. | Rau 1 | MF | Rau | HF | Raw | WF | Rass | HF | Rass | MF | Rau | MF | Rau | HF | Reu | ИF |
| S L C | Ö | Ö | ė | ģ | ŏ | ŏ | ě | ŏ | ĝ | ĝ | . 1 0 | ĝ | ě | ŏ | Ö | ě | | ğ |
| i OTAL | ŏ | ŏ | ģ | 2 | į | i | Ö | ě | ğ | Ď | 0 | 0 | ĕ | ě | ŏ | ŏ | į į. | 1 |
| NI —SQUAI ALUES | RE O- | .ex | S - | -10 | • | 0-15 | - | 5-20 | | 0-25 | · . | 25~30 | - | D~35 | 30 | 5-40 | CHI -SQU | RRF VALI |
| | Ran | LIF | Paul | UF | Rau | WF | Rev | | Rau | | Rau | WF | Rau | UF | Rau | WF | FOR 2 TI | EST PERI |
| .S il. ic iii | 227 | == | | £.000 | | = | == | == | 0.000 | 0.000 | | 1.000 | == | | == | == | 1.000 | 1.800 |
| Ĕ. | | | 1,000 2 | 2.000 | | 1.000 | | | | | == | | | | | | 2.000 | 3.900 |
| ซีกลเ | ` | | 2.000 | (.000 | | 2.000 3.000 | | | | 0.000 | | 1.000 | == | | | | 4,500 | 6.400 |

Table D43. Indian Point hauser test monitoring using 6x12 degree horizontal transducer located at unit \mathfrak{I}_2 intake 35.

| | | | ST PERIO | | | | | | RANGE (H | | | | | | | | •,. | |
|-------------------|--------|---------|----------|-------------|-----|---------------|--------|------------|-------------------------|----------------------|-----------|------------|-------|--------|----------|---------------|----------------------|-------------------------|
| • | 0- | -5 | 5- | -10 | 1 | 0-15 | 15 | 5-20 | | 20-25 | 25 | 5-30 | 3 | 0-35 | 35 | -40 | Tota | 1 |
| race upe | Ray | HF . | Rass | HF | Rau | HF | Rau | MF | Rau | UF | | HF | Rau | HF | Rau | ИF | : Rau | ИF |
| .5 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | o | 0 | 0 | 0 | 1 | 2 |
| L · | 0 | 0 | 0 | 0 | | . 0 | 0 | . 0 | 0 | 0 | 0 | 0 | Û | 0 | 0 | 0 | | 0 |
| c į | • | • | 0 | 0 | 0 | 0 | 0 ' | 0 | 0 | 0 | 1 | 1 | . 0 | ٥ | 0 | 0 | 1 | Ł |
| 194 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 4 |
| otel | 0 | • | 3 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | i 4 | 7 |
| 10 MI | | | T PERIOD | | _ | | • | | RANGE CH | | | | • | 0-35 | . | i– 4 0 | Tota | • |
| race" | 0 | | | -10 | | 0-15 | | 5-20 NF | Rau | 10~25 Lef | | 5-30 UF | Rau | UF | | LUF | I Rau | |
| <u>upe</u> S | Reu | WF | Rau | UF O | Reu | - | R444 | 1 1 | | | <u>~~</u> | #r | | | | <u>~~</u> | - | |
| _ | • | | • | 0 | 0 | | _ | | • | 1 | 0 | 0 | 0 | • | . 0 | . 0 | | 1 |
| c . | 1 | 4 | 1 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | ; ; | |
| H . | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| otal | . 2 | • | 2 | 4 | 0 | 0 | 1 | 1 | > | 3 | 2 | 1 | 1 | 1 | 0 | 0 | -11 | 19 |
| HI-SQUI HAT | ARE 0- | -5 | 5- | -10 | 1 | 0-15 | 1 | 5-20 | | 25 | 25 | 5-30 | . 3 | 0-35 | | - 4 0 | CHI-SHUR FOR 2 TE | RE F-HAT |
| • | Rau | WF 2 | Rau | HF | Rau | HF | Rate | WF | Rau | HF | Rau | HF | Rası | MF | Rau | HF 0 | : Ran | NF S |
| S L C | Ģ | 2 | | ĝ | ě | ŏ | ġ | é | Ī | Ĩ | 0 | Ŏ | Ō | õ | Ŏ | Ŏ | | <u>1</u> |
| N OTAL | Õ 1 | ō | 2 | 3 | ŏ | ĕ | Ŏ 1 | Ŏ 1 | Ō 2 | · 0 | ō 2 | Ŏ 1 | Ŏ | 0 1 | Ö | Ö | | 13 |
| HI –SQUI MLUES | RRE 0- | ·5 | 5 | -10 | 1 | 0-15 | 1 | 5-20 | | 20-25 | 25 | 5-30 | 3 | 0-35 | 25 | -40 | CHI-SBUR | RE VALUI |
| s L C | | | | NF 2.000 | Rau | WF. | 1.000 | 1.000 | 1.000 1.000 1.000 | HF 1.000 1.000 | 0.333 (| HF | 1.000 | 1.000 | Res | HF | 1.800 1.000 | 2.778 1.000 5.444 |

(d.f. = 1, alpha = .05)

Table D44. Indian Point hanner test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| 10 HIM | NTES BEF | ORE TE | ST PERIO | 3 | | | | R | ANDE CHAI | ters) | | | | | | | | |
|---|--|--|---|--|--|--|---|---|--|---|--|--|---|---|---|---|--|---|
| race | 0~! | 5 | 5 | -10 | 1 | 0-15 | 1! | 5-20 | 20 |)-25 | 25 | -30 | 30 |)-3 5 | 35 | -40 | Total | |
| Abe. | Rau I | MF. | Rau | HF | Rau | WF | Rau | HF | Rau | NF | Rau | WF | Rau | uf . | Rau | MF | Rau | UF |
| s | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| L | 0 | 0 | 0 | 0 | ٥ | 0 | 1 | * | 0 | 0 | 0 | .0 | 0 | . 0 | 0 | 0 | 1 | 1 |
| c | 2 | 7 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | Ö | 1 | 1 | 0 | 0 | 0 | 0 | • | 10 |
| N . | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| otal | 2 | 7 | 1 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | . 0 | 0 | 0. | 0 | i 6 | 12 |
| 10 MIN | NTES DUR | INO TE | ST PERIO | > | | | | | RNSE CHO | ters) | | | | | | | | |
| | 0-1 | B | 5 | -10 | . 1 | 0-15 | 11 | 5-20 | | 0-25 | 25 | -30 | 30 |)-3 S | 35 | -40 | Total | ı |
| race yp e | Rau (| | Rass | MF | Rau | LOF | Reu | uf | Ray | 145 | Resi | uf | Rau | uf | Reu | ur | : Rau | WF" |
| .s | 2 | 7 | 1 | 2 | . 0 | 0 | 2 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | | 6 | 12 |
| L. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 1 | 0 | 0 | o | 0 | 0 ' | 0 | 1 | 1 |
| IC: | 2 | 7 | 2 | 4 | 0 | • | 0 | o | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 12 |
| - | _ | • | | | | | | | | | | | | | | | | |
| _ | • | 0 | 1 | 2 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | a | 0 | 0 | 0 | 0 | 1 | 2 |
| M otal | _ | 0 | 4 | 3 | 0 | <u> </u> | 2 | 2 | 2 | 2 | 1 | 1 | • | 0 | 0 | <u> </u> | 1 13 | <u>2</u> 27 |
| otal 10 MIM | 4 | 0 14 ER TES | T PERIOD | | 0 | | 2 | 2 | 2 PANSE CHAI | 2 | 1 | | | | 0 | = | | 27 |
| otal 10 MIH | Q 4 NUTES AFT | 0 14 ER TES | T PERIOD | • | 0 | 0 | 2 | 2 R | 2 PANSE CHAI | 2 | 25 | 1 | <u> </u> | 0 | 95 | 0 | Fotal | 27 |
| otal 10 MIN Pace upe | Q 4 NUTES AFT | 0 14 ER TES | T PERIOD | -10 | 0 | 0-15 | 2 | 2 R 5-20 | 2 PMSE (no.) | 2 ters> 0-25 | 25 | 1 | <u> </u> | 0 | 95 | -40_ | Fotal | 27 |
| tu otal 10 MIN Trace upe | Q 4 NUTES AFTI | 0 14 ER TES | T PERIOD 5 Rew | -10 LtF | O Rana | 0-15 WF | 2 1: Rau | 2 R 5-20 MF | 2 PRISE CHAI 20 Rass | 2 ters> 0-25 WF | 1 25 Rau | 1 30 UF | 0 | 0 0-35 MF | O O Rau | -40 HF | Fotal | 27 UF |
| u otal 10 MIH race upe S | Q 4 NUTES AFT | 0 14 ER TES S MF | T PERIOD 5 Raw | -10 ldF | Rass | 0 0-15 UF | 1: Rau | 2 R 5-20 WF | 2 PANSE CHOI 20 Rand G | 2 ters> 0-25 WF | 25 Rass | 1 30 UF | 90 Rass | 0 0-35 UF | 0 | -40 HF | Total | 27 ur |
| u otal 10 MIH race upe S L | Q 4 NUTES AFT | O 14 ER TES | T PERIOD S Rem 0 | -10 -10 -10 0 | Rans | 0-15 UF 1 | 2 19 Ran 1 Q | 2 R 5-20 WF | RANGE CHAIR | 2 ters> 0-25 WF | 25 Resi 0 | 1 30 4F 0 | 30 Rau 1 | 0 0-35 MF | 9 25 Rass | -40 HF | Total | 27 14 3 |
| nu otal 10 MIN Trace upo S S L IC | Q 4 NUTES AFTI | G 14 ER TES S O O O | T PERIOD 5 Row 0 0 | -10 MF 0 0 | Rassi i O | 0-15 UF 1 0 | 2 Rau 1 Q | 2 R 5-20 WF 1 0 | 2 Rass 0 0 | 2 ters> 0-25 WF 0 | 25 Rau 0 0 | 1 30 4F 0 0 | 36 Rau 1 2 | 0 0-35 UF 1 1 | 0 25 Raw 0 0 | -40 MF 0 | Total Rau 1 3 2 4 6 5 2 13 | 27 IIF 3 1 12 3 |
| nu otal 10 MIN Tace Type S S S IL IC IN Otal CHI-SQUA | Q 4 NUTES AFTI O- Ran 0 0 2 | 0 14 ER TES 5 MF 0 0 7 | T PERIOD 5 Rais 0 1 1 | -10 luf 0 0 2 | Ransi i o i o c | 0-15 UF 1 0 1 | 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 2 85-20 WF 1 0 | 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 2 ters> 0-25 UF 0 0 1 | 25 Reu 0 0 0 | 1 -30 WF 0 0 | 30 Raw 1 2 1 | 0 0-35 iar 1 1 1 | 0 35 Raw 0 0 0 | 0 UF 0 0 | Total Rau 2 6 2 | 27 IIF 3 1 12 3 |
| Multiple of the second of the | Q 4 RUTES AFTI O | O 14 ER TES S MF | F PERIOD S Rem 0 0 1 1 2 5 Rem | -10 ldF 0 0 2 2 | Rass 1 0 1 0 2 | 0-15 WF 1 0 1 0 2 0-15 WF | 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 2 R 5-20 WF 1 0 0 | 2 21 Rate 0 0 1 1 2 2 Rate Rate Rate Rate Rate Rate Rate Rate | 2 terrs> 0-25 WF 0 1 1 2 0-25 WF | 25 Rau 0 0 0 0 0 0 0 25 | 1 -30 MF 0 0 0 0 -30 MF | 0 30 Rau 1 2 1 0 4 30 Rau | 0 0 0 1 1 1 0 3 | 0 25 Rest 0 0 0 0 | 0 14F 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Total Rau Rau 2 6 2 CHY-SQUAI FOR 3 TE: | 27 UF 3 1 12 19 19 UF UF |
| Tace IG MIN Tace IPP S IL IC IN Otal HI-SQUA -HAT | Q 4 RUTES AFTI O | 0 14 ER TES 5 MF 0 7 0 7 | T PERIOD S Raw 0 1 1 2 Faw 0 0 | -10 kg 0 0 2 2 4 4 -10 kg 1 0 0 | Rans 1 0 1 0 2 Rans 0 0 0 0 0 0 0 0 0 | 0-15 WF 1 0 1 0 2 0-15 WF 0 0 | Raw 1 0 0 1 21 Raw 1 0 0 | 2 R 5-20 WF 1 0 0 1 5-20 WF 1 0 | 2 21 Rass 0 0 1 1 2 2 1 Rass 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 ters> 0-25 WF 0 1 1 2 0-25 WF 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 25 Rau 0 0 0 0 | 1 -30 MF 0 0 0 -30 MF 0 0 | 0 30 Rau 1 2 1 0 4 30 Rau 0 1 | 0 0 1 1 1 0 3 0-35 | 0 Rest 0 0 0 0 | 0 UF 0 UF 0 | Total Rau 1 3 2 2 6 6 2 2 CHY-SQUAIFOR 3 TE: Rau 2 3 | 27 UF 3 1 12 19 19 UF UF 5 1 |
| total 10 MIN | Q 4 RUTES AFTI O 2 0 2 0 2 Resu 1 0 2 0 2 | 0 14 ER TES 5 0 7 0 7 5 20 7 7 | F PERIOD SRAW 0 0 1 1 2 SRAW 0 1 1 | -10 MF 10 0 11 10 10 10 10 10 10 10 10 10 10 1 | Ross 1 0 1 0 2 Ross 0 0 0 0 0 0 | 0 0 15 WF 1 0 1 0 2 0 15 WF 0 0 0 0 0 0 0 | 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 2 R S-20 WF 1 0 0 1 5-20 WF 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 21 Rate 0 0 1 0 1 0 0 1 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 0 | 2 ters> 0-25 WF 0 1 1 2 0-25 WF 0 1 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 | 25 Re4 0 0 0 0 0 0 | 30 UF 0 0 0 0 0 0 0 0 0 0 | 0 30 Rau 1 2 1 0 4 30 Rau 0 1 0 0 0 | 0 0-35 MF 1 1 1 0 3 0-35 | 0 25 Raw 0 0 0 0 0 | 0 0 0 UF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Total Rau 1 | 27 14 12 19 19 10 10 11 11 11 11 11 11 |
| total 10 MIN Pace Upe S S S S S S S S S S S S S S S S S S S | Q 4 RUTES AFTI O 2 RAW 1 O 2 RAW 1 O 2 O 3 | O 14 ER TES S WF O 7 O 7 S WF 2 O 7 | T PERIOD S Raw 0 1 1 2 Faw 0 0 | -10 luf 0 2 2 4 | Remail 0 1 0 2 2 Remail 0 0 0 0 0 0 0 0 | 0-15 UF 1 0 1 0 2 0-15 UF 0 0 0 | 1 | 2 8-20 WF 1 0 0 1 5-20 | 2 21 Rass 0 1 1 2 21 Rass 0 0 1 1 1 2 1 1 2 1 1 2 1 1 1 1 1 1 1 1 | 2 ters) 0-25 WF 0 1 1 2 0-25 WF 0 1 | 25 Raul 0 0 0 0 0 | 1 -30 MF 0 0 0 -30 MF 0 0 | 36 Rass 1 2 1 0 4 | 0 0-35 lar 1 1 1 0 3 | 0 0 0 0 0 0 0 | -40 lif 0 0 | Total Ram Ram 13 2 6 2 13 CHI-SQUAI FOR 3 TE: Ram 3 1 1 5 | 27 16 17 19 19 19 19 19 19 19 19 19 19 |
| Trace Type S IL IC IN IN IC IN IN IN IN IN IN | Q 4 RUTES AFTI O 2 RAW 1 O 2 RAW 1 O 2 O 3 | 0 14 ER TES 5 | 5 Rau 0 0 1 1 2 5 Rau 0 0 1 1 2 2 5 Rau 2 2 | -10 MF 10 0 11 10 10 10 10 10 10 10 10 10 10 1 | Remail 1 0 1 0 2 2 Remail Control Cont | 0 0 15 WF 1 0 1 0 2 0 15 WF 0 0 0 0 0 0 0 | 2 2 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | 2 R S-20 WF 1 0 0 1 5-20 WF 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 21 Rass 6 0 1 1 2 21 Rass 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 1 1 0 1 1 1 0 1 | 2 ters> 0-25 WF 0 1 1 2 0-25 WF 0 1 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 | 25 Rau 0 0 0 0 0 | 30 UF 0 0 0 0 0 0 0 0 0 0 | 30 Rass 1 2 1 0 4 30 Rass 0 0 1 | 0 0-35 MF 1 1 1 0 3 0-35 | 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 UF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Total Rau 2 13 CHI - SQUAR FOR 3 TE: Rau 1 11 CHI - SQUAR | 27 uf 3 1 12 19 uf 5 19 uf 19 uf 11 11 11 11 11 11 11 11 11 |
| otal 10 MIN race upe S L 10 11 11 12 13 14 15 15 16 16 16 17 16 17 17 18 18 18 18 18 18 18 18 | RAN O O 2 O RAN I O C C C C C C C C C C C C C C C C C C | 0 14 ER TES 5 MF 0 7 0 7 | T PERIOD 5 Rais 0 1 1 2 5 Rais 0 1 1 2 5 Rais | -10 kg 0 0 2 2 4 -10 kg 1 5 5 -10 kg 5 | Remail 1 0 1 0 2 2 Remail Control Cont | 0-15 UF 1 0 1 0 2 0-15 UF 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 0 1 | 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 2 R S-20 WF 1 0 0 1 1 5-20 WF 5-20 WF | 2 21 Rass 2 21 Rass 2 21 Rass 2 2 Rass 2 Ra | 2 ters) 0-25 WF 0 1 1 2 0 0 1 1 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 1 0 | 25 Rest 0 0 0 0 0 25 Rest 0 0 0 | 1 -30 MF 0 0 0 0 1 1 -30 MF | 30 Raw 1 2 1 0 4 30 Raw 0 1 0 0 | 0 -35 UF 1 1 1 0 3 3 -35 UF 0 0 0 0 1 1 -35 UF | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 UF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Total Ram Ram 13 13 CHI-SQUAR RAM 11 CHI-SQUAR FOR 3 TE: 11 CHI-SQUAR FOR 3 TE: RAM RAM FOR 3 TE: RAM RAM RAM RAM FOR 3 TE: RAM RAM RAM RAM RAM | 27 14 19 19 19 11 11 11 11 11 11 |
| IN TOTAL 10 MIN Frace | 0 4 RUTES AFTI 0 0 0 2 0 2 0 2 0 2 0 2 0 2 0 2 0 0 2 0 | 0 14 ER TES 5 MF 0 7 0 7 | T PERIOD B Rais 0 1 1 2 5 Rais O 1 1 2 5 Rais O O O O O O O O O O O O O | -10 LIF 0 0 2 2 4 4 -10 LIF 1 0 3 1 5 5 -10 | Ross 1 0 1 0 2 Ross 0 0 0 0 0 1 | 0-15 UF 1 0 1 0 2 0-15 UF 0 0 0 1 0-15 | 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 2 8 5-20 WF 1 0 0 1 5-20 | 2 21 Rass 2 21 Rass 2 21 Rass 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | 2 ters) 0-25 WF 0 1 1 2 0-25 WF 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 1 0 1 | 25 Rau 0 0 0 0 0 0 0 0 0 0 1 | 1 -30 MF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 30 Rass 1 2 1 0 4 30 Rass 0 0 | 0 0 0 1 1 1 0 3 0-35 WF 0 0 0 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 40 UF 0 0 0 40 | Total Ram Ram 13 13 CHI-SQUAR FOR 3 TE: Ram 15 11 CHI-SQUAR FOR 3 TE: Ram 15 11 CHI-SQUAR FOR 3 TE: 11 CHI-SQUAR FOR 3 TE: 11 CHI-SQUAR FOR 3 TE: 11 CHI-SQUAR FOR 3 TE: 11 CHI-SQUAR FOR 3 TE: 11 CHI-SQUAR FOR 3 TE: 11 CHI-SQUAR FOR 3 TE: 11 CHI-SQUAR FOR 3 TE: 11 CHI-SQUAR FOR 3 TE: 11 CHI-SQUAR FOR 3 TE: 11 CHI-SQUAR FOR 3 TE: TE: TE: TE: TE: TE: TE: TE: | 27 14 12 19 19 19 11 12 19 17 18 19 19 19 19 19 19 19 19 19 |

Table D45. Indien Point hammer test monitoring using 6#12 degree horizontal transducer located at unit 3, intake 35.

| 10 HIN | WIES BEF | DRE TE | ST PERIOD | 1 | | | | | RANGE (MO | ters> | | | | | | | | |
|--|--|---|---|---|---|--|--|---|--|---|---|---|---|---|---|--|---|--|
| | 0- | 5 | g- | 10 | 1 | 0-15 | 1 | 15-20 | 2 | 0-25 | . 2 | 5-30 | | 0-35 | 3 | S-40 | Total | |
| race. upe | Rass | HF | Rass | MF | Rau | WF | Rau | MF | Rest | HF | Rau | WF | Rass | MF | Rau | HF | : Rau | WF |
| s | Q | 0 | 0 | 0 | 1 | 1 | Q | 0 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | · 5 | 4 |
| L | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | • | 0 | 0 | 0 | ,0 | . 0 | • | 0 | 0 | | 0 |
| c . | 0 | 0 | 0 | 0 | '0 | 0 | 2 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | 2 | 1 | | 5 |
| H | 0 | 0 | Ó | . 0 | _0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | . 0 | o | . 0 | 0 |
| otal | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 2 | . 3 | 3 | 3 | 2 | 0 | 0 | 2 | 1 | 11 | 9 |
| 10 HIN | NTES DUR | ING TE | ST PERIOD | · } | | | | | R AMB E Cno | ters> | | | | | | | • | |
| race | 0- | S . | 5- | 10 | 1 | 0-15 | 1 | 15-20 | 2 | 10-25 | . 2 | 5-30 | . 30 | 0-35 | | 5-40 | Yotal | |
| up+ | Rau | WF" | Rau | HF | Rass | HF | Rau | WF | Rass | WF | Rau | WF | Rau | MF | Rau | HF | 3 Raw | WF |
| .5 | 0 | 0 | . 0 | 0 | 2 | 2 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 4 | 4 |
| L | ø | 0 | 1 | 2 | .0 | 0 | • | 0 | 0 | 0 | 0 - | 0 | 0 | • | o ' | a | 1 | 2 |
| _ | 1 | _ | ۵ | 0 | ٥ | 0 | 1 | 1 | 0 | 0 | 0 | . 0 | 0 | 0 | o | 0 | . 2 | 5 |
| نام | | 4 | • | | _ | _ | _ | | | | | | | | | _ | - | |
| | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | o |
| M otal | - | | 0 | - | _ | 9 | 1 | 1 | 1 | 1 | 1 | . 1 | 0 | 0 | <u>o</u> | - | | 0 11 |
| M otal 10 HIN | 0 1 NITES AFT | O 4 ER TES | 0 1 T PERIOD | <u> </u> | 2 | 2 0-15 | 1 | 1 | 1 RANGE CHA | 1 | 1 | | . 0 | | 0 | 0 | -: | 11 |
| otal 10 MIN Pace | 0 1 NITES AFT | 0 4 ER TES | O 1 T PERIOD S- | 2 | 2 | 3 | 1 | 1 | 1 RANGE CHA | 1 oters> | 1 | . 1 | . 0 | • | 0 | 0 | Total | 11 |
| ntal 10 MIN Trace upe | O 1 O Rou | O 4 ER TES 5 UF | O 1 T PERIOD S- Ress | 2 | 2 Rate | 2 0-15 UF | Ray | 1 | 1 RANGE (ma | 1 (ters) | 1 | 5-30 | . 3 | 0-35 | | 0 0 5-40 | | 11 |
| nd ntal 10 MIN Tace upe | O 1 1 O O O O O | 0 4 ER TES | O 1 T PERIOD S-Ross O 0 | 0 2 | Q 2 2 Resu | 2 00-15 WF | Ray O | 1 15-20 18F | RANGE Code Rau 0 | 1 (0-25 UF | 1 Rau | 5-30 MF | G Rau | 0-35 WF | O Rau | 0 0 8-40 WF | Total | 11 |
| nd atal 10 HIN Trace upe 5 | D 1 1 O-1 Row O O O 1 | O 4 ER TES | O 1 T PERIOD S- Ross O 0 2 | 10 HF 0 | Q 2 2 S S S S S S S S S S S S S S S S S | 2 0-15 0 0 | Rest O O | 1 15-20 16 0 | RANGE CHE RANGE CHE RANGE O O | 1 20-25 MF . 0 | 2 Raw 0 0 0 | 5-30 MF | 0 Rau 0 0 | 0 0-35 UF 0 | G 3 Ram 0 D 0 | 0 0 8-40 WF 0 | Total | 11 MF 0 0 |
| nd nin | D 1 1 O O O O O O O O O O O O O O O O O | O 4 ER TES B O 0 4 | O 1 T PERSON S- Resu O O 2 | 0 2 10 10 10 0 4 | 7 Rass 0 0 2 0 | 2 0-15 UF 0 0 2 | Rau O O | 1 15-20 18F 0 0 | RAMOS Code Radia 0 0 0 | 1 20-25 4F 0 0 | 2 Rau 0 0 0 0 0 | 5-30 UF 0 0 | 0 Rau 0 0 | 0 0-35 WF 0 0 | Ram O O | 0 0 8-40 UF 0 0 | Total | 11 MF 0 0 |
| otal 10 MIN race upe S L C Bi otal | D 1 1 O O O O O 1 O O O O O O O O O O O | O 4 ER TES S O 0 | O 1 T PERIOD S- Ross O 0 2 | 10 HF 0 | Q 2 2 S S S S S S S S S S S S S S S S S | 2 0-15 0 0 | Rest O O | 1 15-20 16 0 | RANGE CHE RANGE CHE RANGE O O | 1 20-25 MF . 0 | 2 Raw 0 0 0 | 5-30 UF 0 | 0 Rau 0 0 | 0 0-35 UF 0 | G 3 Ram 0 D 0 | 0 0 8-40 WF 0 | Total Rau C C C C C C C C C C C C C C C C C C | 11 MF 0 0 11 |
| Trace Type S S C B C C C C C C C C C C C | D 1 1 O O O O O 1 O O O O O O O O O O O | O 4 ER TES | 0 1 T PERIOD S- Resu 0 0 2 | 0 2 10 10 10 0 4 | 7 Rand 0 0 2 0 2 | 2 0-15 UF 0 0 2 | Rasu O O | 1 15-20 18F 0 0 | RAMSE Code Rant O O O | 1 20-25 4F 0 0 | 2 Raw 0 0 0 0 0 | 5-30 UF 0 0 | 0 Rass 0 0 1 | 0 0-35 WF 0 0 | 8 RAM 0 0 0 0 0 | 0 0 8-40 UF 0 0 | Fotal | 0 0 11 0 11 te F-HF |
| Trace Type S S S S S S S S S S S S S S S S S S S | Rem O | O 4 C C C C C C C C C C C C C C C C C C | O 1 T PERIOD S- Rate O 0 2 0 2 5- Rate | 0 2 10 MF | 0 2 0 2 1 Rank | 0-15 WF 0 2 0 | Rass O O O Rass | 1 15-20 MF 0 0 0 | RAMSE Code Rant O O O | 0 0 0 | 2 Rass | 5-30 UF 0 0 | Ress Ress O O I | 0 0 1 0 - 35 UF | Rem G O O O O Rem S Rem | 0 0 UF 0 0 0 | Total Rau Rau O O CHI-Seuni FOR 3 TES | 0 0 11 0 11 te F-HF |
| otal rece upe S L C S HI — SQUA — HAT | D 1 1 C C C C C C C C C C C C C C C C C | O 4 O 4 S LBF O 0 | O 1 T PERIOD S-Resu O 0 2 0 2 5-Resu O 0 | 0 2 10 WF 0 4 10 WF 0 1 | 0 2 0 2 1 Rand 1 0 | 2 00-15 0 0 2 0 2 | Rass | 1 15-20 167 0 0 0 | RAMGE CHE RAMI O O O Rami 1 O | 1 (cers) (co-25 (cers) | 2 Rass 0 0 0 0 2 Rass 1 0 0 | 5-30 UF 0 0 0 0 0 5-30 | Ration O | 0 - 35 - WF 0 - 35 - WF 0 0 | Ram Q Q Q Q Q | 0 0 UF 0 0 0 0 5-40 | Fotal Rau CHI-Scumf FOR 3 TES Rau Rau Rau CHI-Scumf FOR 3 TES | 0 0 11 0 11 E F-HART PERI |
| H otal 10 MIN race upe 5 L C H HI-SQUA HAT S L C | D 1 INTES AFTI O O O O O O O O O O O O O O O O O O O | 0 4 ER TES | O 1 T PERIOD S-Rau O 0 2 0 2 5-Rau O 0 | 0 2 10 WF 0 1 1 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 | 0 2 2 0 2 1 Rand 1 0 1 0 0 1 0 0 | 0-15 0 0 2 0 2 0-15 | Rasu O O O O Rasu O O | 1 15-20 MF 0 0 0 0 15-20 | RANGE Code Rant O O O Rant 1 O O O O O O O O O O O O | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 Raw 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 5-30 UF 0 0 0 0 5-30 | 0 Si Rati O C C C C C C C C C C C C C C C C C C | 0 - 3% - UF - 0 - 3% - UF - 0 - 3% - UF - 0 - 3% - UF - 0 - 3% - UF - 0 - 3% - UF - 0 - 3% - | 0 Ran 0 0 0 0 | 0 0 WF 0 0 0 0 | Total Raw CHI -Saund FOR 3 TES | 11 0 0 11 0 11 EF-H67 PER1 |
| M otal 10 MIN race upe S L C H otal HI-SQUA -HAT S L C H C H HI-SQUA | RE O- | 0 4 5 WF 0 0 3 0 3 0 3 | PERIOD S-Ross O O 2 O 2 C Ross O 1 1 | 0 2 10 WF 0 1 1 0 2 | 7 Raw 0 0 2 0 2 1 1 0 1 0 2 2 | 0-15 0 0 2 0-2 0-15 | Rasu O O O O O O O | 1 1 15-20 HF 0 0 0 0 0 15-20 HF 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 1 0 0 1 0 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 | 2 Rass 0 0 0 0 0 2 Rass 0 0 1 | 0 ters> 20-25 WF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 Raw 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 5-30 UF 0 0 0 0 5-30 UF 1 | 0 Si Rass 0 0 1 0 1 Si Rass 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 - 35 ur 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rani | 0 0 UF 0 0 0 0 5-40 | Total Rau CHI - SQUAR FOR 3 TES Rau Rau Rau Rau Rau Rau Rau Ra | 11 0 0 11 0 11 15 F-H/ 17 PER! |
| otal race upe S L C HI — SQUA — HAT S L C HT — SQUA | RAM O O I O I O I O I O I O I O I O I O I | 0 4 5 WF 0 0 3 0 3 0 3 | PERIOD S-Ross O O 2 O 2 C Ross O 1 1 | 0 2 10 WF 0 1 1 1 0 2 2 10 | 7 Raw 0 0 2 0 2 1 1 0 1 0 2 2 | 0-15 0 0 2 0-2 0-15 | Rasu O O O O O O O | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 2 Rass 0 0 0 0 0 2 Rass 0 0 1 | 1 00-25 WF 0 0 0 0 00-25 WF 1 0 0 0 | 2 Raw 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 5-30 MF 0 0 0 0 5-30 MF 1 | 0 Si Rass 0 0 1 0 1 Si Rass 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 - 35 - ur 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rani | 0 0 UF 0 0 0 0 5-40 | Total Rau CHI-SQUAR FOR 3 TES | O O IIII O III O III O III O III O III O III O III O III O III O III O I |
| Trace Tr | RE O- | 0 4 5 WF 0 0 3 0 3 0 3 | PERIOD S-Ross O O 2 O 2 C Ross O 1 1 | 0 2 10 WF 0 1 1 0 2 | 7 Rans G G G 2 G G G G G G G G G G G G G G G | 2 0 2 0 2 0-15 HF 1 0 1 0 2 | Rasu O O O O O O O | 1 1 15-20 HF 0 0 0 0 0 15-20 HF 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 1 0 0 1 0 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 | RAMSE Code Rams O O O C Rams 1 1 2 Rams A Rams | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 Raw 0 0 0 2 Raw 1 0 0 0 1 2 Raw Raw Raw 1 | 5-30 WF 0 0 0 0 5-30 WF | 0 Si Rass 0 0 1 0 1 Si Rass 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 - 35 ur 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rani | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Total Rau CHI-SQUAR ROY CHI-SQUAR FOR 3 TES | O O II O II O II O O II O II O II O O II O I |
| Frace Fupe S SL NC BL Fotal CHI — SQUA F—HAT S SL CHI — SQUA ANLUES | Ram O O I O O I O O O O O O O O O O O O O | 0 4 5 WF 0 0 3 0 3 0 3 | 0 1 T PERIOD S- Rau 0 0 2 0 2 5- Rau 1 0 0 1 | 0 2 10 WF 0 1 1 0 2 2 10 WF | Rand 1 1 0 2 1 1 Rand 2 0 0 0 2 1 1 0 2 1 1 0 2 1 1 0 2 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 1 1 | 0-15 0 0 2 0-2 0-15 | Rasu O O O O O I | 1 15-20 MF 0 0 0 1 1 15-20 MF | RAMSE Code Rams O O O C Rams 1 1 2 Rams A Rams | 1 00-25 WF 0 0 0 0 00-25 WF 1 0 0 0 | 2 Raw 0 0 0 2 Raw 1 0 0 0 1 2 Raw Raw Raw 1 | 5-30 MF 0 0 0 0 5-30 MF 1 | 31 Rass 0 1 0 1 21 Rass 0 0 0 1 Rass 0 0 0 0 Rass | 0 - 3% - WF - 0 | Ram 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 UF 0 0 0 0 5-40 UF | Total Rau 1 0 1 0 1 6 CHI - Seuri FOR 3 TES 2 84 3 1 0 5 5 0 CHI - Seuri FOR 3 TES 1 Rau 1 4.667 1 | UF O O 11 O 11 E F-HF 7 O 10 10 10 11 11 11 11 11 11 11 11 11 11 |

Table D46. Indian Point hammer test monitoring using 6w12 degree horizontal transducer located at unit 3, intake 35.

| 18677 N Novemb | | | | | 16845755 | | | | | ent Typ | | | | : 011 | Test Time |) ; 20024 <i>2</i> 1 | 0335 | |
|--|--|--|--|------------------------------------|-------------------------------------|---|------------------------------------|---|--|---|---|--|--|--|---|--|--|--|
| TO HIMUT | | | | | | | | | RANGE CHO | | | | | | | | | |
| race | 0-! | 5 | 5 | -10 | | 10-15 | | 15-20 | 2 | 0-25 | 2 | 5-30 | 30 | 3-35 | 3! | 5-40 | Tota | 1 |
| ribe Leca | Rau I | NF. | Rau | HF | Rau | ИF | Rau | ИF | Ran | HF | Rau | WF | Rau | uf | Rau | WF | Rau | WF |
| S | 0 | 0 | 0 | ٥ | 3 | 4 | 9 | ٥ | 5 | 4 | 18 | 11 | Б | 3 | 2 | 1 | 42 | 31 |
| L | 0 | 0 | .0 | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | O | . 0 | 0 | 0 | 0 | • | .0 |
| IC . | 0 | 0 | 2 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 5 | 6 |
| #J | 0 | 0 | 0 | O | 0 | 0 | 0 | 0 | 0 | O | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| otel | 0 | 0 | 2 | 4 | 4 | 5 | 9 | | 5 | 4 | 20 | 12 | 5 | 3 | | 1 | 47 | 37 |
| 10 NIMUT | ES DUR | ING TE | EST PERIO | 0 | | < | - | | RANGE (no | ters> | | | | | | | ٠ | |
| · | 0-! | 5 | | -10 | | 10-15 | : | 15-20 | 2 | 0-25 | 2 | 5-30 | 30 | D-35 | 39 | 5-40 | Tota | 1 |
| race Type | Rau I | WF | Rau | NF | Rau | WF | Rau | HF | Rau | HF | Rau | WF | Rau | MF | Rau | HF | : Rau | MF |
| .5 | . 0 | 0 | 3 | 6 | 3 | 4 | ; 6 | 5 | 0 | 6 | 12 | 7 | 3 | 2 | S | 2 | 40 | 32 |
| iL. | 0 | 0 | 0 | 0 - | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | • | O | • . • | 0 | | 0 |
| ic . | P | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | | 4 | 2 | 0 | 0 | G | ٥ | • | 4 |
| | O | _ | _ | _ | _ | 0 | 0 | 0 | 0 | Ō | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| P4 | | 0 | 0 | 0 | 0 | | | | | | | | | | | | | |
| AI Total 10 HINUT | 0 | o | 3 57 PERIOD | 6 | 3 | 4 | , | 6 | 9 | 7 | 16 | 9 | 3 | 2 | 5 | . 2 | 1 46 | 36 |
| otal 10 HINUT | 0 | O ER TES | 5 PERIOD | 6 | 3 | | 7 | - | RAMBE CHA | | | 5-30 | _ | 2 3-35 | - | 2 5-40 | i 46 | |
| otal 10 MINUT | ES AFTI | O ER TES | 5 PERIOD | 6 | 3 | 4 | 7 | 6 15-20 | RAMBE CHA | ters> | | | _ | | - | | - | |
| otal 10 MIMUT race upo | ES AFTI | O ER TES | 5 PERIOD | 6 | 3 | 4 | 7 | 6 15-20 | RANGE (ne | ters> | 2 | 5-30 | :: | 0-35 | 3: | 5-40 | Tota | 1 |
| otal 10 MINUT Trace Upo | S AFTI | O ER TES | ST PERIOD | -10 IMP | Rau | 4 10-15 | Rest | 15-20 NF | RANGE CHE | ters> 0-25 UF | 2 Rau | 5-30 HF | Sam. | 0-35 UF | Rau | 5-40 UF | Tota ! Rau | 1 UF |
| otal 10 MINUT Trace upp .S | G G-I | O ER TES | FERIOD S | -10 WF | Rau | 4 10-15 18F | Rent 7 | 15-20 NF | RANGE CHE 2 Rais | ters> 0-25 NF | 2 Reu 13 | 5-30 HF | 3: Reи 4 | 0-35 WF | Rau | 5-40 HF | Tota | 1 UF 34 |
| otel 10 HINUT Tace Upe S R. | C | O ER TES | T PERIOD | -10 WF 2 | Rew 7 | 4 10-15 14F | Rast 7 | 15-20 NF 6 | RANGE CHE 2 Rau 4 | ters> G-25 WF 3 | 29 Reu 13 0 | 5-30 WF 8 | З: Raм 4 0 | 0-35 WF 2 0 | Rau 3 0 | 5-40 MF | Tota Rau 40 | 1 UF 34 |
| fotel 10 HINUT Frace Upe S RL IC | C C C C C C C C C C C C C C C C C C C | ER TES | S PERIOD S Raw 1 0 3 | -10 ur 2 0 | 7 0 2 | 4 10-15 167 0 | Rest 7 0 | 15-20 NF 6 0 | RANGE CHE 2 Ran 4 0 | ters> 0-25 HF 3 0 | 29 Rau 13 0 | 5-30 MF 8 0 | 33 Reм 4 0 | 0-35 MF 2 0 | 31 Rass 3 0 | 5-40 WF 1 0 | Tota 1 Rau 1 40 | 1 HF 34 0 |
| Total | CHES REFTI | 0 0 ER TES | 3 Raw 1 0 3 0 4 | -10 MF 2 0 6 0 | 7 0 2 0 | 4 10-15 18F 0 2 0 10 | Rass 7 0 0 0 7 | % S-20 | RAMBE Cree 2 Rate 4 0 0 | 0-25 HF 3 0 0 | 22 Rau 13 0 1 0 | 5-30 MF 8 0 1 0 | 3: Rem 4 0 0 | 2 0 0 | 3: Rau 3 0 0 | 5-40 MF 1 0 0 | Tota Rau 40 3 0 6 6 6 6 6 6 6 6 6 | 1 UF 34 0 9 0 43 RE F-H ST PER |
| Trace Type .5 RL IC MI Total CHI-SQUARE THE | ES AFTI O-1 Ram i 0 0 1 Ram o-1 | 0 ER TES 5 4 0 0 | 3 Raw 1 0 3 0 4 | -10 MF 2 0 6 | 7 0 2 0 | 10-15 lar 0 2 | Rass 7 0 0 0 7 | 6 US-20 NF 6 0 0 0 6 | RAMBE Cree 2 Rate 4 0 0 | ters> 0-25 HF 3 0 0 | 22 Rau 13 0 1 0 | 5-30 WF 0 1 | 3: Rem 4 0 0 | 0-35 MF 2 0 0 | 3: Rau 3 0 0 | 5-40 WF 1 0 | Tota Rau 40 0 0 0 1 45 1 1 1 1 1 1 1 1 1 1 1 1 1 | 1 UF 34 0 9 0 43 RE F-H |
| race upe S R IC INITIAL OTAL HI-SQUARE | ES AFTI O-1 Ram i 0 0 Ram o-1 0 0 | 0 0 ER TES | ST PERIOD Raw 1 0 3 0 4 | -10 MF 2 0 6 0 9 | 7 0 2 0 9 | 10-15 10-15 0 2 0 10 10-15 | Rest 7 0 0 7 | 45-20 MF 6 0 0 15-20 MF 0 | RANGE Cree Rain 4 0 0 4 Rain Rain 0 0 | 0-25 0-25 0 0 0 0 | 2 Rau 13 0 1 0 14 2 Rau 14 0 2 | 5-30 MF 0 1 0 9 5-30 | Ram 4 0 0 0 4 20 Ram 4 0 0 0 0 | 3-35 MF 2 0 0 0 2 0-36 | 31 Rass 3 0 0 0 5 31 Rass 5 0 | 5-40 MF 1 0 0 1 5-40 MF | Tota Rau 40 6 6 7 7 8 8 10 10 10 10 10 10 10 10 | 1 34 0 9 0 43 8E F-H ST PER |
| race upe S R IC IN Otal HI-SQUARE | CONTRACTOR | 0 ER TES | ST PERIOD Ress 1 0 4 Ress 1 0 Ress 1 0 | -10 MF 2 0 6 -10 | 7 0 2 0 9 | 10-15 MF 0 2 0 10 10-15 | Rest T O O T | 15-20 MF 6 0 0 6 | RAMBE CIVE 2 Ram 4 0 0 0 4 2 Ram 6 0 0 | 0 0 3 0-25 UF 4 0 | 2 Reu 13 0 1 14 2 Reu 14 0 | 5-30 MF 0 1 0 9 | 31 Rem 4 0 0 0 4 | 0-35 MF 2 0 0 0 2 | 31 Rate 3 0 0 0 0 3 | 5-40 MF 0 0 1 5-40 | Tota Raw Raw 1 Raw 1 40 1 0 1 6 1 0 1 46 1 Tota 1 40 1 0 1 45 | 1 UF 34 0 9 0 43 RE F-HST PER US |
| otel 10 HINUT Trace Upe S R. IC IN Otel HI-SQUARE IC IC IN IC I | CONTRACTOR OF THE CONTRACTOR O | 0 0 6 MF 4 0 0 0 4 1 0 0 0 1 1 0 0 0 1 | ST PERIOD Raw 1 0 3 0 4 | -10 MF 2 0 6 -10 | Reu 7 0 2 0 9 | 10-15 10-15 0 2 0 10 10-15 | Rest 7 0 0 7 | 15-20 MF 6 0 0 6 15-20 MF 6 | RANGE Cree Rain 4 0 0 Rain C Rain C C C C C C C C C C C C C | 0 0 3 0 0 25 UF 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 Rau 13 0 1 0 14 2 Rau 2 0 0 17 | 5-30 MF 0 1 0 9 5-30 MF 9 0 | Rah 4 0 0 0 4 20 Rah 4 0 0 0 0 4 | 0-35 0 0 0 2 0-35 MF | 31 Rau 3 0 0 0 0 31 Rau 3 0 0 0 | 5-40 MF 0 0 1 5-40 MF 1 0 0 | Tota Rau Rau 1 40 1 0 1 6 1 0 1 46 1 46 1 46 1 46 1 46 1 46 | 1 |
| Total 10 MINUT Frace Fupe S R NC NN Total HI-SQUARE THE T SIL RC RC RC RC RC RC RC RC RC R | Ram i | O O O O O O O O O O O O O O O O O O O | ST PERIOD Remo 1 0 4 Remo 1 0 7 Remo 1 0 1 Remo 1 R | -10 MF 2 0 6 -10 MF 5 0 6 -10 MF | Rau 7 0 2 0 9 9 Rau 4 0 1 0 5 | 10-15 WF 0 2 0 10 10-15 WF 5 10 10-15 | Rest T O O T Rest T O O Rest | 15-20 MF 0 0 0 15-20 WF 5 0 0 | RAMBE CIVE RAM 4 0 0 4 2 Ram 6 0 0 6 Ram 2 Ram 6 Ram 6 Ram 2 Ram | 0 0 3 0 0 25 UF 4 0 0 0 5 0 0 5 UF 4 0 0 0 5 UF 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 Raw 14 2 Raw 14 0 2 C C C C C C C C C C C C C C C C C C | 5-30 MF 0 1 0 5-30 MF 9 0 10 10 | 31 Rah 4 0 0 0 4 28 Rah 4 0 0 0 4 | 0-35 MF 2 0 0 2 0-38 MF 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 31 Rate 3 0 0 0 3 3 3 8 Rate 8 1 Rate 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 5-40 MF 0 0 1 6-40 MF 1 0 0 1 5-40 UF | Tota Raw Raw 1 Raw 2 00 3 00 46 EHE - SQUA 2 40 2 00 3 12 40 40 40 50R 3 TE | UF 34 G 9 G 43 RE F-H ST PER ST PER UF ST PER UF |
| otel 10 MIMUT Trace Upe S R. IC IM Otel HI-SQUARE HI-SQUARE HI-SQUARE HI-SQUARE | B | 0 ER TES | 3 Ram 1 0 2 0 3 Ram 1 0 2 0 3 8 Ram 1 0 2 0 3 8 Ram 6.000 | -10 MF 5.353 | Rest 7 0 2 0 9 | 10-15 MF 0 2 0 10 10-15 MF 5 10 10-15 | Rans 7 0 0 7 7 7 8 7 7 0 0 0 1.714 | 15-20 MF 6 0 0 6 15-20 MF 0 0 7 15-20 UF 1.633 | RAMBE Cree 2 Ram 4 0 0 0 4 2 Ram 6 0 0 0 Ram 0.5500 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 Raw 14 2 Raw 14 2 2 0 17 2 Raw 2.500 | 5-30 MF 0 1 0 5-30 MF 9 0 10 5-20 MF 0,000 | 8aM 4 0 0 0 4 2 2 0 0 0 4 2 2 0 0 0 0 0 0 0 | 0-35 MF 2 0 0 2 0-36 MF 2 0 0 8 | 31 Rate 3 0 0 0 3 3 3 8 Rate 8 1 Rate 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 5-40 MF 0 0 1 5-40 MF 2 0 0 0 1 5-40 | Tota Raw Raw Raw O O O CHE-SQUA CHE-SQUA CHE-SQUA Raw AG CHE-SQUA CHE-SQU | UF 34 G G G G G G G G G G G G G G G G G G G |
| otal 10 HINUT PACO UPO E L C MI Otal HI-SQUARE -HNT S L C HI-SQUARE RIUES | 0-1 Ram 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | O O O O O O O O O O O O O O O O O O O | 3 Ram 1 0 2 0 3 Ram 1 0 2 0 3 8 Ram 1 0 2 0 3 8 Ram 6.000 | -10 MF 2 0 6 -10 MF 5 0 6 -10 MF | Rau 7 0 2 0 9 9 Rau 4 0 1 0 5 | 10-15 WF 0 2 0 10 10-15 WF 5 10 10-15 | Rest 7 0 0 7 7 Rest 7 0 0 7 | 15-20 MF 6 0 0 6 15-20 MF 6 0 0 15-20 15-20 | RANGE CIGA 2 Raid 0 0 0 0 6 2 Raid 0.500 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 Rest 14 2 2 0 17 2 Rest 2 500 3 500 | 5-30 MF 0 1 0 5-30 MF 9 0 10 10 | 30 Ram 4 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 | 0-35 MF 2 0 0 2 0-38 MF 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 30 0 0 0 3 7 8 8 8 9 0 0 0 3 7 8 8 8 8 8 8 8 8 9 8 9 9 9 9 9 9 9 9 9 | 5-40 MF 0 0 1 5-40 MF 1 0 0 1 | Tota 1 Raw 2 40 3 0 3 0 46 EHE -SQUA FOR 3 TE Raw 40 2 6 10 2 6 10 2 7 8 46 EHE -SQUA 10 2 10 2 10 3 10 3 10 4 10 4 10 5 10 6 10 6 10 7 10 8 | UF 34 G G G G G G G G G G G G G G G G G G |

Table 847. Indian Point hammer test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

| | NUTES DU | | | | | | | | 9652426 | ment Ty | | | | | Test Ti | | | |
|----------------|----------|------------|----------|-------|-------|-------|-------|-------|----------|---------|-------|-------|-------|-------|---------|--------------|----------|---------|
| | | | | | | | | 1 | RANGE (H | eters) | - | | | | | | •,• | |
| race | 0 | -5 | | 5-10 | | 10-15 | | 15-20 | | 20-25 | 2 | S-30 | | 30-35 | | 35-40 | Tota | |
| up+ | Rau | HF | Rass | NF. | Rau | uf. | Rau | LAF _ | Rass | HF | Rau | uf · | Rau | NF | Rau | uf | Raw | |
| S | 0 | 0 | 4 | ` • | 5 | 6 | 3 | 8 | 2 | 2 | 16 | 10 | 0 | • | 3 | 1 | 39 | 35 |
| L | 0 | . • | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | . 0 | 0 | . 0 | 0 |
| C | • | 0 | 0 | 0 | 2 | 2 | 0, | 0 | 2 | 2 | 0 | 0 | . 1 | . 1 | 0 | 0 | 5 | 5 |
| M | 1 | 4 | 0 | | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | , 0 | 0 | 0 | 0 | | 1 | 4 |
| otal | 1 | 4 . | 4 | 8 | 7 | 9 | 9 | 6 | | 4 | 16 | 10 | 1 | 1 | 3 | 1 | 3 45 | 44 |
| 10 M | HUTES OF | TER TE | ST PERIO | 0 | , | | | | RANGE (H | eters> | | | • | | | • | | 4 |
| | 0 | -5 | | 5-10 | | 10-15 | ! | 15-20 | | 20-25 | 2 | 15-30 | | 30-35 | : | 35-40 | · Tota | 1 |
| race upe | Reu | WF | Rass | MF | Ress | MF | Rau | HF | Ran | UF | Rau | WF | Reu | WF | Rau | HF | : Rau | WF |
| <u> </u> | 1 | 4 | 3 | 6 | 6 | 7 | S | 5 | . 8 | 6 | 9 | 5 | 4 | 2 | 3 | 1 | 39 | 36 |
| L. | 0 | 0 | 0 | 0 | 0 | 0 | ,0 | 0 | 0 | 0 | . 0 | Ð | 0 | 0 | . 0 | . 0 | | 0 |
| c | 0 | 0 | 1 | 2 | 1 | 1 | 1 | 1 | 2. | 2 | 2 | 1 | 0 | 0 | 0 | 0 | ; 7 | 7 |
| 5-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | | 0 | . 0 | 0 | 0 | 0 | | 0 |
| ctal | 1 | 4 | 4 | • | 7 | • | 6 | 6 | 10 | 8 | - 11 | 6 | 4 | 2 | 3 | 1 | : 46 | 43 |
| HI-SQL —HAT | | -5 | | 5-10 | | 10 15 | | 15-20 | | 20-25 | a | 5-30 | | 30-35 | | : 35-40 | CHI~SQUA | |
| | Rau | LIF . | Rau | | Rau | LIF | Rau | UF | Rass | MF | · Pau | WF | Rau | | Rau | LIF. | t Rau | LIF. |
| 5 · | 1 | 2 | 74 | 7 | 6 | 7 | 7 | 7 | 5 | | 15 | Ę. | 2 | | 3 | - 1 | 39 | 36 |
| Č H | ŏ | ŏ | 1 | ĭ | 2 | ž | 1 | ĭ | ž | ž | . 1 | ì | 1 | i | 8 | . 8 | | ē |
| DTAL. | i | 4 | 4 | 8 | ř | 6 | ě | ř | 7 | ě | 14 | ĕ | š | 2 | š | 1 | 46 | 44 |
| HI-SON | | - s | | 5-10 | | 10-15 | | 15-20 | | 20-25 | | 25-30 | | 30~35 | , | 35~40 | CHI SQUA | es Hell |
| | Rau | uf . | Rau | | Rau | LIF. | Ray | uf | Ray | | Ráu | WF | Rau | | Rass | | FOR 2 TE | |
| 55 L, | | 4.000 | 0. 145 | 0.286 | 0.091 | 0.077 | 1.145 | 0.692 | 3.600 | 2.000 | | 1.667 | 4.000 | 2.000 | 0.000 | 0.000 | | 0.014 |
| | | | 1.000 | 2.000 | 0.333 | 0.333 | 1.000 | 1.000 | 0.000 | 0.000 | 2.000 | 1.000 | 1.000 | 1.000 | | | | 9.333 |
| N OTAL | | 4.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.600 | 0.286 | 2.571 | 1.333 | 0.926 | 1.000 | 1-900 | 0.333 | 0.000 | 0.000 | | 4.000 |

Table D40. Indian Point hammer test monitoring using 6x12 degree horizontal transducer located at unit 3, intake 35.

| 10 HINU | TES OUR | ING T | EST PERI | OD . | | | | | RANGE (H | eters) | | | | | | | F.• | |
|--------------------|----------|----------|----------|-------|--------------|-------------|-------|------------|----------|-------------|--------------|-------------|-------|-------------|-------|-------------|----------------------|----------------|
| | 0- | 5 | | 5-10 | | 10~15 | . 1 | 15-20 | | 20-25 | 4 | 25-30 | 3 | 10-35 | 3 | 35~40 | Tota | 11 |
| race upe | Rau | µF. | Rau | WF | Rani | UF | Reu | WF | Rau | | Rau | WF | Rau | HF | Rau | uF | : Rau | HF |
| 5 | 0 | 0 | \$ | 9 | 3 | 4 | 7 | 6 | 16 | 12 | 23 | 14 | 7 | 4 | 2 | 1 | 63 | 50 |
| L . | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | • | | 0 | 0 | . 0 | 0 | . 0 | 0 | 0 | | 0 |
| C | . 0 | .0 | . 0 | 0 | 2 | 2 | 3 | 3 | 1 | 1 | > | 2 | . • | 0 | 0 | Đ | • | 9 |
| 4 | 0 | 0 | 1 | 2 | 0 | 0 | • | 0 | | | . 0 | 0 | . 0 | 0 | 0 | : O | 1 | 2 |
| otal | 0 | 0 | 6 | 11 | 5 | 6 | 10 | 9 | 17 | 13 | 26 | 16 | 7 | 4 | 2 | 1 | 73 | 60 |
| TO HITHE | TES AFI | ER TE | ST PERIO | o · | | | | | RANGE (n | eters) | • | | | | | | * | • |
| | 0- | 5 | | 5-10 | | 10-15 | 1 | 15-20 | | 20-25 | | 25-30 | | IO-35 | 3 | 95-40 | Tota | 1 |
| race Spe | Rau | HF | Rau | 14F | Rau | lif . | Rass | UF | Rau | MF | Rau | HF | Rau | UF | Rau | LOF | i Rau | ИF |
| s . | • | 0 | 4 | | 10 | 12 | . 11 | 10 | 15 | 11 | 12 | 7 | 7 | 4 | 10 | S | 69 | 67 |
| L . | 0 | • | 0 | ė | 0 | 0 | 0 | • | 0 | 0 | 0 | 0 | 0 | × 0 | | | . 0 | 0 |
| C - | 0 | 0 | 1 | 2 | 1. | 1 | . 1 | . 1 | 1 | 1 | . 0 | 0 | 0 | 0 | . 0 | 0 | 4 | 5 |
| d . | o | • | 0 | 0 | 0 | • 0 | • • | a | 0 | . 0 | , • 0 | 0 | ٥ | 0 | o | 0 | 0. | 0 |
| tal | 0 | 0 | 5 | 10 | 11 | 13 | 12 | 11 | . 16 | 12 | 12 | 7 | 7 | . 4 | 10 | 5 | 73 | 62 |
| LI —SQUAR -HAT | .€ G- | . | | S-10 | | 10-15 | | 15-20 | | 20-25 | | 25-30 | 3 | 10-35 | 3 | 35-40 | CHI-SOUF FOR 2 TE | ARE F-H |
| | Rau | MF | Ras | LAF | Rau | MF | Reu | MF | Rau | | Rau | HF | Raw | MF | Raw | WF | : Rau | WF |
| S | -0 | 8 | ě | 9 | | å | 9 | ě | , 1e | 12 0 | 19 | 11 | 6 | . . | 0 | 3 | : 65 : 0 | 54 0 |
| ı | 0 | Ò | 1 | 1 | 20 | 2 | 2 | 2 | .0 | Š | . 2 | . 0 | . 0 | 8 | 0 | 9 | : [| Ţ |
| TAL, | _ 0 | . • | | 11 | 8 | 10 | 11 | 10 | 17 | 13 | 19 | , 12 | r | | • | 3 | : 73 | 61 |
| IX —SQUAR ILUES | . | 5 | | 5-10 | , | 10-15 | 1 | 15-20 | | 20-25 | | 25-30. | : | 10-35 | | 95-40 | CHI-SQUE | |
| | Rass | MF | 0.111 | 0.059 | Res 3.769 | UF 4.000 | 0.889 | ₩ 1.000 | 0-032 | UF 0.043 | Rau 3.457 | 4F 2.333 | 0.000 | UF 0.000 | 5.333 | UF 2.667 | R44 0.273 | 4.458 |
| | == | | 1.000 | 2.000 | 0.333 | 0.333 | 1.000 | 1,000 | 0.000 | 0.000 | 3.000 | 2.000 | | | | | 1.923 | 0.692 |
| 4 | | | 1.000 | 2.000 | 2.250 | 2.579 | 0.182 | 0.200 | 0-030 | 0.040 | 5.150 | 3.522 | 0.000 | 0.000 | 5.333 | 2.667 | 1 1.000 | 2.000 4.033 |

Table 049. Indian Point hammer test monitoring using 6x12 degree horizontal transducer located at unit 3, intake 35.

CHI-SQUARE - 3.841

| | | | | del Ph | 10 | hrs be | • | | Duration Treatm | ont Tue | |) sec (| her 1,24 on, 30 se | c off | Test Dat Test Tim | | 2/19/88 0435 | |
|-----------------------------|------------|----------------------|-----------|---------------|-------|-------------------|-------|----------------|--------------------|-------------|------------|-------------|-----------------------|-------------|----------------------|-------|----------------------|----------------|
| | | | ST PERIO | | | | | | RANGE (no | | | | | | | | • | |
| | 0- | · S | 5. | -10 | 10 |)-15 | L | 5~20 | 2 | 0~25 | | 5-30 | 3: | 0-35 | 3 | 5-40 | Tota | 1 |
| upe Tace | Rau | WF | Rau | MF | Rau | WF | Rati | WF | Rass | UF | Ram | NF | Rau | MF | Rau | KF | Rau | HF |
| S | 1 | 4 | 4 | 8 | 4 | 5 | 5 | 5 | 10 | 8 | 5 | 3 | 6 | 3 | 6 | 3 | - 41 | 39 |
| L. | 1 | 4 | 0 | 0 | · • | 0 | 0 | 0 | 0 | o | 0 | 0 | 0 | 0 | o - | 0 | 1 | 4 |
| Ċ | 2 | . 7 | 1 | 2 | 1 | 1 | 2 | 2 | \$ | . 1 | . 0 | 0 | • | 1 | 1 | 0 | 9 | ,14 |
| М | 0 | 0 | 0 | . 0 | ø | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | Ö | 0 | 0 | 0 | | 0 |
| otel | 4 | 15 | 5 | 10 | 5 | 6 | 7 | 7 | 11 | 9 | . 5 | 3 | 7 | . 4 | 7 | 3 | 5 5 1 | 57 |
| 10 HI | MUTES AFT | ER TES | ST PERIOD | | · | | | | RRNGE (100 | tors) | | | | | | | | |
| - | 0- | -S | 5 | -10 | 10 |) - 15 | | 5-20 | , | 0-25 | . 29 | 6-30 | . 3 | 0-35 | 3 | 5-40 | Tota | 1 |
| race Lace | Raw | LOF | Rau | MF | Rau | HF | · Rau | LUF | Rasi | uf . | Ray | WF | Rau | ИF | Rau | WF | E Ran | UF |
| <u> </u> | 0 | 0 | 5 | • | 5 | 6 | | 7 | 3 | 2 | 2 | 1 | 3 | 2 | > | 1 | 29 | 20 |
| ┺. | 0 | • | o ' | 0 | 0. | • | . 0 | 0 | • | • | ٥ | 0 | ٥ | 0 | ·o | . 0 | 0 | 0 |
| iC: | 2 | 7 | 2 | 4 | 0 | 0 | 0 | 0 | 3 | 2 | ю. | 0 | Đ | 0 | 0 | 0 | 7 | 13 |
| N4 | 0 | | 0 | 0 | 1 | 1 | Ö | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | . 1 | 1 |
| otal | 2 | 7 | 7 | 13 | 6 | P | . 0 | 7 | 6 | . 4 | 2 | 1 | > | 2 | 3 | . 1 | : 37 | 42 |
| HI –SQU - HAT | IARE 0- | -5 | 5- | -10 | . 10 |)~ 15 | 1 | 5~20 | 2 | 0~25 | 2 : | 5~30 | _ | 0-35 | 3 | 5-40 | CHE-SQUA FOR 2 TE | |
| | Rau | HF | Rau | HF | Rau | MF | Rau | WF | Rau | WF | Rau | ИF | Rau | HF | Rau | UF | Rau | UF |
| S L C | 1 | 2 | 5 0 | Ž | ·5 | ò | é | ò | 6 | 5 | 4 | 2 | Ş | 9 | 5 | ş | 35 | 34 2 14 |
| C M OTRL | Š | , í | Š. | 3 0 12 | 1 | <u> </u> | ġ | ģ | 2 0 9 | 2 0 7 | 0 | 0 2 | ģ | ġ | o d | 9 | 1 1 | 50 |
| HI -SQU FILUES | | - 5 | 5 | -10 | 10 |)-15 | 1 | 5-20 | 2 | 0-25 | 2! | 5-30 | | 0-35 | | S~40 | CHT-SQUE | |
| s L C | 1.000 | UF 1.000 1.000 | | . NF 0.059 | | UF 0-091 | | 0.333 2.000 | | 9.500 | 1.296 | UF 1.000 | 1.000 | UF 0.200 | Rau | 1.000 | 1.000 | 1.806 4.000 |
| N OTAL | | 2.909 | | 0.591 | 1.000 | 1.000 | | 0.000 | 1.471 | 1.923 | | 1.000 | | 0.667 | | 1.000 | : 1.000 | 1.000 |

Table DSO. Indian Point hammer test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

| | NES RES | ORE TES | ST PERIOD | | | | | | ERHGE (no | ters> | | | | | | | | |
|---|-------------------------------|-------------|-------------------------------------|----------|-----------------------|------------------|------------------|----------|-----------|------------|------------------|-------------|-------|------------------|--------|---------|--------------|----------------------|
| | 0- | 5 | 5-1 | 0 | 10 | 0-15 | 1 | 5-20 | 2 | 0-25 | 25 | -30 | 30 | -35 | 35 | -40 | Total | |
| upe Upe | Rau | HF | Rau H | F | Rau | WF | Rau | WF | Rass | WF | Rau | UF | Reu | NF | Rass | NF | s Resi | ИF |
| s | 0 | 0 | 0 | 0 | 1 | 1 | . 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | · · · · | 4 |
| L | 0 | 0 | 1 | 2 | 0 | . 0 | • | . 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | ٥ | 1 | 2 |
| Ċ . | 1 . | 4 | D | Đ | 1 | 1 | 0 | • | 0 | 0 | 1 | 1 | Ð | D | . 0 | 0 | | 6 |
| H | 1 | 4 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | o | 0 | 1 | 4 |
| otel | 2 | | 1 | 2 | 2 | 2 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | . 9 | 16 |
| 10 HIN | ITES DUR | ING TES | ST PERIOD | | | | _ | | | | • | | | | | | | |
| | 0- | _ | | | | | | | MINGE CHO | | | | | | | | . | |
| race | | | 5-1 | <u>_</u> | | D- 15 | | 5-20 | | 0-25 | | -30 uf | | -35 | | -40 | Total | |
| up+ S | Rau | | Rau M | <u> </u> | Rau | | Rau | | Reu | HF 0 | Rau 1 | 1 | Reu | uf o | Rew | ¥F 0 | : Rau : | WF |
| L | • | • | • | 0 | 1 | • | 6 | a | a | | | â | a . | | 9 | | | 0 |
| c | · | 4 | 1 | 2 | 0 | | 0 | 0 | . ο | 0 | 1 | 1 | 0 | | 0 | 0 | | 7 |
| u | . • | 0 | â | • | O. | 9 | 1 | 1 | 1 | 1 | | • | 0 | 0 | 0 | 0 | | 2 |
| otal | 1 | | | | | | <u>-</u> | <u>-</u> | <u>-</u> | <u>i</u> - | | | | | | | · į | |
| race | 0- | 5 | 5-1 | 0 | 10 | D-15 | . 1 | 5~20 | 2 | 0-25 | 25 | -30_ | 30 | -35 | 35 | 40 | Total | |
| ype | Rau | WF . | Rass H | F | Rase | UF | Ress | WF | Ray | uF . | Rau | MF | Rau | MF | Ran | HF | s Reu | HF |
| S | 0 | 0 | 0 | 0 | 1 | 1 | . 1 | 1 | 0 | . 0 | 1 | 1 | 0 | 0 | ٥ | 0 | 3 | 3 |
| L | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 |
| Ċ | 1 | 4 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | | 7 |
| H | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 |
| | 1 | 4 | 1 | 2 | 1 | 2 | 2 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | : , . | 10 |
| otal | | S | 5-1 | 0 | 1 | 0-15 | 1 | 5-20 | 2 | 0-25 | 25 | -30 | 30 | -35 | 35 | -40 | CHI-SQUAR | |
| otal HI-SQUAR -HAT | 0- | | | | | | Rau | ME | Rau | HF. | Rau | HF 1 | Rase | MF | Rau | UF D | : Rau | MĘ |
| HI —SQUAR —HAT | Rau | HF | Rese | HF | Rese | HF | 1 | 1 | | | | | | ŏ | ŏ | . ŏ | i | ī |
| HI – SQUAR –HAT S | 0- | NF 0 | Rass | | 1 | 0 | 1 | 0 | 0 | ŏ | ę. | o 1 | 0 | | | | ; ; | Ť |
| HI —SQUAR —HAT | Rau O | Õ | Q · | 0 | 1 | 1 | 1 | | | _ | 0 1 0 1 | 1 0 1 | 9 9 9 | 900 | 00 | 000 | | 7 2 12 |
| HI — SQUAR — HAT S L C U | 0- Rau 0 0 1 | 0041 | 0 | 1 0 2 | 0 0 1 | 0 | 0 0 0 | 0 1 | 0 0 0 | 0 | 0 | 1 0 | 0 | Ö | 0 0 | 8 | : 3 | 12 |
| HI — SQUAR — HAT S L C G H OTAL HI — SQUAR RLUES | Raw 0 0 1 0 1 | 0041 | 0 0 1 0 1 | 0 2 | 10000 | 0 0 | 1 0 0 0 1 | č | 2 | 0-25 | 25 | -30 | 30 | 0 0 0 0 | 35 | -40 | CHI-SQUAR | 12 E VAL T PER |
| HI — SQUAR — HAT S L C M OTAL HI — SQUAR | 0- Rau 0 0 1 0 | 5 | 0 0 1 0 1 5-1 Ran | 1 0 2 | 1 0 0 0 1 | 0 0 0 1 | 1 0 0 1 | 5-20 | 0 0 0 | 0 | 25 Rau | 0 | 0 | 0 | 0 0 | 0 | CHI-SQUAR | 1Ž E VAL |

Table D51. Indian Point hanner test monitoring using 6x12 degree horizontal transducer located at unit 3, intake 35.

| 10 mI | NUTES DUS | ING T | ST PERIO | | 0×0*0×7** | | | | RANGE (me | | | | | | | | | 1222 |
|-------------------|-----------|---------|-----------|---------|------------|---------|-------|-------|---------------|--------------|------|---------|--------|---------|-----|------|------------------------|---------------|
| | · o- | 5 | 5- | -10 | . 1 | 0-15 | . 1 | 5~20 | 2 | 0−2 5 | | 5-30 | > | 0-35 | 3: | 5-40 | Total | 1 |
| UP4 | Rau | WF | Rau | HF | Ray | KF | Rau | WF | Rau | NF | Rau | WF | Rau | WF | Rau | UF | : Rau | HF |
| <u>s</u> | 0 | 0 | 0 | O | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | | 0 | 0 | _i | 2 |
| . . | 0 | 0 | 0 | ٥ | 0 | ٥ | 0 | Ö | 0 | 0 | 0 | 0 | 0 | a | 0 | 0 | | 0 |
| C | 2 | 7 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | . • | 0 | 0 | 0 | • | 9 |
| M | 0 | . 0 | o ' | 0 | . 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| otal | 2 | 7 | . 0 | 0 | 3 | 3 | 1 | 1 | 1 | 1 | 0 | 0 | | 0 | 0 | Ô | 7 | 12 |
| 10 MI | NUTES AFT | ER TES | ST PERIOD | | | | | , | RANGE (ne | tors> | | | - | | | | | |
| | 0- | 5 | 5- | -10 | 1. | 0- 15 | 1 | 5~20 | 2 | 0-25 | 2: | 5-30 | 3 | 0-35 | 3 | 5-40 | Total | 1 |
| up o | Rau | HF | Reu | WF | Ran | NF | Rass | WF | Rau | UF . | Rass | ИF | Rau | WF | Rau | WF | : Rau | WF |
| \$ | 0 | 0 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | - <u>;</u> | 4 |
| L, | 0 | 0 | 0 | 0 | · o | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o | ٥ | · o | | 0 |
| c | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o | 0 | 0 | 0 | 0 | 1 | 4 |
| M | . 0 | 0 | 1 | 2 | 0 | 0 | 0 | , 0 | • | a | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| otal | 1 | 4 | 2 | 4 | 1 | 1 | 0 | 0 | . 0 | 0 | 0 | o | 1 | 1 | 0 | 0 | 5 | 10 |
| HI —50U HAT | ARE 0- | 5 | 5- | - 10 | 1 | D-15 | 1 | 5-20 | 2 | 0-25 | 29 | 5-30 | · J | 0-35 | 3: | 5-40 | CHÍ-SQUAI FOR 2 TES | |
| s | Rau | WF O | Raw | UF 1 | Rasi | HF 1 | Rati | HF | Reur | 16F | Rau | NF O | Rau | MF 1 | Rau | MF | Rau | HF 5 |
| S L C | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0. 0 | 0 | 0 | . 0 | 8 | 8 | 8 | : 0 | · 0 |
| U OTAL | 2 | 6 | 1 | 1 2 | 1 2 | 2 | 0 | 0 | 0 | 0 1 | 0 | 0 | 0 1 | 0 | 0 | 0 | : : | 11 |
| II-SQU | ARE 0- | | - | -10 | • | D 15 | • | 5-20 | • | n_ e | - | S-30 | _ | 0~35 | - | 5-40 | CHI-SQUA | ~= 4104 1 |
| | Rau | HF | Rau | WF | Rau | HF | Rass | WF | Rau | 0-25 HF | Raw | WF | Rau | UF | Rau | WF | FOR 2 TES | ST PERI MF |
| | == | | 1.000 | 2.000 | | 0.000 | | | | 1.000 | | == | 1.000 | 1.000 | == | | 1 | 0.667 |
| S L IC M | 0.333 (| -910 | 1.000 2 | 2.000 | 1.000 | 1.000 | 1,000 | 1.000 | : | | | | | | | | | 1.923 |

Table D52. Indian Point hammer test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

| | • | | | idal Pi | | i hr aft high tid | • | | Duration Treatm | ent Tuc | e: 1 | LO sec | hurs 1,20 on, 40 sec | : off | Test Dat | e: | 2/19/08 1315 | |
|------------------------------|-----------|------|----------|----------------|-------------------------|----------------------|----------|-------------|--------------------|----------|-------|---------|-------------------------|--------------|----------|-----------|--|---|
| 10 HI | NUTES DUR | | | | | #4256A2 - | | - | RANGE G | | | | | | | | ###################################### | |
| | 0- | 5 | 5 | -10 | | 10-15 | | 15-20 | 2 | 0-25 | | 25-30 | 30 | -35 | 3 | 5-40 | Tota | 1 |
| race Upe | | | Rau | WF | Res | | | | | WF | | WF | Rasi | HF | Rau | WF | I Reu | WF |
| .s | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| iL. | ٥ | 0 | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| ie . | 1 | 4 | 1 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | . 0 | 0 | 0 | 0 | 5 | 9 |
| 414 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | Ò | _i | 2 |
| otal | 1 | 4 | 1 | 2 | 3 | > | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 8 | 12 |
| 10 HI | NUTES RFT | | | | | | | | RAMBE (no | - | | 25-30 | - |)~3 5 | | S-40 | Tota | |
| race upe | O~ | uf | Rau | -10 WF | Rau | 10-15 UF | Rau | 15-20 HF | Rau | 0~25 | Rass | uF | Ray | JAF | Rau | | : Rau | |
| . <u>=</u> .s | 0 | 0 | 1 | 2 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | . 0 | - 5 | 6 |
| SL. | 0 | • | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | • | • | 0 | 0 | 0 | . • | . 0 | 0 |
| IC | 0 | 0 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2. | > |
| M | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | 0_ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| otal | D. | 0 | 2 | 4 | 1 | 1 | > | 3 | 0 | 0 | 0 | o | 1 | 1 | 0 | 0 | i 7 | 9 |
| HI —SQU F—HAT | ARE 0- | 5 | 5 | i-10 | | 10-15 | | 15-20 | 2 | 0-25 | | 25-30 | 30 |)-3 5 | 3 | 5-40 | CHI-SQUA | |
| • | Rau | HF | Rau | MF | Rass | HF | Rau 2 | WF 2 | Rau | HF O | Rau | HF O | Res | MF | Rau | WF | RAN | HF |
| .s il ec | ŏ | ŏ | Ģ | Ö 2 | 0 | Ŏ | ō | õ | ŏ | ě | ŏ | ŏ | ŏ | ē | Ŏ | Ö | | ě |
| IŬ OTRL | ġ | ğ | <u> </u> | 9 | 1 2 | 1 2 | 0 | ŏ | ě | ě | 0 | Õ | 1 1 | 1 | Ö | ŏ | 1 1 | 11 |
| HI-SUM | ARE O- | 5 | - | -10 | | 10-15 | | 15-20 | 2 | 0-25 | 2 | 25-30 | 30 |)~35 | 3 | 5~40 | CHI -SQUA | RE VAL |
| S SL HC HH FOTAL | 1.000 4 | .000 | 1.000 | 2.000 0.000 | 0.333 1.000 1.000 | | 1.000 | 1.000 | Rest | MF | 1.000 | 1.000 | 1.000 | .000 | Rane | WF | 1.286 | ST PER: UF 3.571 1.000 2.000 4.429 |

Table 053. Indian Point hanner test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| 10 M | | | EST PERI | | | | | | RANGE (m | | | | | | ******** | | | |
|------------------|----------------|-------------------------|-----------|---------|----------------|----------------|-------------------------|-------------------------------|-------------------------|--------|--------|----------------|-------------------------|-------------------|----------|----------------|-------------------------------|---|
| | | 0-5 | ν, 9 | 5-10 | | 10-15 | | 15-20 | | 20~25 | . 2 | 25-30 | , | 30-35 | 3 | 35-40 | Tota | 1 |
| race upe | Rai | uF | Rase | uf . | Rau | HF | Rau | ШF | | . HF | Rau | UF | Rau | MF | Rau | WF | i Rau | |
| s . | 1 | 4 | 2 | 4 | 0 | 0 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | : 6 | 11 |
| L, | 0 | 0 | 0 | 0 | 0 | ø | 0. | • | 0 | 0 | 0 | 0 | 1 | 1 | 0 | o | 1 | 1 |
| C | . 1 | 4 | . 0 | 0 | 2 | 2 | 1 | 1 | . 0 | 0 | . 1 | 1 | . 1 | 1 | 0 | • | | 9 |
| M | . 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | : 0 | 0 |
| otal | 2 | 8 | 2 | 4 | 2 | 2 | > | 3 | 1 | . 1 | 1 | 1 | · 2 | 2 | 0 | 0 | 13 | 21 |
| 10 M | MUTES (| | ST PERIO | | | | | ı | RAMBE CH | eters) | | | | | | | | |
| race | | 0-5 | ! | 5-10 | | 10-15 | | 15-20 | | 20-25 | 2 | 5-30 | | 90-35 | - 3 | 5-40 | Tota | 1 |
| up+ | Rai | HF | Ray | HF | Rass | HF. | Rau | UF | Rass | uF_ | Rau | UF. | Reu | uf | Rau | uf | E Rau | HF |
| .5 | 0 | . 0 | 0 | 0 | a | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | · • | 0 | 1 | 1 |
| L, | . 0 | 0 | 0 | . 0 | 0 | • | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Û | 0 | : ``D | 1 | 1 |
| iC | . 0 | 0 | 0 | 0 | , o | 0 | 1 | 1 | 0 | 0 | 2 | 1 | 1 | 1 | 0 | • | • 4 | 3 |
| H | . 0 | | . 0 | 0 | 0 | . 0 | <u> </u> | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 1 |
| otal | 0 | 0 | 0 | 0 | . 0 | 0 | > | 3 | 1 | . 1 | 2 | 1 | ` 1 | \$, | 0. | . 0 | i 7 | 6 |
| HI 501 HAT | UARE | 0-5 | | 5-10 | . <u>~</u> | 10-15 | | 15-20 | | 20-25 | 2 | 5-30 | | 30-3S | | 5-40 | CHI~SQUA FOR 2 TE | |
| . s | Rat | HF 2 | Rase | HF 2 | RaH | HF O | Ran | HF 2 | Rau | MF | Rau | WF | Rau | WF | Rau | MF D | Ray | HE |
| C | ō | Ò | ě | ē | ŏ | ŏ | į | Ī | ě | ē | Ŏ 2 | ŏ | Ĭ | Ĭ | Ŏ | ŏ | 1 1 | i |
| OFAL | . 0 | Ô | ŏ | 0 2 | ė, | ē 1 | Š | Š | i | 1 | 2 | ĝ | ė 2 | ě | ě | ě | 1 10 | 14 |
| HI-SQI RLUES | UARE | 0-5 | • | 5-10 | | 10-15 | - | 15-20 | ; | 20-25 | 2 | 15- 3 0 | | 30~3 5 | ; | 15~ 4 0 | CHI -SQUA | RE VAL |
| S L C W | 1.000 1.000 | 4.000 4.000 9.000 | 2.000 | 4.000 | 2.000 2.000 | 2.000 2.000 | 0.333 1.000 0.000 | UF 0.333 1.000 0.000 | 1.000 1.000 0.000 | 1.000 | | 0.000 | 1.000 0.000 0.333 | 1.000 0.000 | Rau | WF | : 0.000 : 0.400 : 1.000 | ST PER MF 4.333 4.000 3.000 1.000 4.333 |

Table 854. Indian Point hanner test monitoring using 6xi2 degree horizontal transducer located at unit 3, intake 35.

| otal |
|-----------------------|
| tal |
| |
| MF |
| 10 |
| 0 |
| 2 4 |
| 0 |
| 14 |
| |
| |
|) tal |
| MF |
| |
| |
| 2 5 |
| 1 |
| 14 |
| PURRE F-H TEST PER |
| HE |
| 7 |
| 1 1 |
| 14 |
| RUARE VAL |
| 4 UF |
| 4.000 |
| 0 6.111 |
| 2 |

Table 855. Indian Point hammer test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| TO WIN | UTES DUR | HO TES | | | | : | | | RAMOE (N | | | | | | 767627744 | | ·-· | |
|-------------------|------------|----------|-----------|---------|------|-------|--------|----------|----------|-------------|----------|-----------------|-------|-------|-----------|----------|-------------------------------|----------------------|
| | 0 ! | | _ | -10 | | 0-15 | | 15-20 | | 20-25 | | 5-30 | | 0-35 | | 5-40 | Total | |
| Tace Upe | | 4F | Rau | MF. | Rau | WF | Rau | | Rau | | Rau | 9-30 MF | Ray | ME | Rau | uf | | HF |
| s | 0 | 0 | 0 | 0 | . 0 | 0 | 1 | 1 | 0 | 0 | | - - | 1 | · | | | - 2 | 2 |
| L. | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | . 0 | 0. | . 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 |
| C: | 0 | 0 | 0 | 0 | ٥ | . 0 | 0 | | 0 | 0 | 0 | 0 | . 0 | 0 | . 0 | 0 | . 0 | o |
| H | . 0 | o | . 0 | 0 | 0 | 0 | ó | 0 | | . 0 | 0 | 0 | . 0 | 0 | . 0 | 0 | : 0 | 0 |
| otal | 0 | a | 0 | 0 | o | 0 | 1 | 1 | 0 | ø | 0 | 0 | 1 | 1 | . 0 | o | :2 | 3 |
| | NTES AFTI | -a · | 050100 | | | | | - | | | • | | | | | | | |
| LU MAN | MIES MEII | LK IESI | PERIOD | | 4 | | | . 1 | RANGE (m | ters> | | | | | | | | |
| race | 0~! | <u>.</u> | 5- | -10 | 1 | 0-15 | | 15-20 | | 20-25 | 2 | 5-30_ | | 0-35 | 3 | 35-40 | Total | 1 |
| 104 | Rau I | uf . | Rau | MF | Rau | HF | Rau | HF . | Rau | WF | Rew | NF | Rau | HF | Rau | NF | 1 Re4 | μF |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 1 | 1 | 2 | 1 | . 1 | 0 | 4 | 2 |
| L | 0 | 0, | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | . 0 | 0 | 0 | . 0 | 1 | 1 |
| C: | 1, | 4 | ø | 0 | ٥ | . 0 | đ | . 0 | 0 | 0 | 0 | 0 | . 0 | O | • | • | 1 | 4 |
| <u> </u> | 0 | 0 | 0 | 0 | 0. | 0 | | <u> </u> | 0 | . 0 | <u> </u> | 0_ | 0 | 0 | 0 | <u> </u> | 0 | 0 |
| otal | 1 | 4 | 0 | o | 0 | ٥. | . 0 | 0 | 1 | _ 1 | · 1 | 1 | 2 | . 1 | 1 | 0 | i 6 | 7 |
| HI -SQUR -HAT | RE 0-1 | S | 5- | -10 | . 1 | 0-15 | | 15-20 | | RO-25 | 2 | 5~30 | 3 | 10-35 | 3 | 35-40 | CHI-SQUAR | RE F-HA ST PERK |
| | Rau | MF. | Rase | HF 0 | Rau | HF | Rau | MF | Rass | ИF | Rau | HF | Rau | HF | Rau | HF | Ray | UF |
| 55 L. C | Ŏ | 0 2 | ě | ŏ | ŏ | ě | ģ | ; ô | 1 | . 1 | . ô | ó | ŏ | ė | ó | Š | 1 1 | į |
| CITAL | Õ | 2 | ŏ | Ö | ŏ | ŏ | Ŏ 1 | Ŏ 1 | 0 | - 0 1 | Q 1 | · 0 | 2 | Ŏ | 0 | ŏ | . 0 | õ |
| HI-SQUR HILUES | RE 0-1 | 5 | <u>s-</u> | -10 | 1 | 0-15 | | 15-20 | | 20-25 | 2 | S-30 | | io-35 | 3 | 5-40 | CHI-SQUAR | RE VALU |
| 5 . | Raw | MF | Rau | MF | Rass | HF | 1.000 | 1.000 | 1.000 | UF 1.000 | | 1.000 | 0.333 | 0.000 | 1.000 | MF | : Rau : 0.667 6 : 1.000 | uf 1.000 1.000 |
| Č. | 1.000 _4 | .000 | ~~ | | | | | | | | | | | | | | : | 4.000 2.778 |

Table D56. Indian Point hanner test monitoring using 6x12 degree horizontal transducer located at unit 3, intake 35.

CHI-SQUARE - 5.991

| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | | _ | ST PERIOD | | | | | (| RANGE (me | ters) | | | | | | | | |
|--|----------|--|---|--|---|---|--|---|-----------|-------|--|-------------|------|------|-----|-----|---|---------|
| PO Read MF READ MF READ MF READ MF READ MF READ MF READ MF READ MF READ MF REA | 0- | 5 | 5- | 10 | 10 |) - 15 | 15 | -20 | | | | | | | | | Total | L |
| 0 0 0 0 2 2 1 1 1 1 1 1 1 1 1 0 0 6 6 0 0 0 0 0 0 0 | | uf | Resi | HF . | Rau | HF. | Rau | MF | | | | | | | | | Į Rau | NF |
| S 11 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | | 0 | 0 | 0 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 0 | | 6 | 6 |
| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 | 0 | 0 | 0 | 0 | Q | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0. | 0 | 0 | . 0 | 0 |
| RANDE CONSTRUCT TEST PERIOD RANDE CONSTRUCT TO TO TO TO TO TO TO TO TO TO TO TO TO | 3 | 11 | . • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ~ 3 | 11 |
| ## NIMUTES DURING TEST PERIOD ## PAGE MF Rate MF Rate MF Rate MF Rate MF RATE | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | a | 0 | Q . | 0 | 0 | 0 | 0 | 0 | n |
| RANGE (reters) 0-5 | 3 | 11 | 0 | 0 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | • | ; ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | 17 |
| Rest MF Rest M | ITES DUR | ING TE | ST PERIOD | 1 | | | | | RANGE CHI | ters> | • | | | | | | | . ' |
| Result HF REsult HF REsult | 0- | 5 | 5- | 10 | - 10 | 0-15 | 19 | -20 | 2 | 20-25 | 25 | -3 0 | ٠, ع | 0-35 | 35 | -40 | Tota | 1 |
| 1 4 0 0 0 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 | Rau | WF | Rass | HF | Ř ase | WF | Raid | NF | Rase | NF | Rass | 4F | Rau | WF. | Rau | HF | Rau | uf . |
| 1 | 1 | 4 | 0 | 0 | ı | | 0 | | 1 | 1 | 1 | 1 | 1 | 1 | 0 | . 0 | 5 | 6 |
| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 | 0 | . 0 | 0 | 1 | 1 | 1 | 1 | à | 0 | • | Q | 0 | 0 | 0 | . 0 | 2 | ′ 2 |
| ### PAIN PRINCE CHAPTER TEST PERIOD RANGE CHAPTER THAT THE TEST PERIOD RANGE CHAPTER THAT THE TEST PERIOD RANGE CHAPTER THAT THE TEST PERIOD RANGE CHAPTER THAT THE TEST PERIOD RANGE CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST PERIOD RANGE CHAPTER CHAPTER THAT THE TEST THAT THE TEST THAT THE TEST THAT THE TEST THAT THE TEST THAT THE TEST THAT THE TEST THAT THE TEST THAT THE TEST THAT THE TEST THAT THE TEST THAT THE TEST THAT THE TEST THAT THE TEST THAT THE TEST THAT THE TEST THAT THE TEST TH | 1 | 4 | | G | 0 | 0 | 1 | 1 | 0 | 0 | 0 | a | 0 | 0 | 0 | 0 | 2 | 5 |
| ## P HIMITES AFTER TEST PERIOD O-S | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | | 0 | 0 |
| RANGE CHOTOS'S 0-S 5-10 10-15 15-20 20-25 25-30 30-35 35-40 Total 10-6 Raw HF RAW HF | 2 | | 0 | 0 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 9 | 15 |
| PP Raw MF RAW MF | | | | . 10 | 10 | n- 15. | 10 | | | | 29 | (-%n | 5 | 0-35 | | | Tota | |
| E D D Z 4 D D 1 1 2 2 1 1 0 0 0 0 1 6 8 L D D D 1 2 D D D D D D D D D D D D D D D | * | | | *** | | | | | | | | | | | | | **** | |
| L 0 0 1 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | | | | | | | | | | | | 1 | | 0 | | 0 | 6 | 8 |
| L 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 | D | 0 | _ | 2 | 0 | 0 | _ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | a | ø | 1 | 2 |
| ## SQUARE Raw WF | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 2 | 1 | 0 | 0 | 0 | o | : 3 | 5 |
| # - SQUARE +- HAT 0-5 5-10 10-15 15-20 20-25 25-50 30-35 35-40 FOR 3 YEST PER RAM LIF RAM L | 0 | 0 | 0 | . 0 | 1 | 1 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| THAT 0-5 5-10 10-15 15-20 20-25 25-30 30-35 35-40 FOR 3 TEST PER Raw WF | 1 | 4 | ` | | 1 | 1 | 1 | 1 | 2 | 2 | | 2 | 0 | 0 | 0 | 0 | 11 | 16 |
| E | ₹E .0- | -5 | 5- | -10 | 10 | 0-15 | 19 | 5-20 | | 20-25 | 25 | 3~50 | | 0-35 | 25 | | CHI-SQUA | RE F-HE |
| TAL 2 8 1 2 2 2 1 1 1 1 2 1 1 1 0 0: 10 16 ##-SQUARE ##UES 0-5 5-10 10-15 15-20 20-25 25-30 30-35 35-40 CHI-SQUARE VAL ##UES 0-5 5-10 10-15 15-20 20-25 25-30 30-35 35-40 CHI-SQUARE VAL | Rau | W | Rau | HF | Rau | | Rau | UF | Rau | HF | RaH | MF | Rau | LOF | | | t Reu | HF 7 |
| TAL 2 8 1 2 2 2 1 1 1 1 2 1 1 1 0 0: 10 16 ##-SQUARE ##UES 0-5 5-10 10-15 15-20 20-25 25-30 30-35 35-40 CHI-SQUARE VAL ##UES 0-5 5-10 10-15 15-20 20-25 25-30 30-35 35-40 CHI-SQUARE VAL | Ö | | | i | | ŏ | | | Õ | | | | | | | | 1 3 | 1 |
| LUES 0-5 5-10 10-15 15-20 20-25 25-30 30-35 35-40 CHI-SQUARE VAL | 0 | Ď | | | Ō | Ó | | Õ | | | 2 | Q | Õ | 0 | | | | |
| | RE 0- | | | | | | | | | | | | | | | | FOR 3 TE | ST PER |
| | | | | .000 | | | - | | | | | | | | | | : 2.000 | 4.000 |
| E L K C | - P | Resu O O S OTES DUR O Rass O Rass O Rass O Rass O Rass Rass O Rass Rass O Rass Rass | Rem MF 0 0 3 11 0 0 3 11 0 0 3 11 0 0 3 11 0 0 1 4 0 0 1 4 0 0 2 6 0 5 Rem MF 0 0 1 4 0 0 1 6 0 6 0 7 0 7 0 8 Rem MF | Rem MF Rem 0 0 0 0 0 0 3 11 0 0 0 0 3 11 0 0 0 0 3 11 0 0 0 0 0 0 0 0 0 0 0 0 1 4 0 0 0 0 1 4 0 | Read MF Read MF 0 0 0 0 0 0 0 0 0 0 0 3 11 0 0 0 0 0 0 0 3 11 0 0 0 0 0 0 TES DURING TEST PERIOD 0 5 5-10 Raid MF Raid MF 1 4 0 0 0 0 0 0 1 4 0 0 0 0 0 0 1 4 0 0 0 5 5-10 Raid MF Raid MF 0 0 1 2 1 4 0 0 0 0 0 0 1 4 0 0 0 8 5-10 Raid MF Raid MF 0 0 0 0 1 4 0 0 0 0 0 0 0 0 0 | Resul MF Resul MF Result 0 0 0 0 0 2 0 0 0 0 0 0 3 11 0 0 0 0 3 11 0 0 0 2 STES DURING TEST PERIOD 0-5 5-10 11 Rass MF Rass MF Rass 1 4 0 0 1 1 4 0 0 0 2 6 0 0 0 2 STES AFTER TEST PERIOD 0-5 5-10 11 Rass MF Rass MF Rass 0 0 0 0 0 1 1 4 0 0 0 1 Rass MF Rass MF Rass 0 0 0 0 0 1 1 4 0 0 0 0 1 4 0 0 0 0 1 4 0 0 0 0 1 4 0 0 0 0 1 4 0 0 0 0 1 4 0 0 0 0 1 4 0 0 0 0 1 4 0 0 0 0 0 1 4 0 0 0 0 0 1 5 5-10 11 Rass MF Rass MF Rass 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 | Resul MF Resul MF Resul MF 0 0 0 0 0 2 2 0 0 0 0 0 0 0 0 3 11 0 0 0 0 0 3 11 0 0 0 2 2 OTES DURING TEST PERIOD 0-5 5-10 10-15 Rate MF Resul MF Resul MF 1 4 0 0 1 1 1 4 0 0 0 1 1 1 4 0 0 0 0 0 2 6 0 0 0 2 2 OTES AFTER TEST PERIOD 0-5 5-10 10-15 Rate MF Resul MF Resul MF 0 0 0 1 2 0 0 1 4 0 0 0 0 0 1 4 0 0 0 0 0 1 4 0 0 0 0 0 1 4 0 0 0 0 0 1 4 0 0 0 0 0 2 6 0 0 0 1 1 1 4 0 0 0 0 0 0 2 7 4 0 0 1 4 0 0 0 0 0 0 2 8 1 1 2 6 0 0 0 1 1 3 8 1 1 2 6 0 0 0 0 1 1 3 8 1 1 2 6 0 0 0 0 0 0 0 2 8 1 1 1 2 6 0 0 0 0 0 0 0 2 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | Read MF Read MF Read MF Read 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | O-S | O-S | Read MF Read M | O-5 | Co-5 | O-5 | O-5 | O-5 | C-E | Color |

Table D57. Indian Point hanner test monitoring using 5m12 degree horizontal transducer located at unit 3, intake 35.

| 10 111 | MU1E2 001 | CT MO 1E | ST PERIOD | ' | | | | 1 | RANGE (na | ters> | | | | | | | | |
|----------------------|-----------|----------------|-----------|----------------|----------|-------|-------|-------|----------------|-------|-------|--------|-----|--------|--------|---------|------------|-------------------------|
| | 0- | -\$ | 5- | 10 | 1 | 10-15 | 1 | 2-50 | 3 | 0-25 | 2 | 5-30 | | 0-35 | . 35 | 5-40 | Tota | 1 |
| Abe | Raw | uF | Rass | ИF | Rau | uf | Raw | HF | Rau | uF | Rass | UF | Rau | HF | Rau | MF | : Rau | WF |
| S | 2 | 7 | 0 | 0 | 2 | 2 | 2 | 2 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 9 | 10 | . 14 |
| L | 9 | 0 | 0 | 0 | 0 | 0 | 0 | q | 0 | 0 | 0 | 0 | 0 | 0 | 0 . | 0 | i o | 0 |
| C | 2 | 7 | 2 | 4 | 0 | 0 | 0 | 0 | 1 | 1 - | 1 | 1 | 0 | 0 | 0 | 0 | į 6 | 13 |
| M | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 2 |
| otal | .4 | 14 | > | 6 | 2 | 2 | 2 | 2 | 5 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 17 | 29 |
| 10 MI | NUTES RET | TER TES | T PERIOD | | | | | | RANGE (m | ters) | | | | | | | | |
| race | 0- | -5 | s. | 10 | | 10-15 | | 5-20 | 2 | 10-25 | 2 | 25-30 | 3 | 0-35 | 3! | 5-40 | Tota | 1 |
| upe | Rau | UF | Ran | HF | Rau | HF | Rau | WF | Rau | NF | Rase | 4F | Rau | uf . | Rau | HF | Ray | MF |
| s | 0 | 0 | 0 | 0 | 1 | 1. | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| L | 0 | , o | 1 | 2 | • | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | . D | 0 | . 0 | 0 | 1 | 2 |
| IC . | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | . 0 | 0 | 1 | 0 | <u>;</u> > | 5 |
| M | 2 | 7 | 3 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 13 |
| otal | 5 | 11 | 4 | 8 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 11 | 23 |
| HI –SQU –HAT | HRE O- | -5 | 5- | 10 | ; | 10-15 | | 5-20 | 4 | 0-25 | a | 5-30 | 3 | 0-35 | | 5-40 | CHI-SQUA | RE F-HRI |
| s · | Rau | lar_ | Rau | UF | Rau 2 | HF | Rau | uf | Rau | WF 2 | Rau | WF. | Rau | WF | Rass | HF 0 | : Reu | uf. |
| i. | ġ. | ē | i | ĭ | ő | ő | 9 | ő | Ž | ő | Ŏ | Ŏ | 0 | ŏ | ğ | õ | 1 | Ĭ |
| H OTRL | 1 | 13 | 24 | . 4 | 9 | 9 | 9 | 0 2 | Š | ģ | 0 | o 1 | 000 | 0 0 | , 1 | 9 | 1 3 | 9 26 |
| HI –SQU ALUES | 0 | ·s | 5- | 10 | | 10-15 | 1 | 5-20 | ٠. | 10-25 | 2 | 25-30 | 3 | 0-35 | 3! | 5-40 | CHI-SQUA | |
| _ | Rass | UF. | Rau | MF | Rau | HF_ | Rau | uf. | Rau | UF | Rau | WF | Rau | WF. | Rau | MF | FOR 2 TE | UF |
| s . L C | | P.000 | 1.000 | . 000 | 0.333 | 0.333 | 0.333 | 0.333 | 4.000 | 3.000 | | | ~~ | | | == | 1 1.000 | 2.000 |
| ic Mar. | | 0.010 7.000 | 1.000 | 1.000 1.000 | D. 222 | == | 0.222 | 0.333 | 0.000 2.667 | 0.000 | 1.000 | 1.000 | | | 1.000 | | 2-667 | 3.556 8.067 0.761 |

Table D58. Indian Point hammer test monitoring using 6mi2 degree horizontal transducer located at unit 3, intake 35.

| | | | ST PERIOD | | | | | 5 | RIMBE CH | ters> | | | | | | | | |
|-----------------|------------|---------------|-------------|-------------|-------|-----------------------|-------------|-------|-------------|-------------|-------|-------|------------|-------------|-------------|---------------|------------|--|
| race | 0- | | 5- | 10 | 10 | -15 | | 5-20 | | 0-25 | 29 | 5-30 | | 0-35 | 35 | ~40 | Total | <u>i</u> |
| yp+ | | uf | Rass | UF. | Rass | HF . | Rau | HF | Rati | HF | Rau | HF . | Řан | MF | Rau | HF | I Rau | HF. |
| S | 0 | o o | 0 | 0 | 0 | 0 | > | 3 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 5 | 5 |
| L . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 |
| C | 4 | 15 | 2 | 4 | > | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | , , | 23 |
| H | 0 | Q | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 |
| otal | 4 | 15 | 2 | 4 | > | 4 | . 3 | > | 1 | 1 | 1 | 1 | 0 · | 0 | 0 | 0 | : 14 | 28 |
| 10 MI | MUTES INFI | TER TES | T PERIOD | | | | • | ı | kange coe | ters) | | | | , | | | | |
| race | 0- | -5 | 5- | 10 | 10 | - 15 | | 5-20 | | 0-25 | 2 | S-30 | > | 0-35 | 35 | -40 | Total | 1 |
| Abe Abe | | HF | Rau | WF | Rau | WF | Rau | HF | Rase | NF | Rau | WF | Rau | UF | Rau | WF | 1 Rani | UF |
| \$ | 0 | 0 | 2 | 4 | > | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 6 | 9 |
| L | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | G | • | 0 | . 0 | 0 | 0 | 0 | 1 | 1 |
| C | 3 | 11 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | . 0 | 5 | 14 |
| NJ | 0 | 0 | 0 | . 0_ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o_ | 0 | 0 | 0 | 0 |
| otal | > | 11 | > | 6 | 5 | 6 | . 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | Ö | 0 | 12 | 24 |
| HI ~SQL ~HAT | | -5 | | 10 | 10 |) – 15 | 1 | 5-20 | 2 | 0-25 | | S-30 | 3 | 0-35 | | i- 4 0 | CHI-SQUAT | ST PERI |
| _ | Rau | HF | Rau | 140 | Rau | HF 2 | Rau | UF | Rau | W | Rau | W | Rau | WF | Rau | HF | t Rau | HE |
| 5 L C | ğ | ŏ | 9 | 2 | 2 | 1 | 5 | 0 | ò | ò | į | ò | ò | ò | Õ | Ô | ; <u>6</u> | 1 |
| LI DTRIL | - 04 | 13 0 13 | 2 0 3 | 3 0 5 | 204 | 9 | 0 0 2 | 0 2 | 0 0 1 | 0 0 1 | 0 | 0 | 0 | 0 | 8 0 0 | 00 | 1 13 | 26 0 19 |
| HI-SOU ALUES | | -5 | | 10 | 10 |) - 15 | | 5-20 | 2 | 0-25 | . 2 | 5-30 | | 0~35 | 39 | -40 | CHI -şaun | RE VALI |
| 5 | Reu | uF 0.615 | 2.000 4 | HF 1.000 | 1.000 | 14F 4.000 1.000 | Rass | 3.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1-000 | MF 1.000 | Reu | WF | 1.000 | ST PER! MF 1.143 1.000 2.189 |
| NA OTRL | | 0.615 | | 400 | | 3.400 | 3.000 | 3.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | | | 1 | 0.308 |

Table D59. Indian Point hammer test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| 10 WIM | UTES BEF | DKE TE | ST PERIC | 10 | | | | 4 | RANGE CHO | ters) | | | | | | | | |
|---|-----------------------|--|--|---|---------------------------|--|---|--|---|--|--|---|---|--|---|--|---|--|
| _ | 0-9 | 5 | 5 | - 10 | | 10-15 | 1 | 5-20 | | V-25 | 25 | 5-30 | 50 |)-3 5 | 35 | -40 | Total | |
| race upe | Rau | HF. | Rau | UF | Rau | HF | Rau | UF | Reu | HF | Rau | WF | Raw | HF | Rau | HF | I Rau | MF |
| s | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | • | 6 | 14 | • | 4 | 2 | 1 | | 31 | 20. |
| L | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C _ | 1 ; | 4 | 1 | 2 | 0 | 0 | Q | 0 | O | 0 | 1 | 1 | 0 | 0 | 0 | 0 | ·~ > | 7 |
| ч | 0 | 0 | 0 | G | . 0 | 0 | 0 | 0 | o | 0 | 0 | 0 | • • | 0 | o | 0 | D | . 0 |
| otal | 1 | 4 | 1 | 2 | 0 | 0 | 4 | 4 | 6 | 6 | 15 | 9 | 4 | 2 | 1 | 0 | i 34 | 27 |
| 10 HIM | UTES DUR | ING TE | ST PERIO | 30 | | | | | RANGE (He | ters) | | | | | | | | |
| | 0-1 | 5 | | 5-10 | | 10-15 | 1 | 15-20 | | 0-25 | 29 | 5-30 | . 30 | D-35 | 35 | -40 | Total | |
| race upe | Rase | uf | Rau | WF | Rass | | Rau | uf | Rau | HF | Rau | HF | Rau | uf. | | WF | | |
| | 0 | 0 | 2 | 4 | 12 | 14 | | 7 | 13 | 10 | 16 | . 11 | 4 | 2 | 4 | 2 | 61 | 50 |
| L | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | . 0 | 0 | . 0 | 0 |
| c | 1 | 4 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | ٥ | 0 | 1 6 | 10 |
| | | | | | | | | | | | | | | | | | • | |
| ч | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Q | 0 | 0 | Ð | 0 | 0 | 0 | : 0 | 0 |
| otel | 1 UTES AFT | 4 | 3 | 6 | 13 | 15 | 9 | • | 0 14 RANGE (me | 11 | 19 | 11 | 5 | <u>0</u> | 4 | 2 | 67 | 60 |
| otel 10 HIN | UTES AFT | ER TES | 5 PERIOD | 6 5-10 | 13 | 15 | 9 | 15-20 | 14 RANGE Coo | 11 (ters) | 18 | 11 | 5 |)-3F | 35 | 2 | Fotal | 60 |
| otel 10 HIN Tace | 1 UTES AFTI Q-1 | 4 ER TES | T PERIOD | 6 5-10 MF | 13 Rate | 15 10-15 UF | 9 Rasu | 15-20 HF | 14 RRHOE (***) Rate | 11 ters) 0-25 NF | 16 21 Rau | 11 | S 31 | 3 7-35 MF | 3s Rau | 2 -40 HF | Total | 60 MF |
| otal 10 NIN Tace Upe | UTES AFT | 4 ER TES | T PERIOD | 6 5-10 WF | 13 Rau | 15 10-15 UF | g Rass | 15-20 UF 2 | RANGE (ree | 11 (ters) (9-25 MF | 28 Rau 12 | 11 6-30 MF | S 31 |)-3E HF | | 2 -40 UF | Fotal | 60 MF 29 |
| otel 10 HIN Tace Upe S | LUTES PAFTS | 4 ER TES | T PERIOD | 6 5-10 MF 6 | Rau Fau | 15 10~15 HF | Rass 2 0 | 15-20 UF 2 | RRHOE Coop Rau S 0 | 11 (ters) (0-25 MF | 21 Rau 12 | 11 5-30 MF 7 | \$ Rau 7 | 3 0-35 MF -4 0 | 38 Rau 1 | 2 -40 MF | Fotal | 60 MF 29 |
| otel 10 HIN Face Upe 5 | Q | ER TES | ST PERIOR Resu 3 1 | 6 6-10 UF 6 2 | Rau 5 | 15 10-15 UF 6 0 | Rass 2 0 2 | 15~20 UF 2 0 | RRINGE Cree 2 Rate 5 0 | 11 (ters) (0-25 MF 4 0 | 21 Reu 12 0 | 11 6-90 MF 7 0 | S 30 Rand 7 O O | 3 0-35 NF 4 0 | 7 | 2 HF 0 0 | Total Raw 35 | 60 MF 29 2 |
| otel 10 MIN Tace Upe S S S S IL | Q | ER TES | ST PERIOR Reso | 6 0 HF 6 2 | Rau 5 0 | 15 10-15 UF 6 0 | 9 Rass 2 0 2 | 15-20 UF 2 0 2 | RANGE Cree Range S 0 3 | 11 (tors) (9-25 MF 4 0 2 | 18 21 Reu 12 0 3 0 | 11 5-30 MF 7 0 2 | \$ 30 Rau 7 0 | 3 0-36 MF -4 0 | 28 Row 1 1 0 0 | 2 HF 0 0 | Total Rau 35 | 50 MF 29 2 |
| otal 10 HIN Face Upe 55 KL KC KU Otal | Rest | ER TES | ST PERIOR Resu 3 1 | 6 6-10 UF 6 2 | Rau 5 | 15 10-15 UF 6 0 | Rass 2 0 2 | 15~20 UF 2 0 | RRINGE Cree 2 Rate 5 0 | 11 (ters) (0-25 MF 4 0 | 21 Reu 12 0 | 11 6-90 MF 7 0 | S 30 Rand 7 O O | 3 0-35 NF 4 0 | 7 | 2 HF 0 0 | Total Raw 35 2 9 1 0 | MF 29 2 7 0 38 |
| otel 10 HIN Face Upe 5 6L 6C 6U Otel CHI-SQUE | Rest | S O O O | ST PERIOD Rew 3 1 0 | 6 0 HF 6 2 0 | Rau 5 0 1 | 15 10-15 UF 6 0 | Rass 2 0 2 | 15-20 UF 2 0 2 | RANGE Come 2 Rang 5 0 3 | 11 (tors) (9-25 MF 4 0 2 | 10 21 Rau 12 0 3 0 | 11 5-30 MF 7 0 2 | 31 Rau 7 0 0 | 3 0-36 MF -4 0 | 35 Rest 1 1 0 0 | 2 HF 0 0 | Total Rau 35 | 29 27 0 |
| otal 10 HIN Take Type 5 14 16 10 Total THAT | Rem S | S O O O | Raw O Raw Raw | 6 5-10 UF 6 2 0 | Rau 5 0 1 | 15 10~15 UF 6 0 1 | Rass 2 0 2 | 15-20 UF 2 0 2 | RAMOE Cree Ramo S O D B Rama | 11 0-25 MF 4 0 2 | 18 21 Reu 12 0 3 0 15 2: Reu | 11 8-30 MF 7 0 2 0 | Rau P O O O | 3 0-35 MF 4 0 | 2 35 Resi | 2 -40 -40 0 0 | Fot al | 29 2 7 0 38 82 F-H |
| race upe s L C HI-SQUE HAT | Rew C | ER TES | ST PERIOD Ress 3 1 0 4 | 6 S-10 WF 6 2 0 0 8 S-10 WF | Raue F O 1 O 6 | 15 10-15 UF 6 0 1 0 7 | Rate 2 0 4 4 Rate S 0 | 15-20 415-20 | RRANGE Cree Range S O D B Range Range P Range S O O O O O O O O O O O O O O O O O O | 11 -ters) -0-25 MF 4 0 2 0 6 | 18 Reu 12 0 3 0 15 2: Rau 15 0 | 11 6-30 MF 7 0 2 0 9 5-30 MF | Rau P O O O P | 3-35 MF 4 0 0 0 4 0-35 | 2 35 Resu 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 -40 -40 0 0 | Total Rau 35 2 9 0 CNI-SOURI | 80 MF 29 2 7 0 38 RE F-M |
| otel 10 HIN Tace Upe S L IC IN Otal HI-SQUA -HAT S IC IC | Rest S | S WF | Raw Raw Raw Raw | 6 S-10 WF 6 2 0 0 8 S-10 WF | Rau 5 0 1 0 6 | 15 10-15 MF 6 0 1 0 7 | 9 Rass 2 0 2 0 4 Rass S | 15-20 MF 2 0 4 15-20 | RANGE Coop Rate S 0 3 0 Rate Rate | 11 10-25 MF 4 0 2 0 6 10-25 MF 7 | 18 Rau 12 0 3 0 15 2: Rau 15 0 1 0 0 | 11 MF 7 0 2 0 9 5-30 WF 9 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 5 30 Rau 7 0 0 0 7 31 Rau 5 | 0 0 0 4 0 - 35 WF 3 | 38 Rest 1 1 0 0 2 2 35 Rest 2 | 2 HF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Fot al | 29 2 7 0 38 2 F-H |
| otel 10 HIN Tace Upe S K K K HC HI OTEL HI OTEL CHI SUL | Rew CORE CO- | S S S S S S S S S S S S S S S S S S S | Raw Raw Ray C C C C C C C C C C C C C | 6 5-10 WF 6 2 0 0 0 5-10 WF 5 1 1 1 0 0 5 5 1 | Rate 5 | 15 10-15 UF 6 0 1 0 7 | Rass 2 0 2 0 4 | 18-20 MF 2 0 2 0 4 15-20 MF | 14 RRANGE (noe 2 Rate 5 0 3 0 2 Rate 1 0 10 | 11 20-25 MF 4 0 2 0 6 20-25 MF 7 0 1 0 8 | 21 Rau 12 0 3 0 15 2: Rau 15 0 1 0 1 5 0 1 0 1 5 0 1 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 5 0 1 0 0 1 5 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 0 1 | 11 8-30 MF 7 0 2 0 9 5-30 MF 9 | 7 0 0 0 7 7 0 0 0 7 | 0 0 0 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 35 Rau 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 -40 0 0 0 0 | Total Raw 355 2 9 CHI-SOURIFOR 3 TE: Raw 42 42 42 49 | 29 27 0 39 8F F-M 57 95 16 0 |
| otel 10 HIN Tace Upe S K K Otel HI—SQUR HRT S L C HI—SQUR HC HI—SQUR CHI—SQUR | Rew 1 | S WF O O O O O O O O O O O O O O O O O O | Raw Raw Ray C C C C C C C C C C C C C | 6 5-10 UF 6 2 0 0 0 5-10 UF 5 1 1 1 0 5 5-10 | Rate 5 | 15 10-15 147 6 0 1 10-15 | Rass 2 0 2 0 4 | 4 15-20 HF | 14 RRANGE (noe 2 Rate 5 0 3 0 2 Rate 1 0 10 | 11 20-25 MF 4 0 2 0 6 20-25 MF 7 0 1 0 8 | 21 Rau 12 0 3 0 15 2: Rau 15 0 1 0 1 5 0 1 0 1 5 0 1 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 5 0 1 0 0 1 5 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 5 0 1 0 0 1 0 1 | 11 MF 7 0 2 0 9 5-30 WF 9 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 7 0 0 0 7 7 0 0 0 7 | 3 0-35 MF 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 35 Resu 1 0 0 2 35 Resu 2 0 0 0 2 | 2 -40 0 0 0 0 | Fot all Ram 2 35 2 2 3 9 1 0 2 46 CNI - SOURI 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | MF 29 2 7 0 39 WF PER UF 25 41 WF 25 41 WF 25 WF |
| otel 10 MIN Face upe S L C III Otel HI-SQUM -HRT S L C HI-SQUM RLUES | Rew CORE CO- | S S S S S S S S S S S S S S S S S S S | Raw Raw Ray C C C C C C C C C C C C C | 6 5-10 WF 6 2 0 0 0 5-10 WF 5 1 1 1 0 0 5 5 1 | Rate S O i O 6 | 15 10-15 MF 6 0 1 0 7 10-15 MF 7 | Rate 2 0 2 2 0 4 4 Rate 5 0 1 0 6 5 | 15-20 MF 2 0 4 15-20 MF 4 0 15-20 MF 4 0 11 0 5 | RAMOE Cree Ramo S O S B Rama P Rama 2 Rama | 11 10-25 MF 4 0 2 0 6 10-25 MF 7 0 8 | 28 Rew 12 0 15 2: Rew 15 0 15 2: Rew | 11 6-30 MF 7 0 2 0 9 5-30 MF 5-30 MF | Raus P O O O P S Raus S O O Raus Raus S O O Raus Raus Raus Raus | 3 0-35 MF 0 0 4 0-35 MF 3 0-35 | 2 35 Rest 2 0 0 0 2 2 35 Rest 2 0 0 0 2 2 35 Rest 2 0 0 0 2 2 35 Rest 2 0 0 0 0 2 2 35 Rest 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 HF 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 | Total Raw 35 2 39 46 CNI-SQURI FOR 3 TE: 42 42 42 43 CNI-SQURI FOR 3 TE: Raw 1 0 | MF 29 2 7 0 WF PER UPLEST PER UPL |
| Frace Fype LS SL NC SU Fotal CHI-SQUA F-HAT LS SL NC HO FOTAL CHI-SQUA CHI-SQUA | Rest O | FR TES | Rass PRASS RASS RASS RASS RASS | 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 | Rau 5 0 1 0 6 6 0 1 0 6 6 | 15 10-15 MF 6 0 1 0 7 10-15 MF 7 | Rass 2 0 2 0 4 Rass 0 1 0 6 | 18-20 UF 2 0 2 0 4 15-20 UF 4 0 15-20 | RAMOE Cree Ramo S O S B Rama P Rama 2 Rama | 11 20-25 MF 4 0 2 0 6 20-25 MF 7 0 1 0 8 | 28 Rew 12 0 15 2: Rew 15 0 15 2: Rew 15 0 15 | 11 5-30 MF 7 0 2 0 9 5-30 MF 9 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 | Raus P O O O P S Raus S O O Raus Raus S O O Raus Raus Raus Raus | 3 2-3F MF 4 0 0 0 4 0-35 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 35 Rest 2 0 0 0 2 2 35 Rest 2 0 0 0 2 2 2 35 Rest 2 0 0 0 2 2 35 Rest 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2 -40 0 0 0 0 -40 UF | Fot all For 3 TE: Ram 46 | MF 29 2 7 0 38 RE F-M ST PER 41 41 41 41 41 41 41 41 41 41 41 41 41 |

Table D60. Indian Point hanner test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

| | | | 1 | 1del Pi | | hrs be u tide | | ****** | Duration Treatm | ent Typ | ;t; 10 ;e; 30 ;especies | O sec (| her 3 on on, 40 se | c off | Test Dat Test Tim | # : | 2/20/89 0505 | |
|-------------------------------|-----------|---------|----------------|-------------------------|-------------------------|---|---|---|-------------------------|-------------------------|-------------------------------|-------------------------|-----------------------|-------------------------|----------------------|--------------------|--|---|
| 10 HI N | UTES DUR | THO TE | ST PERIO | Ю | | | | 1 | RMIDE CHA | ters> | | | | | | | | |
| | 0- | _ | S | - 10 | 10 |)- 1 5 | | 5-20 | 2 | 20-25 | | 5-30 | 3 | 0-35 | | 5-40 | Tota | 1 |
| upe | Rau | uf | Rass | HF | Rau | 'HF | Rass | MF | Rau | uf. | Rau | HF | Rau | uf . | Rau | WF | i Rau | MF |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | > | , | 7 | , | S | 3 | 2 | 2 | 1 | 26 | 10 |
| L. | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | • | 0 | • | ′ o | 0 | 2 | 2 |
| C | 0 | 0 | 2 | 4 | 2 | 2 | > | > | 2 | 2 | 2 | 1 | 1 | 1 | ı | 0 | į 13 | 13 |
| H | 0 | 0 | 1 | 2 | 3 | 4 | 1 | . 1 | . 0 | 0 | 0 | 0 | 0 | • | 0 | . 0 | 5 | 7 |
| otel | 0 . | 0 | 3 | 6 | 7 | 8 | 7 | 7 | 11 | 9 | 11 | 6 | 4 | > | 3 | 1 | 46 | 40 |
| 10 MIM | UTES AFT | ER TES | ST PERIOD | • | | | | | RANGE (ma | eters) | | | | | | | | |
| FACO | 0- | 5 | 5 | -10 | 10 | D- 15 | 1 | 5-20 | | 20-25 | 2 | 5-30 | 3 | 0-35 | 3 | 5-40 | Tota | |
| upe | Rass | HF | Rass | WF | Rau | MF | Rau | HF | Rau | | Rau | HF | Rau | MF | Rass | HF | t Rass | MF |
| . s | 1 | 4 | 0 | 0 | 4 | | 4 | 4 | T | 5 | 10 | . 6 | 3 | 2 | 2 | 1 | 31 | 27 |
| IL. | 0 | 0 | • | . 0 | 0 | • | 1 | . 1 | 0 | . 0 | 0 | 0 | 9 | 0 | 0 | Đ | i ı | 1 |
| ec . | 0 | • | 1 | 2 | 1 | 1 | 0 | 0 | 1 | 1 | 2 | 1 | 8 | 0 | 0 | . 6 | 5 | 5 |
| M - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0_ | | 0 |
| otal | 1 | 4, | 1 | , 2 | 5 | 6 | 5 | 5 | • | • | 12 | 7 | 3 | 2 | 3 | 1 | i >7 | 23 |
| HI-SOUN HAT | RE 0- | 5 | | 5-10 | | 0-15 | | 15-20 | | 80-25 | | 5-30 | | 0-35 | | 5-40 | CHI-SQUA | |
| .5 | Rau | HF 2 | · Rau | | Rau | HĘ | Rau | HF | Rau | HF | . Вам 10 | HF | Rau 3 | UF 2 | Rau | HF 1 | 1 Rau : 29 | 4F 23 |
| iL IC | Õ | ĕ | Ď | Š | Ĭ | 1 2 | i | 1 2 | 0 | Ŏ | Ŏ 2 | ě | Õ | ō | Ō | Š. | 1 2 | 2 |
| OTAL. | | Ŏ 2 | . Ì | 1 | ž | 2 7 | ī | į | . 10 | Õ | 12 12 | ō 7 | 4 | Š | Š | Õ | 42 | 37 37 |
| HI-SQUA MLUES | IRE 0- | | | 5-10 | 1 | 0-15 | | 15-20 | | 20-25 | | 5-30 | | 0-35 | 3 | 5-40 | CHI-SQUE | RE UAL |
| .S SL IC BH TOTAL | | .000 | 0.333 1.000 | 0.667 2.000 2.000 | 2.000 0.333 3.000 | HF 5.000 2.000 0.333 4.000 0.206 | Ress 0.143 1.000 3.000 1.000 0.333 | 0.143 1.000 3.000 1.000 0.333 | 0.250 0.333 0.474 | 0.333 0.333 0.600 | 0.000 | 0.091 0.000 0.077 | 1.000 | 0.000 1.000 0.200 | 1.000 | 0.000 0.000 | 1 Ray 1 0.439 2 0.333 3 3556 1 5.000 | 1.800 0.333 3.556 7.000 0,671 |

Table D61. Indian Point hammer test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

CHI-SQUARE = 3.841

| LO MI | WITES DU | ING TE | ST PF010 | | | lou tid | | 1600ta | | ment Typ | | | on, 20 s | ***** | Test Tir | | 0525 ******* | ** |
|--------------------|-----------|---------|------------|--------|-------|-------------|---------------|-------------|--------------|-------------|-----------|-------------|--------------|--------------|----------|---------------|----------------------|----------|
| | W1 23 441 | 2,10 | .J, / ER20 | | | | | (| RANGE (m | eters> | | | | | | | | |
| race | 0- | | 9 | -10 | | 10-15 | | 15-20 | | 20-25 | : | 25~30 | : | 30-35 | | 35-40 | Tota | 1 |
| UP+ | Rau | ИF | Rau | NF | Rau | MF | Rau | HF | Rau | HF | Rası | MF | , Rau | HF | Raw | HF | : Ress | UF |
| \$ | 0 | 0 | 0 | 0 | . 8 | 10 | 4 | 4 | 10 | • | 20 | 12 | P | 4 | 3 | L | 52 | 39 |
| - | G | 0 | ø. | 0 | 0 | D | 0 | O | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 1 | 4 | 0 | 0 | 1. | 1 | 4 | · 4 | 1. | 1 | 1 | 1 | • | 0 | . 0 | 0 | | 11 |
| ł | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 |
| tal | 1 | 4 | 0 | 0 | 3 | 11 | • | 0 | 11 | • | 21 | 13 | 7 | 4 | 3 | 1 | : 60 | 50 |
| .O 11711 | NUTES RET | • | | | | | | | RANGE CH | | | • | | | | | | |
| 400 | 0 | | | -10 | | 10-15 | | | | 20-25 | | 25-30 | • | 30-35 | | 35-40 | Tota | |
| JPe | Rau | uf | Ray | HF. | Rau | | Rau | | Rasa | | Rau | | Rau | | | HF | | WF |
| S | 1 | 4 | 2 | 4 | 7 | 11 | 11 | 10 | 13 | 10 | 14 | 8 | 4 | 2 | 2 | 1 | ; 56 | 50 |
| L | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • 0 | . 0 | , O | 0 | 0 | 0 | . 0 | 0 |
| С | 1 | 4 | 2 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | . 0 | 1 | . 0 | | 12 |
| H | | 0 | 0 | 0 | 0_ | 0_ | 0_ | | | 0_ | 0_ | 0- | 0 | 0 | <u> </u> | | .;0 | ٥ |
| Lafo | 2 | • | 4 | 8 | , 10 | 12 | 12 | 11 | 14 | 11 | 15 | • | 4 | 2 | 3 | 1 | 1 64 | 62 |
| HI – SQUI – HAT | | -5 | | 5-10 | | 10-15 | | 15-20 | | 20-25 | | 25-30 | | 30-35 | | 35-4 0 | CHI-SQUA FOR 2 TE | |
| s · | Rand | HF 2 | Ress | 14F | Rau | 11 HF | Rau | ۱Ę | Ra4 12 | UF | Rau 17 | NF 10 | Rau | HE | Rau | MF 1 | Rau 54 | UF 45 |
| Ĺ | Õ | 9 | ě | 0 2 | Õ | Ŏ | Š | ġ | 70 | Ó | Ö | ō | ŏ | ō | · 0 | Õ | | 12 |
| U OTAL | <u> </u> | ģ | . 2 | Ŏ | , Ŏ | . 12 | 10 | 10 | 13 | , Ó | | | . 0 | Š | Š | ě | 0 | 56 |
| HI -SQU RLUES | 0. | -5 | | 5-10 | | 10-15 | | 15-20 | • | 20-25 | | 25-30 | | 30-35 | | 35-40 | CHI-SQUA | |
| 5 | 1.000 | 4.000 | 2.000 | 4.000 | 0.059 | #F 0.048 | Raid 3.267 | UF 2.571 | Rau 0.391 | uF 0.222 | 1.059 | UF 0.890 | Rau 0.918 | NF 0.667 | 0.200 | 0.000 | 2 Rau | 1.360 |
| | 0.000 | .000 | 2.000 | 4.000 | 0.000 | 0.000 | 1.800 | 1.000 | 0.000 | 0.000 | 0.000 | 0.000 | | | 1.000 | | 0.000 | 0.043 |
| u Otril | 0.333 | 1.333 | 4-000 | -8-000 | 0.053 | 0.043 | 0.800 | 0.474 | 0.360 | 0.200 | 1.000 | 0.727 | 0.818 | 0.567 | 0.000 | 0.000 | 0.129 | 1.296 |

 $\langle d.f. = 1, alpha = .05 \rangle$

Table D62. Indian Point hanner test monitoring using 6+12 degree horizontal transducer located at unit \Im_{π} intake $\Im 5$.

| | | | | | | | | | RANGE (M | +++**> | | | | | | | | |
|------------------|---------|-------------|----------|--------|-------|-------|--------|-------|----------|--------|-------|---------|--------|--------|-------|-------|----------|--------------------|
| race | |)-5 | ~ | 5-10 | - | 10-15 | | 15-20 | | 20-25 | 8 | 25-30 | | 30-35 | | 5-40 | .Tota | |
| UP+ | Rau | HF | Rau | UF | Rau | MF | Rass | HF | Rau | uf | Rau | uf - | Rau | uF | Rau | UF | i Raw | UF. |
| 5 | 0 | 0 | 1 | 2 | • | 11 | 5 | 5 | 3 | 2 | 5 | 3 | . 4 | 2 | 1 | 0 | 1 20 | . 25 |
| - | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | . 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| ; | 1 | 4 | 1 | 2 | 1 | 1 | . 1 | 1 | 1 | 1 | , 0 | 0 | 1 | 1 | Q | 0 | 6 | 10 |
| М | 0 | 0 | 0 | 0 | | 0 | Q | | O | 0 | 1 | 1 | 0 | 0 | 0 | . 0 | 1 | 1 |
| ptal | 1 | 4 | 2 | 4 | 10 | 12 | 6 | 6 | 5 | 4 | 6 | 4 | 5 | 3 | 1 | 0 | 36 | 37 |
| 10 HI | MUTES R | TER TE | ST PERIO | 0 | | | | | RANGE (m | ters> | | | | | | | | |
| race | |)-5 | | 5~10 | | 10-15 | | 15-20 | : | 20-25 | | 25-30 | 3 | 30-35 | | 5-40 | Total | <u>.1</u> |
| ype | Rau | WF | Rau | HF | Rau | HF | Rau | NF | Rass | HF | Rau | WF . | Rau | MF | RaM | WF | 1 Rau | WF |
| s | D | 0 | 0 | 0 | 7 | 8 | 4 | 4 | . 3 | 2 | 6 | 4 | 6 | 3 | 3 | 1 | 29 | 22 |
| L | 0 | 0 | 1 | 2 | 0 | 0 | 1 | . 1 | 0 | 0 | . 0 | 0 | . 0 | 0 | . • • | o | 2 | 5 |
| C | . 1 | 4 | | 2 | 1 | 1 | 1 | . 1 | 1 | 1 | 1 1 | 1 | . 0 | 0 | 0 | o o | . 6 | 10 |
| H | 0 | 0 | 0 | 0 | 0 | o | 0 | 0 | 0 | 0 | 0 | q | 0 | 0 | 0 | 0 | 0 | o |
| otal | 1 | 4 | 2 | 4 | В | 9 | 6 | 6 | 4 | 3 | 7 | 5 | 6 | 3 | 3 | 1 | 37 | 35 |
| HI –591 –HAT | |)- s | | 5-10 · | | 10~15 | | 15-20 | ; | 20-25 | , | 25-30 | ; | 30-35 | 3 | 5-40 | CHI-SQU | ARE F-H EST PER |
| | Rau | MF | Ray | Lif | Rau | MF | Rau | MF | Rau | MF | Rau | WF | Rau | uf | Rau | WF | t Rau | MF |
| S L | Ö | Ö | 1 | 1 | 8 | 10 | 5 | 5 | 3 | 2 | 6 | 4 | 5 | 7 | 5 | 1 | 29 | 24 |
| Ç. | ĭ | 4 | į | Ž | 1 | ĭ | i | i | i | i | ĭ | Ĭ | i | ĭ | ŏ | ŏ | : 6 | 10 |
| TAL | 9 | 9 | 2 | 9 | 9 | 11 | 0 6 | ę | 9 | 9 | 7 | 5 | 0 6 | 9 | 2 | 0 | 37 | 36 36 |
| HI –SOL RLUES | | D- 5 | - | 5-10 | | 10-15 | | 15-50 | : | 20-25 | | 25~30 | -: | 20-35 | : | 35~40 | CHI -SQU | ARE VAL |
| | Ray | LIF | Rau | MF | Pau | uf | Rau | | Rau | WF | RAH | WF | Rau | HF | Rau | WF | FOR 2 TO | EST PER UF |
| 5 | == | == | 1.000 | 2.000 | 0.250 | 0.474 | 0.111 | 0.111 | 0.000 | 0.000 | 0.091 | 0.143 | 0.400 | 0.200 | 1.000 | 1.000 | 0.010 | 0.191 |
| S L IC | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 | 1.000 | 1.000 | 1.000 | | | : 0,000 | 0.000 |
| 168 | 0.000 | 0.000 | 0.000 | 0.000 | 0.222 | 0.429 | 0.000 | 0.000 | 0.111 | 0.143 | 1.000 | 1.000 | 0-091 | p. 000 | 1.000 | 1,000 | 1 1.000 | 0.056 |

Table D63. Indian Point hammer test monitoring using 6H12 degree horizontal transducer located at unit 3, intake 35.

| 10 HI | MUTES DUR | IND TE | ST PERIOD | ı | | | | | RANGE CHE | ters> | | | | | | | | |
|----------------|-----------|--------|-----------|------|----------|------------|----------|----------|-----------|-------|-------------|--------|-------|--------|---------------|----------|----------|-------|
| | o- | | 5- | 10 | 10 | 0~15 | | 5~20 | | 0-25 | . 2! | 5-30 | . 3 | 0-35 | | 5-40 | Tota | |
| ype | Rau | MF | Rau | UF | Rau | UF. | | MF | Rau | WF | Rau | HF. | Rau | uf . | Rau | UF | i Rev | WF |
| s | 0 | 9 | 3 | 6 | 12 | 14 | 6 | 5 | > | 2 | 7 | 4 | 16 | • | , | 4 | 56 | 43 |
| Ł | 0 | • | 0 | O | 0 | 0 | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | . 0 | 0 | 0 | 0 | 1 | • | 2 | 1 |
| M | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | Q. | | 0 |
| otal | 0 . | 0 | 3 | 6 | 12 | 14 | 7 | 6 | 3 | 2 | 7 | 4 | 16 | 0 | 10 | 4 | 1 50 | 44 |
| 10 HI | MUTES AFT | ER TES | T PERLOO | | | · × , | | | | | | | • | | | | | |
| | _ | _ | _ | | | | | | RANGE (H | | *** | | | | _ | _ | | |
| F4C4 | | | | | | 0-15 | | 3-20 | | 0-25 | | 5-30 | | 10~3\$ | | 5-40 | Tota | |
| up+ | | HF | | NF. | Rau | uf ———— | Raw | NF | Rau | HF | Rau | uf | Rau | uf | Rau | HF | - Rau | WF |
| . s | 0 | 0 | 3 | • | 1 | 1 | > | 3 | 5 | 4 | 6 | 4 | 4 | 2 | 2 | 1 | : 24 | 21 |
| Ł | G | ٥ | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| IC . | 1 | 4 | 0 | . 0 | 0 | 0 | 0 | 0 | . 1 | . 1 | 1 | 1 | 0 | ٥ | 0 | . 0 | 3 | 6 |
| <u> </u> | 0 | 0 | O | 0 | <u>1</u> | 1 | 0 | | 0 | 0 | . <u></u> 0 | 0 | 0 | 0 | 0 | 0 | · :1 | 1 |
| otel | 1 | 4 | . 3 | • | 3 | 3 | 3 | 3 | 6 | 5 | 7 | 5 | , ◀ | 2 | 2 | 1 | 29 | 29 |
| HI-SQU HAT | PARE 0- | | 5- | -10 | 1 | 0~15 | 19 | 5-20 | | to-25 | | 5-30 | | 0-35 | 3: | 5-40 | CHI-SQUA | |
| _ | Rau | LIF | Rese | MF | Rau | HF | Rau | HF | Rau | HE | Rau | HF | Rau | HF | Rau | HE | I Rau | up. |
| .S IL IC | 9 | 6 | 5 | õ | ĺ | 1 | 5 | Ş | | Š | é | ą | 10 | 5 | Ŏ | 3 | 1 40 | 32 . |
| M | ò | 9 | Õ | ő | 1 | -1 | <u>0</u> | <u>0</u> | ğ | ò | 0 | , | . 0 | 0 | ò | 8 | | 1 |
| OTAL HI-SQU | 1 | 2 | 3 | 6 | 8 | 9 | . 5 | 5 | . 5 | 4 | 7 | 5 . | 10 | 5 | | 3 | 1 44 | 76 |
| ALUES | Q- | | 5- | -10 | | 0-15 | | 5-20 | · | 10-25 | | 5-30 | | 0-35 | | 5-40 | CHI-SQUE | |
| _ | Rau | MF | Reu | WF | Rass | W | Rau | LAF* | Rass | MP | Rew | w | Rau | MF | Rau | MF | Rau | HF |
| .S iL iC | | == | 0.000 | .000 | | 1.000 | | 0.500 | 0.500 | 0.667 | | 0.000 | 7.200 | 3.600 | ** | 1.600 | 1.000 | 1.000 |
| HC HL | 1-000 | 1.000 | | | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | | | 1.000 | | 1 1.000 | 3.571 |

Table D64. Indian Point hammer test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

| 10 NI MUTE | | | | | | | | | RMIDE (met | | | **** | | | | | ********* | |
|---|--|---------------------------------------|--|---------------------------------------|---|---|--|--|--|---|--|---|--|---|---|--|--|--|
| • | 0- | E | 5-1 | 0 | 10- | - 15 | . 15 | -20 - | | ~25 | 25 | -30 | 30 | -35 | 35- | -40 | Total | |
| race upe | | HF | Rau H | | Rau | | | MF | Rau / 1 | | | HF | | WF. | | eF | | WF |
| .s | | 0 | | | 1 | 1 | 5 | | 2 | 2 | 0 | | 0 | 0 | 0 | 0 | ; 6 | 6 |
| L | 0 | | 1 | 2 | 0 | Q | Ð | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 ' | 0 | 1 | 2 |
| c | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | . 0 | 0 | 0 | 0 | 0 | 2 | . 2 |
| ш | . 0 | G | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | o | 0 | 0 | 1 | 1 |
| otal | 0 | 0 | 1 | 2 | 2 | 2 | 4 | 4 | 3 | 3 | 0 | 0 | 0 | 0 , | 0 | 0 | 10 | 11 |
| 10 HINUTE | ES DUR | ING TE | ST PERIOD | | | | * | 1 | RANGE (met | ers) | | | | | | | • | |
| | 0- | S | 5-1 | .0 | 10 | -15 | 15 | -20 | | -25 | 25 | ~30 | . 30 |)- 3 5 | 35- | -40 | Total | |
| race upe | Rass | LL. HF | Rau I | F | Rase | NF | Rau | ur | Rasi | HF | Rau | uf | Raw | HF | Ray I | HF | 1 Rau | HF |
| . <u>. </u> | 2 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | : 2 | 7 |
| iL. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | ٥ | 0 | 0 | : 1 | 1 |
| iC | 1 | 4 | 0 | ο. | 0 | 0 | Q | 0 | 0 | • | 0 | 0 | 0 | 0 | 0 | 0 | : 1 | 4 |
| | | | | | | | | _ | | _ | _ | 1 | _ | _ | _ | _ | 1 | 7 |
| 14 | 1 | 4 | 0 | 0 | 1 | 1 | 0 | 0 | 1. | 1 | 1 | L | 0 | 0 | 0 | 0 | : 4 | • |
| | 4 | 15 | 0 | 0 | 1 | <u>1</u> | <u> </u> | 0 | 1 2 knnoe (met | 2 | 1 | 1 | 0 | 0 | | 0 | | 19 |
| Tetal 10 HI NUTE | 4 | 15 ER TES | 0 | 0 | 1 | | 0 | -20 | 2 RANGE CHART | 2 ers> | 1 | | 0 | | 0 | 0 | · i | 19 |
| otal 10 HINUTE | 4 ES AFT | 15 ER TES | O T PERIOD | 0 | 10 | 1 | 0 | 0 | 2 RANGE (met | 2 | 1 25 | 1 | 34 | 0 | 35 | 0 | | 19 |
| Tetel 10 HINUTE | 4 ES AFT | 15 ER TES | O T PERIOD | 0 | 10 | 1 - 15 | 0 | -20 | 2 RANGE (met | 2 (ers) (-25 | 1 25 | 1 | 34 | 0 | 35 | -40 | Total | 19 |
| Total 10 HI MUTE Trace Type | ES AFT | 15 ER TES | T PERIOD S-1 Rem i | 0 | 10 Rau | 1 15 UF | 0 15 Raw | 0 20 NF | RANGE (met | 2 +r*> -25 uf | 1 25 Rau | 1 -30 UF | 0 30 Rau | 0 0-35 WF | 35 Reid | 0 -40 | Total | 19 |
| Tetel 10 HINUTE Trace Tupe 15 SL | 4 ES AFT | 15 ER TES S HF | O ST PERIOD S-1 | 0 IF | 1 10 Rau 0 | 1 15 ur | 0 15 Raw | 0 20 MF | 2 RANGE (net 20 Rau 1 | 2 -25 UF | 1 25 Rau | 1 HF 1 0 | 0 30 Resu | 0 0-35 UF 0 0 | 0 35 Raid | 0 WF 0 0 | Total 2 Rau 5 1 0 | 19 WF |
| Tetel 10 HINUTE Trace Tupe 15 SL | 4 ES AFT | 15 ER TES S HF | C PERIOD S Rem i | 0 17 2 0 | 10 Rass 0 0 | 1 15 ur 0 0 0 0 | 0 15 Rau 0 0 | 0 20 MF 0 0 | 2 RANGE (net | 2 -25 ur 1 0 | 25 Rem 2 0 | 1 30 MF | 0 Rest 0 0 2 | 0 0-35 WF 0 0 | 0 | 0 -40 -47 0 0 | Total 2 Rau 5 1 0 2 3 | 19 UF 4 0 5 |
| Tetel 10 HINUTE Trace Type 15 SL 40 Total | Rend 0 | 1S ER TES S UF 0 0 4 | C PERIOD S | 0 IF 2 0 | 10 Rass | 1 15 UF 0 0 0 | 0 15 Res | 0 -20 MF 0 0 | RANGE (net | 2 -25 UF | 25 Rau 2 0 | 1 HF 1 0 | 0 Reu 0 0 | 0 0-35 UF 0 0 | 0 | 0 WF 0 0 | Total Resu 5 0 1 3 1 2 | 19 MF 4 0 5 1 |
| Fotel 10 HINUTE Frace Fype LS SL NC MU Fotel CHI-SQUARE | ES RET | 15 ER TES S HF 0 0 4 | C PERIOD S-1 Ram 1 0 0 0 | 0 1F 2 0 0 | 10 Rass 0 0 0 | 1 15 ur 0 0 0 0 | 0 Raw 0 0 | 0 20 MF 0 0 | RANGE CHOT 20 Rau 1 0 0 | 2 -25 ur 1 0 | 25 Rau 2 0 0 | 1 30 MF | 0 Rem 0 0 2 0 2 | 0 0-35 WF 0 0 | 0 | 0 -40 -47 0 0 | Total 2 Rau 5 1 0 2 3 | 19 4 0 5 10 RE F-HF |
| Frace Type LS SL NC MM Total CHI-SQUARE F-NAT | C C C C C C C C C C C C C C C C C C C | 1S ER TES S UF 0 4 0 4 | T PERIOD S Row i 0 0 1 5 Raw | 0 1F 2 0 0 | 10 Rest 0 0 0 0 0 0 0 Rest 10 Rest 10 Rest 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 1 15 UF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 Raw 0 0 | 0 20 MF 0 0 | RANGE CHOT 20 Rau 1 0 0 | 2 ere> i-25 ur 1 0 0 | 25 Rau 2 0 0 | 1 -30 -4F - 1 - 2 - 30 - 4F | 0 Rau 0 0 2 0 2 | 0 0 1 0 0 1 0 0 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0 1 | 0 35- Raw 1 0 0 1 2 | 0 -40 -40 -0 -0 -0 -40 -40 -40 -40 -40 | Total Resi S 1 3 2 1 10 CHI-SQUE | 19 4 0 5 10 RE F-HF |
| otal 10 HINUTE Tace Upp S L NC MU otal CHI-SQUARE THAT | Rest G | 1S ER TES S HF 0 4 0 4 | T PERIOD S-1 1 0 0 1 5-1 Rate 0 0 | 0 0 2 0 0 0 | 10 Rass 0 0 0 0 10 Rass 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 1 15 UF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Raw O O O O O O O O O O O O O O O O O O O | 0 WF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | RANGE CHART 20 Rau 1 0 0 1 20 Raid 1 0 | 2 -25 -25 -25 -25 -25 -25 | 25 Raw 2 0 0 1 3 | 1 | 0 Rass 0 0 2 0 2 | 0 0-35 WF 0 1 0-35 | 35-Raid 1 | 0 0 0 0 WF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Fotal Result 1 0 1 10 CHI-SQUAR FOR 3 TE Result 4 1 | 19 4 0 5 1 10 RE F-HFST PERI |
| race (ype | CONTRACTOR | 1S ER TES S HF 0 4 0 4 5 | T PERIOD S Raw i 0 0 1 5 Raw | 0 0 1 2 0 0 2 | 10 Rass 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Raw O O O | 0 WF 0 0 0 | 20 Rau 1 0 0 0 1 20 Rau | 2 0-25 UF 1 0 0 1 | 25 Raid 2 0 0 1 3 | 1 30 MF 0 | 0 Ram 0 0 2 0 2 | 0 0-35 WF 0 1 0 | 0 35- Rate 0 0 0 1 2 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Total Rew S 1 5 1 0 2 10 CHI-SQUAR FOR 3 TE | 19 4 0 5 1 10 RE F-HFST PERI |
| Total To HINUTE Trace Type LS SL NC MI Total CHI-SQUARE SL NC MI CHI-SQUARE CHI-SQUARE CHI-SQUARE | C-Rand C- | 15 ER TES S HF 0 0 4 0 4 5 | 0 T PERIOD S | 0 0 0 2 0 0 2 | 10 Rass 0 0 0 0 10 Rass 0 0 0 0 0 1 1 | 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rass O O O O O O O O O O O O O O O O O O | 0 MF 0 0 0 6 | 20 Rau E O O O 1 20 Rau 1 O O O O O O O O O O O O O O O O O O | 2 -25 ur 0 0 1 -25 ur 1 0 0 | 25 Ratu 2 0 0 1 3 | 1 30 MF 1 2 30 MF 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 0 Rau 0 0 2 0 2 0 2 0 2 | 0 -35 WF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 35-Rass 1 0 0 1 2 39-Rass 0 0 0 1 1 1 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Total Result 1 0 1 10 CHI-SQUAR FOR 3 TE Result 4 1 1 2 2 1 2 1 2 2 1 2 2 1 | 19 4 0 5 1 10 RE F-H/6 FF PER) 4 3 13 |
| Total 10 HI MUTE Type 5 6 6 6 6 6 6 6 6 6 6 6 6 | Rand G G L G C C C C C C C C C C C C C C C C | 15 ER TES S HF 0 0 4 0 4 5 | T PERIOD S Rand 1 0 0 1 S Rand 0 0 0 | 0 0 0 0 0 0 0 0 | 10 Rass 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Rass O O O O O O O O O O O O O O O O O O | 0 MF 0 0 0 | 20 Rau 1 0 0 0 1 20 Rau 20 20 20 | 2 -25 -25 -25 -25 -25 -25 -25 | 25 Ratu 2 0 0 1 3 | 1 | 0 Rau 0 0 2 0 2 0 2 0 2 | 0 0 1 0 1 0-35 ur | 35-Rass 1 0 0 1 2 39-Rass 0 0 0 1 1 1 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Total Result 1 | 19 4 0 5 1 10 REF-HIST PERI |
| race ype S L C M Otal HI-SQUARE -HAT OTRL M OTRL HI-SQUARE | Rand O O I O I O I O I O I O I O I O I O I | 15 ER TES S HF 0 4 0 4 5 HF 2 9 1 6 5 | 0 T PERIOD S Ram 1 0 0 0 1 5 Ram 0 0 0 1 5 Ram 0 0 0 1 5 Ram 2 | 0 0 0 0 0 0 2 | 10 Rass 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 1 - 15 - 15 - 15 - 15 - 15 - 15 - 15 - | Raw 0 0 0 0 15 Raw 1 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 20 Rau 1 20 Rau 1 0 0 0 2 20 Rau 20 R | 2 -25 -25 -25 -25 -25 -25 -25 -2 | 25 Ram 2 0 0 1 3 25 Ram 1 0 0 1 | 1 | 0 Rest 0 0 2 0 2 0 2 0 2 1 | 0 0 1 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 | 35 Rate 1 0 0 1 2 2 35 Rate 0 0 0 0 1 1 3 5 0 0 0 0 1 1 3 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 | Total Rem 1 5 2 0 3 3 2 10 CHI-SQUE FOR 3 TE: Rem 1 12 2 2 2 9 CHI-SQUE FOR 3 TE: Rem 1 1 1 2 2 3 3 5 7 5 7 5 7 5 7 5 7 5 7 5 7 5 7 5 7 | 19 4 0 5 1 10 RE F-HIST PERI |
| Trace Trace Trace Type | 0 - Rand 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 | 15 ER TES S HF 0 4 0 4 5 HF 2 3 1 6 | 0 T PERIOD S Ram 1 0 0 0 1 5 Ram 0 0 0 1 5 Ram 0 0 0 1 5 Ram 2 | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 10 Rass 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 1 | Raw 0 0 0 0 15 Raw 1 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | -20 WF 0 0 0 -20 WF | 20 Rau 1 20 Rau 1 0 0 0 2 20 Rau 20 R | 2 -25 -25 -25 -25 -25 -25 -25 -2 | 25 Ram 2 0 0 1 3 25 Ram 1 0 0 1 1 | 1 -30 MF 1 0 1 2 -30 MF 0 0 | 0 Rest 0 0 2 0 2 2 3 Rest 0 1 | 0 0-35 WF 0 1 0-35 WF 0 0 0 | 35 Rate 1 0 0 1 2 2 35 Rate 0 0 0 0 1 1 3 5 0 0 0 0 1 1 3 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 40 40 0 0 0 40 40 | Total Rau 1 5 1 0 1 3 1 2 1 10 CHI-SQUAR FOR 3 TE: Rau 1 12 1 22 1 29 CHI-SQUAR 1 1 1 2 1 2 1 1 2 1 2 | UF 10 5 1 10 REF-MF 1 3 13 RE VALUE FREI MF |

Table DSS. Indian Point harmer test monitoring using 6x12 degree horizontal transducer located at unit 3, intake 35.

| 10 MI | MUTES DU | RING TES | T PERIO | D | | | | (| RANGE (ne | ters> | | | | | | | #.* | • |
|-------------------|----------|-------------|---------|---------|--------|----------------|-------|-------|-----------|-------|---------|-------------|-------|-------|-------|--------|----------------------|------------------------|
| · | 0 | -5 | 5 | -10 | | l 0-1 5 | 1 | 15-20 | 2 | 0-25 | 2: | 5-30 · | : | 30-35 | 3 | 5-40 | Tota | 1 |
| race Tupe | Ratu | NF | Rau | HF | Rau | HF | Rau | UF | Reu. | WF | Rau | WF | Rasi | WF | Rasi | NF | ; Reu | LAF |
| .5 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | C | o o | 1 | 1 | 1 | 1 | 1 | 0 | 5 | 4 |
| iL, | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | e | 0 | 0 | 0 | 0 | • | 0 | 0 | | 0 |
| HC · | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | • | 1 | 4 |
| 414 | 0 | 0 | • | 0. | 0 | 0 | 1 | 1 | 0 | o | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| Total | 1 | 4 | 0 | 0 | 1 | 1 | 2 | 2 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | -: | 9 |
| 10 MI | NUTES AF | YER TEST | PERIOD | | | | | , | RANGE (no | ters> | | | | | | | | |
| | 0 | -5 | 5- | ~10 | 1 | 0-15 | ï | 15-20 | | 0-25 | 2! | 5-30 | | 30-35 | 3 | 5-40 | Tota | .1 |
| race Type | Rau | UF | Rau | WF | -: Rau | HF | Rau | NF | Rass | ИF | Reu | HF | Ran | UF | Rau | HF | I Ran | |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | | -14 | 3 |
| SL. | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | . 0 | ٥ | 0 | . 0 | | 0 |
| NC | 0 | 0 | 0 | D | a | 0 | 0 | 0 | 0 | 0 | ò | o | 0 | 0 | 0 | 0 | | 0 |
| 414 | 0 | o | 0 | a | 0 | a | . 0 | 0 | `. 0 | 0 | 0 | ٥ | 1 | 1 | 0 | 0 | i 1 | 1 |
| otal | a | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | Q | 1 | 1 | 2 | 2 | 1 | 0 | -: | 4 |
| CHI —SQU F—HAT | | - \$ | 5- | -10 | 1 | 0-15 | 1 | 15-20 | 2 | 0-25 | 21 | 5-30 | : | 30-35 | 3 | 540 | CHI~SQUA FOR 2 TE | RE F-HA ST PERI |
| L S | Rau | ᄣ | Raw | HF O | Rasa | UF | Rau | ш | Rau | MF. | Rass | MF | Rau | W | Rem | HF | 2 Raul | MF |
| ŠĹ NC | ŏ | ă | 0 | ŏ | Ö | ģ | ģ | ò | 0 | ě | 0 | ò | ò | ò | ò | 8 | ; | 4 |
| AJ TOTAL | Ŷ | Ž | ĕ | ŏ | . 0 | 9 | 1 2 | 1 2 | ŏ | ě | 9 | ğ | 1 | 1 2 | 0 | 0 | | 1 |
| HI-SQU MLUES | | -5 | 5- | -10 | - | 0~15 | _ | 15-20 | 2 | 0-25 | 21 | 5~30 | - : | 30~3S | | S-40 | CHI-SQUA | |
| . s | Rau | WF | Rau | UF | 1.000 | UF 1.000 | 0.000 | 0.000 | Rau | WF | 0.000 (| UF 0.000 | 0.000 | 0.000 | 0.000 | uf | FOR 2 TE | ST PERI UF 0.143 |
| ic ic | 1.000 | 4.000 | | | | | 1.000 | 1.000 | | | == | , == | 1.000 | 1.000 | | . == | | 4.000 |

Table D66. Indian Point hammer test monitoring using 6m12 degree horizontal transducer located at unit 3, intake 35.

CHI-SQUARE = 3.841

| ***** | | | | | 1. | hrs oft m tide | | | Juration Freatm Exemple | ent Tu | D a: 10 | sec (| her 3 on) on, 40 sec | off | Test Date Test Time | • = | 2/20/98 2235 | |
|---------------------|---------|-----------|-----------|--------|------|-------------------|----------------|----------------|-------------------------------|--------|----------------|-------------|-------------------------|-------|------------------------|---------------|---------------------|--------|
| 10 HIN | UTES DU | RING Y | EST PERIO | Ð | | | | Ré | MOE (ne | ters> | | | | | | | *.* | |
| _ | | -5 | 5 | -10 | 10 | D~15 | | 5-20 | 21 | 0~25 | 25 | 5-30 | _ × |)-35 | 39 | 5~ 4 0 | Tota | |
| race 'upe | Rau | HF | Ran | HF | Ran | HF | RAH | MF | Rau | HF | Rau | UF | Rau | NF | Rau | MF | z Raw | |
| .s | 0 | 0 | 0 | ō | . 0 | 0 | 0 | 0 | o | 0 | 1 | 1 | ٥ | 0 | 0 | 0 | 1 | 1 |
| L | . 0 | 0 | 0 | 0 | 0 | ٥ | 0 | ٥ | 0 | • | 0 | 0 | . 0 | Ģ | • | 0 | 0 | . 0 |
| c | 2 | 7 | 0 | 0 | 0 | 0 | 0 | • | 0 | ۵ | 0 | • | . • | 0 | 1 | • | | 7 |
| ш | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | | 1 |
| otal | 2 | 7 | 0 | 0 | 0 | 0 | . 0 | 0 | ø | 0 | 1 | 1 | 2 | 4 | 1 | 0 | 5 | 9 |
| 10 HIN | WYES AF | TER TE | ST PERIOD | | | | | Ri | MIGE (no | ters) | • | | - | | | | | |
| race | 0 | -5 | 5 | -10 | 1 | 0-15 | 1 | 5-20 | 2 | 0-25 | 2 | 5-30 | | 0-35 | 3: | 5-40 | Tota | 1 |
| upe | Rau | NF | Rass | NF | Rast | HF | Rase | HF | Rası | MF | Rass | WF | Rate | WF | Rau | uf | : Rau | WF |
| S | 0 | ٥ | 1 | 2 | 0 | 0 | 0 | Q | 0 | ٥ | a | Q | 0 | 0 | 0 | G | i t | 2 |
| 1. | 0 | . 0 | 0 | 0 | 0 | 0 - | 0 | 0 | - 0 | . 0 | 0 | 0 | . 0 | 0 | . 0 | . • | . 0 | 0 |
| iC . | 0 | 0 | 0 | a | . 0 | a | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | | 1 |
| M | 0 | 0 | 0 | 0 | 0 | 0 | Z | 2 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | . 2 | 2 |
| otel | 0 | 0 | 1 | 2 | . 0 | 0 | 2 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | ø | : 5 | . 5 |
| :HI -SQUA '-HAT | | -5 | S | i-10 | 1 | 0~15 | 1 | 5-20 | 2 | 0-25 | 2: | 5~30 | 3: | 0~35 | 3: | 5~40 | CHY-SOUR | |
| _ | Raw | WF | Ran | MF | RaH | HF. | Rau | MP' | RaH | WF | Rau | HF. | Rass | UF | Rau | HF | Rau | HF 2 |
| S L C | ŏ | ŏ | ģ | é | ŏ | Ö. | ğ | ĕ | ě | ě | Ģ | õ | Ö | õ | ě | ŏ | į į | õ |
| ılık | ò | 3 | ŏ | ă | ě | ŏ | 1 | ĭ | ŏ | ō | ģ | å | ĭ | ĭ | ģ | ě | 2 5 | . 2 |
| OTAL | 1 | • | 1 | . 1 | 0 | 0 | 1 | | • 0 | 0 | 1 | 1 | 1 | | . 1 | | : 5 | • |
| HI — SQUA PILUES | | -5 | 5 | 5-10 | 1 | 0~15 | 1 | 5-20 | 2 | 0-25 | 2: | 5~30 | _ | 0~35 | 3 | 5-40 | CHI-SQUA | RE VAL |
| _ | Raw | MF | Rau | UF | Rast | WF | Rau | WF | Rass | MF | Ran | WF | Ran | uf | Rau | ··HF | t Ram | UF |
| .s iL . iC | | | 1-000 | \$-000 | == | | . == | | | | | 1.000 | - == | | | - | | 0.555 |
| ic | 2.000 | 7.000 | | | | | | 2.000 | | | 1.000 | 1.000 | 1.000 | 1.000 | 0.000 | | 0.200 | 4.500 |
| N OFAL | 2.000 | 7-000 | 1.000 | 2.000 | | | 2.000 2.000 | 2.000 2.000 | | | | 0.000 | | 1.000 | 0.000 | | 20.000 | 1.143 |

Table D67. Indian Point hawner test monitoring using 6w12 degree horizontal transducer located at unit 3. intake 35.

| •• | MUTES DU | | | ·- | | | | 1 | ranse (m | eters) | | | | | - | | •,• | |
|--------------------|----------|-------------|----------|-------------|-------|-------|-------|-------------|----------|--------|-------|-------|-----|------|-------|------|----------------------|---------------|
| | 0 | -5 | | 5-10 | | 10-15 | | 15-20 | | 20-25 | | 25-30 | | V-35 | 3 | 5-40 | Tota | |
| Abe. | | NF | Rau | | Ran | | Rau | ИF | Rau | HF | Rau | WF | Rau | WF | Rass | WF | | MF |
| 5 | 1 | 4 | 1 | 5 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | <u> </u> | 7 |
| | 0 | . 0 | . 0 | Ö | 0 | 0 | O | 0 | 0 | 0 | 0 | · 0 | o | 0 | 0 | 0 | . 0 | u |
| | 1 | 4 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | : 3 | |
| 1 | 0 | 0 | 0 | ٥ | ٥ | 0 | O | 0 | 0 | Ó | 0 | 0 | 0 | 0 | 0 | a | | o |
| tal | 2 | 8 | 2 | 4 | 1 | ~ 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -: | 1-4 |
| o nz | NUTES AF | FER TES | ST PERIO | O | • | | | • | RANGE (n | eters> | | - | | | | | | |
| | 0 | -5 | | 5-10 | | 10-15 | | 15-20 | | 20~25 | | 25-30 | _ | 0-35 | 3 | 5~40 | Total | |
| ace pe | | HF | Rau | MF | Rase | NF | Rasi | UF | Rau | | Raw | KF | Rau | WF | Rau | MF - | E Ran | ur |
| | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| | 0 | • | 0 | 0 | 0 | O | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | O |
| : | 3 | 11 | - O | . 0 | 1 | . 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 6 | 13 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | υ |
| tal | 3 | 11 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 2 | 1 | 1 | 0 | 0 | 1 | 0 | . 9 | 15 |
| II – SQL HAT | | -5 | | S-10 | | 10-15 | | 15-20 | | 20-25 | : | 25-30 | . 3 | 0-35 | 3 | 5-40 | CHI-SQUI FUR 2 TI | ARE F- |
| | Rau | HF | Rau | MF | Rau | | Rau | MF | Rau | MF | RAH | HF | Rau | HF. | Rau | HF | 2 Rau | HF S |
| | 2 | ō | ė | ą | ŏ | ŏ | Ô | ó | Ô | ò | ŏ | ŏ | ŏ | ŏ | ā | ŏ | iŏ | - ŏ |
| TRIL | Ş | , Ö | . • | 2 | ٥٠ | . ģ | ŏ | ŏ | ŏ | ŏ | ģ | ò | 0 | ğ | ò | 0 | 5 9 | 10 0 15 |
| <u>-</u> I –59t | IARE | | • | - | - | • | • | • | • | • | • | • | • | · | • | • | • ' | 15 |
| LUES | | -5 | | 5-10 | | 10-15 | | 15-20 | | 20-25 | | 25-30 | | 0-35 | | 5-40 | CHI-SQUI | ARE VA |
| | 1.000 | ₩F 1.000 | 1.000 | #F 2.000 | Rau | HF | 1.000 | UF 1.000 | 2.000 | 2.000 | Rast | uf. | Rau | HF | Ran | WF | E PAN | 4F 2.778 |
| | 1.000 | 267 | 1.000 | 2.000 | 0.000 | 0-000 | | | | | 1.000 | 1.000 | | | 1.000 | | 1.000 | 1.800 |
| | |).474 | 2.000 | 4.000 | 0.000 | 0.000 | 1.000 | 1.000 | 2.000 | 2.000 | 1.000 | 1.000 | 77 | | 1.000 | | 0.286 | 0.034 |

Test Date:

2/20/89

APPENDIX E:

Hammer Tests Monitored By

6° Vertical Transducer

Table E1. Indian Point harmer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| 15 HIM | ITES BEFO | RE TEST | PERIOD | | • | | • | P | tRMGE (net | ters) | | | | | | | CHI ~S | QUARE F | -HAT |
|--------------------------------|------------|--|--------|--------|----------|------------|---------------------|--------|---------------|----------------|----------|----------------|----------------|-------|----------|-----|--------|----------------|--------|
| race | 0~ | <u>. </u> | 1-2 | 2 | 2-3 | | 3-4 | 1 | 4- | -5 | | -6 | 6- | 7 | Tota | 1 | FOR 3 | TEST P | ERIOD |
| ypt | Rau | uf . | Rasi | eF . | Rass N | F | Rass b | #F | Rau | HF | Rau | UF | Rass | HF | Reu | ИF | Rau | MF | |
| S . | 0 | 0 | O | 0 | 0 | 0 | 1. | 2 | 0 | 0 | . 0 | 0 | . 0 | 0 | 1 | 2 | 7 | 10 | |
| L | o | 0 | ٥ | G | 0 | O . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| c | O | 0 | 0 | ٥ | 2 | 5 | 2 | 4 | 3 | 5 | 3 | 4 | 3 | 3 | IJ | 21 | | 14 | |
| 14 | 0 | 0 | .0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | Q. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| otel | 0 | 0 | Q | 0 | 2 | 5 | > | 6 | > | 5 | 3 | 4 | 3 | 3 | 14 | 23 | 14 | 23 | |
| 15 HIM | JTES DURI | WO TEST | PERIOD | | | | | | | | | | | | , | | | | |
| | 7145 DONA | | FEREUE | | | | | | RNGE Gret | ters> | | | | | | | | | |
| 'r 650 | 0- | 1 | 1 | 2 | 2-3 | | | 4 | | -5 | | i-6. | | 7 | Total | 1 | CHI-S | QUARE U | PERIOD |
| UPP | Rau | | Rau | AF | Rass V | F | Rau I | #F | Reu | UF | Rest | HF | Rass | HF | Rau | W | | Res | М |
| .s | , 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | • | 4 | 8 | ٥ | Ģ | 10 | 15 | LS | 6,000 | 3.60 |
| iL | 0 | 0 | 0 | 0 | . 0 | 0 | 0 . | 0 | ٥ | 0 | O | 0 | 0 | 0 | . 0 | 0 | St. | | |
| IC . | 0 | 0 | 1 | 5 | 0 | 0 | 0 | . 0 | 1 | .2 | 1 | 1 | 2 | 2 | 5 | 10 | NC | 4.375 | 4.78 |
| W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | <u> </u> | 0 | 0 | 0 | <u> </u> | . 0 | . HH | _ | |
| rotal | O . | 0 | 1 | 5 | 0 | • | . 1 | . 2 | 4 | , 10 | 5 | 6 | . 2 | 2 | i 15 | 25 | TOTAL | 1.071 | 2.17 |
| 15 HIM | UTES AFTE | R TEŠT | PERIOD | | | | | | | _ | | | | | | | | | |
| • | | _ | | _ | | | · | • | table (ne | | _ | : | _ | _ | | | CHI -5 | MUNKE - | 5.99 |
| [rate | 0- | | 1- | | 2-1 | | 3 | | | -5 | | i-6 | 6- | | Fot | | Calph | - 2> | 5> |
| Tupe | | WF | | WF | | . | | WF | Rau | HF | Rau | | Rew | NOF | | 47 | • ` - | | |
| .S | . 0 | 0 | 0 | 0 | 2 | 5 | 0 | 0 | 0 | 0 | 6 0 | 7 | 1 | 1 | 7 | 13 | | | |
| 5L | 0 | 0 | 0 | | . • | 0 | | 0. | 3 | 5 | , 0 | | - ·. | 0 | 5 | 10 | | | |
| NC | 0 | . 0 | 0 | 0 | 2 | 5 | 0 | 0 | - | • | 0 | · 0 | ė O | 0 | . 0 | 10 | | | |
| <u> </u> | <u> </u> | | 0 | | 0 | | | | <u> </u> | <u>-</u> - | <u>-</u> | - - | | | 14 | 23 | - | | |
| rotal :HI-squa | 0 RE 0- | . 0 | 0 | . O | 7 | | 0 3 | . 0 | 3 | -s | | 5-6 | 1 .6- | . I | | 23 | | | |
| r-Hat | | L. | | | 2-3 | | | | | | | WF | | MF | | | | | |
| ĻS | Ö | 9 | ā | 0 | . 1 | . 3 | Ran (1 O | 1 0 | Rau 2 0 | 7 | Res | 7 1 | Rasu O O | 9 | | | | | |
| IC IC | 0 | õ | o o | ž | 0 1 | 3 | ĭ | ī | Ž | ă | ĩ | . 2 | ž | ž | | | | | |
| OTAL | 0 | ê | . 0 | 0 2 | 0 2 | . 0 | 0 | . 3 | 9 | 7 | 9 5 | 6 | 8 | 2 | | | | | |
| | RE 0- | 1 | 1- | 2 | 2-3 | | 3- | 4 | | - 5 | ; | 5-6 | 6 | -r | | | | | |
| | | | | | | | | | | UF . | Ran | ME | Rau | LLF. | | | | | |
| ALVES | Rau | WF. | Rass | HF ' | Ran I | F | | HF | Raw | | | | E-64 | 14. | | | | | |
| CHI-SQUA PALVES LS SL | | | | | 2.000 7 | 500 | 0.000 4 | .000 | 7.500 1 | 2.333 | 7.333 | \$.500 | | | | | • | | |
| | Rau | | = 7 | | 2.000 7. | 500 667 | 5.000 15 0.000 4 | | 2.500 | | 6.000 | | 1.500 | 1.500 | | ٠ | | | |

Table E2. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| | | و مواد کشور | | del Pi | Ĺo | S Hr t | • ' | 9 EV548 f | Duration Treatme | ent Tup | • 1 i | ê min | Her 163 on continuous | | Test Dat | l e: 1 | /23/06 1941 | y 60 00 4 |
|----------------------|---------|-------------|---------|-------------|----------|----------|-------|-------------|---------------------|------------------|-----------------------|--------------|--------------------------|-----|----------|---------------|----------------|------------------------------|
| 10 MINUTE | | | | | | | | | RANGE GIA | | | | | | | | 0117 6 | |
| _ | 0- | 1 | 1. | -2 | 2- | -3 | 3 | -4 | 4 | -5 | 5 | ~6 | 6- | 7 | Tota | 1 | FOR 3 | QUARE F-HAT TEST PERIODS |
| Trace Type | Rass | MF | Rau | WF | Resi | WF | Rau | WF | Rau | uf . | Rau | MF | Rau | HF. | : Rau | WF | Rau | UF |
| LS | 1 | 7 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | a | 4 | 14 | 6 | 10 |
| SL | α. | • | 0 | G | 0 | 0 | 0 | 0 | 0 , | 0 | 0 | 0 | 0 | 0 | ٥ | 0 | 0 | 0 |
| HC | 0 | 0 | 0 | 0 | 1 | 3 | 1 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | į , | 7 | 6 | 12 |
| HH | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | . 1 | 1 |
| Total | 1 | 7 | 1 | 8 | 1 | 3 | 1 | 2 | 1 | 2 | 2 | 2 | 0 | 0 | i 7 | 21 | 15 | 55 |
| 19 HINUT | ES DURI | NG TEST | PERIOD | | | | | | RANGE Gret | ters> | | | | | | | | |
| F | 0- | 1 | 1 | -2 / | 2- | -> | 3 | 4 | 4- | -5 | 5 | -6 | 6- | 7 | Tate | 1 | CHI-S | GUARE VALUES TEST PERIODS |
| Trace Tupe | Ress | uf . | Raw | MF | Rau | HF | Rass | MF | Rast | MP | Rass | MF | Rass | W | E RAM | WF | - rem s | Rau HF |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 10 | 4 | 4 | 12 | 14 | L\$ | 9.033 10.300 |
| SL | 0 | 0 | 0 | o | 0 | 0 | 0 | 0 | D | 0 | 0 | 0 | 0 | 0 | . 0 | ø | SL . | |
| HC | 0 | 0 | 0 | 0 | 3 | • | 1 | . 2 | 0 | 0 | 0 | 0 | 0 | 0 | • | 10 | NC | 9.167 4.417 |
| MM | 0 | 0 | 0 | 0 | 0 | 00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | .i | 0 | - 144 | 6.000 6.000 |
| Total | 0 | 0 | 0 | 0 | 3 | • | . 1 | 2 | 0 | 0 | 0 | 10 | 4 | 4 | 14 , | 24 | TOTAL | 4.154 1.227 |
| 18 MINUT | ES AFTE | R TEST | PERI OD | | ٠. | | | | RANGE CHE | ters) | | | | ٠. | | | | |
| _ | 0- | 1 | 1 | -2 | 2. | -3 | 3 | -4 | 4 | ~5 | 5 | -6 | 6- | T | Total | 1 | (d.f. | QUARE = 5.991 |
| Trace Tupe | Rau | WF | Rau | HF | Rass | HF | Rasi | MF | Rau | MF | Rass | ИF | Rass | MF | : Raw | HF | - (alph | ·· ~ -05> |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o | 0 | 0 | 1 | 1 | 0 | • | 1 | 1 | _ | |
| SL | Ð | Ö | 0 | 0 | D | a | 0 | 0 | 0 | Đ | 0 | 0 | 0 | 0 | | ø | | |
| NC | 0 | 0 | 0 | ຄົ | 0 | 0 | 2 | 4 | 5 | 0 | 5 | 6 | o | . • | 12 | 10 | | |
| HH | 0 | 0 | 0 | 0 | 0 | <u> </u> | 0 | 0 | 00 | 0_ | <u> </u> | 0 | | | | | _ | |
| Total | 0 | 0 | 0 | O | . • | 0 | 2 | 4 | 5 | • | 6 | 7 | 3 | > | : 16 | 22 | | |
| CHI -SQUARE F-HAT | | | 1 | -2 | 2 | -3 | 3 | -4 | | -5 . | | <u>-6</u> | 6- | | | | | |
| LS | 0 | ₩ 2 | Rau | HF 2 | Rau O | WF O | Rau | HF O | Rau | ш г 0 | Rau | MF 4 | Rau | W 1 | | | | |
| SL NC | 8 | · Ö | ě | 0 | Ŷ, | 9 | 0 | 9 | 0 2 0 | 2 | 0 | 0 2 | o o | ģ | | | | |
| MH TOTAL | D 6 | 2 | 8 | 2 | 0 | - 9 | 0 | 9 | 0 2 | 8 | <u>0</u> \$ | 6 | 2 | 2 | | | | |
| CHI-SQUARE | : ·· o- | -1 | 1 | -2 | 2 | -3 | 2 |) -4 | 4 | -5 | = | 5-6 | 6- | ·7 | | | | |
| URLUES LS | Ran | HF 7.500 | Reu | UF 7.500 | Rape | HF | Rau | WF | Res | WF. | 8 - 250 | UF 13.250 | Rau 12,000 12 | | | | | |
| LS SL NC MM | == - | | | | 6.000 | 7.250 | 2.000 | 0.000 | 7.000 1 | 2.667 | 7.500 | | | | | | | |
| TOTAL | 67 | 7.500 | | 7.500 | 6.000 | 7.250 | 2.000 | 0.000 | 7.000 1 | 2.667 | 4,600 | 6.500 | 5.500 | 500 | | | | |

Table E3. Indian Point hanner test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| | | | | | idal Pi | L | Hr bei | • | | Duratio Treat | ment Tu | pe: | 11 win | ibur 143 o continuou | 8 | Test D | Lnes | 2/23/ 99 2015 | | |
|--|--------------------|------|----------------|-------------------------|--------------------------|-------------------------|-----------|--------------------------------|-------------------------|-------------------------------|----------------|-------------------------|-------------------------|-------------------------|---|--------|------|-------------------------|-----------|-------------------|
| 11 MINL | | | | T PERIOD | | | + 024501 | | | RANGE (H | | | | | 4 4 5 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | | | | | |
| | | 0-1 | | 1. | -2 | | :-3 | 3 | -4 | | 4-5 | | 5-6 | . 6 | -7 | Te | tal | | QUARE (| PERI OD: |
| Trace Tupe | Rad | 4 HF | _ | Rau | WF | Rau | UF | Rau | HF | Ray | MF | Res | uf . | Rau | MF | : Re | 4 MF | Rass | МF | _ |
| .s | 0 | | 0 | 1 | 5 | 2 | 5 | 4 | 8 | 2 | 3 | 3 | 4 | 1 | 1 | 13 | 26 | 14 | . 35 | _ |
| iL. | 0 | | 0 | 0 | 0 | 0 | • • | 0 | 0 | ٥ | 0 | 0 | . 0 | 0 | 0 | | 0 | 0 | 0 | |
| ŀĆ | Q | | ٥ | 0 | 0 | 0 | 0 | 3 | 6 | . 2 | • | . 4 | 5 | 2 | 2 | 14 | 21 | 12 | 17 | |
| AM . | 0 | · | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 . | 0 | . 0 | 0 | 1 | | |
| rotel | 0 | | 0 | 1 | 5 | 2 | 5 | 7 | 14 | 7 | / 11 | 7 | 9 | 3 | . 3 | 27 | 47 | 26 | 52 | |
| 11 MIM | UTES R | FTER | TEST | PERIOD | | | | | 1 | RANGE G | | | | | | | | | | |
| race | | 0-1 | _ | 1. | -2 | | 5-3 | | -4 | | 4-5 | | 5-6, | 6 | - † | To | tal | CHI -5 | QUARE I | PALUES PERI DO |
| ype | Rad | 4 HF | | Rau | WF. | Rau | lef | Rans | HF. | Rass | HF. | Ras | HF. | Rasu | UF | : Rad | u NF | | Ram | H |
| .\$ | 2 | • | 14 | 2 | 9 | 1 | 3 | 7 | 14 | 1 | 2 | 1 | 1 | 0 | 0 | 14 | 43 | LS | 9.037 | 4. 18 |
| iL. | 0 | | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | D | 0 | 0 | 0 | . 0 | 0 | SL. | _ | |
| łC | 0 | | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | > | 3 | . 4 | 3 | 3 | • | 12 | NC | 1.097 | 2.45 |
| #1 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 1 | 1 | 0 | 0_ | 1 | 1 | IMI. | 1.000 | 1.00 |
| otal | . 3 | | 14 | . 2 | 9 | .1 | 3 | . 8 | 16 | 3 | 5 | 5 | 6 | 3 . | 3 | : 24 | 56 | TOTAL | . 0.176 | 0.78 |
| HI-SQUA | RE. | 0-1 | | 1. | -2 | : | t-3 | 3 |)-4 | | 4-5 | | 5-6 | 6 | -7 | | • | | QUARE | - 3.04 |
| F-HAT LS SL HC HH TOTAL | Ra: 1 0 0 | | - 7000 7 | Rau 2 0 0 0 | ## 7 0 0 0 7 | Rau 2 0 0 0 | 4 000 T | R 344 6 0 2 0 9 | 4F 11 0 4 0 | Rasi 2 0 4 0 5 | MF . | Ray 2 0 4 1 | # WF 3 0 5 1 6 | Ran 1 0 3 0 | UF 1 0 3 0 3 | | | | ia = °.0! | 5> |
| HI-SQUA | RE · | 0-1 | | 1 | -2 | : | 23 | 3 | -4 | | 4-5 | | 5-6 | 6 | -7 | • | | | | |
| VALUES LS SL | 2.000 | | 00 | 0.355 | HF 1.143 | 0.333 | 0.500 | 0.619 | иг 1.636 | 0.333 | 0.200 | 1.000 | 1.800 | | UF 1.000 | | | | | |
| NC UU TOTAL | 2.000 | 14.0 | - | 0.333 | 1.143 | 0.223 | 0.500 | 0.067 | 0.133 | 1.600 | 2.273 2.250 | 0.145 1.000 0.333 | 0.111 1.000 0.500 | | 0-000 0-500 | | ٠ | | | |

Table E4. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| | res B efor | rtautu K vect | ري الرواط الأك الدر | del Phe | H | Hrs be | fore le | | Duration Treatme | ent Tupe | : 5 | min co | er 163 on ontinuous | | Test Dat Test Tip | 142 1 | | |
|---------------------|-----------------------|------------------|---------------------|---------------|----------|---------|---------------------------|------------|---------------------|----------|-----------|----------|------------------------|---------|----------------------|--------------|--------|-------------|
| 2 (11114) | ES SEFUK | E IEDI | PERAUD | | | | | • | tange chet | :ers> | | | | | | | CMT ~S | QUARE F-HAT |
| race | 0- | | 1. | -2 | | -> |) | -4 | 4- | -6 | 5- | • | • | -7 | Tota | .1 | FOR 3 | TEST PERIO |
| up+ | | MF | Reu | WF | Rau | NF | Rau | uf | Rau | HF | Rau | MF | Rau | MF | Rass | HF | Reu | WF |
| ,5 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | > | 5 | 0 | 0 | 0 | 0 | , F | • | • | 13 |
| iL. | O | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0, | 0 | 0 | 0 | ٥ |
| (C | 0 | 0 | 0 | . 0 | • | 0 | o | 0 | 0 | 0 ' | 1 . | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| 454 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | o | Q |
| otal | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | > | s | 1 | 1 | 1 | 1 | 7 | 11 | 10 | 15 |
| S MINU | res durin | O TEST | PERI OD | | | | | , | tance quet | ters) | - | | | | | | | |
| | 0- | 1 | 1. | -2 | 3 | :-3 | 3- | · 4 | 4- | -5 | 5- | •6 | • | -7 | Tota | .1 | CHI -S | QUARE VALUE |
| frace Type | Rau | MF | Rest | MF | Rept | W | Rau | WF | Res | HF | Rana | WF | Rasi | HF | : Rau | WF | FOR 3 | TEST PERIO |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 10 | 3 | 5 | 4 | 5 | 0 | 0 | 12 | 20 | LS | 3.250 6.3 |
| 5L | a | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | • | 0 | 1 0 | 0 | SL. | |
| 4C | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 1 | 1 | NÇ | -0.500 -0.5 |
| ш | 0 | 0 | o | 0 | 0 | o | 0 | 0 | Q. | a | D. | 0 | 0 | Ö | | 0 | MH | |
| Total . | o | 0 | 0 | Q | 0 | 0 | 5 | 10 | 3 | 5 | 4 | 5 | . 1 | 1 | 15 | 21 | TOTAL | 0.900 3.7 |
| S MINU | TES AFTER | TESŤ A | PERION | | | | | | | | | • | | | | | | |
| | | | | | | | | _ | RANGE GIOT | ters> | | , | | | | | CHI -S | QUARE - 5.9 |
| Trace | 0~ | | 1 | -2 | | 2-3 | | | | -5 | | -6 | | i-7 | Total | 1 | (d.f. | - 2> |
| Tupe | | HF | <u>Reu</u> _ | . | Ray | | Res | WF | | HF | Rau | WF | Rau. | uf | : Ram | uf | | |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 6 | * | 3 | 2 | 2 | 0 | • | 1 7 | 11 | | |
| SL | O | O | 0 | 0 , | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 0 | 0 | | |
| NC | Q | 0 | . • | 0 | 0 | 0 | 0 | 0 | • | 0 | 2 | . 2 | G | 0 | 1 2 | 2 | | |
| | <u> </u> | 0 | | 0 | <u> </u> | 0 | 0 | 0 | . 0 | <u> </u> | 0 | <u> </u> | <u> </u> | | | | | |
| Total | 0 | 0 | 0 | 0 | 0 | • | 3 | 6 | , 2 | 3 | 4 | 4 | , 6 | • | i 9 | 13 | | |
| CHI -SQUAI F-HAT | | | | -2 | | 1-3 | . 3- | | 4- | -5 | 5- | | | 5-Y | | | • | |
| LS | Ran | HF O | Rau | HF O | Rau | MF O | Rau S | uf | Rau 3 | HF 4 | Rass 2 | ИF 2 | Rest | MF D | | | | |
| SL NC | 0 | 0 | 0 | 9 | ò | 0 | 0 | 0 | ò | 0 | 0 | 9 | 0 | 0 | • • | | | |
| HU Total | o o | ò | Ď | Õ. | ě | . 0 | Š | Õ | Š | Ž | Š | Š | , Ō | Õ | | | | |
| CHI -SQUAI | RE 0- | 1 | 1 | -2 | 4 | 2-3 | >- | -4 | 4- | -5 | 5- | -6 | | 5-T | | | | |
| VALUES | Rau | µF . | Rau | ИF | Rass | MF | Ran | HF | Rau | WF | Reu | MF | Ran | MF | | | | |
| L\$ SL | | | | | - | | | 1.714 | -0.667 | 1.750 | - | 7.500 | | == | | | | |
| SL NC W | | | == | | | | | == . | | | | 2.000 | 0.000 | 0.000 | | | | |
| TOTAL | | | | | ~- | | 2.667 | 1.714 | -0.667 | 1.750 | 2.000 4 | 1.000 | 0.000 | 0.000 | | | | |

Table E5. Indian Point harmer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| | | | | | H | igh Tid | • •• *• ••• | | enteer? decem en | nt Typ | +: 9 | min co | entinuous Hennema | | Test Ti | e: 1 | 350 | | |
|--------------------|----------|----------|--------|-----|-----------|---------|---------------------------|----------|--------------------------------|--------|----------|---------|----------------------|---------|---------|------|---------|---------|---------|
| 0 1,211011 | | | | | | | | RF | WIBE (met | ers> | | | | | | | CHT-S | QUARE F | -MOT |
| Trace | Q- | 1 | 1- | -2 | 2 | -3 | 3~ | 4 | 4- | 5 | 5- | -6 | 6- | -7 | Tota | 1 | FOR 3 | TEST F | ERIOD! |
| Tupe | Resi | ЦF | Rau | WF | Rass | HF. | Rass | HF | Rass | HF | Rass | LEF | Rau | ME | Rau | ИF | Rau | HF | _ |
| LS | 0 | 0 | 0 | 0 | 0 | ۰,۵ | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 2 | > | |
| SL. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ¢ | 0 | 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | ٥ | |
| NC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o | 0 | ٥ | 0 - | • | O | • | • | 0 | 0 | . 1 | |
| HH | 0 | 0 | 0 . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 1 | 1 | |
| Total | o | 0 | 0 - | Q | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | O | 0 | . 0 | 0 | 4 | \$ | |
| B HINUT | ES DURIN | O TEST | PERIOD | | | | | 24 | MGE CHOT | -v-> | | | | | | | | | |
| • | 0- | 1 | 1. | -2 | ٠, | -3 | 3- | | 4- | | 5- | -£ | 6 | -T | Tota | .1 | CH1 -5 | QUARE L | ALIES |
| Trace Type | | up. | | WF | Rant | WF | | YEF | | HF | | WF | Ran | WF | Rau | | FOR 3 | TEST (| ERI ODS |
| L\$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 5 | 0 | 0 | 5 | 7 | L\$ | 7.500 | 9.661 |
| SL | 0 | G | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | O | 0 | | 0 | SL | | |
| HC | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2. | ٥ | 0 | 0 | 0 | 0 | 0 | 1 | 2 | NC | | 2,000 |
| HH | 0 | ٥ | 0 | G | 0 | 0 | 0 | • | D | 0 | 1 | 1 | | 1 | 5 | 2 | HH | 4.000 | 4.000 |
| Total | 0 | 0 | 0 | 0 | 0 | • · | 1 | 2 | 1 | 2 | 5 | 6 | 1 | 1 | | 11 | TOTAL | . 0.000 | 12.400 |
| 8 HINUT | ES AFTE | R TEST I | ERI OD | | ٠, | | J. | | MIGE (net | | | | | | | | | | |
| _ | Q- | -t | | -2 | | -3 | 3- | 4 | 4- | | 5- | -6 | | -r | Tota | a l | (d.f. | GURRE (| |
| Trace Type | Resi | MF | Rau | HF | Rau | HF | Rau | HF. | Ray | HF | ReH | HF | Ran | HF | RAN | WF | - carbu | 0 | 5) |
| LS | 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 2 | 2 | • | | |
| SL | 0 | . 0 | 0 | Q | 0 | 6 | 0 | .0 | 0 | Ò | ٥ | 0 | 0 | 0 | | 0 | | | |
| NC | 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | 0 | 0 | Q | 0 | 0 | | 0 | | | |
| мы | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1.1 | 1 | 1 | 2 | 2 | | | |
| Total | 0 | Q. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 1 | 1 | 1 | 4 | • | | |
| CHI-SQUAR F-HAT | E | -1 | 1 | -3 | 2 | -3 | 3- | 4 | 4- | 5 | 5- | -6 | 6 | -7 | | | | | |
| LS | · Rau | HF G | Rass | HF. | R-mi O | HF Q | Rau O | HF | Rass | HF | Ran 2 | HF 2 | Rass | HF O | | • | | | |
| SL NC | Ö | Ġ | ò | 0 | Ŏ | 0 | Ŏ | ģ | Ď | ě | Ō | ō | Ó | ğ | | | | | |
| HH TOTAL | ě | ò | š | ŏ | ŏ | . 8 | ŏ | ė | ŏ | ŏ | 1 | ĭ | į | į | | | | | |
| CHI-SQUAF | £ ·· 0· | -1 | • | -2 | | :-3 | 3- | <u> </u> | 4- | _ | 5. | -6 | | | | | | • | |
| UALUES | Rass | HF | Rau | uf | Rest | HF. | Rau | HF. | Rau | NF. | Raw | HF | Rau | HF | | | | | |
| LS Si | | | | == | | | | | == 2 | .000 | 4.000 | r.500 | | == | | | | | |
| SL NC | == | | | | | == | = : | .000 | == | | | _== | | | | | | | |
| HII TOTAL | | | | | | | 2 | .000 | 2 | .000 | | 0.000 | | 0.000 | | | | | |

Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| | | | | del Pho | HL | Hrs bet gh Tid | ore | | Duration (Treatmen | of Yest: nt Type: | 6 | ain Ha | r 163 on ntinuous | | Test Dat | ei i | | |
|-------------------------------|----------|--------|------------|---------|---------------|-------------------|----------|---------|------------------------|----------------------|------------|-----------|----------------------|---------|-----------|------|--------|-------------|
| 6 MINUTE | | | | | | | | RI | ANDE CHAR | ers> | | | | | | | CHT-S | QUARE F-HAI |
| _ | 0-1 | | 1-2 | 2 | 2- | • | 3 | 4 | 4-1 | 5 | 5-0 | 5 | 6~ | ·7 | Tota | 1 | FOR 3 | TEST PERIO |
| Trace Type | Rest H | F | Rau | # | Rasi | WF | Rass (| 4 | Ran | MF | Rau | HF. | Rest | MF | Rau | MF | Rau | LAF. |
| .s | 0 | 0 | 0 | - 0 | 0 | Q | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| SL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | • | Ð | 0 | ٥ |
| (C | 0 | 0 | 0 | ø | 0 | 0 | . 0 | 0 | . 0 | ¢ | . • | 0 | 0 | 9 | • | 3 | 2 | · > |
| HH | a | q | 0 | a | 0 | O | . 0 | ó | 0 | 0 | 0 | D | . 1 | | 1_ | 1 | 1 | 1 |
| Total | 0 | | 0 | 9 | 0 | 0 | | 0 | Ó | 0 | 0 | 0 | 1 | 1 | 1 | 1 | • | s |
| 6 MINUTE | S DURING | TEST | PERIOD | | | | | R | ANGE Goet | ers> | | , | | | | | | |
| | 0-1 | | 1- | 2 | 2- | .> | 3 | 4 | 4- | 5 | 5- | 6 | 6- | -7 | Tota | -1 | CHI - | QUARE VALUE |
| Trace Type | Res S | eF. | Rasi | WF | Rast | WF | 2 404 | W | Rau | HF | Rau | uf- | Rass | HF | t Ran | HF | · rust | Rass |
| ĻS | 0 | 0 | 0 | 0 | 0 | Q | 0 | | 1 | 2 | 0 | 0 | 0 | 0 | 1 | 2 | LS . | 2. |
| SL. | 0 | 0 | 0 | 0 | 0 | Q | 0 | 0 | . 0 | Q | 0 | 0 | 0 | 0 | Q | 0 | SL | |
| NC | 0 | • | 0 | 0 | . 0 | 0 | 1 | 2 | 1 | 2 | 3 | 4 | 1 | 1 | • | • | NC | 11.500 17. |
| ш | 0 | 0, | 0 | 0 | 0 | 0_ | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | <u> </u> | 1 | LELL . | 0.000 0. |
| Total | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 4 | 3 | 4 | 3 | 2 | • | 12 | TOTAL | . 6.250 14. |
| 6 HINUTE | S AFTER | TEST F | ERI QO | • | ٠. | | | R | ANGE Gret | ers> | | | | | | | | QUARE - S. |
| _ | 9-1 | L | 1- | 2 | 2. | -3 | >- | 4 | 4- | 5 | S - | 6 | 6 | ~7 | Total | -1 | (4.6 | 2) |
| Trace Type | Rest | ar . | Rest | MF | Res | WF | RAH | М | Rest | WF | . Rau | WF | Rası | HF | Rau | MF | | 055 |
| LS | 0 | 0 | 0 | 0 | Q | q | ō | 0 | 0 | P | 0 | q | 0 | 0 | 0 | 0 | | |
| SL | 0 | • | o (| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | . 0 | 0 | | • |
| NC · | 0 | 0 | o | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | į . | . 1 | | |
| HSI . | 0 | | 0 | 0 | 0 | 0 | .0 | 0 | 0 | 00 | 0 | 0 | 1 | 1 | <u>;1</u> | 11 | • | |
| Total | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | 11 | 1 | 1 | 1 | : 2 | 2 | | |
| CHI~SQUARE F-HAT | E | 1 | 1- | 2 | 2. | -3 | | 4 | | | 5- | | | -7 | | | | |
| | Rau | WF · | Rau | NF O | Rass | HF O | Ran C | uf O | Rass D | HF 1 | Rau | MF | Rest | HF O | | | | |
| SL NC | 0 | 8 | 8 | Ö | 8 | 0 | 0 | 0 | . 0 | 0 | 1 | 50 | 8 | 8 | | | | |
| LS SL NC HU TOTAL | Ö | Ö | Ö | ġ 6 | Ö | . 0 | 0 | Ŷ | . 0 | 9 | 0 1 | ', O 2 | 1 | i | ÷ | | | |
| CHI-SQUAPE | E ~ O- | 1 | 1- | 2 | 2 | -3 | 5- | -4 | 4- | -5 | 5- | -6 | 8 | -7 | * | | | |
| VALUES | Rau | NF | Rass | MF | Ran | μF | Reut | HF | Rest | uf | Rau | WF | Rasi | μF | | | | |
| LS SL NC | | === | | == | | | == | . == | | 2.000 | | | | | | | | |
| HR HC | | | | == | . | | | 1.000 | | | | -500 | | 0.000 | : | | | • |
| TOTAL | | | | | | | 2 | 2.000 | 2.000 12 | 2.000 | 6.000 3 | .500 | 2,000 | 2.000 | | | | |

Table E7. Indian Point harmer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

Tidal Phase: 3 Hrg before

| | | | | | | ou Tide | | | Treatm | ent Tup | ėi i | | ontinuou | | Test Ti | | 957 | | |
|-----------------------|----------------|----------|-------|--------|--------|-------------|------|---------|-------------|--------------|--------------|-------------|----------|-----------|---------|------------|---------|---------|----------------|
| 13 NIMUI | res Befo | RE TEST | PERLO |) | • | | | | RANGE (ne | ters) | | | | | | | CHI —S | QUARE F | -HAT |
| race | 0- | | | -2 | | 2-3 | | -4 | 4 | -5 | 5 | -6 | | -7 | Tot | | FOR 3 | TEST P | ERI 009 |
| upe | Rau | HF | Rau | WF | Rası | HF | Rau | MF | Rau | MF. | Rass | H.F | Rau | MF | Ran | uf | Rau | UF | |
| .s | 0 | 0 | 0 | O. | . 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | a | 0 | 2 | 5 | 3 | . 5 | |
| SL | Đ | • | | 0 | 0 | . 0 | 0 | 0 | 0 | • • | 0 | . • | D | 0 | . 0 | 0 | 0 | 0 | |
| NC | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | , o | 7 | . 9 | 1 | 1.1 | | 10 | . 9 | 13 | |
| 414 | Ð | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0_ | 0 | ۵ | | 0 | . 1 | 1 | |
| Total | 0 | ٥ | 0 | 0 | 2 | 5 | 0 | 0 | 0 | . 0 | 7 | 9 | 1 . | 1 | i 10 | 15 | 13 | 19 | |
| 13 HINU | res duri | NO TEST | PERIO | | | | | | RANGE Core | ters> | | | · | | | | | | |
| | 0- | 1 | 1 | 1-2 | | 2-3 | 3- | -4 | . 4 | -5 | 5 | ;~ 6 | 6 | -7 | Tot | a 1 | CHI -S | QUARE V | ALVES |
| Trace Type | Ran | MF | Rass | NF | Ran | HF | Rau | LOF" | Rau | HF | Rau | HF | Reu | HF | : Ran | HF | - FOR 3 | TEST P | EREODS HF |
| LS | 0 | ő | 0 | 0 | 0 | 0 | 0 | 0 | 2 | > | 2 | 2 | 1 | 1 | : S | 6 | LS | 2.667 | 0.400 |
| 5L | 0 | 0 | 0 | 0 | 0 | ۵ | 0 | 0 | 0 | a | 0 | 0 | 0 | • | | . 0 | SL | | |
| NC | • | • | D | 0 | 0 | 0 | 1 | 2 | 3 | . 6 | 3 | • | . 1 | 1 | | 12 | NC | 0.667 | 0.462 |
| 414 | 0 | 0 | 0 | 0 | 0 | G | D | | 1 | 2 | 0 | | .1 | 1 | . 2 | > | 5464 | 2.000 | 6,000 |
| rotal | 0 | <u> </u> | 0 | 0 | 0 | 0 | 1 | . 2 | 6 | 10 | <u> </u> | 6 | > | 3 | 15 | 21 | TOTAL | 1.077 | 3. 222 |
| 15 MINU | TES AFTE O- | • | | 1-2 | | }-3 | > | -4 | RANGE CHA | ters) I-S | | i~6 | 6. | -r | Tot | -1 | CHI -S | OUARE = | 5. 99 1 |
| Trace Tupe | | LIF | Rau | WF | Rau | HF | Ran | HF. | Rau | HEF | Rau | µF | Rau | HF | : Raw | ЦF | - Calph | 05 | > |
| | 0 | a | 0 | 0 | 0 | | 0 | a | 0 | G | 3 | 4 | 0 | 0 | : | 4 | - | | |
| SL . | 0 - | 0 | 0 | 0 | 0 | o · | 0 | 0 | ٥ | 0 | 0 | o | 0 | 0 | : 0 | ٥ | | | |
| NC | 0 | ٥ | 0 | o | 1 | 3 | Đ | 0 | > | 5 | .3 | 4 | 4 | 4 | : 11 | 16 | | | |
| MM | 0 | o | 0 | 0 | 0 | . 0 | 0 | 0 | D | 0 | 0 | 0 | . 0 | 0 | | 0 | | | |
| rotal | 0 | | ۵ | 0 | 1 | 3 | 0 | 0 | | 5 | | • | 4 | | 14 | 20 | - | | |
| CHI -SQUARI | E 0- | 1 | 1 | -2 | | 2-3 | . 3- | -4 | 4 | ⊢ 5 | 5 | ;-6 | 6 | -7 | | | | | |
| F-HAT | Raw | MF. | Raid | ЫF | Rass | UF | Rau | HF | Rau | MF | Rau | HF | Rau | MF | | | | | |
| LS SL | . 0 | 0 | 0 | 0 | 1 0 | . 2 | 0 | 0 | 1 0 | 0 | 2 0 | 2 | 0 | 0 | | | | | |
| NC AM | 8 | 0 | D | . 0 | . 0 | . 0 | 0. | 10 | 2 | 3 | 1 | 6 | 2 0 | . 3 | | | | | |
| POTAL | 0 | • | ٥ | 0 | 1 | 3 | 0 | | > | • • | 6 | • | 3 | ,3 | | | | | |
| CHI —SQUARI VALUES | E | | | 1-2 | | 2-3 | | -4 | 4 | | 5 | <u>-</u> | | <u>-7</u> | | | | | |
| LS | Rau | HF | Ram | uf | 2.000 | ИF 7.500 | Rass | HF | 2.000 | 6.000 | Rau 1.500 | 4.000 | Rau | HF | | | | | |
| LS SL NC | | | | == | | 6.000 | : | 2.000 | | 6.667 | 3.750 | 1.033 | 3.000 | 3.000 | | | | | |
| HH FOTAL | | | | | | 3.333 | | 2.000 | | 2.000 | | -0.375 | | D-667 | | | • | | |
| U. FIL. | | | | | <.uu | 3.333 | | E . UUU | 5.UUJ 1 | U-000 | u.333 - | U.3(5 | U.BBT | u-991 | | | | | |

Table E8. Indian Point hanner test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| | **** | | | dal Pho | L | O min Dil wo | • | Leggeli | Duration Treatm | ent Tupe | 1 1 | 0 min co | er 1,345 ontinuous | | Test Dat | +1 2 | /24/88 244 ********************************* |) Tyana |
|-------------------------------|----------|----------|--------|---------|------|-----------------|-------|---------|--------------------|----------------|------|-------------|-----------------------|---------|----------|-------------|--|----------------------------------|
| 10 HI MUTE | ES BEFOR | E TEST | PERIOD | | | | | | tanse (no | | | | | | | | | WARE F-HAT |
| | 0-1 | l | 1- | -z | . 2 | :-3 | 3 | -4 | 4 | - 5 | 5 | -6 | 6- | 7 | Tota | 1 | FOR 3 | TEST PERIOD: |
| Trace Type | Rau b | IF . | Rau | MF | Rau | HF | Rest | HF | Rest | HF | RaH | HF | Rass | HF | : Rau | HF | Rest | MF |
| LS | 0 | 0 | o | 0 | o | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 3 | 4 |
| SL. | 0 | 0 | ٥. | 0 | 0 | q | 0 | 0 | ø | 0 | ø | 0 | 0 | • | . 0 | 0 | ٥ | ٥ |
| NC | 0 | 0 | o o | 0 | o | Ö | 2 | 4 | 2 | 3 | 0 - | 0 | 0 | 9 | • | T | 3 | |
| MI | 0 | 0 | 0 | Q | 0 | 0 | 0 | 0 | 0 | Ċ | 0 | 0 | 0 | 0 | 0 | 0 | . • | • |
| Total | 0 | 0 | o | 0 | 0 | 0 | 2 | 4 | 2 | 3 | 0 | 0 | . 0 | 0 | i 4 | 7 | 5 | 10 |
| 10 HEMUTE | ES DURI | O TEST | PERIOD | | | | | | tANGE (ne | ters> | ÷ | | | | | | | |
| | 0-: | L | 1- | -2 | 2 | 1-3 | 3 | -4 | _4 | -5 | 5 | ;-£ | 6- | 7 | Tota | 1 | CHI-S | QUARE VALUES TEST PERIOD |
| Trace Tupe | Ran) | eF | Rau | WF | RAH | HF | Rau | WF | Rass | HF | Rau | LIF | Ress | MF | : Rau | MF | · FUR J | Res |
| LS | 0 | 0 | 0 | 0 | 1 | 3 | 3 | 6 | 1 | 2 | 3 | 1 | 0 | 0 | 6 | 12 | LS. | 12.000 24.0 |
| SL | G | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | SL | |
| NC · | ٥ | 0. | 0 | 0 | 0 | 0 | 2 | 4 | . > | 5 | 0 | 8 | 0 | 0 | 5 | • | NC | 4.000 4.8 |
| ш | ٥ | O | 0 | 0_ | • 0 | 0 | 0 | 0_ | O | 0 | o · | 0 | . 0 | 9 | 0 | Q | . uu | |
| Total | 0 | 0 | Q | 0 | 1 | 3 | 5 | 10 | 4 | 7 | \$ | 1 | 0 | 0 | 11 | 21 | TOTAL | 11.600 20.1 |
| TUNIA OL | ES AFTE | t EST | PERIOD | | ٠. | | | | RANGE (no | ters> | | | | | | | | |
| | 0 | ı | 1 | -2 | | 2-3 | 3 | -4 | 4 | I- 5 . | • | i-6 | 5- | -T | Total | al . | CHI-S | GURRE = 5.99 = 2) 4 = .05> |
| Trace Tupe | Ran I | MF. | Rana | WF | Rau | ИF | Ran | WF. | Res | MF | Ran | MF | Raw | WF | 2 Res | HF. | . carbu | 4057 |
| LS | 0 | 0 | o | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | |
| SL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o | 0 | 0 | 0 | 0 | 0 | | • | | |
| NC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Q | 0 | • | 0 | . 0 | 1 | 1 | 1 | 1 | | |
| ни | 0 | 0 | 0 | 0_ | 0 | 0 | ø | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | | |
| Total | 0 | 0 | ٥ | 0 | 0 | 0 | ø | 0 | 0 | 0 | 0 | 0 | 1 | 1 | i 1 | 1 | | |
| CHI-SAURRE F-HAT | 0- | 1 | 1 | -2 | : | 5-3 | 2 | -4 | | H-5 | | 5-6 | 6- | -1 | | | • | |
| | Rau | HF | Rau | NF O | Rau | HF | Rani | WF 2 | Rass | MF 1 | Raid | MF | Rasi | HF O | | | | |
| SL NC | ä | ŏ | ě | ò | ŏ | ġ | ō | Š | Ŏ 2 | ģ | ŏ | ŏ | ŏ | ě | | | - | |
| LS SL NC HH TOTAL | ŏ | ő | ĕ | ě | ò | . 9 | 0 | é | o 2 | ğ | ŏ | ŏ | ĕ | ŏ | | | | |
| CHI-SQUARE | - | _ | • | -2 | _ | 2-3 | - | | _ | - -5 | - | 3~ 6 | 6- | - | | | | |
| NUT -200ME | | L. | | | | 2-3 | | MF | Rati | WF | Rau | uf | Rass | MF | | | | |
| LS | Rau | <u> </u> | Ran | HF | Rana | 6.000 | 6.000 | | | 2.000 | | | | | | | | |
| LS SL NC UH_ | | == | == | | == | == | 4.000 | 2.667 | | 3.333 | == | | | | | | | |
| TOTAL | | | | | | 6.000 | 7.500 | 9.200 | 4.000 | 9.333 | == | | | | | | | |

Table E9. Indian Point hawner test monitoring using 5 degree vertical transducer located at unit 3, intake 35.

| 40 HI NUI | TES BEFO | RE TESI | PERIOD | 1 | | | | R | MOE (not | ers> | | | | | | | | | |
|--------------------------|------------|-------------|-------------|-----------|------|-------------|---------------|-------------|-----------|-------------|---------|-------------|-------|------------|--------|------------|----------------|-----------------|-----------------|
| · | 0- | | | -2 | 2 | :~ 3 | > - | | 4- | | 5 | -6 | 6 | - 7 | (Tota | 1 . | CHI-S FOR 3 | TEST | F-HAT PERIOD |
| Pace Upe | | MF | Rau | HF | Rest | HF | Raid | HF | | MF | Rau | HF | Rass | WF | Rau | LIF | Rau | ИF | - |
| .1 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 5 | 5 | 5 |
| iL. | 0 | 0 | 0 | 0 | 0 | 0 | D | 0 | 0 | 0 | 0 | 0 | , 0 | 0 | | 0 | 0 | 9 |) |
| ie | 0 | 0 | • | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | 2 | 2 | 0 | G | 2 | 2 | 2 | . 2 | : |
| 1 | 0 | 0 | 0 | O | 0 | 0. | 0 | ٥ | 0 | 0 | - 0 | a | 1 | 1 | 1 | 1 | 0 | 0 | • |
| atal | 0 | 0 | 0 | 0 | 0 | 0 | o | ō | 0 | 0 | 2 | 2 | 1 | 1 | . 5 | 3 | 4 | 1 | • |
| 20 NI NU | TES DURI | NG TEST | PERIO | | | | | | WBE (net | | | | | | • | | | | |
| | 0- | • | | l-2 | | 2-3 | 3- | | 4- | | | -6 | • | -7 | Tot | _1 | CHT-S | 340103 | VALUES |
| Trace Type | | LIF | Ran | WF | Ran | MF | | HF. | | | Res | WF | Ran | W | I Rau | | FOR 3 | TEST | PERIOD: |
| .1 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 2 | 3 | 4 | 0 | 0 | 5 | 9 | LS | 7.500 | 8.40 |
| SL | . 0 | G | . 0 | 0 | 0 | 9 | . 0 | 9 | 0 | 0 | • | • | O | 0 | . 0 | 0 | SL | | |
| | o | 0 | 0 | 0 | a | 0 | 0 | Q | 0 - | 0 | 1 | 1 | 1 | 1 | 2 | 2 | NC | -0.500 | -0.50 |
| H1 | 0 | 0 | 0 | q | 0 , | 0 | 0 | . 0 | a | 0 | | ` 0 | 0 | 0 | .0 | 0 | ш | | |
| Tetal | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 2 | 4 | 5 | 1 | 1 | 7. | 11 | TOTAL | . 3,750 | 4.57 |
| 10 ni Nu | TES . RFTE | R TEST | PERIOD | | ٠. | | | | | | | | | | | | | | |
| | _ | _ | | | _ | | _ | | WISE Cost | | _ | | _ | _ | | | | | - 5.99 |
| Trace Type | 0- Rau | <u>1</u> | Ran | L-2 UF | Rau | 1-3 | | ur Ur | Ray | -5 | Reu | -6 | Ran | -7 | Tot: | | Calpt | = 2) 10 = .(| 95> |
| Li | | | | <u></u> | | | <u></u> | | | | | | | | | | | | |
| SL | 0 | . 0 | | | 0 | .0 | 0 | 0 | ٥ | 0 | 0 | 0 | • | 0 | | 0 | | | |
| NE | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 1 | | 1 | | | |
| HS | 0 | | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | . 0 | 0 | | | |
| Tetal | 0 | | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 7 0 | 0 | | 2 | 2 | : | 7 | | | |
| CII-SQUAR | E .0- | 1 | : | 1-2 | 2 | :-> · | 3- | 4 | 4 | -5 | 5 | -6 | • | -7 | | • | | | |
| F -HR T LS | Rau | W | Rau | μF | Rau | HF | Rass | HF | Resi | UF | Rau | HF | Rau | WF | • | | | | |
| E) SL N(| . 6 | 0 | 8 | . 0 | Ş | ò | 8 | Ş | 8 | ò | 0 | ģ | è | 8 | | | | | |
| HB | Ö | . 0 | ò | <u> </u> | . 8 | . 0 | o o | 8 | Ö | 9 | 0 | ò | å | - Õ | | | | | |
| Tital | ō | . 0 | Ō | ž | Ō | 1 | Ŏ | . 0 | 0 | _ 1 | . 2 | 3 | | | | 5 | | | |
| cat-squar Values | | | | 1-2 | | 2-3 | 3- | | | -5 | | -6 | | -7 | | | | | |
| LI | R-04 | HF | Rau | 7.500 | Reu | HF 6.000 | Ran | HF | Rau | 2.000 HF | 6.000 t | HF 2.000 | _Ran | KF | | | | | |
| SI NC | | | | == | | | | | | == | 2.000 | 2.000 | 0.000 | 0.000 | | | | | |
| HP. | | | | | | | | - | | | | | | | | | | | |

Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 35. Table E10.

| | TES BEFO | | | | | | | | tates (net | - | , | | hor va 4.00 c | | | | | | |
|--|-----------|------------|-------------|------|----------|---------|----------|---------|------------|----------|------|---------|---------------|------------|----------|---------------------|----------------|-----------------------------------|--------------|
| | 0- | 1 | 1- | 2 | 2- | . 3 | 3- | 4 | 4 | -5 | 5 | -6 | 6 | - 7 | Tota | 1 | CHI-5 FOR 3 | QUARE F-H TEST PER | IRT LIOD: |
| race Tupe | Rau | WF | Rau | uF. | Ran | WF | Rau | WF | Rau | WF | Rass | HF | Ran | WF | Rau | WF | Rau | WF | |
| .s | 0 | 0 | 0 | 0 | 0 | G | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 4 | |
| iL. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | 0 | . 0 | 0 | |
| c | 0 | Q | D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 3 | • | 4 | 2 | 2 | |
| I L | 0 | o | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | . 0 | 0 | |
| otal | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | ٥ | 0 | , 0 | 1 | 1 | 3 | 3 | 4 | 4 | 5 | 6 | |
| 10 HIM | TES DURI | NO TEST | PERIOD | | ć | | | | RANGE CHO | | | | | | | | | | |
| | 0~ | | 1- | | 2- | | 3- | - | | -5 | 5 | -6 | | -7 | Total | .1 | CHI-S | QUARE UAL | LUES |
| race upe | | I UF | | HF . | | MF | | ii | Rase | MF | Reu | HF | Rass | UF | E Rau | | FOR 3 | TEST PER | KI OÜ: W |
| . <u></u> | 0 | 0 | 0 | | 0 | 0 | 2 | 4 | 4 | 6 | 1 | 1 | 0 | 0 | ! | 11 | LS | Q.667 10 | 0.25 |
| iL | 0 | . 0 | 0 | 0 | Q | q | 0 | 0 | - 0 | o | 0 | 0 | 0 | 0 | | a | SL | | |
| iC | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | o | ٥ | 0 | 1 | 1 | | 1 | NC | 3.500 |). 50 |
| irs | 0 | 0 | , 0 | 0 - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | . 0 | • | ын | | |
| otal | 0 | 0 | <u>-</u> | 0 | 0 | • | 2 | | 4 | 6 | 1 | 1 | 1 | 1 | | 12 | TOTAL | . 2.000 1 | 9.16 |
| 10 MIM. Tace | JTES RFTE | 1 | PERIOD | 2 | 2- | -> |)- - | ٠ | RANGE (ne | ters> | | -6 | | -T | Tota | . 1 | <4.f. | FQUARE = 1 , = 2> \4 = .05> | 5.99 |
| UP. | Rau | HF. | Rest | MP | Rau | HF | Rau | HF | Rau | HF | Raw | MF | Ř. | uf | Rau | WF | | | |
| .s | . • | 0 | 0 | 0 | 0 | 0 | 1 | 2 | C | 0 | 0 | Q | 0 | • | 1 | 2 | | | |
| AL. | o | 0 | 0 | 0 | . 0 | . , 0 | 0 | 0 | 0 | a | 0 | 0 | 0 | 0 | . 0 | 0 | | | |
| 4C | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | · 0 | 0 | . 0 | 0 | . 0 | 0 | | | |
| | 0 | 0 | 0 | 0 | <u> </u> | 0 | 0 | 0_ | 0 | <u>.</u> | 1 | 1_ | <u></u> | 0 | <u> </u> | <u>-</u> | • | | ! |
| [otal | 0 | . 0 | a | 0 | 0 | 0 | 1 | 2 | 0 | - 0 | 1 _ | | 0 | - 0 | : 2 | 3 | | | |
| CHI —SQUAI F—HAT | | | 1- | | 2- | | | | | -5 | | 5-6 | | -7 | | | | | |
| LS SL NC | Rau Q | HF Q | Rau | MF. | RaH | MF O | Rau 1 | HF 2 | Rass | HF 2 | Ran | WF Q | Rane | MF 0 | | | | | |
| šL. | ě | 0 · | Ş | 0 | 0 | ô | 8 | Ô | Õ | ĝ | 8 | 8 | .0 | 0 | | | | | |
| ** | Ô | 0 | 0 | 8 | 0 | . 0 | 0 | 0 2 | 9 | 2 | 0 | 9 | 0 | 1 | | | | | |
| ## | v | | _ | - | 9. | -3 | 3. | -4 | 4 | -5 | . 5 | i-6 | 6 | -7 | | | | | |
| H FOTAL CHI –SQUAI | • | 1 | 1- | | | | | | | | | | | | | | | | |
| HH FOTAL CHI-SQUAI VRLUES | • | HF. | Rau Rau | HF | Rest | HF | Resi | HF | Rest | UF | Reu | NF | Rest | UF | | | | | |
| NH TOTAL CHI-SQUAI VALUES LS SL NC NC UH | RE 0- | HF | | | | | Resi | | 12.000 1 | 2.000 | Resi | MF | Resi | | | | | | |

Table Eil. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| 11 NINUTE | S DUR | NG TEST | | 18 ha e e : | PARA BARRA | | ***** | | MOE (not | | | | .,, | ا مند دخوپ | 88 8 1 1 1 1 1 1 1 | | | |
|---------------|-------|---------|--------|---------------|------------|--------|-----------|------------|----------|--------|-------|-------|------|------------|-------------------------------|--------|---------|----------------------------|
| | | | | _ | | | _ | | | | _ | | _ | _ | | | CHI -50 | WARE F-HAT TEST PERIOD |
| Trace | 0 | -1 | 1 | -2 | | 5-3 | 3- | | | | 5- | | 6- | | Tota | | | |
| Tupe | Rass | WF | R ass | WP. | Ray | NF. | Rasi | WF | Rau | uf | Rau | uf | R44 | uf | Rau | uf | RaH | MF |
| LS | 0 | 0 | 0 | 0 | 1 | 3 | . 0 | ٥ | 0 | 0 | 6 | 7 | . 0 | • | į 7 | 10 | 4 | S |
| SL. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | o |
| #C | 0 | • | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | . 0 |
| ММ | 0 | 0 | O | ٥ | 0 | 0 | 0 | 0 | 0 | • | 0 | . 0 | 0 | 0 | 0 | ٥ | 0 | 0 |
| Total | 0 | 0 | 0 | 0 | 1 | > | 0 | o | ō | 0 | 6 | 7 | 0 | 0 | 7 | 10 | 4 | 5 |
| 14 HIMUTE | s nft | ER TEST | PERIOD | ÷ | | | | Rí | MGE Grot | ers> | | - | | | | | | |
| | 0 | -1 | 1 | -2 | | 2-3 | 3- | 4 | 4- | 5 | 5- | -6 | 6- | 7 | Tota | 1 | CHI -S | WARE VALUES TEST PERIOD |
| Trace Type | Res | HF | Ratt | HF | Rau | UF | Rau | HF | Rass | WF | Rasi | HF | R464 | MP' | Rau | | | Rass H |
| LS | 0 | 0 | 0 | 0 | 0 | , O | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | LS | 7.000 10.00 |
| siL | 0 | 0 | 0 | | 0 | 0 | . • | 0 | · • | 0 | 0 | G | 0 | 0 | . 0 | 0 | SL | |
| NC | 0 | 0 | o | 0 | . D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0, | NC - | |
| нн | 0 | 9 | ò | 0 | 0 | Q | 0 | 0 | . 0 | 0 | . 0 | 0 | 0 | 0 | . 0 | 0 | ми | |
| Total | 0 | 0 | 0 | O | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | D | 0 | | 0 . | TOTAL | 7.000 10.00 |
| CHI-SQUARE | q | -1 | | -2 | | 2~3 | · 3- | · 4 | 4- | -5 | 5- | -6 | 6- | -7 | | ç | HI-SQUA | RE - 3.841 |
| F-HAT | Rau | ME | Rass | HF | Ran | | Reu | HF | Rass | ИF | Ran | HF | Rast | MF | | 2 | alpha - | .05> |
| LS SL | 8 | 0 | ò | 8 | 100 | 2 0 | 8 | ä | 8 | 8 | 3 | Ö | 8 | ŏ | | | • | |
| NC HU | 0 | 0 | ò | ò | ò | 0 | 8 | 0 ~ | 2 | 8 | ò | 0 | . 8 | - O | | | | |
| TOTAL | ŏ | ŏ | ŏ | ŏ | ĭ | ž | Ğ | Č | Ō | ō | 3 | . 4 | 0 | 0 | | | | |
| CHI-SQUARE | | -1 | 1 | -2 | | 2-3 | 3. | -4 | 4 | 5 | | -6 | 6- | -7 | | | | |
| VALUES | Rass | HF | Raw | ИF | Rasi | | Rau | HF | Rau | HF | Rate | ИF | Rass | HF | | | | |
| LS SL | | | | | 1.000 | 3.000 | | | | | 6.000 | 7.000 | == | | | | | |
| SL NC | | • | | | | | | | | | | | == | | | | | |
| TOTAL. | | | | ~ | 1.000 | 3.000 | | == . | == | | 6.000 | 7.000 | | | | | | , |

Table E12. Indian Point hanner test monitoring using 6 degree pertical transducer located at unit 3, intake 35.

| | | | | dal P | | 2 Hr af High Ti | de | | Duration Treatm | ent Tus | st: 4 pe: 4 | l min c | mr 1,345 ontinuou | 5 | Test D | i ne : | 2/26/88 0806 | |
|--------------------------------|---------------|--------|---------------|---------|----------|--------------------|------------|-------|--------------------|---------|----------------|---------|----------------------|----------------|---------------|--|--------------------|-------------------------------|
| 4 MINUTE: | S BEFOR | E TEST | PERIOD | | | | | | RANGE (no | | | | | | | · ************************************ | | |
| | 0- | 1 | 1- | 2 | : | 2-3 | 3- | -4 | | -5 | 5 | i-6 | | 6-7 | To | tal | | SOUARE F-HAT 3 TEST PERICE |
| race Tue | Rau | MF | Rau | HF | RaH | ИF | Rass | UF | Rau | HF | Ran | HF | Ran | WF | ; Re | 4 UF | Ran | ИF |
| - 1 | 0 | a | 0 | 0 | 0 | 0 | 0 | 0 | • | 0 | G | 0 | 0 | 0 | -:ō | 0 | 1 | 2 |
| iL . | 0 | . 0 | . 0 | 0 | 0 | 0 | 0 | 0 - | 0 | 0 | 0 | o · | 0 | 0 | | 0 | 0 | 0 |
| K | 0 | 0 | 0 | • | 0 | 0 | 1 | 2 | 2 | 3 | 3 | 4 | 3 | > | . 9 | 12 | . 11 | 14 |
| 16 | a | • | 0 | 0 | Ð | 0 | 0 | 0 | • | • | 0 | 0 | 1 | 1 | | . 1 | 3 | . > |
| retal | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 10 | 13 | 15 | 19 |
| 4 MINUTES | S DURIN | O TEST | PERI 00 | | | | | | RRMOE (me | ters> | | | | | | | | |
| Trace | 0- | 1 | 1- | 2 | | 2~3 | 3- | -4 | 4 | -5 | 5 | i-6 | * | 6-7 | To | tel | CHX- | SQUARE VALUE |
| p. | Rau | HF | Rau | MF | Rau | ИF | Rau | HF | Rau | HF | Rau | HF | Rau | HF | . Ra | н WF | - FOR | TEST PERIO |
| .1 | 0 | . 0 | 0 | 0 | 2 | 5 | 1 | 2 | 0 | o. | 0 | . 0 | 0 | 0 | 3 | 7 | L.S | 6.000 17.9 |
| 5L | 0 | e | 0 | 0 | 0 | 0 | , o | 0 | Q | 0 | 0 | 0 | 0 | 0 | 0 | 0 | SL, | |
| 46 | ø | 0 | | 0 | 0 | 0 | 0 | 0 | 4 | 6 | | 10 | 3 | 3 | 15 | 19 | NC | 1.636 2.2 |
| 46 | 0 | 0 | 0 | 0 | 0 | 0_ | 0 | 0 | 0 | • | 2 | 2 | 1 | 1 | | 3 | 144 | 2.667 2.66 |
| retal | 0 | 0 | . 0 | 0 | · 2 | 5 | 1 | 2 | 4 | 4 | 10 | 12 | 4 | 4 | 21 | 53 | TOYM | L 3.333 0.0 |
| A MINUTES | S RFTER | TEST P | ERI OD | | | | | דיר | | | | | | | • | | | |
| | | | | | | | • | | RANGE (He | | | | | | | | CHI- | SQUARE - 5.9 |
| Trace | 0- | | 1- | ′ | | 2-3 | | | | -5 | | i-6 | | 6-7 | | <u>tal</u> | <d. ≠<br=""> </d.> | . = 2> ha = .0%> |
| Tepe | | uf | | HF | Raw | | | uf | Ran | HF. | Rau | MF | Rau | | _:R4 | | - | |
| LS | 0 | 0 | 0 | 0 | . D | 0 | 0 | • | 0 | 0 | 0 | 0 | 0 | 0 | : 0 | 0 | | |
| SL | 0 | 0 | D | O | 0 | . 0 | 0 | 0 | 0 | • | • | . 0 | 0 | 0 | : 0 | • | | |
| NC | 0 | 0 | 0 | 0 | 0 | , 0 | 0 | ٥ | 2 | 3 | Б | 6 | 1, | 1 | • | 10 | | |
| 48 | | | <u></u> | | · | <u> </u> | <u> </u> | | <u> </u> | | 2 | 2 | | 3 | -: <u>-</u> 5 | | - | |
| l'etal Cai — Sour re | 0 0~ | . 0 | • | • | . • | | 0_ | . 0 | 2 | | 7 | | . 4 | | 1 13 | 15 | | |
| F-HAT | | | 1- | | | t-> | 3- | | | -5 | | i-6 | | 6-7 | | ÷** | | • |
| .5 | Rau O O | To . | Ren 0 0 | UF O | Rau 1 | UF 2 0 | Pau D | 1 | Re4 O | | Ram | uF 0 | Reu | a | | | | |
| ŠĹ NC UB | 8 | Ŏ | t a | Õ | Ŏ | · ŏ | 0 | ĭ | Š | 4 | 9 | Ť | . 0 | 2 | | | | |
| TETAL. | . 0 | 8 | 6 | 0 | 0 | 2 | 0 | 0 | 9 | 9 | ř | è | 4 | 4 | | | | |
| HI-SQUARE | 0- | 1 | 1- | \$ | | }3 | _ 3 | -4 | 4 | -S | 9 | -6 | - | 6-7 | | | | |
| | Rau | HF | Reu | MF | Rau | NF TOO | Rau | LIF. | Ray | WF | Rau | UF | Ran | ЫF | | | | |
| LS SL NC | | | | == | 2.000 | 7.500 | _ | 2.000 | | == | | | | | | | • | |
| NC /N FATAL | == | : | | | | _ == | | 2.000 | | 1.500 | 4.000 | 1.714 | | 2.500 0.500 | | | | |
| ui sü, | | | | | 2.000 | 7.500 | 0.000 | 1_000 | 0.000 | 1.500 | 2_571 | 4.000 | 0.000 | ሰ-በሰብ | | | | |

Table E13. Indian Point hanner test monitoring using 6 degree pertical transducer located at unit 3, intake 55.

| | | | | dal Phas | H1 | Hors af gli Tid | 7.61 ⁻ - | | ten-prion Troutes | | e: 3 | min HS | r 1,3&S , 5 min | H1,3 | Tost De Test Fi | He: O | 814 814 | | |
|---------------|---------------|---------|-------|----------|----------|--------------------|-------------------------------------|-------|----------------------|---------|------------|-------------|--------------------|-------|--------------------|-------|--|--------------------|-----------------|
| 8 MINUFES | | | | | | | | , | tinise inet | ers! | | | | | | | | | |
| | 0- | | 1- | . > | 2- | - % | 3- | -4 | 4~ | -5 | 5- | 6 | 8 | -7 | Tot | -1 | CHI-S FUR 2 | OUARE F | -HAT PERI ON |
| Frace Type | | | | NF. | | uF | | UF | | WF | | HF . | Rau | MF | : Pau | | Rau | WF | - |
| LS | | 0 | 0 | 0 | 0 | .= | 0 | | | 0 | 1 | 1 | 0 | 0 | : | 1 | | | • |
| iL | a | ú | ۵ | 0 | 0 | 0 | 0 | 0 | ú | o | 0 | 0 | . 0 | o | : 0 | 0 | . 0 | 0 | |
| | Ó | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 3 | 8 | 10 | 1 | 1 | : 12 | 16 | 9 | 11 | |
| 414 | 0 | 0 | 0 | o · | . 0 | 0 | 0 | 0 | 0 | u) | 2 | 2 | 4 | .4 | 6 | 6 | 6 | 7 | |
| rotal | <u>-</u> | | | | <u>`</u> | | · | 2 | | | 11 | | 5. | 5 | 19 | 23 | 15 | 10 | |
| | • | - | _ | - | • | _ | - | - | | - | | | | | | , | | , | |
| 8 MINUTES | AFTER | TEST PE | RI OD | | | | | | RINGE inet | imensi) | | ٠ | | | | | | | |
| | 0 - | | 1- | -2 | 2- | - > | 5- | -4 | 4- | 5 | 5- | - 6 | | ·-7 | Tot | :al | CH1 -5 | QUARE (| JALUES |
| frace Fupe | | uf | Rou | HF | Rau | WF | Rau | HF | Rau | MF | Rass | HF . | Rast | HF | i Ras | HF | FOR 2 | TEST (| PERION H |
| LS | - | 0 | 0 | o o | 0 | - - | 0 | 0 | ··· | n | o | 0 | 0 | ō | | 0 | LS | 1.000 | 1.00 |
| SŁ. | 0 | υ | 0 | υ. | 0 | 0 | 0 | n | Ç) | o | 0 | 0 | 0 | 0 | | 0 | SL | | - |
| NC | 0 | 0 | 0 | 13 | • | 0 | 0 | 0 | . 2 | 3 | 1 | 1 | 2 | 2 | 5 | 6 | NC | 2.002 | 4.54 |
| MH | o | o | 0 | o | 0 | 0 | 0 | 8 | Ú | 0 | 3 | 4 | 3 | 3 | • | 7 | ии | 0.000 | 0.07 |
| Total | 0 | 0 | 0 | 0 | 0 | | (1 | 9 | 5 | 3 | 4 | 5 | 5 | 5 | 11 | 13 | TOTAL | . 2.133 | 2.77 |
| CHI-SRUARE | 0- | 1 | 1- | -2 | 2- | - 3 | 3. | -4 | .4- | - E | 17. | -6 | | 5-7 | | | CHI -9 | GUARE . | - 3.84 |
| F-HHT | Rau | I | Rau | HF | Rau | uf | Rau | ue | Rest | LE-LE | Rau | LE LE | Ray | ur | | | <d.f.< td=""><td>. = 15 .a = .0!</td><td></td></d.f.<> | . = 15 .a = .0! | |
| LS SL | õ | ő | 6 | 0 | Õ | Ö | Ĩ | Ö | ű | 73 | 1 | 1 | Ü | 'n | | | | | |
| eć: | ě | ŏ | ŏ | ŏ | ő | ŏ | i | ĭ | ž | ڎ | 5 | ĕ | ž | 2 | • | | | | |
| HH FOTRL | 0 | 0 | 0 | D D | 0 | 9 | 0 | 0 | 0 2 | 1) 3 | 3 | 3 | 4 5 | 4 5 | | | | | |
| CHI-SQUARE | 0- | 1 | 1. | -2 | 2- | -3 | ٠, | -4 | | 5 | ς. | -6 | - (| 57 | | | | | |
| WALUES | | | | | | | | | | | | | | | | | | | |
| | Rasi | WF | Rass | MŁ | R.su | HF | Rau | MF | RaH | MI. | 1.000 | ИF 1.000 | Rau | uf | | | | | |
| LS SL | | | | | | | | | | | 1.000 | | == | | | | | | |
| 140 | ~ | | | | | | 1.000 | 2.000 | 0.000 0 | 0.000 | 5,444 1 | 7.364 | 0.333 | 0.333 | | | | | |
| HH | | | | | | | | | | | 0.200 (| .667 | 0.143 | 0.143 | | | | | |
| OTAL | | | | | | | 1.000 | 2.000 | 0.000 (| 1.000 | 3.267 | 3.556 | 0.000 | 0.000 | | | | | |

Table Ei4. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| E MINUTES | DURLE | 16 1621 | PERIOD | | | | | RA | NBE (net | ers> | | | | | | | | _ | |
|---------------------|-------|---------|------------|----------------|-------|--------|----------|---------|-----------|--------|----------|-------------|-------|-------------|------|------|------------------|------------------|-------------------|
| | 4)- | · L | 1- | 2 | 2 | -3 | 3- | 4 | 4- | 5 | 5 | ;- 6 | • | 6-7 | Tota | -1 | CHI-54 FUR: 2 | MARE F TEST P | reriod: |
| frace rupe | Rau | HF | | HF | Rau | HF | Rau | HF | Rau | uf | Rau | WF | Ran | UF : | Rau | WF | Raw | NF | • |
| LS | - a | | o | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 4 | 5 | ó | o | 4 | 5 | 2 | > | • |
| 5L | 0 | 0 | a | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | |
| NC. | 0 | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 2 | 3 | > | 5 | 5 | > | > | |
| 414 | o. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 2 | 2 | 2 | 2 | 1 | 1 | |
| Total | a | D | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 6 | 7 | 5 | 5 | 11 | 12 | . 6 | r | |
| 6 MINUTES | | | | | _ | | | | MIGE chet | | _ | 5-6 | | 6- <i>7</i> | Fot | a. 9 | ćui "e | QUARE I | UAI 1 15 4 |
| Trace | | | 1 | | | -3 | 3- | | | | | | | | | | FUR 2 | TEST F | PERIOD: |
| Tupe | Rau | WF | | WF | Rau | uf | | HF | | WF | | | RAH | | Reu | | | | |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Ű | 0 | 0 | 0 | . 0 | 0 | LS SL | 4.000 | 5.00 |
| 3L | 0 | 0 | . 0 | . 0 | , a | 0 | 0 | Ð | 0 | 0 | 0 | 0 | 0 | 0 | • | 0 | | | |
| HC | 0 | G | 0 | Ų | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Ù | 1 | 1 | | 1 - | NC | 2.667 | |
| HH | | 9 | <u>-</u> | o [.] | 0 | | 0 | | | | 0. | | 0 | | : | | HH | 2.000 | |
| Total | ٥ | 0 | o | o | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | : 1 | • | 10114 | 8.333 | 9,30 |
| CHI-SQUARE F-HAT | 0 | | <u>t</u> . | -2 | | -3 | 3- | -4 | 4- | | | 5-6 | | 6-7 | | | CHI-SI | QUARE | - 3.84 |
| LS | Rau | µF D | ReM | #F | Ran | HF | Rau O | uF O | Rau | HF | Raw 2 | HF | Rass | HF | | | (a) ph | 0! | 5 > |
| SC NC | Ó | õ | Ó | ñ | Ö | ŏ | ŏ | Õ | ŏ | ğ | õ | Õ | ŏ | ğ | | | | | |
| MM | Ö | 0 | 0 | o o | 8 | 8 | 0 | ö | Õ | ŏ | ó | ij | į | 1 | | | | | |
| TOTAL. | o | ů | -0 | 0 | Ö | 0 | 0 | . 0 | 0 | 0 | 3 | 4 | 3 | 3 | | | | | |
| CHI-SQUAPE | O | -1 | 1 | -2 | 2 | -3 | 3- | -4 | 4- | | | 5-6 | | 6- 7 | | | | | |
| LS | Rass | ME | Rass | HF. | R-844 | HF | Rass | HF | Ran | HF | 4.000 | 9.000 | Rass | HF | | | | | |
| 31 | | | | | | | | | | | 2.000 | 2.000 | 1.000 | 1.900 | | | | | |
| ЙČ | | | | | | | | | | | | | | | | | | | |

Table E15. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| | | این بد در اسد: | | del Pha | He | Hrs aft gh Tide | • | | Duration Treatme | nt Tup | | 0 min c | ers 1,3t ontinuou | \$ ====== | Test De Test Ti | mei (| 2/26/88 3849 | | |
|-----------------------|------------|----------------|----------|---------|------|--------------------|-----------|---------|---------------------|----------------|--------------|---------|----------------------|--------------|--------------------|-------|---------------------|--------------|------------------|
| 10 HINU | JTES BEFOR | E TES | r PERIGO | | | | | | MANGE (not | ers> | | | *, | | | | CHI-S | , DUARE F | -HAT |
| race | 0-1 | | 1-3 | 2 | 2~ | 3 | 3-4 | l | 4- | 5 | 5 | -6 | 6 | -7 | To | :al | FOR 3 | | PERIODS - |
| UP+ | Rau H | F | Rau I | af . | Rass | LIF | Raut 4 | F | Rau | WF | Rau | HF | Rass | HF | E Rai | 4 HF | Reu | HF | - |
| .5 | 0 | 0 | 2 | , | Ö. | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | | 11 | 1 | • | 4 |
| iL. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 . | 0 | 0 | Q | 0 | 1 | 2 | 0 | 1 | 1 |
| tC . | 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | 0 | 3 | 4 | 6 | 6 | • | 10 | 15 | . 11 | 7 |
| 464 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 1 | 1 | o o | 0 | 1 | 1 | | 3 | 3 |
| Total | 0 | 0 | 2 | 9 | 0 | 0 | 0 | 0 | 2 | 4 | 4 | 5 | 6 | 5 | 14 | 24 | 20 | 2 | 5 |
| 10 NIM | UTES DURIE | 10 TES | T PERIOD | | | | | | tallok (met | ers> | | | - | | * | | | | |
| | 0-1 | L | 1 | 2 | 2- | 3 | . 3-4 | • | 4- | -5 | 5 | -6 | 6 | -7 | To | tal | CHI-S | QUARE ! | VALUES PERIOD |
| Trace Yupe | Rau I | UF | | HF | Rau | WF | Rasi 1 | ıF | Rest | WF | Rass | HF | Rass | MF | : Re | 4 WF | - FQR 3 | TEST (| PERIOD: |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | LS | 6.00 | 0 10.50 |
| SL | 0 | 0 | o · | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Q | 0 | : 0 | 0 | SL. | | 2.00 |
| NC | 0 | 8 | 0 | 0 | 0 | 0 | . 0 | 0 | 2 | 3 | 12 | 15 | 4 | 4 | 10 | 22 | NC | 5.06 | 7 7.29 |
| WW | 0 | 0 | 0 | 0 | ò | 0 | • | 0 | 0 | 0 | 3 | 4 | 3 | > | | 7 | 1414 | 4.66 | 7 8.00 |
| Total | 0 | 0 | 0 | o | 0 | 0 | 0 | 9 | 2 | 3 | 16 | 20 | 7 | 7 | 25 | 30 | TOTAL | 3.10 | 0 3.20 |
| 10 MIM | UTES AFTE | R TRST | PERIOD | | ٠. | • | | | | | • | | | _ | | | | | |
| | | | | | | | | | RANGE (met | - | | | | _ | _ | | | | - 5.79 |
| Trace | 0-: | | 1- | 2 | 2- | > | | | | -5 | | 5-6 | | -7 | | tel | . (d.f. - (alph | _ Z?.o | 5 > |
| Tupe | | ef | Rau | NF | Ran | HF | Rass | #* | Rau | MF | Rau | HF. | Rau | NF. | _ | | _ | | |
| LS | ů | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | a | • | 0 | . 0 | 0 | ; 0 | _ | | | |
| SL | 0 | . 6 | 0 | 0 | 0 | • | 0 ′ | 0 | 0 | 0 | O | 0 | . 0 | .0 | : 0 | 0 | | | |
| HC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | 10 | 12 | 9 | . 9 | 19 | 21 | | | |
| HH | 0. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | <u> </u> | 1 | 11 | 1 | 1 | 2 | | - | | |
| Total | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | 11 | 13 | 10 | 10 | 1 21 | 23 | | | • |
| CHI-SQUAI F-HAT | RE 0- | 1 | 1- | 2 | 2- | > | | 4 | 4- | -5 | | 5-6 | | 5-T | | | | | |
| LS | Reid | HF D | Rau | MF | Reu | HF O | Rass D | MF O | Raw O | MF | Ren | µF O | Ran | HF O | | | | | |
| SL NC | ě | ŏ | ó | ő | ŏ | ě | ŏ | ŏ | Ŏ 1 | į | Ď | 10 | Ŏ. | Q | • | | و | | • |
| UH TOTAL | ŏ | ŏ | ŏ | Š | ŏ | . 8 | ŏ | ě | ģ | ģ | 6 2 10 | 13 | 1 | ĭ | | | | | |
| CHI-SQUAL | • | • | 1- | | 2- | _ | 3- | - | _ | -s | - | 5-6 | _ | 5-T | | | | | |
| VALUES | Rau | L UF | Rau | | Rau | HF | Ran | HF | Rau | UF | Reu | WF | Rau | MF | | | | | |
| LS | | | 2.000 10 | | | | | == | | 2.000 2.000 | | == | == | | | | | | |
| LS SL/ NC NH | | - | | | | | | == | 2.000 | .000 | 6.625 | 7.500 | 3.167 | 3.167 | | | | | |
| | | ~- | | | | ~~ | | | | | u.suni | 3-WU | الاستدادة | | | | | | |

Table E16. Indian Point harmer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| | -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 - | Raw 0 0 | -2 UF 0 | Rem | 2-3 UF | | | RANDE CH | | | | | | | | CHI -E | OURRE F- TEST PE | Hat |
|-------------|---|---|---|-----------------------------|-----------|------------|---|---|-----------------------|-----------|---------------------------------|-----------------------------------|---------------------------------------|--|---|--|--|--|
| 0 0 0 | ur 0 0 | Rau Q Q | HF 0 | Rem | иF | | 4 | 4 | . – | | | | | | _ | 2072 27 | | |
| 0 0 | 0 | 0 | 0 | 0 | | g.au | | | 1-5 | | -6 | | -7 | Tota | 7 | FOR 3 | TEST PE | RIODS |
| 0 | 0 | 0 | _ | _ | | | WF | Resi | MF | Rass | SEF | Rau | uf | E Reu | NF. | Rau | HF | |
| 0 | 0 | = | 0 | | 0 | 0 . | Ð | 0 | 0 | . 1 | 1 | 0 | 0 | 1 | 1 | > | 3 | |
| 0 | = | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 0 | | 0 | 0 | 0 | 0 | 0 | 13 | 20 | 12 | 15 | r | T | 32 | 42 | 20 | 36 | |
| . 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | <u> </u> | 6 | 4 | 4. | <u> </u> | 10 | | . 9 | |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 20 | 1.9 | 22 | 11 | 11 | i 42 | 53 | 39 | 48 | |
| ES DUR | ING TES | PERIOD | | | | | | RANGE (ma | iters> | , | | • | | | , . | | | |
| 0 | -1 | 1 | -2 | 2 | 2-3 | 3 - | -4 | 2 | 1-5 | • | i-6 | | 5-7 | Tota | al . | CHI -SC | MARE U | LUES |
| R-864 | WF | Rass | WF | Rass | MF | Ran | WF | Rest | WF | Ran | WF | Rest | HF | Ran | WF | · FOR 3 | TEST PE | 200 I.K. W |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Ó | 0 | 0 | 5 | 5 | 8 | 5 | LS | 2.667 | 4.000 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | . 0 | Q | 0 | 0 | | 0 | SL | | _ |
| ٥ | 0 | ٥ | 0 | 0 | . 0 | 0 | 0 | 12 | 18 | 14 | 17 | 4 | 4 | 30 | 39 | NC | 2.000 | 4.02 |
| 0 | | 0 | . 0 | 0 | ٠.0 | 0 | 0 | 0 | 0 | . 5 | • | 1 | 1 | | 7 . | . 1414 | 0.750 | 0.667 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 10 | 19 | 23 | 10 | 10 | 41 | 51 | TOTAL | 0.974 | 3.450 |
| | | | -2 | ·. : | 2-3 | 5- | | | | | 5 -6 | | 5 -7 | Tota | al . | (d.f. | = 2) | |
| Rest | WF | Rasi | HF | Rass | HF | Ran | NF | Rest | MF | Rass | MF | Rasi | H | 1 Res | W | | 05/ | , |
| 0 | o | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 2 | Ö | Q | 3 | 4 | - | * • | |
| 0 | . 0 | 0 | 0 | . • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| 0 | 0 | 0 | . 0 | 0 | 0 | • , | 0 | 4 | 6 | 15 | 19 | 3 | 3 | 22 | 24 | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 6 | 4 | ٩ | <u> </u> | 10 | | | |
| 0 | 0 | 0 | 9 | 0 | C | 0 | . • | 5 | | 22 | 27 | . 7 | 7 | i >4 | 42 | | | |
| 0 | -1 | | -2 | | 2-3 | | | ***** | | 1 | | | | | | • | | |
| Rem | HF O | Rau | MI. | Raw | HP O | Rass D | HF | Rest | MF 1 | Rest 1 | . HP | R 244 2 | NF 2 | | | | | |
| 0 | 0 | Ö | 8 | Ö | Ŏ | . 0 | 8 | 10 | 0 15 | 0 14 | 17 | 9 5 | . O 5 | | | | | |
| . 0 | ٥ | 0 | Ö | Ò | . 8 | 0 | 0 | . 10 | 0 15 | 19 | 6 24 | 3 9 | . 3 | | | | | |
| ··· Q | -1 | . 1 | -2 | | 2-3 | Э. | -4 | | 4-5 | , | 5-6 | . ** * 1 | 6-7 | | | | | |
| Rass | HF | Paul . | HF | Ran | ИF | Rau | HF | Rau | ИF | Rau | WF | | ИF | | | • | | |
| == | == | | | | == | ` | | | | 2.000 | | 7.500 | | | | | - | |
| == | == | == | | ` | | | | | | 0.000 | 0.471 | 2.000 | 2.000 | | | | | |
| | C Rani | 0-1 Rass WF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Ram MF Ram 0 | O-1 1-2 Rass MF Q | Q-1 1-2 | C-1 | 0-1 1-2 2-3 3- Rew MF Rew MF Rew MF Rew MF Rew 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | No. No. | C-1 1-2 2-3 3-4 | C | C-1 1-2 2-3 3-4 4-5 E | D-1 1-2 2-3 3-4 4-5 5-6 | C-1 1-2 2-3 3-4 4-5 5-6 0 | Coli 1-2 2-3 3-4 4-5 5-6 6-7 | Co-1 1-2 2-3 3-4 4-5 5-6 6-7 Toto | ### Rest MF RE | Col 1-2 2-3 3-4 4-5 5-6 6-7 Total CHI-56 6-7 T | Col 1-2 2-3 3-4 4-5 5-6 6-7 Total CNI-SQUARE MF Rest M |

Table E17. Indian Point hawer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| <u> </u> | | | | del Pha | Ē | Hrs bei ou Tide | | e wa s # i | Duration Treatme | nt Tupe | - 2 | D min c | ter 5 only | | Test Dat Test Tim | e: 1 1 | /26/ 40 007 | <u> </u> |
|-------------------------------|-----------|--------|---------|---------|------|--------------------|------|------------|---------------------|--------------|-------|-------------------------|-----------------------------|-------|----------------------|---------------|-----------------------|-----------------------------|
| TO HINUT | | | | | | | | | RAMBE (mot | | | | | | • | | | |
| | 0~1 | ı | 1-: | 2 | 2 | -7 | 3- | 4 | 4- | 5 | 5. | ~B | 6- | -7 | Tota | 1 | FOR 3 | QUARE F-HAT TEST PERIOD: |
| Trace Type | Rass b | | Resi | MF | Rass | WF | Rau | MF | Rest | HF. | Rass | ИF | Rau | HF : | Rau | HF | Rau | UF |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | o | 0 | 1 | 2 | 1 | 2 |
| SL | 0 | . 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | 0 | 0 | a | q | 0 | 0 | Q . | ø |
| NC . | 0 | .0 | 0 | • | • | 0 | ٥ | 0 | 1 | 2 | 15 | 19 | 10 | 11 | 26 | 32 | 19 | 23 |
| ш | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0_ | ٥ | 0 | 2 | 2 | 2 | 2 | 4 | 4 | 2 | 2 |
| Total | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 17 | 21 | 12 | 13 | 31 | 30 | 22 | 20 |
| 10 HINUT | res Durti | O TEST | PERIOD | | | | | , | RFINGE Gret | ers> | | , | | | | | | ÷ |
| _ | 9-1 | ι | 1- | 2 | a | :-3 | 3- | 4 | 4- | 5 | 5 | -6 | 6- | -7 | Tota | 1 | CHI-S | QUARE VALUES |
| Trace T ype | Rest | 析 | Raul | MF | Rau | WF | Ress | NF | Reu | MP . | Rau | WF | Rasi | MF | Rass | H. | , | Res |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | LS | 0.000 7.5 |
| SL, | ٥ | ø | 0 | 0 | 0 | Q | 0 | ø | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | \$L | |
| NC | 0 | o | 0 | o ĺ | . 0 | 0 | 0 | 0 | 4 | 6 | 21 | 14 | 12 | 13 | 27 | 33 | MC | 17.263 22.4 |
| ын | 0 | 0 | O | 0 | 0 | 0 ' | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 11 | | 3 | MM | 5.500 5.5 |
| Total | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | .6 | 13 | 16 | 13 | 14 | 30 | 36 | TOTAL | 19.227 17.1 |
| TO WINNI | TES AFTE | R TEST | PERI OD | | | | | 1 | RANGE CHOC | ers) | | | ٠. | | | | | |
| | 9~ | 1 | 1- | 2 | : | :-> | 3- | -4 | 4- | 5 . | 5 | ~6 | 6 | ~7 | Total | ı.1 | (d.f. | QUARE = 5,99 |
| Trace : Tupe | Ran I | 4F | Ray | uf | Rest | uF. | Rasi | HF | Rau | UF | Rest | ИF | Rau | ИF | RaH | W | carp | .05> |
| LS | 0 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | ÷ 0 | 0 | 0 | 0 | 0 | 1 | 5 | | |
| SL | 0 | O | D | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | . 0 | Q | 0 | Q | 0 | 0 | | |
| NC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ø | 0 | Q | 4 | 5 | 1 | 1 | 5 | 6 | | |
| ни | 0 | o | 0 | 0 | 0 | ٥ | 0 | Ø | 0 | 0 | q | 0 | 0 | 0 | 0 | 0 | | |
| Total | 0 | Ü | 1 | 5 | . 0 | 0 | 0 | 0 | 0 | 9 | 4 | 5 | 1 | 1 | | 11 | | |
| CHI-SQUAPE F-NRT | £ 0- | l | 1- | 2 | | 2-3 | 3- | -4 | 4- | 5 | 5 | -6 | 6 | -7 | | • | | |
| | ReH | HE . | Rau | uf 2 | Rau | uF | Rasi | HF O | Rad | WF | Rass | MF | Rest | HF | ٠. | | | |
| LS SL NC | ŏ. | ö | | ā | ŏ | ě | ŏ | ŏ | Ò | ġ | 10 | 13 | Ö | Ď | - | | | |
| HH TOTAL | ŏ | . 8 | 0 | Ö | ŏ | ğ | ŏ | ě | 2 0 2 | ğ | 11 | 14 | ĭ | ĭ | | | | |
| CHI -SQUARE | - : | , - | 1- | | . • | 2-3 | 3- | | - 4- | - | • | -6 | 6 | -7 | | | | , |
| VALUES | Rau | IL. | Raw | HF | Rau | uF | Ran | HF | Rasi | NF | Rest | HF | Rest | HF | | | | • |
| LS «I | | | 7 | .200 | | == | == | == | == 2 | 2.000 | | | | | | | | |
| LS SL NC HU TOTAL | == | == . | == | .500 | = | | === | | | .333 .333 | 4.000 | 6.769 4.000 9.571 | 7.625 1 2.000 8.000 1 | 2,000 | | | | |

Table E18. Indian Point hammer test monitoring using 6 degree pertical transducer located at unit 3, intake 35.

| | | | | | dal Phase | | S Hrs | before | | Duration Treat | n of Tes | t: i | 0 min f 0 min c | ier 143 o ontinuou | mly s | Test D Test T | ate: 2 ine: 1 | /26/88 .027 | | |
|--|--------|------------------------|-------|---------------------|-------------------|---------------------------|---------------|------------------------------|------------------------|------------------------------|------------------------|---------------------------|-------------------------|-------------------------|-------------------------|------------------|------------------|----------------|----------|-------|
| 10 MINUT | | | | | | | | | | LPINGE Con | eters> | | <u>-</u> | | | | | | · . | |
| | . 0 | - 1 | | 1-: | 2 | 2. | · > | · 3- | -4 | | 4-5 | . 5 | -6 | - 6 | -7 | To | tal | | PUARE F~ | |
| Trace Tupe | Rasa | MF | | Resi | MF | Rau | WF | Rau | HF | Rest | WF | Rasa | UF | Rasi | WF . | ; R4 | H UF | Ran | ME | |
| LS | 0 | 0 | | | 0 | ō, | 0 | 3 | 6 | 1 | 2 | 1 | 1 | 0 | 6 | 5 | • | 3 | 5 | |
| SL | 0 | 0 | | . 0 | o | o | o | a | 0 | 0 | 0 | 0 | O | ٥ | Q | • | . 0 | 0 | Q | |
| HC | 0 | บ | | 0 | 1) | 0 | ø. | 0 | . 0 | 1 | 2 | 4 | , s | 4 | 4 | 9 | 11 | 6 | 6 | |
| ин | ū | 0 | | 0 | 0 | 0 | a | 0 | ٥ | . 0 | 0 | 0 | 8 | 0 | 0 | | 0 | | 1 | |
| Total | | 0 | | 0 | 0 | 0 | o · | 3 | 6 | 2 | 4. | 5 | 6 | 4 | 4 | 14 | 20 | 9 | 77 | |
| TO HINUT | ES AFT | ER TE | ST PE | RIOG | | | | | 1 | RANGE (m | eters> | | • | | | | • | | | |
| | 0 | - 1 | | 4- | | 2 | ~3 | 3- | -4 | | 4~5 | 9 | -6 | | i-7 | Te | tel | CHI-S | QUARE VA | LUES |
| Trace Type | Rau | MF | | | HF. | Rasi | HF | Rau | UF | Rau | UF | Rau | MF | Rasi | HF | | 14 HF | | Raw | HF |
| LS | . 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Ō | 0 | 0 | 0 | | | LS | 5.000 | 9.000 |
| SL | 0 | Ð | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | ٥ | \$L | | |
| MC . | Ó | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 1 | ı | 1 | | 4 | NC | 3.000 | 3.267 |
| MM | 0 | n | | 0 | 0 | 0 | Ü | o · | o | 0 | o | o . | O | L. | 1 | | 1 | HH | 1.000 | 1.000 |
| Total | 0 | 0 | | 0 | ú | 0 | Ų | 0 | ŋ | 1 | 2 | 1. | 1 | 2 | 2 | | 1 5 | TOTAL | 5.556 | 9.000 |
| CHI-SHURFE | | 1 | | 1- | 2 | 2 | -3 | 3 | -4 | | 4-5 | 5 | -6 | | 6-7 | | | CHI-S | QUARE = | 3.641 |
| F-HIT LS SL NC NU TOTAL | R-864 | NF 0 0 0 0 | | Raul O O O | NF 0 0 0 | Raн 0 0 0 | #F | Rau 2 0 0 0 2 | #F 3 0 0 0 | Rau 1 0 1 0 2 | HF 1 0 2 0 | R est 0 3 0 3 | HF 1 0 3 0 | Rau O O J 1 | UF U D T 1 | | | Calph | a`=°,05> | • |
| CHI -SQUAPE | σ | -1 | | 1- | 2 | | -> | 3 | -4 | | 4-5 | | 5-6 | | 6-7 | | | | | |
| LS SL HC HC HH TOTAL | £ w | иF | | Rasi | uf | Resi | #F | . == | 6.000 | 0.000 0.333 | 0.000 0.000 | 1.000 1.600 2.667 | 1.000 2.567 3.571 | 1.800 1.000 0.667 | 1.800 1.000 0.667 | | | · | | |

Table E19. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| TO WINDLE | S DURI | NO TEST | PERIOD | **************** | | | ## #E 222 F | | :BERBERT :ANUE (na | | X 7 35 25 C5 TT | | | | | | | | - |
|--|--------------------|-------------|-------------------------|------------------|--------------------|-------------------|---------------------|-------------------|-------------------------|-------------------------|--------------------------|------------------------|------------------------------|------------------------|-------|-----------|--------|-------------------|----------------|
| | u - | 1 | 1- | 2 | 2 | -3 | 3- | | | i~5 | 5- | ·6 | 6 | -7 | Tot | -1 | | NUARE F TEST P | |
| race upe | | HF | Rau | WF | Rau | MF | Rau | HF | Rau | UF | Rası | MF | Rass | HF | I Rau | ИF | Rau | UF | |
| .s | o - | 0 | 0 | υ | 1 | 3 | 0 | 0 | 0 | υ | 0 | 0 | U | 0 | 1 | 3 | 1 | . 2 | |
| iL. | 0 | U | o | O | 0 | 0. | ŭ | 0 | 0 | 0 | 0 | 0 | Ü | 0 | 0 | 0 | 0 | v | |
| ic | 0 | U | 0 | o | 0 | 0 | 0 | 0 | 0 | a | O | U | 2 | 2 | 2 | 2 | 4 | 4 | |
| u | ø | ٥ | O | 0 | 0 | O | 0 | ø | 0 | 0 | 0 | o | O | n | 0 | 0 | 0 | 0 | |
| otel | 0 | ū | 0 | 0 | 1 | 3 | 0 | Ů | 0 | 1) | 0 | Ü | 2 | 2 | : | 5 | 4 | 6 | |
| 10 HINUTE | S AFTE | R TEST | PERIOD | | | | | | RANNIE Gre | rters> | | | | | | | | | |
| | o- | 1 | 1- | 2 | 2 | -3 | 3- | - 4 . | 4 | I-Ś | 5- | -6 | 6 | -T | Tot | al | CHI-SE | TEST P | ALUES |
| nace ype | Rau | HF | Rana | NF | Rau | HF | Rau | UF | Rau | uf | Rau | MF | Rese | HF | Pau | WF | FUR 2 | Rau | ME |
| \$ | 0 | n | à | 9 | 0 | 0 | 0 | 0 | 0 | 0 | o | 0 | 0 | v | 0 | 0 | LS | 1.000 | 3.000 |
| L | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0. | 0 | ø | 0 | 0 | 0 | 0 | SL. | | .) |
| ¢ | 0 | 0 | 0 | . 0 | 0 | 0 | o | 0 | 1 | 2 | 0 | 0 | 4 | 4 | 5 | 6 | NC | 1.296 | 2.000 |
| ш | o | 0 | 0 | ٥ | . 0 | · • | 0 | 0 | Ü | . 0 | 0 | 0 | 0 | 0 | | 0 | нн | | |
| otal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | n | 4 | 4 | 5 | 6 | TOTAL | 0.500 | 0.091 |
| HI-SNUARE | 0- | 1 | t- | -2 | a | -3 | 3 - | -4 | • | 4-5 | 5- | -6 | 6 | -T | | | CHI-S | OUARE - | 3.841 |
| F-HAT IS IC IU IU IOTAL | Ram 0 0 0 | HF 00000 | Rau D D D O | #F 0 0 0 | Rau 1 0 0 | WF 2 0 0 | R au 0 0 0 | #F 0 0 0 | Raw 0 0 1 0 | #F. 0 0 1 0 | 8 ен 0 0 0 0 | UF 0 0 0 0 | Rau 0 0 0 3 0 | NF 0 0 3 0 | | | Calph | a = 1.0s | |
| HI -SOURPE | . 0- | 1 | 1- | | . 2 | :-3 | 3- | -4 | | 1-5 | 5- | -6 | | -7 | | | | | |
| filles s il | Raw | HF | Raw | HF | 1.000 | ₩F 3.000 | Raw | HF | Rau | HF | R 404 | uf | Rau | MF | | | | ı | |
| ic ic | | | | == | == | | · | | 1.000 | 2.000 | | | 0.667 | 0.667 | | | • | | . : |
| CTAL | | | | | 1.000 | 3.000 | | | 1.000 | 2.000 | | | 0.667 | 0.467 | | | | | |

Table E20. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| 10 HI MUTE | 5 BEFO | RE TEST | PERIOD | | | | | | ANGE (no | ters> | | | | | | | | |
|-----------------------|---------|---------|--------|----|-------|------------|-------|--------------|-----------|-------------|-----------|------------|-------|-------------|--------|------------|--------|---------------------------|
| _ | 0- | | 1- | | 1 | -3 | 3- | 4 | 4 | -5 | 5 | -6 | • | - 7 | Tot | 1 | FOR 3 | AUARE F-HAT YEST PERIO |
| Trace Type | Rass | uf. | | WF | Ran | HF | Rau | HF | Rass | WF | Rass | HF | Rasi | MF | : Rau | MF | Rau | HF. |
| .£ | 0 | 0 | 0 | a | 0 | 0 | 1 | 2 | 0 | 0 | 4 | 5 | 3 | 3 | • | 10 | 5 | 6 |
| iL | 0 | 0 | 0 | 0 | .0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | a | 0 | 0 |
| IC . | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 5 | 0 | 0 | 4 | 5 | Ł | . 2 |
| HI. | 0 | 0 | D | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | • 0 | 0 | 0 | - 0 | | 0 | 0 | 0 |
| otal | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 8 | 10 | 3 | 3 | 12 | 15 | 7 | 10 |
| 10 HI MUTE | \$ DURI | NO TEST | PERLOD | | | | | | PANGE Coo | ters) | | | | | | | | |
| | 0- | -1 | 1- | 2 | 2 | 1-5 | 3- | | | - 5 | 5 | 5–6 | • | 5-7 | Tot | a l | CHI -Ş | BUARE VALUE |
| Trace Type | Rass | MF | Rau | WF | Rau | WF | Rass | HF | Rau | WF | Rau | MF | ReH | MF | i Rau | uf | FOR 3 | TEST PERIO |
| LS | 0 | 0 | ······ | 0 | 2 | 5 | 2 | .4 | 1 | 2 | 3 | 4 | 0 | 0 | | 15 | LS | 9.600 15.0 |
| 5 L | 0 | 0 | 0 | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Q | 0 | 0 | 0 | 0 | SL | _ |
| IC . | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ٥ | | 0 | NC | 12.000 7. |
| HM | 0 | | o d | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | 0 | HH | |
| Total | 0 | 0 | 0 | 0 | 2 | S | 2 | 4 | 1 | 2 | 3 | 4 | 0 | 0 | | 15 | TOTAL | 9.714 15. |
| 10 MIMUTE | S AFTI | ER TEST | PER100 | | ** | | | _ | MANGE (He | | | | | | | | | |
| | O. | -1 | 1- | .2 | • | 2-5 | 3 | - - 4 | | -5 | | 5-6 | | 6~P | Tot | al | CHI-S | QUARE = 5.9 |
| Trace Tupe | Rau | HF | | MF | R-Bas | | Rass | WF | Ran | MF | Ran | HP. | Ran | ИF | I Rass | | Calph | · 05> |
| LS | 0 | 0 | 0 | 0 | 0 | <u>-</u> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | <u>-</u> | | | · ~ | |
| SL | 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | | |
| NC | 0 | o | o | o | 0 | 0 | ø | 0 | 0 | 0 | 0 | o | 0 | ٥ | | 0 | | |
| ни | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | . 0 | | |
| Total | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | O | 0 | . 0 | 0 | | |
| CKISQUARE F-HAT | 0 | -1 | 1- | 2 | | 2-3 | > | -4 | | l~ 5 | | 5-6 | | 6-7 | | | | |
| | Rau | HF O | Ran | WF | Rau | ИF 2 | Resi | NF 2 | Rau | μF | Ress 2 | HF. | Rent | HĘ | | | | |
| LS SL | 0 | ŏ | Ŏ | Ŏ | Ō | 0 | Õ | ō | ŏ | ĝ | 0 | ō | ā | ō | | | | |
| NC HH | 8 | 0 | 8 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 1 0 | 2 0 | . 0 | 8 | | | | |
| TOTAL | Õ | Ö | 0 | Ó | 1 | ' 2 | 1 | 2 | ă | 1 | 4 | Š | 1 | 1 | | | | |
| CHI -SQUARE VALUES | ·· Q | ~1 | 1- | -2 | | 2-3 | 3 | -4 | | I-S | | 5-6 | | 6-T | | | | |
| | Rau | HF | Rass | MP | Reu | μF | Raut | MF 4.000 | Rau | 4F 2.000 | 8 . SOO | 4.567 | E.000 | 4F 6.000 | | | | |
| LS SL NC | | | | == | 2.000 | 7.500 | 2.000 | | | | | | | | | | | |
| NC | | | *** | | _ | | | | | | 12,000 | 7.500 | | | | | | |
| ÜŬ | | | | | | | | | | ~- | | | | | | | | |

Table E21. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| race upe S L | Rau O O | UF 0 | | 2 UF | · | | | | | | | | | | | | CHI -SQ | TUARE F-HAT |
|-----------------------|---------------|---------|---------------|---------|-------|-----------|---------------|-------|---------------|----------------|-------|---------------|------|------------|-------|-----|-----------------|-----------------------------|
| ype S L | 0 | 0 | | 145 | | 2-3 | 3 · | -4 | 4 | - 5 | 5 | -6 _ | 6- | -7 | Tota | 1 . | FOR 3 | TEST PERIODS |
| iL . | o | - | | - | Reu | ИF | Rau | HF | Rau | HF | Rau | WF | Rau | HF | : Raw | HF. | Rau | UF |
| | - | | Ö | 0 | 2 | 5 | . 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 3 | 6 | 2 | 4 |
| c | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | | 0 | 0 | . 0 | 0 | o o | • | . 0 | 0 | | 0 |
| | | 0 | • | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 2 , | . 0 | 0 | • | 4 | > | • • |
| N4 | 0 | . 0 | 0 | 0 | 0 | <u>a</u> | 0. | 0 | 0 | 0 | O. | . 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| otal | 0 | 0 | D | 0 | 2 | . 5 | 0 | 0 | 1 | 2 | 3 | 3 | 0 | 0 | i 6 | 10 | 5 | 0 |
| 10 MINU | TES DURI | NO TEST | PERIOD | | | | | | | .* | | | | | | | • | |
| | | | | | | | | | RANGE (H | ters> | | : | | | | | · | |
| Face | 0- | 1 | 1- | 2 | | 2-3 | 3. | -4 | | 1-5 | 5 | -6 | 6- | ~7 | Tota | 1 | CHI-SO | URRE VALUES TEST PERIODS |
| UP+ | . Rau | HF - | Rau | HF | Rass | HF | Rau | WF | Rasa | ИF | Rau | UF | Rau | HF | : Rau | HF | run J | Ram |
| .\$ | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | LS | 1.500 4.2 |
| L | 0 | 0 | ø | 0 | 0 | 0 | 0 | · a | 0 | • | 0 | 8 | 0 | 0 | | 0 | SL | |
| C | 0 | • | 0 | ø | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | NC | 6.000 8.00 |
| IH | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | MM | - : |
| otal | 0 | Q | 0 / | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | . 0 | .0 | 0 | Ģ | i o | 0 | TOTAL | 6.000 10.5 |
| 10 HINU | TES RETE | R TEST | PERI OD | | | | | | | | | | | | | | | |
| | | _ | | | | | | | RANGE (He | | • | | | | | | CHI-SE | RUARE - 5.99 |
| FACE | | | 1- | | | 2-) | | -4 | | 4-5 | | -6 | | - ? | Tota | | (d.f. (alpha | = 2> = .05> |
| 'UP+ .S | | uf | Rau. | | Ray | | | HF | Rau | WF | Rau | WF | Res | uf | Rau | | | |
| .> iL | 0 | 0 | 0 | 0 | 2 | 5 | . 0 | 0 | .0 | 0 | 0 | 0 | Ď. | 0 | 2 | 5 | | |
| IC . | | 0 | 0 | 0 | . 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 " | . 0 | 0 | | |
| ш | 0 | 0 | o a | 0 | .0 | | 1 | 2 | 2 | 3 | 2 | 2 | . 1 | 1 | : 6 | 8 | * | |
| otel | | | | | 2 | | | 0 | | | | <u> </u> | | <u> </u> | 0 | | | • |
| :HI -SQUAR | | _ | 1- | _ | | 5 2-3 | 1 | . = | 2 | | 2 | 2 | 1 | 1 | : 0 | 13 | | • |
| -HAT | Rau | WF | | uF | | 2-3 UF | | -4 | | 4-5 | | . | | -7 | | | | |
| .5 IC | 6 | Ö | Rau O O | Ď | . Rau | Š | Rau D D | , M. | Ran D O | Ö | Rem | uf D | Rest | HF 0 | | | | |
| Č · | Ď | Õ | Ō | ğ | ŏ | ŏ | ŏ | . 1 | ĭ | 5 | 9 | 9 | . 0 | 8 | | | | |
| OTAL. | 0 | 8 | 8 | ő | 9 | 9 | 8 | . 1 | 9 | . 0 | 50 | 0 2 | 8 | 8 | | | | |
| HI -SQUAR ALUES | Æ . O- | 1 | 1- | 2 | | 2-3 | 3 | -4 % | | 4-5 | • | 5-6 | 6- | ~T | | | | |
| ntues S | Rau | MF | Rau | HF | Rau | | Reu | NF | Rase | µF. | Rau | HF | Rau | HF | | | • | |
| L C | == , | | | == | 4.000 | 6.667 | | | | | - == | == | | | | | | • |
| ru - | | | == | == | | | | 2.000 | 2.000 | 1.500 | 4.000 | 4.000 | | == | | | | |
| OTAL. | | | | | 4.000 | 6.667 | ; | 2.000 | 2.000 | 1.500 | 1.500 | 1.500 | | | . • | | | |

Table E22. Indian Point hanner test monitoring using 6 degree pertical transducer located at unit 3, intake 35.

| | | | T4 | del Pho | 501 2 H | Hrs aft gh Tide | *************************************** | | | nent Ty | st: pel | lO min 10 min | Har 5 on continuo | ly us midron | Test D | | /26/88 040 | |
|-----------------------|---------|------------|---------|---------|-------------|--------------------|---|------|----------|---------|----------------|------------------|----------------------|--------------------|--------|------|----------------|------------------------------|
| TO MEMPIL | ES DURI | NO TEST | PERIOD | | | | | | RANGE (H | eters> | | | | | | | | |
| _ | 10~ | | 1- | 2 | 2- | 3 | · 3- | -4 | | 4-5 | . , | 5-6 | | 6-7 | To | tal | FUR 2 | PURRE F-HAT TEST PERIODS |
| Trace Type | Rau | UF | Rasi | 4F | Rau | MF. | Rau | MT | Rau | UF | Rau | WF | Rau | ш | : Rai | 4 HF | Rau | uf |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5L | O | 0 | 0 | 0 | 0 | 0 | 0, | 0 | Q. | 0 | 0 | . 0 | . 0 | 0 | . 0 | O | 0 | O |
| IC | 0 | o | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 8 | 10 | 1 | t | 11 | 14 | . 11 | 14 |
| 464 | 0 | o . | 0 | 0 | 0 | 0 | o . | 0 | 0 | o | 0 | Ò | 0 | 0 | | 0 | 0 | G |
| Fotal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 8 | 10 | 1 | 1 | 11 | 14 | 11 | 14 |
| 10 HINUT | ES AFTE | R TEST | PERI OD | | | | | ı | RAMBE (H | eters) | | | , | | Ŧ | | | |
| frace | 0- | | 1- | 2 | 2. | -3 | 3- | -4 | | 4-5 | | 5-6 | | 6-7 | To | tal | CHI-SO | QUARE VALUES TEST PERIODS |
| ype | Rass | MF | Rau | HF | Rau | uf | Raw | MF | Rass | LOF | Rau | UF | Rau | UF | : Ran | u uf | | Raw MF |
| LS | . 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | LS | |
| 5Ł | 0 | • | O | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | SL | |
| #C | 0 | 0 | 0 | 0 | 0 | ø | 0 | 0 | 1 | 2 | | 10 | 1 | 1 | 10 | 13 | NC | 0.048 0.037 |
| 4 4 | 0 | 0 | 0 | 0 | · 0 | 0 | 0 | 0 | | 0 | 0_ | 0 | D | 0 | 0 | 0 | . MAJ | |
| rotal | O | • | D | 9 | 0 | n | . 0 | 0 | 1 | 2 | 8 | 10 | 1 | 1 | : 10 | 13 | TOTAL | 0.048 0.037 |
| HI-SOURRE | | | | -2 | 2- | -3 | 3- | -4 | | 4-5 | | 5-6 | | 6-7 | | | | QUARE - 3.841 |
| F-HnT | Rau | NF | Rau | UF | Rau | ИF | Rass | LAF. | Ray | | Rau | | Rau | HF | | | (d.f. (alph | * 1> * = .05> |
| LS SL HC JU | 0 | 0 | 0 | 0 | 0 | Ů | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | | | | |
| NC 5 | Ö | 0 | Ö | ย | Ö | ŝ | 0 | 9 | 2 | 3 | 8 | 10 | 1 | 1 | | | - | |
| FOTAL | ŏ | ŏ | ŏ | ŏ | ŏ | ŏ | ŏ | ŏ | ž | 3 | ě | 10 | ĭ | · ĭ | | | | • |
| CHI «SQUARE PALLES | 0- | . 1 | 1- | -2 | Ž | -3 | 3- | -4 | | 4-5 | | 5-6 | | 6-7 | | | | |
| | RaH | LEF | Rau | HF | Rau | ur | Rau | WF | Rau | MF | Rau | WF | Rau | HF | | • | | |
| LS SL NC MB | . , | | | | | == - | | | | | | | · | | | | • | |
| 4C | | | == . | | | | | | 0.333 | 0.200 | 0.000 | 0.000 | 0.000 | 0.000 | | | | |
| μης Γάτων . | | | | | | | | | 0.333 | 0200 | 0.000 | 0-000 | 0.000 | 0_000 | | | | |

Table E23. Indian Point hawner test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| ***** | | | T1 | dal Phase | : 4.5 Lou | Hr s Tid | before + | | Duratio Treat | n of Te ment Ty | st: p+: | 10 min 10 min | 1,3,45 o continuo | n Us | Test D Test T | ate: ime: | 2/26/ 88 2100 | ***** | |
|------------------|-----------|---------|--------|-------------|--------------|-------------|-------------|------------|------------------|--------------------|------------|------------------|----------------------|---------|------------------|--------------|-------------------------|--------------------|-----------------|
| 10 H3 M1L | ES DURI | NO TEST | PERLOD | | | | | | RNNBE (H | eters) | | | | | | | | | |
| | n- | 1 | 1- | 2 | 2-3 | | | 3-4 | | 4~5 | | 5-6 | | 6-7 | Fo | tal | FOR 2 | QUARE I | F-MAT PERIOD |
| Frace Type | Rase | uf | Rau | UF | Rau W | r | | WF | Rau | NF. | Rau | WF | Rau | WF. | : Ra | u WF | Rau | WF | - |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | - . |
| SL . | 0 | 0 | 0 | o . | 0 | O | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • 0 | . 0 | |
| 4C | O | . 0 | Þ | 0 | D | 0 | 3 | 6 | 4 | 6 | 6 | 7 | 0 | 0 | 13 | 19 | 14 | . 19 | |
| Иш | 0 | 0 | 0 | υ . | D | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Fet:al | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 6 | 4 | 6 | 6 | 7 | 0 | 0 | : 13 | 19 | 14 | 19 | |
| 10 MINUTE | ES RFTE | R TEST | PERIOD | | | | | | RFINGE (H | eters> | | | | | • | | | | |
| • | 0- | 1 | 1- | 2 | 2-3 | | | 3~4 | | 4-5 | | 5-6 | | 6~7 | To | tal | CHI-S | QUARE (| VALUES |
| France Figo-s | | WF | Rau | U F | Ran H | F | Rau | WF | Rau | ur | Row | uf . | Rau | MŁ. | ; P.a | u HF | FUK . | Rau | |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ĹS | | _ |
| 5L | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | SL | | |
| HC . | 0 | 0 | 0 | 0 | ø | 0 | 1 | 2 | 2 | 3 | 8 | 10 | 4 | 4 | 15 | 19 | NC | 0.143 | 0.00 |
| uw | 0 | 0 | 0 | 0 | D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Q | 0 | 0 | 0 | - MM | | - |
| rot.ml | 0 | 0 | 0 | 0 | Ð | 0 | 1 | 2 | 2 | 3 | 8 | 10 | 4 | 4 | : 15 | 19 | TOTAL | 0.143 | 0.00 |
| HI - SQUARE | 0- | 1 | t- | 2 | 2-3 | | ; | 3-4 | | 4-5 | | 5-6 | | 6-7 | | • | CHI - | OUARE | - 3.94 |
| F-1011" | Rau | WF | Rau | HF | Rau | ИF | Rau | SUF. | Rau | HF | Rau | | Rau | | | | | . = 1> .a = .0! | 5> |
| _ S | 0 | 0 | 0 | 0 | 0 | 9 | () D | ა ი | . 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| 3L | Ď | ŏ | ŏ | ō | Ŏ | Ŏ, | ž | 4 | 3 | Š | ř | š | 2 | ž | | | | | |
| JÚ FOTAL | 0 | 0 | 0 | 0 | 0 | 0 | 0 2 | 9 | 9 | 0 5 | õ | 9 | 0 2 | Ú 2 | | | | | |
| HI -SOURCE | . 0- | 1 | 1- | 2 | 2-3 | | . : | 3-4 | | 4-5 | | 5-6 | | 6~7 | | | • | • | |
| ALI ES | Rau | uf. | Raw | UF. | Rau | WF | Rau | HF | Ray | ИF | Rau | ИF | Rau | | | | | | |
| .s št | | | | | | | | | | | | | | == .^ | - | | | | |
| 141 | | | | | | | 1.000 | 2.000 | 0.667 | 1.000 | 0.286 | 0.529 | 4.000 | 4.000 | | | | | |
| HA FATFEL | | | | | | | 1.000 | 2.000 | 0.667 | 1.000 | 0.286 | 0-529 | 4.000 | 4.000 | | | | | |

Table E24. Indian Point hawner test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| | | | | del Pi | 1927: | 4 Hrs b Lou Tid | | *** | Duration Treatment | went fu | #======= b+: s<: | 7 min c | the Etc. Continuous Continuous | | Test Test | Date: Time: Desero | 2/26/8 2123 | , , , , , , , , , , , , , , , , , , , | - |
|---------------------|--------------------|-----------------|---------------|--------------|---------------|--------------------|---------------------|--------------|-----------------------|-------------------|-------------------------|-------------------------|--------------------------------------|-------|----------------|--------------------------|----------------|---|---------|
| 7 HINUIE | S DURIN | U TEST | PERIOD . | | | | • | | RAMBE (N | eters> | • | | | | | | ٠٠ | | |
| | 1)- | 1 | 1- | 2 | | 2-3 | 3 | 1-4 | | 4-5 | | 5-6 | | 6-7 | , te | otal | FOR | -SQUARE 2 TEST | PERI CO |
| Trace Type | Rau | uf' | Rau | WF | Ras | 4 HF | Rau | ИF | Rau | MF | Rau | MF | . Ray | HF | : R | au UF | Rev | uf. | |
| _\$ | 0 | 0 | O. | 0 | 1 | 3 | 0 | 0 | 2 | 3 | 0 | 6 | 0 | 0 | | 3 6 | | 4 | 7 . |
| iL | 0 | 0 | 0 | . 0 | . 0 | O | D | 0 | 0 | 0 | Ð | -0 | . 0 | . 0 | | 0 0 | | 0 | o · |
| ic . | ` o | 0 | Ö | 0 | 0 | 0 | 0 | . 0 | . 3 | . 5 | 6 | 7 | 0 | . 0 | | 9 12 | • . • | 3 2 1 | 7 |
| ene . | 0 . 1 | o o | , 0 | 0 | . 0 | . 0 | 0 | 0 | 0 | 0 | 0 | ,0 | . 0 | . 0 | | o .a | | 1 | 1 |
| rot =1 | 0 | • | D | 0 | 1 | 3 | 0 | 0 | . 5 | | 6 | 7 | 0 | ō | 1: | 2 19 | | 7 2 | • |
| 7 MINUTE | S AFTER | TEST F | ERI OD | | | ٠ | | | RANGE (m | | | 7.7 | • | | | | | | |
| | η- | | 1- | | | 2-3 | | 1 4 | • | 4-5 | | 5-6 | | 6-7 | | otal | CUT | -SQUARE | uni urc |
| race upe | - - | i | | | Rai | | Rass | | Rau | | Ray | | Ras | | | au HF | FOR | 2 TEST | PERI OU |
| . -S | 0 | 0 | 6 | | | | 4 | | 0 | | | 0 | | 0 | | 4 8 | LS | 0.14 | |
| iL. | 0 | · · · · · · · · | 0 | . 0 | | | D | 0 | . 0 | 0 | . 0 | . 0 | . 0 | 0 | 1 | 0 0 | SL | _ | |
| ıc | . 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 5 | 5 | 6 | . 8 | | | 7 21 | NC | 2.46 | 2 2.45 |
| 418 | . 0 | 0 | 0 | • | 0 | | . 0 | 0 | . 0 | 0 | 1 | | 0 | . 0 | | 1 1 | . 44 | 1.00 | |
| retal | 0 | | 0 | 0 | • | 0 | \$ | 10 | 3 | \$ | 6 | 7 | 9 | 8 | | 2 30 | | AL 2.94 | |
| HI -SQUAPE | 0~ | 1 | 1- | 2 | , | 2-3 | 3 | I-4 | | 4~5 | | 5-6 | | 6-7 | | | CHI | -SQUARE | - 3.84 |
| . \$ \$L 4C | Ram D O O | ИF 0 0 | Rau D G | UF 0 0 | Ras 1 0 | 2 0 0 | Rass 2 0 1 | HF 4 0 | Raw 1 0 3 | UF 2 0 5 | Ra4 0 0 | UF 0 0 7 | Ran 0 0 | | | | (al | f. = 1) pha = . | 05> |
| IN FORMU | 0 | 0 | 8 | Ü | 1 | 0 | . 0 | 0 5 | . 9 | . 7 | 1 6 | 17 | 9 | 4 | | | | - | |
| HI SQUARE | 10 - | 1 | 1- | 2 | | 2-3 | 3 | -4 | | 4-5 | | 5-6 | | 5-7 | | | | | |
| _\$ | Raw | uF | Rau | UF | Ra4 | 3.000 | 8 Au 4.000 | 9.000 | 2.000 | .WF 3.000 | Rate | · WF | Ras | UF | | ? | | | |
| il II III | -= | == | | == | 1.000 | 3.000 | | 2.000 | 0.000 | 0.000 | 0.091 1.000 0.000 | 0.077 1.000 0.000 | 8.000 | 8.000 | | | | | |

Table E25. Indian Point hanner test monitoring using 6 degree invertical transducer located at unit 3, intake 35.

| - 45-45-55 | | | | idal Pha | | .5 Hrs | before e | · · | Buratio Treat | | | 10 min 10 min | Hmr 5 on Continuo | ly us | Test I | ime: | 2/25/ 88 2140 | · |
|----------------------|---------|-------|--------------|-------------|--------|--------|-------------|---------------|------------------|-------------|---------|------------------|----------------------|-------------|--------|------|--|-----------------------------|
| | | | T PERIOD | | | | | | RANGE (H | eters) | | | | | | | | |
| | o- | | 1. | -2 | 2 | -3 | 3 | -4 5 | | 4-5 | | 5-6 | | 6- 7 | Го | tal | | QUARE F-HAT TEST PERLODS |
| race upe | | WF | Rau | ur- | Rau | MF. | Rau | MF | Rau | HF | Rau | HF | Rau | WF | : R4 | u HF | Rau | HF |
| s | 0 | 0 | 1 | 5 | 0 | 0 | 2 | 4 | 5 | 3 | 1 | 1 | 0 | 9 | | 13 | 4 | 7 |
| L | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Ð | 0 | 0 | o | | • 0 | 0 | n |
| c | 0 | 0 | 0 | 0 | 0 | 0 | 3 | . 6 | 14 | 21 | 15 | 19 | 4 | 4 | >6 | 50 | 26 | 35 |
| l u | 0 | . 0 | O | 0 | 0 | 0 | 0 | O | 0 | . 0 | 0 | 0 | D | O | | 0 | 0 | 0 |
| otal | 0 | 0 | 1 | 5 | 0 | 0 | 5 | 10 | 16 | 24 | 16 | 20 | 4 | 4 | 42 | 6.3 | - 29 | 42 |
| 10 HIMUT | ES AFTE | R TES | PERIOD | | | r | | I | RANGE (M | +t+r=> | | • | | | | | | |
| race | 0- | 1 | 1. | -2 | 2 | -3 | 3 | -4 | | 4-5 | | 5-6 | | 6-7 | Te | tal | | QUARE VALUES |
| 4b+ | Rau | MF. | Rau | MF | Rau | MF | Rau | HF | Reu | HF. | Res | . HF | Rau | HF | : R4 | M HF | - rux 2 | Rau I |
| .\$ | 0 | O | 0 | 0 | 0 | 0 | D . | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | , LS | 3.571 10.20 |
| L | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | • | 9 | SL | |
| 102 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 4 | 6 | 7 | 9 | 4 | 4 | 15 | : 19 | NC | 9.647 13.9 |
| łW <u>;</u> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | O | 0 | 0 | 0 | 0 | 0 | 1 | • 0 | LELI | |
| atel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 6 | 9 | 10 | 4 | 4 | 10 | 20 | TOTAL | 11.655 22.2 |
| HI -SOURFE | 0- | 1 | 1- | -2 | | -3 | 3 | -4 | | 4-5 | | 5-6 | | 6-7 | | | | QUARE - 3.84 |
| -HAT | Rau | ur | Rau | <u>uf</u> | Rau | WF | Rau | ИF | Ran | UF | Rau | | Rau | и | | | <d.f. <a3ph< td=""><td>= 1> • = .05></td></a3ph<></d.f. | = 1> • = .05> |
| Ĺ | 6 | 9 | ò | 3 | D 0 | 9 | ò | จ็ | 0 | 2 0 | 0 | ņ | 8 | ő | | | | |
| 15 14 | Ö | 9 | 0 | O D | . 0 | 0 | 2 0 | 2 | 9 | 14 | 11 0 | - 14 | 4 | 7 | | | | |
| at ur | 0 | 0 | . 1 | Š | Ō. | Ŏ | 5 | . 5 | 10 | 15 | 12 | ıš | | ă | | | | - |
| H1 - SQUARE ALUES | 0- | | 1. | -2 | | -3 | 3 | -4 | | 4-5 | | 5-6 | · | 6-7 | | • | | |
| | RAM | UF | Rau 1.000 | 4F 5.000 | Rau | . UF | 2.000 | . UF 4.000 | 2.000 | 4F 3.000 | 0.000 | 9.000 | Rass | ur | | | ; | |
| S L | -,- | | | | | · | | | | | | | | | | | | |
| C M | | | == | | | | 3.000 | 6.000 | 5.556 | •.333 | 2.909 | 3.571 | 0.000 | 0.000 | | | | |
| BTFIL | ' | | 1.000 | 5.000 | · | | 5.000 1 | 0.000 | 7.200 | 10.800 | 2.667 | 3.333 | 0.000 | 0.000 | | | | |

Table E26. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| | | | · | ridal P | | 3 Hrs b Low Fid | • | | Treat | n of Te went Ty | D+: | 10 min | 1,3,65 or continuo | 11:11 | Test Da | me: 2 | 200 | | |
|--------------------------------|--------------------------|-------------------|-------------------------|-------------------|--------------------|--------------------|-------------------------|-----------------------------|------------------------------|--------------------|--------------------|--------------------------|-------------------------|------------------------|---------|-------------|-----------------|---------|-----------------|
| 10 MIMUI | S OUR | INO TE | ST PERIO | D | ***** | | | | RANGE (H | | | | | | | | | | |
| _ | 0 | -1 | | 1-2 | | 2-3 | 3 | 5-4 | | 4~5 | | 5-6 | | 5-7 | Tot | :01 | FOR 2 | FURRE F | -HAT ERI 00: |
| Frace Type | Rau | HF | Rand | MF | Raw | Left. | Rau | MF | Ran | uF. | Ran | , UF | Raw | WF | Rau | MF | Rau | MF | |
| LS | 0 | 0 | 1 | 5 | 1 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 10 | 2 | 6 | |
| 5l. | c | 0 | Đ | 0 | 0 | 0 | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | • | 0 | 0 | |
| 4C | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 2 | 3 | . 1 | 1 | O | 0 | • | 4 | 3 | 4 | |
| 86 4 | 0 | 0 | • | 0 | Ð | 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | | 0 | 0 | 0 | |
| rotal | 0 | 0 | 1 | 5 | 1 | 3 | 1 | 2 | 2 | 3 | 1 | 1 | 0 | 0 | 6 | 14 | . 5 | 10 | |
| 10 MINUTE | S AFT | ER TEST | r Perioo | | | | | . (| RANGE (H | eters> | | | | | | | - | | |
| Trace | 0 | -1 | | 1-2 | | 2-3 | | 3-4 | | 4-5 | | 5-6 | | 6~7 | Tot | : -1 | CHI-SI | TEST P | ALUES |
| upe | Rau | uf | Rau | uf | Rau | MF | Rau | HF. | Rau | LIF | Ras | uF | Rau | UF | Ras | 4F | | Rau | H |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | O | 0 | 1 | 2 | LS | 1.000 | 5.33 |
| šL. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | SL. | | - |
| (C | 0 | 0 | 0 | 0 | D | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 2 | 3 | NC: | 0.200 | 0. 14 |
| M | 0 | U | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | LMI | | - |
| Total | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 0 | 0 | 1 | 1 | . 3 | S | TOTAL | 1.000 | 4.25 |
| CHI-SQUARE | 0 | -1 | | 1-2 | | 2-3 | 3 | 3-4 | | 4~5 | | 5-6 | | 6-7 | | | | NIARE - | 3.81 |
| LS SL NC HAI TOTAL | Rapp 0 0 0 0 | MF 0 0 0 | Rau 1 0 0 0 | NF 0 0 0 | Rew 1 0 0 | WF 2 0 0 | Raw 1 0 0 0 | MF 2 0 0 0 2 | R#1 0 0 2 0 2 | #F 0 0 3 | Rai 0 0 1 | , UF 0 0 1 0 | Rau D O 1 O | UF 0 0 1 0 | | | (d.f. (a) ph | - '.ºs | > |
| HI -SYURRE IRLUES | 0 | - 1 | | 1-2 | | 2-3 | | 9-4 | | 4~5 | | 5-6 | | 6-7 | | | | | |
| LS SL NC | Raw | HF | 1.000 | 5.000 | 1.000 | 3.000 | 0.000 | 0.000 | 0.333 | 0.200 | Rat | 1.000 | Rau 1.000 | 1.000 | | | | | |
| UU TOTAL | | == | 1.000 | 5.000 | 1.000 | 3.000 | 0.000 | 0.000 | 0.333 | 0.200 | 1.000 | 1.000 | 1.000 | 1.000 | | | | | |

Table E27. Indian Point hammer test monitoring using 6 degree pertical transducer located at unit 3, intake 35.

| | | | | idel Phe | | Hris be | | | Duration Treatm | of Tes ent Tys | | | 163 only continuou |)\$ | Test D | | | | |
|----------------------|--------------|---------|-------------|----------|------|---------|------------|------------|--------------------|-------------------|-------|---------|-----------------------|-------------|--------|------|-------|------------------------|-----------------|
| | | | F PERIOD | | | | | | RANGE (Me | ters> | | | • | | | | | | |
| | 0- | 1 | | -2 | 2- | -3 | ₹ 3- | -4 | | 1-5 | 5 | -6 | 6 | 5- 7 | To | tal | FOR 2 | SQUAKE F- C TEST PE | -MAT ERJ ODS |
| Traise Tippe | Rau | uf | Rau | uf . | Rau | WF | Rau | uf | RaH | MF | Rau | MF | Rau | MF | : Pa | W WF | Rau | иF | |
| | 0 . | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 2 | 4 | 2 | 5 | |
| SL | 0 | 0 | 0 | Ō | 0 | 0 | 0 | 0 | 0 | ø | 0 | 0 | o | 0 | 0 | 0 | 0 | 0 | |
| NC | 0 | 0 | 0 | 0 | 0 | 0 | n | 0 | 0 | o . | . • | 0 | 0 | 0 | | 0 | 5 | 6 | |
| มม | 0 | 0 | 0 | 'n | o | 0 | O | 0 | 0 | o | a | 0 | o | . 0 | | | 1 | 1 | |
| fotal | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | | 4 | ~ | 11 | |
| 10 HINU | TES AFTE | R TESI | PERIOD | | | | | | RANGE (He | ters> | | ٠ | | | | | | | |
| | 0- | 1 | 1. | -2 | 2- | -3 |) - | -4 | 4 | - 5 | . 5 | i-6 | · · | 5- 7 | To | tal | CH1-5 | SQUARE VA | ALUES |
| Trace Typer | Rau | MF" | Rau | HF | Rau | uf- | Rau | WF | Ran | MF | Rан | ИF | Rau | uF | : R. | H UF | FOR 2 | R TEST PE | ERIODS WF |
| 1,5 | 0 | D | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | 1 | 5 | LS | 0.333 | 0.11 |
| SL | 0 | 0. | 0 | 0 | 0 ' | 0 | 0 | . 0 | . 0 | 0 | 0 | 0 | 0 | 0 | | 0 | SL | | |
| NC | a | 0 | 0 | 0 | o o | 0 | 0 | . 0- | 1 | 2 | 6 | 7 | 3 | 3 | . 10 | 12 | NC | 10.000 | 12.000 |
| Nh . | . 0 | 0 | 0 | 0 | 0 | υ | 0 | 0 | 0 | 0 | ·0 | e 0 | 1 | 1 | 1 | 1 1 | ш | 1-000 | 1.00 |
| Total | 0 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 1 | 2 | 6 | 7 | 4 | 4 | 12 | 19 | TOTAL | . 7.143 | 8.90 |
| CHISQUAR! F-Hit | E 0- | 1 | 1 | -2 | 2- | -3 | | - 4 | 4 | 1~5 | | 5-6 | | 5-7 | • | | | 50UARE = -/1> | 3.64 |
| r -m// I.S | Ram | ur o | Reu | LIF 3 | Rass | WF | Rau | HF | Reu | WF | R44 | HF O | Rau | HE 0 | | | | 05) | • |
| 3L | 0 | ŏ | Ó | ő | Ō | õ | Ó | ō | ģ | ģ | Ú | ŏ | ō | ŏ | | | | | |
| MC UU | 0 > | 0 | 0 | 0 | 8 | 0 | 0 | 9 | i | 0 | 3 | . 4 | 2 | 2 | | | | | |
| TOTIAL. | 0 | 0 | , i | 3 | Ō | Ó | | Ł | 1 | Ž | . 3 | 4 | 2 | 2 | | | | | · |
| CHI~SQUARI VALFES | E 0~ | 1 | 1 | -2 | 2- | | 3- | -4 | 4 | I 5 | 9 | 5-6 | | 6-7 | | | | | |
| | Rau | HF | Raw | UF | Raw | MF | Rass | LIF | Rau | LIF | Raw | MF | Rau | LUF | | | | | |
| LS ぶし | | | 1.000 | 5.000 | | | 1.000 2 | 2.000 | 1-000 | 2.000 | | | | | | | | | |
| HC. | · _ _ | | . == | == | | | | ~- | 1.000 | 2.000 | | 7.000 | 3.000 | 3.000 | | | | | |
| LIM | | | | | | | | | | | | | 1.000 | 1.000 | | | | | |
| FORM | | | 1.000 | 5.000 | | | 1.000 2 | 2.000 | 0.000 | 0.000 | 6.000 | 7.000 | 4.000 | 4.000 | | | | | |

Table E2R. Indian Point hammer test monitoring using 5 degree pertical transducer located at unit 3, intake 35.

| | | | | | Lo | u Tide | | | Treati | ent Typ | → : | 10 min e | continuo: | ly us | Test T | | 2/26/8 8 2 24 0 | | |
|--|-------------------------|-------------------|--------------------|--------------|-------------------------|--------------|--------------|----|-------------------------|---------------------|--------------------------|--------------------|--|--|--------|---------|--|-----------------------|------------------|
| TO ULWILL | | | PERIOD | | | ***** | | | RANGE (m | ters> | | | | 6#422e#1 | | | | | |
| | 0-1 | 1 | 1- | 2 . | 2- | • | 3- | | | t-5 | • | 5-6 | | 6-7 | To | tel | CHI-SO FOR 2 | QUARE F-H TEST PER | IAT RI CO |
| race Tupe | | 4F | Rau | MF . | Rau | HF | Rau | ЦF | Rau | MF | Rau | MF | Rau | MF | : Rat | u · UF | Rass | MF | |
| .s | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Ō | 0 | 1 | 1 | 0 | 0 | 1 | 1 | | 3 | |
| 5 L | 0 | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | O | 0 | 0 | 0 | | 0 | 1 | 1 | |
| IC . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 5 | 7 | .9 | 2 | 2 | 12 | 16 | 19 | 25 | |
| ana | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 1 | 1 | |
| fotal | 0 | 0 | 6 | 0 | | 0 | 0 | 0 | 3 | 5 | 8 | 10 | 2 | 2 | 13 | 17 | 23 | 30 | |
| 10 MINUTE | ES AFTEI | | | | | | | - | RANGE CH | | | | | | | | | | |
| Trace | | | 1- | | | | | | | 1-5 | | 5-6 | ! | 6-7 | | tel | CHI-SI - FOR 2 | QUARE VAL TEST PER | .(IES RI 00 9 |
| [up+ | Ram I | af | Rau | UF | Rau | MF. | Rau | WT | Rass | uf | Rau | _ MF | Raw | WF | : Rai | u NF | _ | Rass | LIF |
| LS | 0 | 0 | D | 0 | .0 | O | 0 . | 0 | Đ | Ó | 3 | . 4 | 1 | 1 | • | 5 | LS | | 2.657 |
| SL. | 0 | 0 | . 0 | 0 | 0 | Ð | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | : 1 | 1 | SL | 1.000 | 1.000 |
| HC | 0 | 0 | 0 | ٥ | 0 | Œ | 0 | 0 | 10 | 15 | 11 | 14 | 5 | 5 | : 26 | 34 | NC | 5.158 | 6.490 |
| M | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | | 5 | 2 | . 2 | 2 | - MM | 2.000 | 2.00 |
| Total | O | 0 | 0 | 0 | D | 0 | 0 | 0 | 10 | 15 | 14 | 18 | 9 | 9 | : 33 | 42 | TOTAL | 9.696 10 | 0.533 |
| HI -SQUARE | | 1 | 1- | 2 | 2- | 3 | 3- | 4 | | 4-5 | | 5~6 | ĺ | 5- 7 | | | | QUARE - : | 3.81 |
| F-HAT L.S SL SIC UM FOTAL | Raw O O O O | #F 0 0 0 | Rau 0 0 0 | UF 0 0 | Rau 0 0 0 0 | MF 0 0 | *Ram 0 0 0 7 | #F | Rau 0 0 7 0 | 10 0 10 10 | R au 2 0 9 0 | #F 0 12 0 | Rau 1 1 4 1 6 | UF 1 1 4 1 6 | | | <d.f. <alph< td=""><td>▲"+¹.05></td><td></td></alph<></d.f. | ▲"+ ¹ .05> | |
| HI-SQUARE | | | 1 | 2 | 2- | 3 | 3- | -4 | | 4-5 · | | 5-6 | | 6-7 | | | | | |
| PALUES I.S SL PIC BUTAL | Reu | MF | Resi | MF == , | Raw | MF | Rau | WF | 3.769 3.769 | S.000 | 1.000 0.889 | 1.007 2.286 | Rau 1.000 1.000 1.296 2.000 4.455 | UF 1.000 1.000 1.286 2.000 | | | | | |

Table E29. Indian Point hanner test monitoring using 5 degree vertical transducer located at unit 3, intake 35.

| | *** | | Ti | dal Phas | . 2. Lo | 5 Hrs u Tid | before | | Duration Treate | | | 10 min 10 min | 1,3,45 c continuo | 115 115 | Test (| Date: Tine: | 2/26/88 2300 | | : |
|-------------------------|----------------|--------------|---------------|---------------|---------------|----------------|---------------|-------------------|-----------------------|--------------------|--------------------------|-------------------------|-------------------------|-------------------------|--------|----------------|-----------------|--------------------------|------|
| 10 HIMUT | ES DURI | NO TES | PERIOD | 医甲基氏试验 医 | | | | | RANGE (M | ters) | | | | | | | ***** | | |
| •. | 0- | 1 | 1- | 2 | 2- | 3 | 3 | -4 | | - 5 | 7 | S-6 | | 6-7 | Te | otal | | QUARE F-HIG TEST PERI | |
| Trace Type | Rau | uf | Rau | uf | Rası | uF | Rau | WF | RaH | UF | Rau | WF | RAH | , NF . | : R | au WF | Rau | uf . | |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 2 | 2 | 0 | 0 | -: | 4 6 | 2 | 3 | |
| SL | 0 | o | 0 | Ó | 0 | 0 | Ů. | 0 | . 0 | o | a | o | Ó | o o | | 0 0 | 0 | 0 | |
| NC | a | O | 0 | 0 | 0 | 0 | 1 | 2 | 15 | 23 | 12 | 15 | 8 | 8 | : 30 | 6 .48 | 26 | 34 | • |
| HW | 0 | 0 | ٥ | 0 | o, | 0 | . 0 | 0 | 0 | . 0 | 2 | 2 | 1 | 1 | | 5 ,3 | 5 | , S | - |
| Total | ō | | 0 | 0 | 0 | 0 | 2 | 4 | 16 | 25 | 16 | 19 | 9 | 9 | 43 | 57 | 32 | 41 | |
| 10 HIMOT | ES AFTE | R TEST | PERI OO | | | | , | • | RANGE (M | ters> | • | | | • | | ٠. | • | | |
| | . 0- | 1 | 1- | 2 | 2- | 3 | 3 | 3- 2 4 - 1 | _ | 1-5 | | 5-6 | | 6-7 | | otal | CHI -S | QUARE VALU | ES |
| Trace: Type | Rau | uf | Rau | HF | Rau | HF. | Rau | MF | Rau | WF | Rau | WF | Ras | HF | | au KF | | TEST PERI Row | OD: |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 0 | LS | 4:000 6. | 0131 |
| SL | Ó | 0 | 0 | • | . 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | o | 0 | | 0 0 | 5L | · ., | _ |
| NC | O | 0 | 0 | 0 | 0 | ` o | 0 | 0 | 4 | . 6 | , 9 | 11. | 2 | 2 | 11 | 5 19 | NC NC | 8.647 12. | 55 |
| 11G | 0 | 0 | • | 0 | 0 | . 0 | 0 | 0 | 0 | <i></i> 0 | . 2 | 2 | 4 | . 4 | | 6 6 | HH | 1.000 1. | 00 |
| Tatal | 0 . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 5 | 11 | 13 | 6 | 6 | 2 | 1 25 | TOTAL | 7.563 12. | 43 |
| CHI -SQUARE F-MIT | 0 | 1 | 1- | 2 | 2- | .9 | 3 | 3-4 | | 1-5 | - | 5-6 | | 6-7 | | | CHI - | OUARE = 3. | . 84 |
| LS SL NC Hu | R MH 0 0 | UF 0 0 | Rau O O | 14F 0 0 | Rau O O | UF 0 0 | Rau 1 0 | NF 1 0 | R 844 1 0 10 | 45 1 0 15 | Rau 1 0 11 2 | UF 1 0 13 2 | Rai 0 0 5 | | | | | a = 1.05> | |
| TOTAL | ŏ | ŏ | ŏ, | ő | ŏ | ŏ | . 1 | ž | 10 | 16 | 14 | 16 | | ě | | | | | |
| CHI -SQUARE VALUES | 0- | 1 | | 2 . | 2- | 3 | | 9-4 | | 1-5 | | 5-6 | | 6-7 | | - | | | |
| LS | Rass | WF | Rau | MF | Rau | UF | Ra44 1.000 | UF 2.000 | 1.000 | 2.000 | 2.000 | UF 2.000 | Ras | . NF | | | ÷ | | |
| SL NG NU TOTAL | | | | 1=1 | | == | 1.000 | 2.000 | 6.368 7.200 | 9.966 | 0.429 0.000 0.926 | 0.615 0.000 1.125 | 3.600 1.800 0.600 | 3.600 1.800 0.600 | | • | | | • |

Table E30. Indian Point hammer test monitoring using 6 degree pertical transducer located at unit 3, intake 55.

| 10 MIMUT | ES DURI | NO TEST | PERLOD | | | | | (| RANGE (H | eters> | | | | | | | | | |
|------------------------|-----------|-------------|--------------|-----------|----------|---------|----------|----------|----------------|----------|----------|---------|----------|---------|-----|--------------|-----------------|---------|---------------|
| Trace | 0- | 1 | <u>t</u> - | | 2- | -3 | 3- | 4 | *** | 4-5 | . 5 | -6 | | 5-7 | Fot | | CHI-SI FOR 2 | QUARE F | -HHT ERION |
| Tupe | | er" | | UF | | NF | Rau | MF | Ray | WF | Rau | WF | Rau | HF | Rau | | Rau | WF | • |
| ĻS | . 0 | 0 | .0 | 0 | 0 | 0 | 2 | 4 | \$ | 8 | 4 | s | 0 | 0 | 11 | 17 | 8 | 12 | • |
| SL . | 0 | D | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0, | 0 | 0 | 0 | 0 | 0 | O | 0 | 0 | |
| ₩C | 0 . | 0 | 0 | • | 0 | 0 | 1 | 2 | 12 | 10 | 11 | 14 | \$ | 5 | 29 | 39 | 24 | 32 | |
| | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | s | 3 | | 4 | 3 | 3 | . 8 | 10 | , r | . 6 | |
| Fotal | 0 | 0 | 0, | 0 | . 0 | 0 | 3 | 6 | 19 | . 29 | 10 | 23 | 8 | 8 | 48 | 66 | 30 | 51 | |
| 10 MINUŤI | ES AFTE: | | PERIOD 1- | • | 2- | _ | | | RANGE CH | | _ | | | | | | | | |
| race | | 4F | | 4 | | | 3- | | | 4-5 | | -6 | | 5-7 | | | CHI-50 FOR 2 | QUARE U | ERJ ODS |
| Γγρ ε LS | Rau | | Rass | ···· | RaH O | HF O | Raw D | uf o | Reu | | Кам | | Rau | ur | | uf | | Rau | LEF |
| 5L | o o | | 0 | 0 | . 0 | 0 | 0 | 0 | 9 | 5 0 | . 0 | . 1 | . 0 | 0 | 1 | 6 | . L\$ | 3.267 | 5.26 |
| łC | 0 | 0 | a | 0 | . 0 | . O | 1 | 2 | 4 | 6 | 12 | 15 | 0 | 1 | 18 | 24 | SL NC | | |
| .u :- | 0 | 0 | . 0 | 0 | 0 | 0 | | 0 | . 7 | 0 | 0 | 0 | 5 | 5 | 5 | -5 | NC UU | 2.574 | 3.57 |
| otal | | | | <u>-</u> | | | <u>-</u> | <u>-</u> | - - | | 13 | 16 | | | 27 | ² | • | 5.890 | |
| | - | _ | _ | _ | _ | _ | • | . – | • | | | • | | • | | | | 3.650 | 7.50 |
| CHI SOUARE F-HAT | 0- | | | | 2- | | 3- | 4 | - | 4-5 | 5 | -6 | | 5-7 | | | | PIARE = | 3.84 |
| ĻS | Ğ SPri | O HE | Ran D | WF O | Rau Q | UF O | Rau 1 | HF 2 | Rau 4 | 7 | Rau 3 | uf 3 | Rau O | MF O | | | Calph | .05 | 5 > |
| 3L 40 44 | 0 | 9 | . 0 | 0 | 0 | 0 | 0 | 8 | . 6 | 12 0 | 12 | 15 | 9 | 3 | | | | | |
| FOTAL. | 0 | Ö | 0 | 8 | 0 | 0 | 0 2 | 9 | 13 | 20 20 | 16 16 | 20 | 7 | 7 | | | | | |
| HI-SQUARE | 0~ | - | · 1- | 2 | 2- | .3 | 3- | • | | 4-5 | 5 | -6 | | 5-7 | | | | | |
| -S | P.au | HF | Rau | NF. | Rau | ИF | Rass | MF | Reu | UF | Rau | MF | Rass | WF | | | | 7, | ٠. |
| | .== | | == | | | | ~- | -000 | 0.500 | 0.692 | | 2.667 | | | | | | | |
| 40 | | | | | | | 0.000 0 | -000 | 4,000 | 6.000 | 0.043 | 0.034 | 2.667 | 2.667 | | | | | |

Table E31. Indian Point hanner test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| | | | T1 | dal Phi | | e Hrs | before • | | Duratio Treat | n of Te went Гу | st: p t : | 10 min 10 min | 1,3,45 or continuo | n US ETERREC | Test D Test T | | 2/26/88 2342 | | |
|-----------------|----------|---------|---------|---------|-----|-------|-------------|-------|------------------|--------------------|-------------------------|-------------------------|-----------------------|--------------------|------------------|------|-----------------|------------|---------|
| DM IN OF | TES DURI | NO TEST | PERIOD | | | | | | RANDE (M | eters) | | | - | | | | | | - 115.5 |
| _ | 0- | | 1- | 2 | 2- | 3 | 3 | -4 | | 4-5 | | 5-6 | • | 6-7 | ro | tal | FOR 2 | TEST P | ERI OUS |
| Traise Type | | HF. | Ram | WF | Rau | WF. | Rau | WF | RaH | MF | Ray | ЧF | Rau | WF | : Ra | u HF | Rau | NF | _ |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 2 | 2 | 4 | 5 | - |
| 5 L | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | O | 0 | 0 | 0 | . 0 | . 0 | 0 | 1 | 1 | |
| HC 1 | 0 ' | 0 | 0 | 0 | 0 | 0 | 4 | 8 | 19 | 29 | 18 | 22 | 4 | 4 | 45 | 63 | 33 | 45 | |
| M | 0 | 0 | 0 | o | 0 | O | 0 | 9 | 0 | 0 | . 0 | 0 | 2 | 2 | 2 | 2 | 3 | 3 | |
| Total | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 8 | 19 | 29 | 20 | 24 | 6 | 6 | 49 | 67 | 41 | 54 | |
| 10 HI NU | TES AFTE | RTEST | PERI OD | | | • | | | RANGE CH | eters) | | | | | | | | | |
| | 0- | 1 | 1- | 2 ` | 2~ | > | 3 | -4 | | 4~5 | : | 5-6 | , | 6-7 | To | tal | CHI-S | QUARE L | ALUES |
| frace Type | Rau | H | Rass | WF | Raw | WF | Ram | WF | Rau | MF | Ras | ИF | Rau | WF | ; P.e | M MF | FOR 2 | Rau | H |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 6 | 0 | 0 | • | 8 | LS | 2.000 | 3,60 |
| 5L | O | 0 | 0 | 0 | O | 0 | 0 | 0 | 0 | 0 | , 1 | 1 | 0 | 0 | 1 | 1 | SL | 1.000 | 1.00 |
| łc | ø | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 8 | 8 | 10 | 7 | 7 | 21 | 27 | NC | 9.727 | 14.40 |
| HU | · o | 0 | 0 . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 5 | 4 | 4 | 181 | 0.667 | 0.66 |
| Total | 0 | 0 | 0 | o | 0 | 0 | 1 | 2 | 6 | 10 | 16 | 19 | 9 | 9 | 32 | 40 | TOTAL | 3.568 | 6.81 |
| CHI SOLIAF: | E 0- | 1 . | 1- | 2 | 2- | 3 | . 3 | | | 4-5 | | 5-6 | | 6-7 | | | | QUARE | - 3.64 |
| F-M91 | Rau | WF | Reu | HF | Rau | MF | Rau | MF | Raw | WF | Rau | HF | Rau | ИF | | | | - 1> 05 | \$> |
| LS SL Nr; | 0 | . 0 | 0 | 0 | 0 | 0 | 0 0 | 0 | 1 0 | 9 | 1 | 7 | 0 | 8 | | | | | |
| HC WU | 0 | 0 | 0 | 0 | Ċ | 0 | 3 | 5 | 12 | 19 | : 13 | 15 | ઠ 2 | 6 | | | | | |
| TOTAL | ŏ | ŏ | ŏ | ŏ | ŏ | ŏ | š | 5 | 13 | 26 | 1 18 | 22 | ê | ē | | | | | |
| HI -SQUAP | E 0- | 1 | 1- | 2 | 2- | 3 | 3 | | _ | 4-5 | | 5-6~ | | 6-7 | | | | * | |
| MALUES | RaH | MF | Rau | MF | Rau | WF | Raw | MF | Rau | | Rat | | Rau | | | | | | |
| 1.S Si | | | | | | | | | 1.000 | 2.000 | 1.286 | 2.000 1.000 | | | | | | | |
| SL NC | · | | | | | | 1.800 | 3.600 | | 11.919 | 3.846 | 4.500 | 0.618 | 0.818 | | | | | |
| HU TOTEL | | | | | | | 1.800 | 3.600 | 6.760 | 9.256 | 2.000 0.444 | 2.000 0.5 8 1 | 0.000 | 0.000 | | | | | |

Table E32. Indian Point harmer test monitoring using 6 degree cortical transducer located at unit 3, intake 35.

| | | | | del Fi | | 1.5 Hr t Lou Tide | efore | | Duratio Treat | n of Tes work Typ | +: +: | io min io min | 1,3,65 or continuo | 11 U S | Test Da Test Ti | te: 2 me: 0 | /27/8 8 002 | |
|---------------------------|----------------|------------|------|--------|-------|----------------------|--------------|-------------|-------------------------|----------------------|----------|------------------|-----------------------|------------------|--------------------|----------------|--------------------------------------|----------------------------|
| 10 HINU | | | | | | | | | RANGE (M | -ters> | | | | | | | | |
| | IJ | -1 | 1- | 2 | | 2-3 | : | 3~4 | | 4-5 | | 5-6 | | 5-7 | Tot: | a1 | CHI-S | QUARE F-HAT TEST PERJOD |
| irace iyp e | Rau | WF. | Rau | MF | Rau | WF | Ran | NF | Rau | WF | Rau | MF | Rase | WF | : Pau | NF | Rau | WF |
| .s | 4 | 27 | 0 | 0 | 0 | 0 | ō | 0 | 9 | 12 | \$ | 2 | 1 | 1 | 15 | 42 | 9 | 25 |
| j L | 0 | 0 | 0 | 0 | 0 | o | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | S. 100 | 0 |
| tc: | 0 | o | 0 | 0 | 1 | 3 | t | 2 | 7 | . 11 | 10 | 12 | 3 | 3 | 22 | 31 | 22 | 30 |
| 41 | 0 | 0 | ø | 0 | ٥ | 0 | B | 0 | 1 | 2 | 0 | יט | 3 | 3 | 4 | 5 | 4 | 4 |
| rotal | 4 | 27 | 0 | 0 | 1 | 3 | 1 | 2 | 16 | 25 | 12 | 14 | r | 7 | 41 | 78 | 34 | 50 |
| | o | ER TEST | 1- | | | 2-3 | : | 3-4 | RANGE O | aters> 4-5 | | 5-6 | ı | 6-7 | Tot | | CHI-S | OUARE VALUES |
| Frace Fype | Rau | MF | Rass | WF | R-se | UF | Rane | WF | Rasi | HF | Rau | WF | R-su | NF | : Pau | uF | FOR 2 | PEST PERIOD Raw H |
| LS | 0 | 0 | 0 | 0 | 1 | 3 | 1 | | 1 | 2 | 0 | 0 | 0 | υ | 3 | 7 | LS | 8.000 25.00 |
| SL | 0 | 0 | o | ø | 0 | 0 | 0 | 0 | 0 | n | В | 0 | 0 | 0 | . 0 | 0 | SL | |
| NC | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 9 | 13 | 16 | 2 | 2 | 21 | 58 | NC | 0.023 0.15 |
| MM | D | 0 | O | ŋ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 3 | มม | 0.145 0.50 |
| rotal | 0 | บ | 0 | 0 | 1 | 3 | 2 | 4 | 6 | 10 | 13 | 16 | 5 | 5 | 27 | 30 | TOTAL | 2.002 13.79 |
| :111 - SAUA | | - 1 | | -2 | | 2-3 | | 3-4 | | 4-5 | | 5-6 | | 5-7 | | | CH1 -5 | OVARE - 3.04 |
| F-HAT LS | Raw | HF 14 | Resi | WF | Rau | | Reu | WF | Res | WF | Rasi | | Rau | | | | <alpr< td=""><td>05></td></alpr<> | 05> |
| 3L 140 | Š | 100 | ŏ | ņ | ġ | 0 2 | ģ | 9 | Š | , 10 | 12 | 14 | ą | ģ | | • | | |
| HM FOTAL | 9 | 14 | ŏ | ņ | ģ | ő | 1 0 2 | õ | , i | 10 | iõ | 10 | Š | ຼີ້ | | | | |
| CHI -SNURF | | -1 | | -2 | | 2-3 | _ | 3-4 | | 4-5 | | 5-6 | | 5-7 | | | | |
| MALUES LS | Rau 4.000 2 | HF | Reu | ME | R 444 | 4F 3.600 | Rau 1.000 | WF 2,000 | Rau 5,444 | 7.143 | 2.000 | ı HF | Rau | 1.000 | | | | |
| SL NC NU TOTAL | | 7.000 | | | 1.000 | 3.000 | 0.000 | 0.000 | 0.333 1.000 4.545 | 0.474 | 0.391 | 0.571 | 0.200 | 0.200 | | | | |

Table E39. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| ************ | 7 E 9 C 2 C | **** | | dal Ph | ı | l.5 Hr b ligh Tid manacan | 14. | و در المراجع الم | Duration Treatme | ent Tube | t: 1 +: 1 +++++ | O min 1 O min 6 ======= | i,3,65 on ontinuou | \$ Barca4£ | Test Dat Test Tit | 10: 17 | /27/88 750 ******* | P |
|--------------------------|-------------|----------|---------|---------|---------|---------------------------------|-------|------------------|---------------------|----------------|-----------------------|-------------------------------|-----------------------|-------------------------|----------------------|------------|--------------------------|----------------------------|
| TO HIMUTE | S BEFO | RE TEST | PERIOD | | | | | | RANGE (met | | | | | | | | | |
| | 9- | 1 | 1~ | 2 | : | 2-3 | . 3 | -4 | 4- | -5 | 5 | -6 | 6 | -7 | Tota | ol. | FOR 3 | QUARE F-HAT TEST PERIOD |
| race upe | Rau | NF | Ran- | HF. | Rau | MF. | | UF | Rasi | WF | Rau | MF | Rass | HF | : Ran | ИF | Rau | uf |
| 5 | 0 | 1) | 0 | 0 | 0 | 1) | 0 | 0 | Ο. | υ | 0 | 0 | 0 | 0 | . 0 | 0 | 1 | 1 |
| L | 0 | 0 | 0 | o | o | 10 | 0 | 0 | 1 | 2 | ø | 0 | 0 | 0 | 1 | 2 | ^ 1 | 2 |
| | ٥ | o | 0 | o | 0 | 13 | 2 | 4 | . 0 | 0 | 11 | 14 | 2 | 2 | 15 | 50 | 22 | 32 |
| 4 | O | 0 | 0 | 0 | ŭ | n | Ð | O | Ö | 0 | 9 | 10 | 7 | 7 | 15 | 17 | 9 | 11 |
| otal | ø | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 1 | 2 | 19 | 24 | 9 | 3 | ; 31 | 39 | 33 | 45 |
| 10 HIMUTE | S DURI | NG TEST | PERI OD | | | | | ı | RANGE (met | ters) | | | | | | | | |
| | g- | . 1 | . 1- | 2 | ; | ?-3 | 3 | -4 . | 4. | -5 | 5 | -6 | , 6 | -7 | To to | a 1 | CHI-S | QUARE VALUES |
| race UD+ | Rau | NF | | uf | W. 4044 | HF | Ran | WF | Rast | MF | Rau | HF | Raw | ₩F | : Ran | WF | FOR 3 | TEST PERIOD |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | LS | 2.000 2.0 |
| • | , o | o | 0 | 0 | 0 | o | 0 | Ð. | 1 | 2 | 9 | 0 | 0 | 0 | 1 | 2 | SL | 0.000 -0.9 |
| : | 0 | 0 | 0 | 0 | 1 | . 3 | 9 | 17 | 8 | 12 | 10 | 12 | 9 | 9 | 37 | 53 | NC | 16.091 21.2 |
| 1 | 0 | O | Ð | a | 0 | 13 | O | Đ | 3 | 5 | 5 | 2 | 1 | 1 | . 6 | 8 | uu | 6.444 4.9 |
| t =1 | 0 | Ó | 0 | 0 | 1 | 3 | 3 | 17 | 12 | 19 | 1> | 15 | 11 | 11 | i 46 | 65 | TOTAL | 9.697 14.6 |
| to HIMUTE | S AFTE | R TEST | PERIOD | | | | | , | RANGE (M#1 | ters> | | | | | | | | |
| | 6)- | . 1 | . 1- | 2 | ; | 2-3 | - 3 | ı -4 | 4 | -5 | 5 | i-6 | 6 | -7 | Tot | a 1 | (d.f. | |
| race upe | Rau | MF | Reu | uF | Rass | HF | Rau | MF | Rasi | MF | RaH | ИF | Rass | HF | : Pau | MF | (a) ph | ·· · · 05> |
| 5 | 0 | 0 | o | 1) | 0 | n | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| L, | 0 | n | o | 0 | 0 | ŋ | o | . 0 | 0 | 0 | 1 | 1 | 0 | n | 1 | 1 | | |
| C: | 0 | 0 | 0 | o | 2 | 5 | 2 | 4 | 4 | 6 | 4 | 5 | 4 | 4 | 16 | 24 | + | |
| 4 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | O | 0 | 0 | 3 | 4 | 4 | 4 | 7 | 8 | | • |
| tal | Ü | 0 | 0 | 0 | 2 | 5 | 2 | 4 | ed . | 6 | 9 | 10 | 8 | 8 | 24 | 33 | | |
| II -SAURPE -HAT | 0- | -1 | 1- | \$ | | 2-3 | | -4 | 4 | ~5 | | -6 | 6 | - T | | | | |
| 5 5 | Rau | HF 41 | Rau | MF Q | Rass | ⊭F | Rau | . WE | Rasi | HF 0 | Rau O | WF. | Rau | MF D | | | | |
| | ō | õ | Ō | Õ | ā | 1) | 9 | ŏ | 1 | i | Ó | 10 | 0 | 0 | | | | |
| | ă O | 0 | 0 | 0 | o Q | 2 | 40 | 8 0 8 | 7 | 5 2 9 | 4 13 | 16 | 7 4 9 | 4 | | | | |
| ITAL | 0 | | ٥. | n n | 1 | 3 | 7 | • | • | -5 | | 5-6 | | ~7 | | | = | |
| II -SAUARE NLUES | . 0- | - L | 1- | WF | | 2-3 LF | Pau | 1-4 | Ran | | Raw | LF | Rau | uF | | | * | |
| s | Rass | | Rau | | Rau | | | | | 4.000 | | === | | == | `. | | | |
| S L C U OTAL | | == | . == | == | 2.000 | 3.333 | 9.250 | 5.125 | 8.000 1 | 2.000 7.500 | 4.625 6.250 | 5.500 8.000 7.313 | 4,500 | 5.200 4.500 1.556 | | | | |

Table E34. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| ****** | | | 1 | idel F | hase: | 1.5 Hr 1 High Ti | before de | | Duratic Treat | n of Te ment Ty | | 10 min 10 min | 1,3,65 or constnuor | 18 | Test D | ate: ime: | 2/27/88 1810 | |
|---------------------------------------|-----------------|--------------|---------------------|--------------|---------------|---------------------|--------------------|-------------|-------------------------|--------------------------|-------------------------|-------------------------|-------------------------|-------------------------|----------|--------------|------------------|---------------------------|
| 10 MIMUTE | S DURI | NO TES | PERIO |) | | | | | RFMGE (M | eters> | | | | | | | | |
| · · · · · · · · · · · · · · · · · · · | +)~ | t i | 1 | 1-2 | | 2-3 | 3 |)-4 | | 4~5 | | 5-6 | | 5-7 | te | tal | CHI -S FOR: 2 | QUARE F-HAT TEST PERIO |
| Trace Type | Resi | UF | Rass | UF. | Rau | HF. | Rau | ИF | Rası | NF | R. | u UF | Rau | HF | E4 | w HF | Rau | MF. |
| LS. | 0 | 0 | 3 | 5 | 0 | o | 0 | O | ø | 0 | ð | o | 8 | υ | į | 5 | 2 | 4 |
| SL | 0 | 0 | . 0 | n | 0 | 0 | . 0 | 0 | 0 | 0 | a | 0 | , , 0 | . 0 | | 0 | . 0 | . 0 |
| NC ' | 9 | . 0 | . 0 | 0 | 0 | 0 | 1 | 2 | 0 | Ò | 8 | 10 | 9 | . 9 | 16 | 21 | 19 | 24 |
| ill. | 0 | 0 | 0 | . 0 | O | ŋ | 0 | n | 1 | 2 | ō | Q | 0 | O | <u>.</u> | . 2 | 3 | . 4 |
| rotal | 0 | 0 | 1 | 5 | 0 | 0 | | 2 | 1 | 2 | 8 | 10 | 9 | 3 | : 20 | 26 | . 24 | >1 |
| 10 HINUTE | S AFTE | R TEST | PERLOD | | • | 1.74 | | | RANGE CH | eters) | | | | | | | | |
| | 13- | 1 | | l-2 | | 2-3 | |)~ 4 | • | 4-5 | • | 5-6 | | ; 6-7 | To | tal | CHI-S | OURRE WALUE |
| Trace Tupe | Rasi | uF | Rau | UF | Rau | HF | Reu | NF | Rase | NF | Re | N MF | Rau | HF | | и ИЕ | ·- FOR 2 | TEST PERIO |
| LS | 0 | o | 0 | 0 | 0 | ō | · | 0 | • | | 2 | 2 | | | | | .i. LS | 0.333 1.2 |
| 3L | · o | 9 | 0 | 0 | 9 | o | D | 0 | | 0 | o | | 0 | 0 | : | . 0 | SL | |
| HC . | Ô | - 0 | . 0 | . 0 | 1 | 3 | 0 | 0 | 7 | . 11 | . 3 | . 4 | 9 | 9 | 20 | 27 | NC | 0.105 0.7 |
| uni | oʻ | 43 | ٥ | , n | . 0 | ٠ ٥. | 0 | 0 | 0 | 0 | | . 1 | . 4 | . 4 | : : | 5 5 | ми | 2.657 1.2 |
| Total | 0 | 9 | 0 | 0 | 1 | 3 | 0 | 0 | 7 | 11 | 6 | 7 | 13 | 13 | 21 | 34 | TOTAL | 1.043 0.5 |
| CHI-SOUARE F-MOT | 17~ | 1 | | 1-5 | | 2-3 | | 5~ 4 | | 4-5 | | 5-6 | | 6-7 | | | CIII -S | QUARE - 3.8 |
| LS 3L NC NU | R 644 0 0 | #F 0 0 | Raid 1 0 0 | HF 3 0 | Rau 0 0 | 0 | R44 0 0 1 | WF O | Rau 0 0 | иг 0 0 | Ra 3 0 | W NF | Rass O O 9 | WF 0 0 | | | (d.f. (a) ph | a = 1.05> |
| TOTAL | 8 | Ü | ž. | ž | î | , 2 | ì | 1 | 4 | ÷ | 1 | | 11 | 11 | | | | |
| CHI -SQUARE VALUES | U- | 1 | | l-2 | | 2-3 | |)-4 | | 4-5 | | 5-6 | | 6-7 | | | | |
| l.S | Rau | HF | 1.000 | 5-000 | Raw | | R and | HF | Rau | HF | 2.000 | 4. UF | Rau | 바 | | | - | |
| SL NG HU TOTAL | == , | == | 1.000 | 5.000 | 1.000 | 3.000 | 1.000 | 2.000 | 7.000 1.000 4.500 | 11.000 2.000 6.231 | 2.273 1.000 0.206 | 2.571 1.000 0.529 | 0.000 4.000 0.727 | 0.000 4.000 0.727 | | | | |

Table E35. Indian Point harmer test monitoring using 6 degree vertical transducer located at unit 3, intake 35.

| | | | Ti | del P | hasei | 1 Hr be High Ti | | | Duration Treat | n of Te: went Ty | st: pe: | iD min iO Hin | Hur 1,3,1 continuo | NS on | Test | Date | +: 2 | 2/27 /88 1830 | | |
|----------------------|----------|-------------|--------------|---------|----------------|--------------------|-------|---------------------------|-------------------------|---------------------|------------|-------------------------|-------------------------|-------------------------|-------|-------|------|-------------------------|-------------------|---------------------------|
| TIMEN OF | ES IVURI | NG TES | T PERIOD | | 897#2 # | ****** | | | RANGE (m | rters> | | | 岩色水井生中市的 | | ***** | | | | 2024 | |
| | . 0- | 1 | · 1 - | ·2 - | | 2-3 | | 3-4 | | 4-5 | • | 5-6 | | 6-7 | | Total | ı | CHI-5 FUR 2 | RUARE 1 TEST 1 | F-HAT P ER1 O (|
| upe upe | Rau | ur | Rau | WF | Rai | 4 HF | Rau | UF | Rau | ИF | Rau | WF | Rau | ME | : | Rau | MF | Rau | uF | - |
| .5 | 1. | 7 | 0 | 0 | 70 | 0 | 0 | 0 | 1 | 2 | 0 | .0 | 1 | | -: | 3 | 10 | 2 | 6 | - |
| L · | 0 | 0 | 0 . | O | . 0 | 0 | 0 | 0 | . 0 | 0. | 1 | | · o | 0 | • | 1. | 1 | 1 | 1 | |
| Hrt | o | 0 | 0 | 0 | 1 | 3 | 12 | 23 | 15 | 23 | 10 | 12 | 4 | . 4 | į | 42 | 65 | 32 | · 49 | |
| IU | n | <u> </u> | 0 | . 0 | 0 | 0 | 1 | 2. | 3 | 5 | 2 | 2 | . 2 | 2 | _: | 8 | 11 | 5 | 6 | |
| otal | 1 | 7 | 0 | . 0 | 1 | 3 | 13 | 25 | 19 | 30 | 13 | 15 | 7 | 7 | : | 54 | 87 | 39 | 60 | |
| 10 HI HUT | ES AFTE | R TEST | PERI OD | | | | - | 1 | RANGE SH | eters> | | | | | a | | | | | |
| | 0- | 1 | 1- | 2 | | 2-3 | | 3-4 | • | 4-5 | | 5-6 | | 6-7 | | rota | 1. | CIII-S | OURRE | VALUES |
| race 'upe | Rau | UF | , Rau | uf . | Rai | 4 HF | Rau | WF | Rau | HF | Rau | WF | Rau | μF | : | Rau | MF | · FUR 2 | TEST (| |
| Ś | 0 | 0 | 0 | 0 | 0 | Q. | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | -: | 1 | 2 | LS | 1.000 | 5.33 |
| iL 19 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | , 0 | 0 | 0 | 0 | • | 0 | 0 | SL | 1.000 | , 1.00 |
| IC - | 0 | 0 | o | o | 1 | . 3 | . 1 | 2 | 5 | | 11 | 14 | 3 | 3 | į | 21 | 30 | NC | 7.000 | 12.81 |
| ın | O | 0 | 0. | Ó | 0 | o o | 0 | 0 | 0 | - 0 | . 0 | Ö | 1 | 1 | _ | 1 | 1 | HW. | 5.444 | 8.3 |
| otel | 0 | 0 | 0 | 0 | 1 | 3 | 1 | 2 | 6 | 10 | 11 | . 14 | 4 | 4 | -: | 23 | 33 | TOTAL | 12,481 | 24.30 |
| HI-SQUARE | . 0- | 1 | . 1- | 2 | | 2-3 | | 3-4 | | 4-5 | | 5-6 | | 6-7 | | | | CHI -S | QUARE | - 3.8- |
| S S | Rau 1 | UF 4 | Raw | HF O | Rai | 0 | Ray | 0 | Rate | HF. | Rau | HF O | Reu 1 | . UF | | | | (d.f. (alph | - '.o | 5> |
| ec . | 8 | o o | . 6 | 9 | 1. | 3 | 7 | - 13 | 10 | 16 | | 13 | 4 | 4 | | | | | | |
| N OTAL | î | 4 | 0 | 0 | 0 | 9 | 7 | 14 | 13 | 20 20 | 12 | 15 | 2 6 | 2 6 | | | | | ٠. | > |
| HI-SAURPE | . 0- | 1 . | 1- | ·2 | : | 2-3 | | 3-4 | ٠, ٠ | 4-5 | | 5-6 | | 6-7 | | | | | | |
| i.L | .000 7 | иF - 000 | Rau | WF | Rai | | Rau | ИF | 0.000 | 0.000 | 1.000 | 1.000 | 1.000 | 1.000 | | | | | | 4. |
| Hr. HM Total 1 | .000 7 | -000 | · = | | 0.000 | 0.000 | 1.000 | 17,640 2,000 19,593 | 5.000 3.000 6.760 | 7.258 5.000 | 2.000 | 0.154 2.000 0.034 | 0.143 0.333 0.818 | 0.143 0.333 0.818 | | | | | | |

Table E36. Indian Point hammer test wonitoring using 6 degree vertical transducer located at unit 3, intake 35.

| | | | T1 rucakasa u | del Phe | H | 1gh Ti | d⊕ | | Duration Treatm | of Te | # : | 10 min | Her 183 c continuo | 18 | Test Da | Me: 1 | 2/27/1850 1850 | | |
|---------------------------|----------|-------|-----------------------------|-------------|---|--------|---------|------|--------------------|--------------|---------|--------|-----------------------|-------------|---------|------------|-------------------|-----------|---------|
| | | | ST PERIOD | | ======================================= | | | | RANGE CHA | ters> | | | : | | | | | RURRE F | -HAT |
| race. | 0- | 1 | 1- | 2 | | -3 | 3- | 4 | 4 | -5 | | 5-6 | | L-7 | Tot | <u> </u> | FOR 2 | TEST P | eri od: |
| up+ | Rass | UF | Rası | HF . | Rau | HF | Rau | MF | Reu | UF | Resi | MF | Rau | ЦF | : Rau | MF | Rau | MF | |
| . \$ | 0 | 0 | 1 | \$ | 0 | 0 | . 0 | 0 | 1 . | . 2 | 0 | 0 | 0 | 0 | 2 | 7 | 2 | 5 | |
| iL. | 0 | 0 | 0 ' | 0 | • | 0 | 0 | 0 | 0 | G | . 0 | . 0 | 0 | 0 | | 0 | 0 | 0 | |
| ic . | • | , 0 | 1 | • | . 1 | 3 | . 0 | 0 | 5 | • | T | 9 | 4 | . 4 | 10 | 29 | 17 | 24 | |
| # | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 1 | . 1 | 0 | 0 | 1 | 1 | 2 | 2 | |
| retal | 0 | 0 | 2 | 10 | 1 | 3 | 0 | 0 | . 6 | 10 | • | 10 | 4 | 4 | 21 | 5 7 | 20 | 30 | |
| 10 NIMUT | | | PERLOO | | | | | | • | | | | | | | | | | |
| 10 HIMDH | | R ILS | PERLUD | | | | | | RAMBE (100 | ters) | | | | | | | | | |
| · | 0- | 1 | 1- | 2 | 2 | :-3 | 3- | 4 | 4 | -5 | | 5-6 | | 5- 7 | Tot | al | CHI-S | DURRE V | ALUES |
| Trace T upe | Rase | HF | Rass | HF | RaH | UF | Rau | WF | Rau | UF | Rau | UF | Rass | HF | I Rau | NF | - FUR Z | TEST PI | ERL DU: |
| .s | 0 | 0 | 0 | Ó | 0 | . 0 | 1 | 2 | 0 | 0 | . 0 | 0 | 0 | 0 | 1 | 2 | LS | 0.333 | 2.77 |
| 5L | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | ٥ | 0 | D | 0 | 0 | . 0 | 8 | 0 | 0 | SL. | | ER |
| 4C . | O | 0 | 0 | 0. | 0 | 0 | 0 | 0 | 4 | 6 | 9 | 11 | 2 | 2 | 15 | 19 | NC | 0.273 | 2.08 |
| MM - | 0 | 0 | 0 | O | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 2 | MM | 0.333 | 0.33 |
| Total | 0 | ō | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 6 | 7 | 11 | 4 | 4 | 19 | 23 | TOTAL. | 0.251 | 3.26 |
| CHI-SQUARE | . 0~ | 1 | 1- | -2 | 2 | :-3 | 3- | 4 | • | ~ 5 | | 5-6 | • | B-7 | | | CHI -S | OUARE - | 3.84 |
| F-HAT | Rau | MF | Rass | MF | Rau | HF | Reu | WF | Rau | UF | Ran | | Rau | LIF | | | (d.f. (alph | a ~ `-05: | > |
| LS SL NC | ğ | ğ | ò | 9 | Ö | 9 | ğ | ò | <u>0</u> | <u>.</u> | 0 | .0 | 0 | ğ | | | | | |
| L114 | . 0 | . 0 | ò | ğ | į | Õ | ě. | 0 | ŏ | · 6 | . 1 | 10 | 1 | 1 | | | | | |
| TOTAL. | 0 | 0 | 1 | \$ | 1 | 2 | 1 | . • | * | 8 | | 11 | • | 4 | | | | | |
| CHT-SQURRE VALUES | <u> </u> | 1 | 1 | | | -3 | 3- | | | 5 | | 5~6 | | 5-7 | | | | - | |
| LS | Rau | WF | 1.000 f | UF - 000 | Rau | HF | 1.000 2 | .000 | 1.000 | LEF 2.000 | Rass | | Rau | WF | | | | | |
| LS SL NC | | | 1.000 5 | .000 | 1.000 | 3.000 | | _ | 0.111 | 0.286 | 0.250 | 0.200 | 0.667 | 0.667 | | | | | |
| liu Total | | | 2.000 10 | -000 | 1.000 | 3.000 | 1.000 2 | .000 | 0.400 | 1-000 | 0.059 | 1.000 | 2.000 0.000 | 2.000 | | | | | |

Table EST. Indian Point harmer test monitoring using 5 degree vertical transducer lecated at unit 3, intake 36.

| | | | | | | Hrs book tide | | | Duration Treatm | ent TW | | min, h O sec or | 1. 20 Sec | off | Test Dat | w : 0: | 320 | | |
|-------------------------|------------|----------------|---------|----------|----------|---------------|----------|------------|--------------------|----------|-------|--------------------|------------|---------|----------|--------|-----------------|---------|---------|
| S HINUTES | S DURII | 4G TES | T PERIO | D | | | | • | EANOE CH | ters> | | | | | | | CU1 -66 | WARE F | - 407 |
| _ | 0 - | L | | 1-2 | 2- | -3 ° | |)-4 | | -s | | -6 | 6- | 7 | Tota | 1 | FOR 2 | TEST P | ERI OUS |
| race 'ype | Rans I | 45- | R.m. | WF . | Rau | WF | Rau | UF | Raw | UF | Rau | UF | Rau | HF | t Rau | ИF | Rau | ИF | |
| .s | 0 | 0 | 0 | 0 | 3 | 8 | 3 | 6 | 4 | 6 | 2 | 2 | 0 | 0 | 12 | 22 | 15 | 29 | |
| 1. | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | a | 0 | O | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | |
| IN . | 0 | 0 | 0 | 0 | a | 0 | 0 | 0 | 0 | ø | 0 | 0 | O | 0 | a | 0 | a | 0 | |
| otal | 0 | | 0 | 0 | > | 6 | 3 | 8 | 4 | • | 2 | 2 | O | 0 | 12 | 22 | 15 | 26 | |
| race | 0- | | | 1-2 | | -3 | | 3-4 | | 1-\$ | | -6 | <u></u> 6- | | | | CHI-SI FOR 2 | TEST P | ERIOD |
| race 'upe | | | E.m. | | | | Eau | | | | East | uf | | MF | 1 Rau | | FOR 2 | TEST P | ERI OD |
| .5 | 1 | - - | 1 | <u>-</u> | 0 | | | 0 | 10 | 15 | 6 | 7 | 0 | 9 | 10 | 34 | LS | 1.200 | 2.57 |
| iL . | o · | - 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | SL | | _ |
| IC | 0 | 0 | 0 | 0 | . 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | | 0 | NC | | - |
| 114 | 0 | 0 | 0 | 0 | 0 | 0 | a | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | MM | | - |
| otal | 1 | 7 | . 1 | 5 | 0 | • | . 0 | 0 | 10 | 15 | 6 | T | 0 | 0 | 10 | 34 | TOTAL | 1.200 | 2.57 |
| HI-SQUAPE | 0- | 1 | | 1-2 | 2 | -3 | | 3~4 | | 4-5 | 5 | -6 | 6- | 7 | | * | CHI-S | QUARE - | - 3.84 |
| . s | Ran . | uf 4 | Rau | MF | Ran 2 | HF | Rau 2 | uf 3 | Rau | HF 11 | Raw | HF S | Ran | MF O | | | (al ph | 405 | 5> |
| ŠĹ IC | ġ | õ | Ö | ŏ | õ | ò | Ö | ō | ġ | Ö | ġ | ō | Ŏ | Ō | | | | | |
| IN OTAL | ŏ | 9 | ğ | ě | ŏ | ž | Ŏ | ğ | ğ | , Ŏ | ŏ | ě | Ŏ | ğ | | | | | |
| HI-SQUARE | - 0- | 1 . | | 1-2 | _ | -5 | - ; | 3~4 | • | 4-5 | 5 | ;-6 | 6- | -7 | | | | | |
| PALUES | R 844 | WF | Ran | WF | Rau | HF | Rau | HF | R-844 | WF | Res | HF | Rau | MF | | | | | |
| .s 1 iL IC III | 000 7 | .000 | 1.000 | 5.000 | 3.000 | 9.000 | 3-000 | 6.000 | 2.571 | 3.857 | 3.000 | 2.778 | | | | | | | |
| / | | | | | | | | | | | | | | | | | | | |

Table E38. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| | | | | dal Pha | 1 | ou tide | before , ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | | Duration Treatm | ent Typ | e : 5 | | ers 163 :tinuousl | | Test Da Test Ti | me: C | 73/88 340 | | |
|----------------------|----------|--------|-----------|---------|------|---------|---|------|--------------------|----------------|------------------|-------|----------------------|------------|--------------------|-----------|----------------|--------------|--------|
| | | | ST PERIOD | | | | | | RANGE CHA | | | | | | | | CHI ~S | QUARE F | -HAT |
| Tace | 0 | -1 | 1. | -2 | 2 | -3 | | | 4 | -5 | | -6 | 6- | | Tot | al . | FOR 2 | TEST P | ERI OU |
| Tup-e | | HF | Rass | HF | Rau | MF. | | ЦF | Rass | uf | Rau | HF | | MF | : Reu | HF | Rass | MF | |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 2 | 3 | 6 | 7. | 0 | 0 | • | 12 | 9 | 17 | |
| şi, | 0 | • | 0 | 0 | D | 0 | 0 | • | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 2 | |
| +C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 1 | 0 | 0 | 2 | 3 | 1 | 2 | |
| LINE . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | 0 | o | 0 | | 0 | Œ | . 0 | 0 | 0 | 0 | |
| Tetal | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 5 | • | • | . 0 | 0 | 1.2 | 16 | 11 | 20 | |
| 10 HX M | UTES AFT | ER TES | r PERIOO | | | | | ı | RANGE CHA | ters | | | | | | | | | |
| · | 0 | -1 | _ 1- | -2 | 2 | ~3 | 3- | 4 | . 4 | - 5 | 5 | -6 | 6- | -7 | Tot | a1 | CHI-S | OURRE P | ALUES |
| Trace Tupe | Raw | UF | Ran | HF | Raw | MF | Raw | WF | Rest | WF | Rau | MF | Rew | HF | Res | MF | · FUR 2 | Rau | H N |
| LS | 1 | 7 | 1 | 8 | ó | 0 | ð | 0 | 5 | 5 | 4 | 5 | 0 | 0 - | • | 22 | LS | 0.000 | 2.94 |
| SL. | Đ | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | D | 0 | 0 | 0 | 1 | 2 | SL. | 0.000 | 0.33 |
| +c | D | , 0 | D | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | NG | 2.000 | 3.00 |
| 110 | 0_ | 0 | · 0 | 0 | . 0 | 0 | 0 | 0 | 0 | . 0 | 0_ | . 0 | Ö | 0 | . 0 | ٥ | LAN | | - |
| rotal | 1 | 7 | 1 | £ | 0 | 0 | 1 | 2 | 3 | 5 | 4 | 5 | 0 | 0 | 10 | 24 | TOTAL. | 5.192 | 1.60 |
| HI-SQUA | P.E 0 | -1 | 1- | -2 | 2 | -3 | 3- | 4 | | ⊢ 5 , | 5 | -6 | 6- | | | | CHI-S (d.f. | ANUVE - | 3.84 |
| F-HAT | Rau | MF | Rau | ME | Rass | WF | Reu | HE | Rass | JAF | Rau | HF | Rau | WF | | | | 05 | > |
| LS SL HC WH | å | 5 | ŏ | 3 | 8 | ő | 1 | i | . 3 | 3 | 1 | ì | 0 | ő | | | | | |
| HC HG | 9 | 0 | õ | 0 | . 8 | 0 | ě | õ | ì | 100 | 1 | 1 | 8 | ô | | | | | |
| TOTAL | ĭ | 4 | ĭ | š | ŏ | ŏ | ĭ | ž | 5 | Š | ě | ř | ŏ | ŏ | | | | | |
| CHI SQUAF VALUES | P.E. O | - 1 | 1- | -2 | 2 | -3 | 3- | 4 | | 1-5 | 5 | -6 | 6- | - 7 | | | | | |
| | Rasi | MF | Rass | UF | Rau | HF | Rau | MF. | Rau | WF | Rau | UF | Rau | WF | | | | | |
| LS St | 1-000 | r.000 | 1.000 1 | 5.000 | | | 1.000 2 | .000 | 0.200 | 0.500 | 1.000 | 9.333 | | | | | | | |
| KC | - | - | == | | | | 4.000 2 | .000 | 1-000 | 2.000 | 1.000 | 1.000 | | == | | | | | |
| HIII | == | | | | | | 0 000 0 | ~~~ | 0.000 | | | | == | | | | | | |
| TOTAL | 1.000 | 7.000 | 1.000 | 5.000 | _ | | 0.000 0 | -000 | 0.000 | 0.000 | 1.333 | 1.143 | | | | | | | |

Tible E39. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| | | | | idal Pi | 1 | l.5 hrs | • | | | Hent Tus | >+ 1 | 5 min. 5 min c | hmrs 103 ontinuous | ity | Test | Date: Time: | 3/3/88 0350 | | |
|----------------|-----------|-----------|----------|----------|---------------------------|-----------|--------|----------------|----------|---------------|---|-------------------|-----------------------|---------------------------------------|------|----------------|----------------|----------|---------|
| | JTES DURI | | T PERIOD | ****** |) هدایندی ای به انازها از | | | | RANGE (m | | | <u> </u> | 4 55 6 4 Mass | · · · · · · · · · · · · · · · · · · · | | | | -SQUARE | E-WAT |
| 1959 | 0- | | 1 | -2 | | 2-3 | 3 | -4 | | 4-5 | | 5-6 | | 5-7 | | otal | FOR | 2 TEST | PERIO |
| (p+ | Rau | MF. | Rau | HF | Rau | UF | Rau | ИF | Rasi | WF | Rau | WF | Rau | MF | ; R | au HF | Rau | MF | _ |
| ! | i | T | . 0 | 0 | 1 | 3 | 0 | 0 | 1 | 2 | 2 | 2 | 4 | 4 | | 9 16 |) | 9 23 | _ |
| | 0 | 0 | 0 | 0 | O | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | • | 0 0 | • | 1 1 | |
| : | o | ø | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 2 | 1 | 1 | • | 4 5 | 5 | 2 3 | 1 |
| . | . 0 | D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | 1 | 1 | 0 | œ | • | 1 | ι | 1 1 | ļ |
| tal | 1 | 7 | 0 | 0 | 1 | 3 | . 1 | 2 | 1 | 2 | 5 | 3 | 5 | 5 | 1 | 4 24 | | .2 27 | • |
| S MINU | JTES AFTI | ER TEST | - | -2 | | 2-3 | • | l ⊶4 | RANGE CH | eters> 4-5 | | 5-6 | | 5-7 | | otal | cut | -square | LEGI EN |
| 754 | | MF. | | | | | | | | | | | | | | | FOR | 2 TEST | PERI (|
| | | | Rau | | Reu | | Rate | uf | Ress | | Ray | MF | Rau O | | | au W | | Ran | |
| . | 2 | 14 | • • | . 5 | | 3 | | 2 | . • | 0 | 3 | • | • | 0 | | 20 | | 0.059 | |
| | 0 | . 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 1 | | 0 | 0 | | 1 1 | | 4,000 | |
| | 0 | 0 | 0 | 0 | .0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | i . | 0 (| • ••• | 1,000 | |
| tel | 2 | <u>-</u> | | <u>`</u> | | | | | | | <u>-</u> | <u>-</u> - | | | | 9 29 | | AL 1.097 | - |
| | - | • | • | | • | . | • | - | • | • | 7 | • | · | ŭ | • | | | 11001 | • |
| L-SQUAF HAT | ?E0- | -1 | | -2 | _ : | 2-3 | 3 |) -4 | - | 4-5 | | 5-6 | (| 6-F | | | CHI | -SQUARE | - 3.6 |
| | Raii 2 | HF 11 | Rau | HE | Rau | NF | Rau | MF | Rau | MF | Res | HĘ | ReH | WF | | | (31 | pha = _C |)5) |
| | ō | . 🧃 | ġ | ğ | ó | ő | Ģ | Ģ | ġ | ġ | į | ī | ō | ō | | | | | |
| TAL | Ď | 10 | ŏ | Š | ŏ | ğ | Õ 1 | ġ 2 | ŏ | ŏ | į | į | Ģ | ġ | | | | | |
| -SYUAF | P.E 0- | | 1 | -2 | _ ; | 2~3 | - 3 | | | 4-5 | | 5-6 | | 5- 7 | | | | | |
| LUES | 02353 a | 2.335 | 1.000 | \$.000 | 0.000 | 9.000 | | 2.000 2.000 | 1.000 | 2.000 | Ray 0.200 1.000 2.000 1.000 | | 1.000 | 4.000 1.000 | | - | | | |

Table E40. Indian Point hammer test monitoring using 8 degree vertical transducer located at unit \mathbf{J}_{9} intake \mathbf{J}_{6} .

| S HIND | res ours | 40 TES | T PERIOD | | * | | | 1 | tringe (He | ters) | ÷ * | | | | | | | |
|---------------------|---------------------|---------|----------------|--------------|---------------|--------------|---------------|--------------|---------------------|-------|----------------|--------------|---------------|--------------|----------|------|-----------------|----------------------------|
| | 0- | | 1- | -2 | 2- | 3 | 3 | -4 | 4- | -5 | 5 | -6 | | 6~7 | To | otal | CHI-54 FOR 2 | QUARE F-HAT TEST PERIOD |
| yp + | Rau | | Rass | UF | Rau | HF | Rau | uf . | Ren | WF | Rass | ₩F | Resi | HF | ; R4 | H HF | Rau | uF |
| .\$ | 1 | 7 | 1 | 5 | 3 | 8 | 3 | 6 | 1 | 2 | 4 | 5 | 0 | 0 | 12 | 33 | 9 | 19 |
| L , , | 0 | 0 | , 0 | .0 | 0 | ,o | . 0 | Ġ | 0 | 0 | 0 | 0 | 0 | 0 | • | o o | 0 | o . |
| C | D | O | 0 | ø. | D | 0 | 0 | O | a | 0 | 1 | 1 | 1 | 1 | | 2 2 | 1 | 1 |
| R4 | 0 | 0 | 0 | . 0 | 0 | 0 | Ó | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 0 | 0 ' | 0 |
| otal | 1 | 7 | 1 | 5 | 3 | 9 | 3 | 6 | 1 | 2 | \$ | 6 | 1 | 1 | 1 11 | 5 25 | 10 | 20 |
| T-2-C-0 | 0~ | | 1. | -2 | 2- | 3 | 3 | -4 | RANGE (ne | -5 | 5 | -6 | | 6-7 | T- | otal | CHI-SI | QUARE VALUES |
| race 'upe | | | Rau | | | MF | Rau | WF | Rau | UF | Rau | UF | Rau | | | | - FOR 2 | TEST PERIOD |
| .s | 0 | • | 0 | 0 | 0 | | 0 : | 0 | 0 | 0 | 4 | 5 | 0 | | | 4 5 | - LS | 4.765 20.63 |
| и. | 0 | 0 | 0 | 0 | . 0 | D | 0 | 0 | • | | 0 | 0 | 0 | | • | 0 0 | SL | |
| ıc | O | 0 | . 0 | 0 | . 0 | 0 | D | 0. | 0 | 0 | • | 0 | 0 | . 0 | 1 . | 0 0 | NC | 2.000 2.00 |
| ш | 0 | 0 | 0 | 0 | 0. | . 0 | 0 | o | ø | 0 | 0 | 0 | 0 | . 0 | • | 0 0 | W | |
| otel | 0 | 0 | 0 | 0 | Đ | 0 | 0 | 0 | 0 | 0 | 4 | 5 | 0 | 0 | | 4 5 | TOTAL | 6.360 22.50 |
| HI-SQUAR -HAT | E 0- | 1 ' | 1- | -2 | 2~ | > | 3 | -4 | 4 | -5 | 5 | -6 | | 6-7 | , | | | QUARE - 3.04 |
| .5 5L 1C | Rasi 1 0 0 | HF 0 | Rass 1 0 | UF 3 0 | Rau 2 0 | #F 4 0 | Rau 2 0 | HF 3 0 | Rass 1 0 0 | UF 1 | Rana 4 0 | NF 5 0 | Rau O O | WF 0 0 | | | (d.f. (alph | a = 1.05> |
| M FOTAL | 0 | . 4 | Ŷ | 3 | Ŏ 2 | 4 | 2 | 9 | 1 | 0 | \$ | 6 | . 0 | . 0 | | | | • |
| HI SQUARI HALUES | E 0- | 1 | 1. | -2 | 2- | 3 | | -4 | 4 | -5 | 5 | -6 | | 6-7 | • | | • | |
| | 1.000 7 | . 000 | 1.000 | 5.000 | 3.000 e | .000 | 3.000 | 6.000 | 1.000 | 2.000 | | 0.000 | Ran | ~~ | | | | |
| | | | | | | | | | | | 1.000 | 1.000 | 1.000 | 1.000 | | | | |

Table E41. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| S MI MUTE | | | FT PERIOD | | - 429 - 100 | | | # ## ## ## | بخالهماند | BE (MA | | | هرية التساط ال | on, 20 s | | | est Tie | | | |
|---------------------------|------------|---------|-----------|-------------|-------------|------------|-------------|-------------------|-----------|-------------|--------------|--------------|----------------|----------|---------|-----|---------|-----|----------------|-----------------------------|
| _ | 0 - | | | -2 | | 2~3 | | 3-4 | | | -s | | 5~6 | | 6-7 | | Total | a L | CHI-S FOR 2 | QUARE F~HAT TEST PERIOD: |
| Trace Typ e | Rau | HF | Rau | MF | Rel | uf uf | Re | u MF | • | Rasi | WF | Rasi | WF | Rau | NF | • | Rau | uf | Rau | HF. |
| .s | 0 | 0 | 2 | 9 | 2 | 5 | 9 | 17 | | 1. | 2 | | 5 | 3 | 3 | - | 21 | 41 | 10 | 32 |
| L. | . 0 | 0 | . 0 | D | . 0 | , o | 0 | | , | . 0 . | D | 0 | 9 | ′ '0 | Ð | į | 0 | 0 | . 0 | 0 |
| C | 0 | 0 | 0, | 0 | 0 | . 0 | . 0 | | • 1 | o | • | 1 | 1 | 1 | 1 | į | 2 | 2 | 2 | > |
| iu | 0 | 0 | 0 | 0 | 0 | g | 0 | | 1 | . 0 | 0 | Ò | 0 | 0 | 0 | ! | 0 | 0 | 0 | 0 |
| otal | 0 | . 0 | 2 | 9 | 2 | 5 | 9 | 17 | | 1 | 2 | , , 5 | . 6 | 4 | 4 | | 23 | 43 | \$0 | >5 |
| S MINUTE | 0- | 1 | | . -2 | | 2-3 | | 3-4 | RAM | GE (na | ters> I-S | | 5~6 | • | 6-7 | , | Tota | -1 | CHI-S | QUARE VALUES TEST PERIOD |
| race Upe | | NF | Rana | WF | Ras | 4 HF | Ra | 4 MF | • | Rest | WF | Ran | WF | Rau | HF | | Rau | HF | FOR 2 | TEST PERIOD |
| .s | 0 | 0 | 0 | 0 | 1 | 3 | 1 | | : | 1 | 2 | 12 | 15 | 0 | 0 | } | 15 | 22 | LS | 1.000 5.73 |
| L | 0 | . 0 | 0 | 0 | 0 | 0 | ٥ | |) | 0 | 0 | 0 | . 0 | . 0 | | | 0 | 0 | SL | |
| | · 0 | o | 0 | 8 | 1 | 3 | 0 | |) | o | 0 | ø | 0 | 1 | . 1 | • | 2. | 4 | NÇ | 0.000 0.66 |
| m | 0 | 0 | O | 0 | 0 | 0 | 0 | |) | 0 | 0 | | Q | . 0 | . 0 | _ : | . 0 | | ин | |
| otal | 0 | 0 | 0 | .0 | 2 | . 6 | 1 | | : | 1 | 2 | 12 | 18 | . 1 | - 1 | | 17 | 26 | TOTAL | 0.900 4.10 |
| HI-SQUARE | 0- | 1 | | -2 | | 2-3 | | 3-4 | | | I-\$ | | 5-6 | | 6-7 | | | | CHI -S | QUARE - 3.84 |
| .s | Rau | NF O | Rest | HF 5 | Ras 2 | 4 HF | Ra 5 | | | Rau | HF 2 | Rass | MF 10 | Rau 2 | HF 2 | | | | | ie = .05> |
| iL IC | 8 | 0 | Ó | Ö | 0 | 0 | Ö | . (| | Ö | Ď | Ŏ. | 0 | Ō | Õ | | | | | |
| OTAL . | 8 | 8 | 9 | 9 5 | 2 | . 0 | 9 | | ; | 0. | 2 | 9 | 11 | 3 | . 9 | | | | | |
| HI -SOURPE | 0- | 1 | | -2 | | 2-2 | | 3-4 | | | I~S | | 5-6 | | 6-7 | | | | | • |
| ALUES S | Reu | UF | 2.000 | 1F | 0.333 | 0.500 | R4 6.400 | | | Reu -000 | UF 0.000 | Rau 4,000 | MF 5.000 | 7.000 | 3.000 | | | | | |
| E IC IN | | | | | 1.000 | | | | | | | 1.000 | 1.000 | 0.000 | 0.000 | | • | | | |
| N OTM | ~~ | | | | | | | · | | | | | | | | | | | | |

Table E42. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| 10 MIHUI | IES PURI | 140 153 | ST PERIO | • | | | | | RANGE (H | eters> | | | - | | , | | AUT. 5 | QUARE F | - 110= |
|--------------|----------------|----------------|----------|-------------|---------------|-------------|----------------|--------------|-------------|---|--------------|---------|-------|---------|------|------|--------|--------------------|-------------|
| race | 0- | | | 1-2 | | 2-3 . | | 3-4 | | 4-5 | | 5-6 | | 6-7 | Te | tal | | TEST P | |
| ype | Rail | LIF | Rau | MF | Rau | HF | Rau | HF | Rau | HF | Rau | MF | Raid | MF | : Ra | u WF | Rau | ИF | |
| .s | 1 | 7 | 2 | . 9 | 1 | 3 | 1 | 2 | 1 | 2 | 4 | 5 | 2 | \$ | 11 | 30 | 10 | 30 | |
| FL. | 0 | 0 | 0 | • | Ó | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 0 | 0 | . 0 | : |
| ı¢ | 0 | • | 0 | Ö | 0 | . 0 | 0 | 0 | • | . 0 | • | . 0 | 54 O | . 0 | | 0 | 1. | | |
| IN . | 0 | . 0 | 0 | Ð | 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | | • | _ | 0. | 0 | . 0 | |
| otal | 1 | 7 | 2 | 9 | 1 | > | 1 | . 2 | 1 | 2 | 4 | \$ | 2 | 2 | 12 | 30 | 11 | 31 | |
| 10 HINUT | TES AFTE | R TEST | PERIOD | | | | | • • | RANGE (H | eters) | ,, | | į. | | | | | | • |
| | 0- | · 1 | | 1-2 | | 2-3 | 1 | 3-4 | | 4-5 | | 56 | | 6-7 | Te | otal | CHI-S | QUARE U | ALUES |
| race 'ype | Rau | WF | Rau | | Rau | NF | Rau | HF | Rau | HF | Rau | | Rau | | | u UF | | TEST P | |
| .s | 2 | 14 | 2 | 9 | 2 | 5 | . 0 | 0 | 0 | 0 | 1 | 1 | ō | 0 | | r 29 | L\$ | 1.316 | 0.01 |
| iL. | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | · • | . 0 | 0 | 0 | . 0 | 0 | : (| 0 | SL | | _ |
| ic . | 0 | . 0 | 0 | 0 | 0 ' | ` Q | 0 | 0 | 0 | 0 | 1 | . 1 | 1 | . 1 | | 2 2 | NC . | 2.000 | 2.00 |
| MA . | 0 | • | 0 | ,0 | , ,0 | . 0 ' | ,o | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | |) O | HH | | |
| otal | 2 | 14 | 2 | 9 | 2 | 5 | 0 | 0 | | • | 2 | 2 | 1 | 1 | Ţ | 31 | TOTAL | 0.429 | 0.01 |
| HI~SQUARE | E 0- | 1 | | 1-2 | | 2-3 | . : |)-4 ° ° | | 4-5 | | 5-6 | • | 6-7 | | | CHI -S | OUARE . | 3.84 |
| .s | ReM 2 0 | MF 11 0 | Rau | HF 9 | Rau 2 0 | HF 4 | Rau ·1 0 | MF 1 0 | Resid | HF 1 | * Rau | MF 3 | Rand | HF 1 | | | | . = 15 ta = .05 | > |
| OTAL | 0 0 2 | . 0 0 11 | 0 2 | 0 | · 0 | 004 | 0 0 1 | 0 | 0 0 1 | 0 | 1 0 3 | . 4 | 0 2 | 0 2 | | | . , | | * |
| HI-SQUARE | E 0- | 1 | : | 1-2 | | 2-3 | ; | 3-4 | | 4-5 | | S-6 | · . | 6-7 | ٠. | | | | |
| | Re4 0.333 2 | uF | 0.000 | UF 0.000 | 0.333 | UF 0.500 | RAH 1.000 | UF 2.000 | 1.000 | 2.000 | Rau 1.800 | 2.667 | 2.000 | 2.006 | . • | 1.5 | | | |
| i. | 7- | | | | | | | | | ======================================= | 1.000 | 1.000 | 1.000 | 1.000 | | | - | | |
| l u . |).333 <i>2</i> | .333 | 0.000 | 0.000 | 0.333 | 0.500 | 1.000 | 2.000 | 1.000 | 2.000 | 0.667 | 1.286 | 0.333 | 0.333 | | | | | |

Table E43. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| | | | | | low tid | before F | | Treat | n of te | pe: | 5 mlm, h 5 mlm com | ntinuousi | v | Test Dat | me: O | /3/88 430 | |
|-------|---|--|--|---|--------------------|--|--------------------|---|--------------------|--------------------|-----------------------|--------------------|--------------------|--|---|--|---|
| DURIN | O TES | PERIOD | 14 1 0 1 - 1 | | | | | | | a 422 N V N 4 | | | | | | | |
| 0- | . 1 | 1 | 1-2 | | 2~3 | , | | | | | 5-A | . 6- | .7 | Total | a I | CHI-SC | WARE F-HAT TEST PERIO |
| | . <u>-</u> | | | | | | | | | | | | | | | Reu | WF |
| 0 | 0 | 0 | 0 | 4 | 11 | 4 | 8 | 2 | | 6 | 7 | 0 | 0 | 16 | 29 | 13 | 20 |
| 0 | 0 | 0 | . 0 | . 0 | 0 | 0 | 0 | 0 | o | 0 | 0 | 0 | 0 | : 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | . 0 | 0 | . 0 | 0 | 0 | 0 | o | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 |
| 0 | . 0 | • | ٥ | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | | 0 | 0 | 0 |
| 0 | C | 0 | 0 | 4 | 11 | 4 | | 2 | 3 | 7. | • | 0 | 0 | 17 | 30 | . 14 | 29 |
| AFTER | TEST | PERIOD | | | - | | | RANGE (* | eters) | | | • | | | | · | |
| 0- | -1 | 1 | 1-2 | | 2-3 | : | 3-4 | | 4-5 | | S-6 | 6- | 7 | Tot | al | CHI-S | OURRE VALUE |
| Rass | UF | Rau | MF | Rau | MF | Rass | UF | Ras | HF | Rau | MF | Rau | HF | : Rau | MF | PURZ | Rau |
| 0 | 0 | 3 | 14 | 2 | 5 | 0 | 0 | 3 | 5 | 2 | . 2 | 0 | 0 | 10 | 26 | LS | 1.365 0.1 |
| 0 | 0 | 0 | . 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | SL. | |
| 0 | 0 | 0 | . 0 | 0 | 0 | . 0 | 0 | .0 | D | 1 | 1 | 0 | 0 | 1 | 1 | NC | 0.000 0.0 |
| 0 | 0 | 0 | 0 | 0 | o | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | HM | |
| 0 | 0 | , 3 | 14 | 2 | 5 | 0 | 0 | 3 | 5 | 3 | 3 | . 0 | 0 | 11 | 27 | TOTAL | 1.286 0.1 |
| 0- | -1 | : | 1-2 | | 2~3 | 2 | 5-4 | | 4-5 | | 5-6 | 6- | 7 | | | CHT-SI | NUARE - 3-8 |
| Reu | HF | Rau | uf | Res | HF | Rau | HF | Res | MF | Rau | ME | Rau | HF | | | Celph | -05> |
| Č | ŏ | ō | ě | | ŏ | Š | 5 | ğ | õ | õ | ò | ŏ | · ŏ | | | | |
| Ö | Ö | 9 | ě | 9 | - 8 | 0 | 9 | Š | 9 | 9 | ę | 9 | 0 | | | | |
| | | | 1-2 | | 2-3 | 3 | 3-4 | | 4-5 | | 5-6 | 6- | ٠, | | | | |
| Reu | UF | Rau | MF | | LEF | Rau | WF | Ray | UF OF SOR | | | Rau | · WF | | | | • |
| | == | 3.000 | | 0.661 | 2.250 | 7.000 | | 0.200 | 4.500 | | | | . == | | | | |
| | | | | | | | | | | | | | | | | | |
| | C-Rasid C C C C C C C C C C C C C C C C C C C | 0-1 Raw MF 0 | Rass MF Rass 0 | 0-1 1-2 Rati MF Rati MF 0 | DURING TEST PERIOD | O-1 1-2 2-3 Raw MF Raw MF Raw MF 0 0 0 0 0 0 4 11 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 Raw MF Raw MF Raw MF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | DURING TEST PERIOD | OURING TEST PERIOD O-1 1-2 2-3 3-4 Raw MF Raw MF Raw MF Raw MF O | DURING TEST PERIOD | DURINO TEST PERIOD | DURING TEST PERIOD | DURING TEST PERIOD | DURING TEST PERIOD | TOURING TEST PERIOD O-1 1-2 2-3 3-4 4-5 5-6 6-7 RAM MF | DURING TEST PERIOD RANGE Conterpy Dot 1-2 2-3 3-4 4-5 5-6 6-7 Tot | OURINO TEST PERIOD Contemple Contemp | Our 1-2 2-3 3-4 4-5 S-6 6-7 Total FOR 2 |

Table E44. Indian Point hammer test monitoring using 6 degree pertical transducer located at unit 3, intake 36.

| | | · | | Fidal P | hase: | 40 min Low tid | . | | Treat | m of Te ment Ty | pe: | 10 sec (| hwrż 1,30 on, 20 se | e off | Test Test | Time: | 3/03/88 0440 | |
|---------------------|------------|--------|---------|---------|-------|-------------------|----------|------------|----------|--------------------|-------|----------|------------------------|--------------|----------------|-------|-----------------|----------------------------|
| 5 HIM | ITES DURLI | NO TES | PERIOD | | | | | | RANGE (r | | | | | | | | | |
| | 0- | -1 | | 1-2 | | 2-3 | . : | 5-4 | | 4~5 | | 5-6 | • | 5 ~ 7 | Ť | otal | CHI-S FOR 2 | QUARE F-HAT TEST PERIOD |
| Trace Type | Rau | ИF | Rev | WF | Ran | uF | Rau | HF | Ras | | Rau | UF | Ran | uF | : R | au NF | Rau | uF |
| .s | 2 | 14 | 2 | 9 | 0 | 0 | D | 0 | 1 | 2 | 3 | 4 | 0 | 0 | | B 29 | 8 | 21 |
| iL. | • | 0 | . 0 | • | 0 | 0 | . 0 | 0 | 0 | . 0 | 0 | . 0 | . 0 | 0 | • | 0 0 | 0 | o . |
| 4C | 0 | 0 | a | • | Ð | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | 0 0 | 0 | 0 |
| uu | 0 | 0 | • | 0 | 0 | 0 | 0 | | | 0 | | 0 | 0 | 0 | | D 0 | 0 | G |
| Total | 2 | 14 | 2 | 9 | 0 | . 0 | 0 | ō | 1 | 2 | 3 | 4 | a | G | - | 8 29 | • | 21 |
| 5 MINU | ITES AFTEI | R TEST | PERI OD | | | | | | RANGE G | eters> | | | ٠ | | | | | |
| _ | | -1 | | 1-2 | | 2~3 | ; | 3-4 | ** | 4-5 | | 5-6 | 6 | 5- 7 | Τ. | otal | CHI -S | OUARE VALUES |
| Trace Type | Rau | WF | Ran | MF | Ran | KF | Rau | NF | Ran | HF | Ray | WF. | Rau | HF | : R | ou HF | FOR 2 | TEST PERIOD |
| LS | a | • | 0 | 0 | 1 | 3 | 1 | 2 | 3 | 5 | 2 | 2 | 0 | o | -! | 7 12 | LS | 0.067 7.04 |
| SL | 0 | 0 | 0 | . 0 | . 0 | 0 | · o | . 0 | Ō | · o | 0 | , 0 | 0 | 0 | | 0 0 | SL. | |
| HC | 0 | G | a a | 0 | 0 | 0 | . 0 | 0 | • | 0 | 0 | 0 | · o | 6 | | 0 0 | NC | 4 |
| им | g ' | 0 | . 0 | . 0 | 0 | 0 | . 0 | 0 | 0 | Ö | 0 | 0 | 0 | 0 | | 0 0 | 1884 | <u></u> - |
| Total | ٠ ٥ | o, | 0 | 0 | 2 | 3 | . 1 | 2 | 3 | 5 | 2 | 2 | 0 | 0 | -! | 7 12 | TOTAL | 0.067 7.04 |
| CHI-SQUA F-NAT | IRE G | -1 | | 1-2 | | 2-3 | . : | 3-4 | | 4-5 | | 5-6 | | 5-7 | | | CHI -s | SOURRE - 3.84 |
| | Rau | ME | Rau | MF | Ran | ME | Rau | MF | Ray | HF | . Raw | HE | Rau | HF | | | Colpt | na = .05> |
| LS SL NC | ġ | ģ | é | Ó | ·ģ | ō | , ĝ | ğ | ŏ | õ | ŏ | ő | ě | ĕ | | | | |
| TOTAL | ŏ | ě | 0 | Š | 0 | . 0 | 0 | ŏ | Ŏ. | ŏ | ğ | Š | ŏ | ŏ | | | | |
| CHI-SQUA | RE 0 | -1 | | 1-2 | | 2-3 | | 3-4 | | 4-5 | | 5-6 | | 57 | | | | |
| LS SL NC W | 2.000 1 | 4.000 | 2.000 | 9.000 | 1.000 | 3.000 | 1.000 | 2.000 | 1-000 | 1.286 | 0.200 | 0.667 | Rau | HF | | | | |
| NC LILL | | | | | | | | | | | | | | | | | | |
| TOTAL | 2.000 14 | 4-000 | 2.000 | 9.000 | 1.000 | 3.000 | 1.000 | 2.000 | 1.000 | 1.285 | 0.200 | 0.667 | | | | | | |

Table E45. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| | | | | idal Pi | | 30 min (| • | | Duration Treatm | want Tus | oe: L | O sec | hmrs 1,3 on, 20 s | ec off | Test Da Test Ti | me: 0 | /03/88 450 | | |
|-------------------------------------|--------------------|-------------------------|--------------------|-------------------|---------------|--------------------|---------------------|-------------------|--------------------|-----------------|---------------|--------------|-------------------------|--------------|--------------------|-----------|----------------|---------------------|-------------|
| 5 M1NU | TES DURIN | IB TES | | | | | | | RANGE CHA | | | | and and a | #44 PP 5 4 5 | | | | | |
| _ | 0- | | 1. | -2 | | 2-3 | 3. | -4 | 4 | (~5 | 5 | -6 | | 6-7 | Tot | al le | | RUARE F. TEST PI | |
| Trace Tupe | Rau | UF | Rau | MF | Rau | uf | Rau | MF | Rau | UF | RAU | MF | Rau | MF | Rau | HF | Rau | UF | |
| LS | 1 | 7 | 1 | 5 | 4 | 11 | 4 | • | 4 | 6 | 4 | 5 | 5 | 2 | 20 | 44 | 16 | 40 | |
| SŁ | 0. | 0 | 0 | 0 | 0 | 0 | 0 | o | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | |
| NC . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 ' | 2 | 2 | 1 | 1 | | 3 | 2 | 2 | |
| w | 0 | 0 | 0 | 0 | | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o | 0 | 0 | |
| Yotal | 1 | 7 | 1 | 5 | 4 | 11 | 4 | 0 | 4 | . 6 | 6 | 7 | > | 3 | 23 | 47 | 17 | 41 | |
| S MINU | TES AFTER | FEST | PERIOD | | | | | 1 | RANGE (H4 | rters) | | | | | • | | | | |
| Trace | 0- | -1 | 1. | -2 | 2 | 2-3 | 3- | -4 | 4 | (5 | 5 | -6 | , | 5 P | Fot | al | CHI-S | QUARE V | NLUES |
| Type | Rau | HF | Res | MF | Rau | WF | Ran | HF | Rau | HF | Rau | ИF | Rau | UF | Reu | | FOR 2 | TEST PI | HE OUS |
| ĻS | 2 | 14 | 1 | \$ | 3 | • | 1. | 2 | 1 | 2 | 3 | 4 | . 0 | G | 11 | 35 | LS | 2.613 | 1.025 |
| SL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | q | 0 | 0 | . 0 | ٥ | SAL | | |
| NC | 0 - | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | a | 0 | `• | 0 | | 0 | NC | 3.000 | 3.000 |
| WH . | . 0 | 0 | 0 | 0 | , 0 | 0 | · О | ٥ | 0 | 0 | 0 | 0_ | 0 | 0 | 0 | 0_ | MM | | |
| Total | 2 | 14 | 1 | 5 | 3 | 8 | 1 | 2 | 1 | 2 | 3 | 4 | 0 | 0 | 11 | 35 | TOTAL | 4.235 | 1.756 |
| CHI -SQUAI F-HAT | RE O- | · t | 1- | -2 | . 4 | 2-3 | 3. | -4 | | (-5 | 5 | -6 | | 6 - 7 | | | | QUARE - | 3.94 |
| LS SL HC HC HM TOTAL | Reu 2 0 0 | #F 11 0 0 0 | Rau 1 0 0 | WF 5 0 0 | Rau 4 0 | UF 10 0 0 | Rest 3 0 0 | UF 5 0 0 | Rau 3 0 0 | #F 4 0 0 0 4 | Rau 4 0 | UF 5 0 1 0 6 | Rau 1 0 1 0 | MF 1 0 | | | (d.f. Calph | 4GS: | > |
| CHI-SOUAF | RE 0- | . 1 | 1. | -2 | | :-> | 3- | -4 | 4 | 4-5 | 5 | -6 | | 6-7 | | | | | |
| VALUES LS SL | 0.333 Z | NF - 333 | 6.000 (| иғ 3.000 | 0.143 | UF 0.474 | 1.800 | иғ 3.600 | 1.600 | 2.000 | 0.143 | uF 0.111 | Rau | | | | | | |
| SL NC NU | | | | | | | | | | | 2.000 | 2.000 | 1.000 | 1.000 | | | | | |
| TOTAL | 0.333 2 | . 333 | 0.000 | 0.000 | 0.143 | 0.474 | 1.800 | 3.600 | 1-800 | 2.000 | 1.000 | 0.010 | 3.000 | 3.000 | | | | | |

Table E46. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| | | ٠, | | dal Pi | 100 | u tid | before e | | Duration Treatme | nt Tue |)e: 10 | O min c | hers 1,36 ontinuous | lu | Test Dat | e: 1 | /03/ 98 .600 | |
|------------------------------|------------|----------------|-----------|--------|----------|--------|-------------|-------|----------------------|------------|----------|---------|------------------------|----------|----------|---------|--------------------------|-----------------------------|
| | | | ST PERIOD | | | | | | RANSE (met | | | | | | | | | |
| | G. | -1 | 1- | 2 | 2- | 5 | 3- | -4 | 4- | 5 | 5. | -6 | 6- | .7 | fota | .1 | CHI+SO | QUARE F-HAT TEST PERIODS |
| Trace Type | | WF | Raw | uf | Rau | UF. | Raw | WF | | | Rau | WF | Rau | MF | : Rau | uF | Rau | NF |
| .s | 0 | | 0 | 0 | 3 | 8 | 9 | 16 | 2 | 3 | 2 | 2 | 0 | 0 | 15 | 29 | 14 | 29 |
| RL. | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | o | 8 | ø | ø | 0 | . • | 0 | a | 0 | 0 | 0 |
| tc | 0 | 0 | 1 | 5 | 3 | . 8 | 0 1 | 0 | 0 . | 0 | 2 | 2 | a | 0 | 6 | 15 | 2 | 6. |
| 4U | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 2 | . 0 | 0 | 0 | 0 | 1 | 2 | 1 | 1 |
| rotal | 0 | 0 | 1 | 8 | 6 | 16 | • | 16 | 3 | 5 | 4 | 4 | 0 | 0 | 22 | 46 | 17 | 37 |
| 10 MINU | ITES DUR | ING TE | ST PERIOD | | | | | | RRNGE (not | | | | | | | | | |
| | O | -1 | 1- | 2 | 2-: | 3 | 3. | -4 | 4- | | 5- | -6 | 6- | 7 | Tota | ı | CHI-S | QUARE VALUES |
| Trace Type | Rau | UF | Rau | uf | Ran | uf | Rau | UF | Rau | HF | . Rau | NF. | Rau | uf. | : Rau | WF | FOR 3 | TEST PERIODS |
| L S | 2 | 14 | 1 | 5 | 1 | 3 | 3 | 6 | 3 | 5 | 10 | 12 | o o | 0 | 20 | 45 | LS | 6.214 17.58 |
| SL . | . O | 0 | 0 | 0 | • | O, | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | SL. | |
| lC | 0 | 0 | • | 0 | 0 | 0 | 0 | a | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | HC | 11.500 21.00 |
| 14 | . 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | ō | 0 | . 0 | 0 | 0 | 0 | LIS4 | 0.000 4.00 |
| rotal | 2 | 14 | 1 | S | 1. | 3 | 3 | 6 | 3 | F | 10 | 12 | ō | 0 | 20 | 45 | TOTAL. | 5.765 11.73 |
| 10 HINU | ITES AFT | ER TEST | F PERIOD | | | | | | | | | | | | | | | |
| | | | | | | | • | | RANGE CHOT | | | | | | | | | QUARE - 5.991 |
| Trace | | -1 | 1- | | 2-: | | | -4 | | ~~~ | | -6 | - - | | Tota | | <d.f. ≺alph</d.f. | = 2> a = .05> |
| Type | RaM | uf | | WF | | MF | Rau | MF | Rau | | Raw | uf | | uf | Rass | | , | |
| L S SL | 1 | 7 0 | 0 | 0 | 0 | 0 | 2 | . 4 | · i | 2 | 2 0 | 2 0 | 0 | 0 | . 6 | 15 0 | | |
| NC | 0 | 0 | 0 | 0 | 0 | 0 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 3 | | |
| Mu | 0 | 0 | 0 | 0 | 0 | ٥ | 0 | . 0 | 1 . | 2 | a | 0 | 0 | 0 | . 1 | 2 | | |
| rotal | · <u>-</u> | - - | | | 1 | | <u>2</u> | | 2 | | <u>-</u> | | | <u>-</u> | | 20 | • | |
| CHI -SOUAR | | -1 | 1- | _ | 2-: | | | -4 | 4- | 5 | 5 | -6 | 6- | -7 | | | • | |
| F-HAY | Rau | HE | Rass | WF | Reu | ИF | Raw | WF | Rau | WE | Rau | MF | Rau | ИF | | | | ~ |
| LS FL PC | ģ | Š | 0 | Š | ģ | . 6 | 4 | 3 | 2 | 9 | 5 | ó | 0 | 8 | | | | |
| 4u · | | 0 | Ď. | 2 0 | 1 0 | 9 | 8 | 0 | 0 | 0 1 | . 1 | ò | 0 | 8 | | | | |
| TOTAL | | . 7 | 1 | . 3 | 3 | , ż | 4 | . 9 | 3 | . 5 | Š | • | Ō 6- | . 0 | | | | |
| CHI —SQUAR V ALUES | | -1 | 1- | | 2-: | | | -4 | 4 | D LIF | | -6 | | UF | | | | |
| LS | 2.000 1 | | Rau 7 | .500 | 6.000 7 | . 250 | | 8,222 | | .667 | 7.600 1 | | Rau | —— | | | | |
| LS SL NC | | == | | -500 | 6.000 7 | -250 | | | | | | 2.000 | | | | | | |
| KÚ FOTAL | 2.000 1 | 4.000 | 0.000 6 | .667 | 4.667 17 | . 140 | 6.250 | 8.222 | 0.000 4 -0.667 -0 | .000 | 8.000 | 9.355 | | | | | | |

Table E47. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| | | | | idal Pha | 1 | hr be | • | | Duration Treate | ent Tu | st: pe: pe: | 10 min, 10 min c | hers 1,36 continuous | kS kly masses | | ime: 1 | | |
|--------------------|-----------|-------------|-----------|-------------|-----|-------------|----------|-------------|--------------------|---------------|-------------------|---------------------|-------------------------|---------------------|------|--------|----------------|----------------------------|
| 10 MINU | ITES DURI | 40 TES | T. PERIOD | | | | | | RANGE (M | rters> | | | | | | | | |
| _ | · o- | | | -2 | | :- 3 | 3 | -4 | 4 | !-5 | | E-6 | 6- | | Го | tal | CHI-S FOR 2 | QUARE F-HRT TEST PERLOD |
| Trace Tupe | Rau | | Rest | WF | Rau | UF | Rasi | WF | Ran | MF | Rau | MF | | MF | : Ra | u HF | Rau | uf . |
| L\$ | 1 | 7 | 1 | 5 | 0 | 0 | 1 | 2 | 3 | 5 | 2 | 2 | 0 | ō | • | 21 | 11 | 26 · |
| 5L | • | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | . 0 | 0 | 0 | ٥ |
| NC . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 4 | 0 | 0 | . 4 | 6 | 3 | 4 |
| nin | D | 0 | 0 | 0 | 0 | 0 | 0. | 0 | . 0 | 0 | 0 | 0 | . 0 | 0 | . 0 | 0 | • | 0 |
| fotal | 1 | 7 | 1 | 5 | 0 | 0 | 1 | , 2 | 4 | 7 | 5 | 6 | 0 | ø | 12 | 27 | 14 | 30 |
| 10 MIHL | JTES AFTE | | | -2 | • | !~3 | | I–4 | RRNGE SH | rters) I-S | | 5-6 | 6- | -7 | το | tal | CHT-S | QUARE VALUES |
| frace Type | ~~~~ | i | Rau | MF. | Rau | LIF | Rau | | Rau | WF | Rau | | Raw | uf | | u UF | | TEST PERIOD |
| | 1 | 7 | 1 | <u> </u> | | | | | | 12 | | 1 | | | | | LS | 1.636 1.92 |
| SL | 0 | | • | | | ò | . 0 | | 0 | 0 | | • | 0 | o | | | SL | |
| NC. | n | 0 | 0 | 0 | | 0 | . 0 | 0 | • | 2 | ů | 0 | | 0 | | . 2 | HC | 1.800 2.00 |
| uu uu | o | • | n | o | o | a | 0 | a | - 0 | - | 0 | 0 | 0 | 0 | | _ | 181 | |
| Total | · | | | <u>-</u> | | | 3 | | | | | | <u>-</u> | | 15 | | • | 9.333 0.60 |
| 10141 | - | • | • | _ | • | | • | | _ | • | • | • | | • | | , | | 4,555 |
| CHI-SQUAI F-NAT | tE 0- | 1 | 1 | -2 | | 2~3 | |)-4 | | 1-5 | | 5-4 | 6- | -7 | | | CHI-S | QUARE - 3.04 |
| 15 | Rau | MF 7 | Rau | MF 5 | Rau | HF D | Rau 2 | HF 4 | Ram | UF 9 | Rau 2 | HF 2 | Rass | NF O | | | Calph | a = .05> |
| SL NC | <u> </u> | . 0 | ā | 0 | Ö | 0 | Ö | 0 | 0 | 0 2 | \$ | . 0 | 0 | ø | | | | |
| NU TOTAL | 0 | Ŷ | 0 | 9 5 | 0 | 0 | 0 2 | . 4 | 9 | 11 | 9 | 9 | 8 | 0 | | | | |
| CHI -SQUAR | RE 0- | 1 | | -2 | | t~3 | 3 |)~ 4 | 4 | 1-5 | | 5-6 | 6. | - 7 | | | | |
| values. Ls | 0.000 0 | ИF . 000 | Rau | MF 0.000 | Rau | WF | 1.000 | UF 2.000 | 2.273 | UF 2.882 | 0.333 | NF 0.333 | Rass | uf | | | . • | |
| SL' NC | | | | = | *** | | == | | 0.000 | 0.000 | 3.000 | 4.000 | ~~ | == | | | | |
| TOTAL | 0.000 0 | .000 | 0.000 | 0.000 | | | 1.000 | 2.000 | 1.923 | 2.333 | 2.667 | 3.571 | | | | | | |

Table E48. Indian Point hanner test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| | | | | dal Ph | | w tide | before | | uration Treatme | nt Tup | •: 7 | Min cor | ers 1,345 htinuousl | u i | Test Dat Test Ti | . 1 | | |
|--|--------------------------|--------------------|--------------------|-------------|--------------------|--------------|--------------------|-------|--------------------|------------|-------------------------|-----------------------------|------------------------|--------------|---------------------|-----|----------------|---------------------------|
| 7 MINU | TES DURI | O TES | | | | | | RA | MGE (not | | | | | | | | | |
| | 0- | -1 | 1- | 2 . | 2- | · 3 | 3~ | 4 | 4- | -5 | 5~ | 6 | 6- | 7 | Total | -1 | FOR 2 | QUARE F-HAT TEST PERIO |
| Trace Tupe | Rau | UF | Rau | HF | Rau | ИF | Rau | WF . | Rass | LF. | Rass | UF | Ram | UF : | Rau | WF | Rasi | HF |
| LS | 1 | 7 | 1 | 5 | > | 8 | 1 | 2 | Þ | 0 | 2 | 2 | 0 | 0 | • | 24 | | 27 |
| SL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | O . | D | 0 | 0 | 0 | 0 | .0 | 1 | 1 |
| HC . | 0 . | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | o | o | • | 1 | 1 |
| MM | 0 | 0 | o | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 |
| Total | 1 | 7 | 1 | 5 | 3 | • | 1 | 2 | 0 | 0 | 8 | 2 | b | 0 | • | 24 | 9 | 20 |
| 7 HINU | TES AFTER | TEST | PERIOD | | | | | RA | N96 (met | | | | | | | | | |
| Trace | | -1 | 1- | 2 | 2- | .3 | 3~ | 4 | 4- | ·S | 5- | 6 | 6- | 7 | Tot | 1 | CHI-S | QUARE VALUE TEST PERIC |
| Гире | Rau | UF | Ress | uf | Ran | uf . | Raw | ur . | Reu | HF | Rau | UF | Rau | WF | Rau | uf | | Rau |
| LS | ,≇ | 14 | 1 | \$ | 1 | 3 | 3 | 8 | Ğ | 0 | 1 | 1 | 0 | 0 | • | 29 | LS | 0.000 0.4 |
| SL | D | o | 0 | 0 | 0 | 0 | O | 0 | 0 | 0 | 1 | . 1 | 0 | 0 | t · | 1 | SL. | 1.000 - 1.0 |
| NC . | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | NC | 1.000 1.0 |
| IM . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | LIM | |
| Total | 2 | 14 | . 1 | 5 | ~ 1 | 3 | 3 | 6 | 0 | 0 | > | 3 | . 0 | 0 | 10 | 31 | TOTAL | 0.222 0.1 |
| CHI-SQUA | RE. 0- | -1 | 1- | -2 | 2- | .3 | 3- | 4 | 4- | · S | 5- | -6 | 6 | 7 | | | CHI -S | QUARE - 3.0 |
| F-HRT LS SL NC UU TOTAL | Rasi 2 0 0 0 | MF 11 0 0 | Rau 1 0 0 | 14F 5000 | Rau 2 0 0 | ## 6 0 | Raw 2 0 0 | 40004 | Rau 0 0 0 | #F 0000 | Rau 2 1 1 0 | #F 2 1 1 0 3 | Rau 0 0 0 | UF 0 0 | | | Cd.f. Calph | |
| CHI-SQUAL | RE 0- | -1 | 1- | 2 | 2- | 3 | 3 | 4 | 4- | - 5 | 5- | 6 | 6- | 7 | | | | |
| LS SL NC UU TOTAL | | 2.355 | 0.000 0 | .000 | | 275 275 | | .000 | Raw | UF | 1.000 1 | 1.000 1.000 1.000 | Reu | MF | | | | |

Table E49. Indian Point hanner test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| 10125 00 | (ING IE: | H PERLU | , | | | | | ERMBE (M | eters> | | | | ٠ | | | CHI -S | OUARF F | -HAT |
|-----------|--|---|-------|--|-------|--------------|--|----------|--------|-------|-------|-------|--------------|-------|--|--|---|--|
| |)-1 | | 1-2 | | 2-3 | | 3-4 | | 4-5 | | 5-6 | | 5-7 | Tot | :al | FOR 2 | TEST P | ERLO |
| Rau | HF | Raw | UF | Rau | WF | Rau | UF | Rau | HF | Rau | HF | Rass | HE | : Rau | UF | Rau | HF | , |
| 4 | 27 | 5 | 23 | 2 | 5 | 2 | 4 | 3 | s | . 6 | 7 | 0 | 0 | 22 | P1 | 26 | 76 | • |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | . 4 | 0 | 0 | | 4 | 2 | 3 | |
| 0 | . 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | o | ٥ | 0 | 0 | o | . 0 | • | 0 | 0 | |
| 4 | 27 | 5 | 23 | 2 | 5 | 2 | 4 | 3 | = | 9 | 11 | 0 | 0 | 25 | 75 | 20 | 76 | |
| IUTES AFT | ER TES | PERIOD | : | | | | | RANGE CH | eters> | | | | | - | | | • | |
| • | | : | 1-2 | | 2-3 | | 5-4 . | | 4-5 | | 5-6 | | 5 ~ 7 | Tot | al. | CHI-S | QUARE Y | ALUE |
| Rau | UF | Rau | UF | Rau | UF | Rau | HF | Raw | MF | Ras | HF | Rau | WF | Rat | HF | - FOR 2 | Rau | CENCE C |
| 2 | 14 | 7 | 32 | 1 | 3 | 5 | 10 | , | 14 | 6 | 7 | • | 0 | 30 | 80 | LS | 1.231 | 0.5 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | SL. | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | . 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | NC | 1-000 | 1.0 |
| 0 | a | o | 0 | 0 | 0 ' | 0 | 0 | 0 | 0 | 0 | 0 | o | 0 | | 0 | LTL | | |
| 2 | 14 | 7 | 32 | 1 | 3 | 5 | 10 | 9 | 14 | 6 | 7 | 1 | 1 | 31 | 61 | TOTAL | 0.643 | 0.2 |
| IRE (| -1 | : | 1-2 | : | 2-3 | | 5-4 | | 4-5 | | 5-6 | | 5-7 | | • | CHI-S | OURRE . | ·).{ |
| Rau | UF | Rew | . UF | Rau | WF | Rass | ᄪ | Rau | | Res | ME | RM | WF | | | | | 5> |
| | -6 | Ŏ | -0 | ő | õ | 3 | . 6 | ğ | Õ | ğ | ŏ | ŏ | ğ | • | | | | |
| ě | Ò | ğ | . Ó | | ŏ | ŏ | .0 | ŏ | | ŏ | 0 | ò | å | | | | | |
| | | • | | - | • | • | ' | • | | • | | ♣. | | | | | | |
| | | | | ~~~ | | | | | | | | | | | | | | |
| 0.667 | 4. 122 | 0.333 | 1.473 | 0.333 | 0.500 | Rau 1,286 | 2.571 | 3.000 | 4.263 | 0-800 | 0.000 | Reu | | | | | | |
| | | | | | | | ~~ | | | 3.000 | 4.000 | 1.000 | 1.000 | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | Rand Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q | 0-1 Raw MF 4 27 0 0 0 0 0 0 4 27 UTES AFTER TEST 0-1 Raw MF 2 14 0 0 0 0 2 14 RE 0-1 Raw MF 3 21 0 0 0 0 0 0 3 81 RE 0-1 Raw MF | | Raw MF Raw MF 4 27 \$ 25 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 4 27 \$ 23 UTES AFTER TEST PERIOD | O-1 | O-1 | The column The | O-1 | C-1 | | O-1 | C-1 | O-1 | O-1 | ### UF Rest UF UF UF UF UF UF UF U | ### UP Raw MF Raw | ### DUTING TEST PERIOD ### Continue Test Period #### Continue Test Period #### Continue Test Period #### Continue Test Period #### Continue Test Period ##### Continue Test Period ################################### | ### DURING TEST PERIOD #### Control of the control |

Table E50. Indian Point hawner test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| | | | | idel Ph | | 20 min lou tid | • | | | ent Tup | *: 1 | O sec | h or s 1,2 on, 20 se | c off | Test I | ime: 1 | /03/88 720 | | |
|-------------------|----------------------------|----------------|---------------|---------------|-------------------------------------|-------------------|---------------|---|---------------|----------------|---------------|-------------------------|------------------------------------|---------------|------------|--------|----------------|----------|-----------------|
| 10 MI | MUTES DU | | ST PERIOD | | 4 4 5 2 2 2 2 | | | 20 22 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | RANGE (ne | | | | | | : 2000 HAZ | ****** | | | |
| | | 0-1 | 1 | -2 | | 2-3 | 3 | | | 1-5 | 5 | -6 | • | 5-7 | Fo | tal | CHI-S FOR 2 | QUARE F | -HAT ERI OD: |
| Trace Type | Rau | WF | Rau | MF | Rass | MF | Rau | иF | Raw | ИF | Rau | laF | Rau | MF | : Ra | w WF | Rau | UF | |
| LS | 6 | 41 | \$ | 23 | 12 | 33 | 5 | 10 | 6 | 9 | 9 | 11 | 0 | 0 | 43 | 127 | 34 | 109 | |
| iL. | 0 | 0 | o | 8 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | o | | 0 | 2 | 5 | |
| IC | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 1 | 2 | 1 | 1 | 0 | O | | . 3 | 2 | 3 | |
| M | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | . 0 | 0 | • | |
| otal | • | 41 | 8 | 23 | 12 | 33 | 3 | 10 | 7 | 11 - | 10 | 12 | 0 | • | 41 | 130 | 40 | 116 | |
| 10 MI | NUTES AF | TER TES | T PERIOD | | | | | | RANGE (H | ters) | | | | • | | | | | |
| • | | 0-1 | 1 | -2 | | 2-3 | 3 | -4 | 4 | 1-5 | 5 | -6 | • | 5-7 | te | tal | CHI-S | QUARE V | ALUES |
| race Type | Rau | NF | Reu | NF | Rau | NF | Raw | NF | Rau | MF | Rau | WF | Rau | MF | ; R. | w WF | * FOR 2 | TEST P | ERL QO: |
| LS | 4 | 27 | 7 | 32 | 5 | 14 | 2 | 4 | 4 | 6 | 5 | 6 | 2 | 2 | 21 | 91 | LS | 2.722 | 5.94 |
| 5L, | 1 | 7 | Q | 0 | 0 | 0 | ` 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | : : | 9 | SL | 3.000 | 9.00 |
| 4C | 0 | . 0 | a | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | | 2 | NC | 0.000 | 0.20 |
| | 0 | 0 | 0 | 0 | 0 | o | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | HM | | - |
| Total | 5 | 34 | 7 | 32 | 5 | 14 | 2 | 4 | 4 | 6 | • | 10 | 2 | 2 | : 34 | 102 | TOTAL | 1.532 | 3.37 |
| CHI-SQUI F-HAT | ARE | 0-1 | 1 | 1-2 | | 2-3 | | -4 . | | 1-5 | 5 | -6 | | 5-7 | × | | CHI-S | QUARE - | 3.04 |
| LS SL NC | Rau S 1 | UF 34 | Ran 6 0 | 4F 29 0 | Rau 9 0 | 24 0 | Rau 4 0 | HF 7 0 | Rau 5 0 | HF B O | Reu 7 1 | MF 9 | Rau 1 0 | ИF 1. 0 | | | (alph | a = °.05 | > |
| HU FOTAL | 0 | . 0 38 | 0 | 0 20 | 9 | 0 0 24 | 9 | ě | 0 6 | 9 | 2 0 10 | 11 | 0 0 1 | 0 0 1 | | | | | |
| CHI-SQUI | RRE (| D-1 | 1 | -2 | | 2-3 | | -4 | | 4-5 | 5 | -E | | 5- 7 | | | | | |
| LS SL HC | R au 0 - 400 1 - 000 | 2.892 7.000 | 0.353 | 1.475 | 2.892 | 7,681 | 1.285 | 2.571 | | 0.600 2.000 | 2.000 | 1.471 2.000 0.333 | 2.000 | 2.000 | | | | _ | |
| IN TOTAL | 0.091 | 0.653 | 0-355 | 1.473 | 2.862 | 7.681 | 1.286 | 2.571 | | 1.471 | | 0.102 | 2.000 | 2.000 | | | | | |

Table E51. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| | | | | Tidal P | | 40 min low tid | • | | Duration Treat | Hent Fu | pe: | 10 sec | h445 1, on, 20 s | ec off | Test | Time: | 3/03/88 1740 | | |
|--------------------------|-----------|-----------|---------|-----------|----------------|-------------------|--|-------|-------------------|---------|--------------|------------|---------------------|--------|---------------------------------------|-------|----------------------------|---------|----------------|
| IN OI | NUTES DUI | LING TES | F PERIO | | 309 - 11 A B B | : | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | | RANGE (m | | | : | | ***** | # # # # # # # # # # # # # # # # # # # | | وببري بارد کا ان بدر ده به | | |
| _ | (|)1 | | 1-2 | | 2-3 | | 3-4 | | 4-5 | | 5-6 | | 6-7 | te | otal | CHI-S FOR 2 | QUARE F | -HAT ERLOD: |
| race 'yp e | Rau | WF | Rau | HF | Res | , WF | Ran | μF | Rau | WF | Ras | MF | RaM | uf | : R | au HF | Rau | ИF | • |
| .s | 3 | 20 | 8 | 23 | B | 14 | 6 | 12 | 0 | 0 | \$ | 6 | 0 | 0 | 2 | 4 75 | 22 | 64 | |
| L | 0 | • | 0 | 0 | 0 | • | 0 | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | • | 0 0 | 0 | 0 | |
| C | 0 | • | 0 | . 0 | 0 | Ð | 8 | 0 | 0 | • | 1 | 1 | 0 | 0 | | 1 1 | 2 | 2 | |
| m , | 0 | 0 | 0 | 0 | O | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 0 | | | |
| otal | 3 | 20 | 8 | 25 | K | 14 | . 6 | 12 | 0 | 0 | 6 | 7 | 0 | 0 | i 21 | F 76 | 33 | 60 | |
| 10 MX | NUTES AF | TER TES | PERIOD | | | | | | RANGE (10 | eters> | | | | | | | | | |
| race | |)-1 | | 1-2 | | 2-3 | | 3-4 | | 4-5 | | 5-6 | | 6-7 | T- | otal | | QUARE U | |
| VP+ | Rau | MF | Rau | WF | Rau | HF | Res | UF | Rau | HF | Ray | HF | Rau | UF | ; R | an UF | | Rass | W |
| .5 | 4 | 27 | 2 | 9 | 1. | 3 | 1 | 2 | 9 | 14 | 2 | 2 | 0 | . • | 1 | 9 57 | LS | 0.581 | 2.45 |
| iL. | 0 | 0 | 0 | 0 | . 0 | 0 | . 0 | 0 | 0 | 0 | 0 | · Q | 0 | 0 | • | 0 0 | SL | | |
| IC | 0 | . 0 | 0 | Đ | 0 | 0 | 0 | 0 | O - | ٥ | | 1. | 1 | 1 | • | 2 2 | MC | 0.333 | 0.33 |
| N | 0 | 0 | 0 | 0 | 0 | o " | 0 | 0 | <u> </u> | 0 | 0 | 0 | 6 | 0 | | 0 0 | IASA | | |
| otal | 4 | 27 | . 2 | • | . 1 | 3 | 1 | 2 | 9 | 14 | 3 | . 3 | 1 | 1 | : 2 | 1 59 | TOTAL | 0.349 | 2, 14 |
| HI -SQU | ARE (|)-1 | | 1-2 | | 2-3 | | 3-4 | | 4-5 | | 5-6 | | 6-7 | | | CHI ~5 | QUARE - | 3.84 |
| | Rass | WF 24 | Rau | 18F 16 | Rau | HF | Rass | HF | Rau | HF | Ras | | Raw | | | | čelph | | ;> |
| .s iL iC | . 0 | ŤÕ. | õ | Ď | ŏ | ő | õ | ò | Ď | ģ | Ģ | Ģ. | . , | ě | | | | | |
| M OTAL | ŏ. | ŏ 24 | ŏ | , 16 | Š | ŏ | ŏ | ě | Ö | ě | Ô | ġ | Õ | ĝ | | | | | |
| HI-SQU | ARE (| -1 | | 1-2 | | 2-3 | | 3-4 | | 4-5 | | 5-6 | | 6-7 | | | | | |
| .S iL IC | 0. 143 | 1.043 | 1.286 | 6.125 | 2.667 | 7,119 | 7.571 | 7.143 | 9-000 | 14.000 | 1.286 | 2.000 | Ran | == | | | • | | |
| ic ic | | | | | | | == | | | | 0.000 | 0.000 | 1.000 | 1.000 | | | | | |
| OTOL | 0.143 | 1 043 | 1 206 | 6. 190 | 2 457 | 7 110 | 3.671 | 7 143 | 4.000 | 14-000 | 1.000 | 1.600 | 1.000 | 1.000 | | | | | |

Table E52. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| | | | : ** | del Pr | 1 | l hr aft | | | | eent Tu | > 1 | 10 min | hers 1,3 | u (a) | Test | Date: Time: | 10 | 300 (03/88 | | |
|--------------------|----------|-------------|-----------|-------------|-------|---------------------|-----------|---------|--------------|-----------------|----------------|-------------------------|--|-------------|------|----------------|----|-----------------|------------------|---------------|
| 10 HIM | UTES DUR | MG TE | ST PERIOD | | | 2 m in spin in 10 a | ********* | | RANGE (M | | - | 140 (proje 17 17 18 18) | ************************************* | | | | | | | |
| | | -1 | 1 | -2 | : | 2-3 | 3- | -4 | | 1-5 | | 5-6 | • | 5 −7 | T | otal | | CHI-SQ FOR 2 | UARE F TEST F | -HAT ERIOD |
| irace Type | Rass | uF . | Rau | WF. | Rem | UF | Rau | WF | Rau | WF | Ray | MF | Rau | WF | | au H | F | Reu | WF | • |
| .5 | 2 | 14 | 2 | 9 | 2 | 5 | 3 | 6 | 2 | 3 | 3 | 4 | 0 | 0 | 1 | 4 | 1 | 14 | 34 | • |
| iL, | • | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | • | 0 | 0 | 8 | 0 | • | 0 | 0 | 1 | 1 | |
| ic | 0 | 9 | . 0 | 0 | Ð | 0 | 0 | 0 | 0 | • | 2 | 2 | 0 | 0 | | 2 | 2 | 2 | 2 | |
| nu . | 0 | . 0 | 0 | 0 | D | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | 0 | 0 | 0 | 0 | |
| otal | 2 | 14 | 2 | 9 | \$ | 5 | 3 | 6 | 2 | 3 | 8 | 6 | 0 | 0 | 8 1 | 16 4 | 3 | 16 | 36 | |
| 10 HIM | UTES AFT | ER TESI | PERIOD | | | | | ı | RANGE (m | etérs) | | | | | | | | | | |
| race | 0- | - 1 | 1- | -2 | | 2-3 | . 3 | -4 | | 1- 5 | | 5-6 | | 5-7 | 1 | otal | | CHI-SO FOR 2 | | |
| ype | Rau | UF | Rau | UF | Rau | WF | Rau | MF | Rau | HF | Ras | HF | Rau | MF . | | tau u | F | , or 2 | Rau | ü |
| .5 | 1 | 7 | . 0 | 0 | 1 | 3 | > | 6 | 4 | 6 | > | 4 | 1 | 1 | | 3 2 | 7 | LS | 0.037 | 2.98 |
| iL. | . 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | Ę | 1 | 1 | SL | 1.000 | 1.00 |
| IC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | 1 | 1 | 0 | 0 | į | 1 | 1 | HC | 0.333 | 0.33 |
| M | 0 | 0 | 0 | 0 | 0 | 0 . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | · | 0 | 0 | MM | _ | - |
| otal | 1 | 7 | 0 | 0 | 1 | 3 | 3 | . 6 | 4 | £ | 5 | 6 | 1 | 1 | i : | 15 2 | 9 | TOTAL | 0.032 | 2.72 |
| HI-SQUAR | RE O | -1 | 1- | -2 | : | 2-3 | 3 | -4 | · | 4-5 | | 5-6 | | 5-7 | | | | CHI-SC | WARE 4 | - 3.84 |
| F-HAT | Rau | WF 11 | Rau | HE | Reu | HF. | Rau | ME | Rau | UF S | Res | UF | Rau | MF | | | | (alphi | | 5> |
| .5 il ic | Ď | Ö | ģ | <u>.</u> | 8 | 3 | Ŏ | ŏ | ō | 9 | 1 | 1 | á | ģ | | | | | | |
| พ | 8 | . 0 | 0 | ô | 8 | 0 | 0 | 8 | . 0 | ŏ | 2 | ő | ě | · ŏ | | | | | | |
| OTAL | 2 | 11 | . 1 | 5 | 2 | • • | 3 | 6 | 3 | 5 | 5 | 6 | 1 | 1 | | | | | | |
| HI SQUAS MILUES | RE0 | -1 | 1. | -2 | | 2-3 | 3· | -4 | | 4-5 | | 5-6 | | 5-7 | | | | • | | |
| .5 | 0.333 : | uf 2.333 | 2.000 · | ₩F 9.000 | 0.333 | 0.500 | 0.000 (| UF .000 | Rau 0.667 | 4F 1.000 | Q.000 | 0.000 | 1.000 | 1.000 | | | | | * | |
| ic ic | | | | | | | | | | | 1.000 | 1.000 | | | | | | | | |
| 44 | _ == | == | = | | | | | | | | | | 4 4000 | | | | | | | |
| TOTAL | 0.333 | 2.555 | 2.000 | 3.000 | 0.333 | 0.500 | 0.000 | 0.000 | 0.667 | 1.000 | 0.000 | 0.000 | 1.000 | 1.000 | | | | | | |

Table E53. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| 10 HIMUTE | S DURI | | PERIOD | | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | low tid | | | Treatm RANGE (me | | | | on, 20 s | | Test T | 200774 | 433V | | |
|---------------------|--------|---------|--------|------|---|-------------|-------|-------|---------------------|----------------|--------------|----------------|--------------|---------|-----------|------------|--|-----------------|--------------|
| _ | 0~ | ı · | . 1- | .2 | | 2-3 | | 3~4 | | -S | 5 | i-6 | | 6-7 | , - Ta | tal | CHI-S | QUARE F | -HAT |
| trace Tupe | | L | | HF | | HF | Raw | WF | Rass | uf | Rau | UF | Rau | | : Ra | | Rau | WF | |
| LS | 0 | 0 | 0 | 0 | 2 | 5 | 0 | 0 | - 2 | 3 | 6 | 7 | 1 | 1 | 11 | 16 | | 9 | • |
| 5L. | 0 . | .0 | , o | 0 | G | 0 | Ď | . 0 | . 0 | 0 | . 0 | 0 | 0 | 0 | | 0 | 1 | 2 | |
| VC | 0 | • | 0 | 0 | | 0 | 1 | 2 | . 2 | 3 | 0 | 0 | 0 | . 0 | 3 | 1 5 | 6 | , 9 | |
| in . | 0 | 0 | . 0 | 0 | | .0 | 0 1 | Đ | . 0 | D | 1 | 1 | 0 | 0 | | 1 | . 1 | .1 | |
| Total | o | 0 | 0 | 0 | 2 | , 5 | 1 | 2 | 4 | 6 | 7 | | 1 | 1. | 15 | 22 | 14 | 21 | |
| 10 MINUTE | S AFTE | R TEST | PERIOD | | | | | | RANGE (me | ters | | | | ** | | • | | • | |
| | 0- | 1 | 1~ | 2 | | 2-3 | • | 3-4 . | 4 | -5 | 5 | -6 | • | 6-T | Ta | tal | CHI-S | QURRE U | ALUES |
| irace Type | Rau | ur | RaH | HF - | Rai | 4F | Reu | ИF | Rase | SUF | Rau | MF | Rau | NF | : R4 | sa MF | - FOR 2 | TEST F | PERIOD: |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | . 0 | 0 | | 2 | LS | 8.333 | 10.88 |
| FL. | 0 | 0 | 0 | • | 0 | | 1 | 2 | . 1 | 2. | a. O | .0 | , 0 | ø | 2 | . 4 | SL | 2.000 | 4.00 |
| (C | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 5.0 | ' 3 | 5 | 5 | 6 | 1 | . 1 | 9 | 12 | NC | 3.000 | 2.88 |
| una . | G ' | 0 | • | • | . 0 | O. | 0 | 0 | 0 | 0. | 1 | . 1 | 0 | 0 | 1 | L 🕺 🖈 | 181 | 0.000 | 0.00 |
| Total | 0 | • | 0 | o | 0 | 0 | 2 | 4 | 4 | 7 | . 6 | 7 | 1 | 1 | 13 | 19 | TOTAL | . 0.143 | 0.22 |
| CHI-SQUARE F-HAT | 0- | 1 | . 1- | -2 | | 2-3 | | 3-4 | 4 | -5 | 5 | -6 | | 6-7 | • | | CHI-S | SQUARE 4 | - 3.04 |
| | Rati | uf D | Raw | . UF | Rau | UF 3 | Rate | WF. | Rass 1 | UF 2 | Rau 3 | HF 4 | Raw | MF 1 | | | <alp*< td=""><td>- 1> ha - 19</td><td>;></td></alp*<> | - 1> ha - 19 | ;> |
| s L IC | 9 | . 0 | Õ | ୍ତି | . 0 | ő | 1 | 1 | 5 | 4 | Ş | 9 | 1 | 0 | | | | | |
| iu Fotal | ő | 8 | 0 | . 0 | . 1 | 3 | 2 | 3 | 4 | ş | · 1 | 9 | 1 | . 1 | | - | | | |
| HI-SQUARE | 0~ | 1 | 1- | 2 | | 2-3 | | 3-4 | 4 | 5 | 5 | -6 | | 6-7 | | - | | | |
| | Rau | up | Rau | ИF | 2.000 | UF 5.000 | 1.000 | 2.000 | 2.000 |).000 | 8au 6.000 | 7.000 | Ra4 1.000 | 1.000 | | | • | | |
| .S iL iC | | == | | | = | | 1.000 | 2.000 | | 2.000 0.500 | 5.000 | 6.000 | 1.000 | 1.000 | | | | | |
| NI OTAL | | | | | 2.000 | 5.000 | 0.332 | 0.667 | 0.000 | 0.077 | 0.000 | 0.000 0.067 | 9.000 | 0.000 | | | | | |

Table E54. Indian Point harmer test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| | | | T1 | dal Pt | 1 | hrs be | | | Duration Treatm | of Tes | t: : | lO min, lO min | hurs 183 continuous | | Test D Test T | ine: | 3/04/88 0350 | |
|--|----------------------|--------------|-------------------------|--------------|-------------------------------|----------------|--------------------|--------------|-------------------------|---|--------------------------------|--------------------------------|------------------------------|------------------------|------------------|------|-----------------|----------------------------|
| 10 HI HUT | ES DURI | 40 TEST | PERI 00 | | | | | | RAMBE (Ind | ters) | | | | | | | | |
| • | . 0-1 | 4 | 1- | 2 | | :-3 | 3 | -4 | 4 | -5 | \$ | 5-6 | 6- | -7 | ro | tal | FOR 2 | QUARE F-HAT TEST PERIOD |
| Trace Type | Rass I | uf | Rast | uf | Raw | WF | Rau | WF | RM | MF | Rau | MF | Rau | MF | : Ra | u UF | RaH | WF |
| LS | 0 | 0 | 0 | 0 | 3 | 8 | 1 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | | 13 | 4 | |
| SL | 0 | 0 | 0 | 0 | C | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | | 0 | 1 | 1 |
| NC , | 0 | • | ,O | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 12 | 15 | 2 | 2 | 16 | 20 | 16 | 19 |
| ин . | 0 | 0 | 0 | 0 | D | 0 | D | 0 | 1 | 2 | 0 | 0 | 0 | . 0 | | . 2 | 1 | 1 |
| Tetal | 0 | 0 | 0 . | 0 | 3 | • | 1 | 2 | 5 | • (| 12 | 15 | 2 | 2 | 23 | 35 | 21 | 29 |
| 10 HINUT | ES AFTE | R TEST | PERIOD | | | | | 1 | RAMBE GIO | tèrs) | • | | | | · | | | : |
| · | 0-: | 1 | 1- | 2 | 2 | :-3 | 3- | -4 | | 5 | | 5-6 | 6- | - 7 | Ta | tal | CHI-S | QUARE VALUES |
| Trace Tupe | Rana I | LEF. | Rau | uF | Rass | uF | Rau | WF . | Raw | HF | Rau | ИF | Raw | HF | 1 R4 | M MF | PUK 2 | TEST PERIOD |
| LS | 0 | 0 | 0 | 0 | 0 | ō | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | | 2 3 | LS | 2.000 \$.25 |
| SL. | 0 | . 0 | Ö | 0 | 0 | . 0 | 0 | 0 | . 1 | 2 | 0 | 0 | 0 | 0 | 1 | . 2 | SL. | 1.000 2.00 |
| MC . | 0 | 0 | G | 0 | • | 0 | 0 | 0 | . 0 | • | 14 | 27 | . 1 | . 1 | 15 | 19 | , NC | 0.032 0.10 |
| MW. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0. | o ´ | . 0 | Q | . 0 | 0 | | 0 | LILL . | 1.000 2.00 |
| Total | 0 | ġ. | 0 | 0 | 0 | 0 | 0 | 0 | 3 | . 5 | 1-1 | 17 | . 1 | 1 | 10 | 23 | TOTAL | 0.610 2.4 |
| CHI —SQUARE F-HAT | 0- | 1 | 1- | 2 | a | :-3 | _ | -4 | | I-5 | | 5-6 | 6- | -7 | | | CHI-S | QUARE - 3.6 |
| LS SL NC W TOTAL | R 844 0 0 0 | #F 0 0 | Ram O O O O | MF 0 0 0 0 0 | Rate 2 0 0 0 2 | # TOOO T | Rau 0 0 0 | UF 0 0 | Ren 2 1 1 1 | UF 3 1 2 1 7 | Rau 0 0 13 0 13 | 14F 0 0 16 0 16 | Rau 0 0 2 0 2 | HF 0 2 0 2 | | | Čelpř | a ≈ ~.05> |
| CHI -SQUARE | 0- | 1 . | 1- | 2 | 2 | :-3 | 3 | -4 | 4 | - -s | • | 5-6 | 6- | -7 | | | | |
| VALUES LS SL NC INI TOTAL | Rau | | Rau | WF | 3.000 3.000 | 8.000 8.000 | == | 2.000 | 1.000 2.000 1.000 | UF 0.000 2.000 3.000 2.000 0.692 | 0.154 0.154 | 0.125 | | HF | | | | |

Table E55. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| | | | | del Phase | 1 ou | tide | | | Treat | m of Te ment Ty | st: pe: | 10 min, 20 sec | hers 1& on, 20 |) sec off | Test [Test] |)ate: : [ime: (| 0410 | | |
|-------------------------------|---------|---------|---------|-----------|-------|------|--------|-------------|----------|--------------------|---------------------------|-------------------|-------------------|--------------|------------------|--------------------|-------|---------------|---------|
| 10 HINUT | ES OURI | NO TEST | PERI 00 | | , | | | | RANGE CH | eters) | | • | | | | | | | |
| | 0~ | 1 | 1- | -2 | 2~3 | | . 3 | -4 | | 4-5 | | 5-6 | 1 | 6-7 | To | otal . | FOR 2 | QUARE I | PERI CO |
| Trace Type | Rau | MF . | Rau | MF | Raw M | F | Reu | ИF | Rat |) WF | Ras | e HF | Rau | WF | ; R4 | H UF | Rana | WF | • . |
| LS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | > | 4 | 0 | 0 | 2 | 4 | 3 | 4 | - |
| 5L | 0 | Ó | 0 | 0 | D | 0 | 0 | 0 | 0 | 0 | 2 | 2 | D | 0 | 1 | 2 | 1 | 1 | |
| + C | 0 | 0 | 0 | . 0 | D | 0 | 1 | 2 | 3 | 5 | 1 | 1 | 1 | 1 | | 9 | 5 | 7 | |
| HH . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | D | 0 | . 0 | 0 | | 0 | 0 | 0 | |
| Total | 0 | 0 | 0 | 0 | b | 0 | 1 | 2 | 3 | 5 | 6 | 7 | 1 | 1 | 1 1 | 1 15 | • | 12 | |
| 10 HIMUT | ES AFTE | R TEST | PERI 00 | ٠. | | | | 1 | RANGE C | eters) | | | | | | | ٠ | | |
| [race | 0- | 1 | 1- | 2 | 2-3 | | | -4 | | 4-5 | | 5-6 | | 6-7 | T | etal | CHI-5 | QUARE (| PALUES |
| Tupe | Rau | uf | Rau | HF | Rau H | F | Rau | WF | Ras | HF. | Res | uf . | Rau | uf | ; R4 | M HF | | Rau | W |
| LS | 0 | . 0 | 0 | 0 | D | 0 | • | a | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 4 | LS . | 0.000 | 0.00 |
| 54, | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | . 0 | 0 | ុ០ | . 0 | | 0 | SL | 2.000 | 2.00 |
| NC | • | O | 0 | 0 | D | 0 | 0 | 0 | 2 | 3 | 1 | 1 | 0 | 0 | 1 | 3 4 | NC | 1.000 | 1.92 |
| W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | đ | 0 | 0 | 0 | 0 | | 0 | 1464 | . | |
| Total | 0 | Ö | . 0 | 0 | 0 | 0 | 0 | • | 3 | . 5 | 2 | 2 | 1 | 1 | | 6 0 , | TOTAL | 1.471 | 2. D |
| CHI-SQUARE F-HAT | 0~ | 1 | 1- | -2 | 2-3 | i | ` 3 |)- 4 | | 4-5 | | 5-6 | | 6-7 | | | CHI-S | QUARE | - 3.84 |
| LS | Rau | WF | Rau | NE. | Rass | HF | Raw | UF | Ras | WF | Ran | u u u | Rau | NF | | | | o | 5) |
| LS SL NC | ŏ | ĕ | ŏ | 9 | ě | ŏ | ŏ | ě | Õ | è | 1 | 1 | ò | ò | | | | | |
| IU FOTAL | 0 | . 0 | ě · | 8 | 6 | 8 | 0 1 | ġ | Š | ē | 9 | Ó | | ġ | | | | | |
| CHI-SQUARE VALUES | | 1 | 1- | 2 | 2-3 | | 3 | 14 | | 4-5 | | 5-6 | | 6-7 | * | | | | |
| | Rau | HF | Rau | UF | Raw | MF | Rau | HF | 1.000 | 2.000 | 1-000 | 1.800 | Ram 1.000 | 1.000 | | | | | - |
| LS SL NC HU TOTAL | == | | | | | | 1.000 | 2.000 | 0.200 | 0.500 | 2.000 0.000 | 2.000 0.000 | 1.000 | 1.000 | | | | | |
| AM TOTAL | | | | | | | 1-000 | 2.000 | 0.000 | 0.000 | 2.000 | 2.778 | 0.000 | 0.000 | | | | | |

Table E56. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| | | _ | | idal Phes | | Lou tid | | | Duration Treate | ent Ty | pe: | 10 min | her 3 o | usly | Test Da | HOS C | 3/04/88 0430 | | |
|---|-------------------------|-------------------|--------------------------|-------------------|--------------------|-------------------|---|------------------------------|-------------------------|-------------------------------|---------------------------------------|--------------------------------|-------------------------|--------------|---------|--------------|-----------------|--------------------|-------|
| | | | F PERIOD | | | | # in 12 12 12 12 12 12 12 12 12 12 12 12 12 | | RANGE (m | | | • , | | | | | | | |
| · | 0- | | | -2 | | 2-3 | 3 | -4 | | 1-5 | | 5-6 | | 6~7 | Tot | -1 | FOR 2 | QUARE F | ERI O |
| Type Type | | WF. | Rau | UF | Rau | WF | Rau | UF | Rau | HF | Rai | | Rau | NF | 2 Reu | UF | Rau | MF | |
| LS | 0 | 0 | 0 | 0 | 0 | | 2 | 4 | 3 | 5 | 3 | 4 | 2 | 2 | 10 | 15 | • | 14 | |
| iL | 0 | . 0 | 0 | 0 | 0 | ΄ο | 1 | 2 | 0 | 0 | 5 | 6 | . 0 | 0 | • | 8 | 3 | 4 | |
| ŧC | O | 0 | ٥ | 0 | 0 | 0 | 6 | 12 | • | 14 | 3 | 4 | 0 | 0 | 16 | 30 | 15 | 24 | |
| 44 | 0 | 0 | 0 | 0 | 0 | 0 | D | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | . 1 | 1 | |
| Tetal | 0 | 0 | 0 | 0 | 0 | 0 | • | 10 | 12 | 19 | 11 | 14 | 2 | 2 | 34 | 53 | 27 | 43 | |
| 10 HI MUTE | ES AFTE | | r Period | -2 | : | 2-3 | 3 | , ⊢ -∢ | RANGE (m | rters) I-5 | | 5-6 | | 6- 7 | Tot | : a l | CHI ~S | QUARE V | RLUE! |
| Trace Tupe | | IIII | Rau | | | | Raw | | Rau | WF | Rai | 4 WF | Ran | MF | : Rev | HF | - FOR 2 | TEST P | ERIOD |
| LS | | | 1 | | | | 2 | 4 | | 0 | 3 | 4 | | 0 | | 13 | - LS | 1,000 | 0.14 |
| SL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | . SL | 6.000 | 8.00 |
| NC | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 8 | 4 | 5 | 2 | 2 | : 12 | 17 | NC | 1.200 | 3.59 |
| Litti | 0 | . 0 | . 0 | 0 | 0 | a | 0 | 0 | 1 | 2 | 0 | o | . 0 | 0 | . 1 | 2 | нн | 1.000 | 2.00 |
| Fet-al | 0 | Ö | . 1 | 5 | 0 | 0 | 3 | 6 | 6 | . 10 | · · · · · · · · · · · · · · · · · · · | 3 | 8 | 2 | 19 | 32 | TOTAL | 4.245 | Б. 10 |
| CNI -SQUARE | 0- | 1 | . 1 | -2 | ; | 2-3 | 3 | -4 ·· | 4 | - 5 | | 5-6 | | 6-7 | | | | QUARE - | 3.84 |
| F-HAT LS SL NC UU TOTAL | Ram 0 0 0 0 | UF 0 0 0 | Rana 1 0 0 0 | uF 3 0 0 | Rau G O O | MF 0 0 0 | Rau 2 1 4 0 6 | UF 4 1 7 0 12 | Raw 2 0 7 1 | #F 2 0 11 1 15 | Rai 33 40 9 | u UF 4 3 5 0 12 | Rew 1 0 1 0 | UF 1 0 1 0 2 | | | Cal ph | . = 1> .a = .05 | > |
| CHI —SQUARE | 0- | 1 | 4 | -2 | : | 2-3 | . 3 | -4 | | 1-5 | • | 5-6 | | 6-7 | | | 4.1 | • | |
| VALUES LS SL NC NC HU Teral | Rau | | | 5.000 | Rass | HF | 1.000 3.571 | 0.000 2.000 7.143 | 1.143 | 1.636 2.000 2.713 | 0.000 5.000 0.143 | 0.000 6.000 0.111 | 2.000 2.000 0.000 | | | | | | |

Table EST. Indian Point hanner test monitoring using 5 degree vertical transducer located at unit 3, intake 36.

| | | | Ti | del Pho | 1 | hr be | fore i e | | Duration Treate | ment Tu | >+: | continu | . hwr 3 oi ious | _ | Test | Time: | 3/04/ 98 0450 | | |
|----------------------|-----------|--------|----------|-------------|------|------------|-------------|----------|--------------------|---------------|---------------|---------|--------------------|-------------|------------|-------|-------------------------|----------------------|-----------------|
| 10 NI NUTE | S DURI | NO TES | T PERIOD | | | | | | RANGE (m | | | | | | | | | , | |
| | 0- | 1 | 1- | 2 | 2- | -3 | 3 | -4 | | 4-5 | | 5-6 | | 6- 7 | Te | otal | CHI- FOR | SQUARE F 2 TEST P | -KAT ERI (D) |
| Trace Tupe | Rau | WF | Rau | WF | Ran | WF | Rass | WF. | Rau | WF | Res | uf. | Rau | WF | ; R | au HF | Ran | KF | • |
| LS . | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | · | 1 1 | 2 | \$ | • |
| 5 4. | D | 0 | 0 | . 0 | 0 | G | 0 | 0 | 0 | 0 | 0 | Ð | .0 | . 0 | 1 | 0 0 | • 0 | 0 | |
| NC | 0 | 0 | 0 | 0 | 0 | 0 | 2 | · • • | 3 | 5 | . 4 | 5 | 2 | 2 | 1 | 1 16 | 6 | | |
| 1814 | 0 | o | . 0 | G | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | | 0 0 | | 0 | |
| Total | 0 | 0 | ŏ | 0 | 0 | 0 | 2 | 4 | 3 | 5 | 5 | 6 | 2 | 2 | 1 1 | 2 17 | • | 13 | |
| 10 MIMUTE Trace | .S PAFTE. | 1 | PERIOD | · 2 | 2. | -3 | 3 |)4 | RANGE CO | eters> 4-5 | | 5-6 | | 6-7 | T - | otal | CH1- | SQUARE U 2 TEST P | ALVES |
| Tupe | | HF" | Rau | | Rau | HF | Ram | UF | Reu | HF | Ras | leF | Rau | HF | 1 R | an UF | | Rau | E.R.A. CUI |
| LS | 0 | 0 | 1 | 5 | 0. | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | | 5 | Ls | 1.000 | 5.44 |
| SL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 0 | Si, | | - |
| MC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ,O | 0 | 0 | 0 | 0 | . 0 | 0 | • | 0 0 | HC HC | 11.000 | 16.00 |
| МИ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | D | 0 | 0 | 0 | | 0 0 | <u> </u> | | _ |
| Total | D | Ó | 1 | 5 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | • | 3 8 | TOTA | L 5.400 | 3.24 |
| CHI-SQUARE F-HAT | 0- | 1 | 1- | -2 | 2 | -3 | | 4 | | 4-5 | | 5-6 | | 6-7 | | | CHI- | SQUARE . | - 3.84 |
| r-wiii LS | Rau | HF. | Rau | HF 3 | Rass | HF. | Rass | LIF | Rau | MF | Rat | 145 | Rau | WF | | | | ha = 1.0! | 5> |
| SL NC NU | Ď | ŏ | ģ | 0 | Š | ŏ | Ô | ĝ | ě | ğ | ģ | ġ | ŏ | ě | | | | | |
| HH TOTAL | ŏ | Ö | ŏ | Ŏ | Ď | Ö | ġ 2 | ē | Ď | ğ | ō | ğ | Ģ | ė | • | | | | |
| futhil Chi-Square | · · | _ | ` . | _ > | 0 | - 3 | _ |)-4 | * | 3 4~5 | 3 | 5-6 | • | 6-7 | | | | | |
| VALUES | | | | | | | | | | | Ray | | | | | | | | |
| LS | Rau | | 1.000 t | ₩F - 000 | Rau | HF | 1.000 | 2.000 | R 444 | | 0.000 | 0.000 | Ram | | | | | | |
| LS SL NC | | == | | | | == | | 4.000 | 3.000 | 5.000 | 4.000 | 5.000 | 2.000 | 2.000 | | | | | |
| uu | | | | | | | | == | | | == | | === | | | | | | |

Table E58. Indian Point hammer test monitoring using 5 degree vertical transducer located at unit 3, intake 36.

| | | | | del Phese: | 1 04 | ti de | efore | <u>.</u> | Duration Treatm | ent Tur | • : 1 | D min c | her 3 onl ontinuous | £u | Test I | [ine: | 3/04/88 0510 | |
|---|-------------------------|--------------|--------------------------|-------------------|-------------------------|--------|-------------------------|---------------------|-------------------------|----------------------------------|--------------------|--|------------------------------|-------------------|--------|--------|-----------------|---------------------------|
| | TES OURI | | | | | | | | RANGE (100 | | | | | | | | | |
| | 0- | 1 | 1- | | 2-3 | | 3- | 4 | • | -5 | 5 | -6 | 6~ | 7 | re | otal . | FOR 2 | QUARE F-HAT TEST PERIO |
| Trace Type | Rau | MF | | MF | Rau H | F | Rau | WF | Rau | WF | Rass | HF | Rau | HF | : R | M HF | Rau | UF. |
| LS | 1 | 7 | 0 | 0 | 0 | 0 | 2 | 4 | D | 0 | 7 | 9 | 0 | 0 | 10 | 20 | 7 | 13 |
| 51. | O | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | . 0 | 0 | 1 | 1 2 | 1 | |
| HC | 0 | • | . 0 | 0 | 0 | 0 | o o | 0 | . 1 | 2 | 1 | 1 | 0 | 0 | | 2 3 | 2 | * |
| MR | 0 | o | D | • | 0 | 0 | 0 | 0 | 0 | . 0 | 1 | 1 | 0 | 0 | 1 | | 1 | 1 |
| Total | 1 | 7 | D | 0 | D | 0 | 2 | 4 | 2 | 4 | 9 | 11 | 0 | | 1 | 1 26 | 10 | 17 |
| 10 HX NL | UTES AFTE | R TEŠT | PER100 | | | | | | RANGE (100 | ters) | | | | | | | | |
| | 0- | 1 | 1- | 2 | 2-3 | | 3 | 4 | 4 | -5 | S | -6 | 6- | 7 | Te | iete | CHI-S | OURRE VALUE |
| Trace Tupe | Rau | WF | Rase | WF | Rau H | F | Raw | UF | Rau | WF | Rau | HF | Rau | MF | : R | ou HF | ·- FUR 2 | Rest PERIO |
| LS | 0 | 0 | . 0 | ō | 0 | 0 | 1 | 2 | 1 | 2 | 2 | 2 | 0 | 0 | | 4 6 | LS | 2.571 7.5 |
| SL. | D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | O O | 0 | . 0 | 0 | | 0 | SL | 1.000 2.0 |
| HC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | a | 0 | 0 | 1 1 | 1 | 0 ' | . 0 | | 1 1 | NC | 0.333 1.0 |
| W. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | UN | 1.000 1.0 |
| Tetal | Ö | á | . 0 | a | 0 | 0 | 1 | 2 | 1 | 2 | 3 | 3 | 0 | o | : | 7 | TOTAL | . 4.263 10.9 |
| CHI SQUAF F-HAT | RE 0- | 1 | 1- | 2 | 2-3 | | 3- | 4 | | -5 | 5 | -6 | 6- | ·† | | | CHI-S | SQUARE - 3.6 |
| LS SL NC NU TOTAL | Rau 1 0 0 0 | UF 0 0 | Rais 0 0 0 0 | UF 0 0 0 | Rau 0 0 0 0 | 0000 | Rau 2 0 0 0 | UF 20 00 0 | Rou 1 1 0 2 | 1 1 1 0 3 | Raw S U 1 | UF 6 0 1 | Rau 0 0 0 0 0 | UF 0 0 0 | | | ₹ ĕ 1 pi | ia = 1.05> |
| CHI — SQUAF | ?E 0− | 1 | t- | 2 | 2-3 | | 3- | | 4 | -5 | 5 | -6 | 6~ | · P | | | | |
| UNLUES LS SL NC NU TOTAL | | .000 | Rau | us | Resu | uf | | .667 | 1.000 | 2.000 2.000 2.000 2.000 | 0.000 | uF 4.455 0.000 1.000 4.571 | Rau | WF | | | | |

Table E59. Indian Point harmer test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| | | | | idal Pha | 1 | ou tid | • | | | ment Fy | pe: | IO Hin, | har 3 c continuo | naja uta | Test I | Times | 3/04/68 0530 | | |
|-------------------------|---------------|--------------|-----------|------------|---------------|--------------|----------|--------------|--------------|-------------|-----------------------|----------------|---------------------|-------------|--------|--------|-----------------|----------|----------------|
| 10 HIN | NUTES DU | ING TE | ST PERIOD | | · . | | | | RAMBE (| | | | , | | | | | | |
| | |)-1 | 1 | 1-2 | 2 | -5 | 3 | -4 | • | 4~5 | | S-6 | • | 6-7 | To | iete | FOR | QUARE (| PERIC |
| upe ' | Rau | HF | Rau | WF | RaH | HF . | Rass | ur . | Res | HF | Rau | MF. | Ras | | R | M MF | Rau | MF | - |
| \$ | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 2 | 0 | 0 | | , 1 | | 8 | <u>-</u> |
| L . | .0 | 0 | 0 | • | 0 | 0 | .0 | | , e | 0 | ` 1 | . 1 | . 0 | 0 | | 1 | 1 | 1 | . • |
| ; | . 0 | | 0 | O - | 0 | . 0 | . 0 | 0 | 1 | 2 | • | 0. | 1.1 | 1 | | 2 3 | 4 | .5 | . • |
| н | 0 | . 0 | 0 | . 0 | 0 | 0 | 0 | 0 | . 0 | 0 | . 0 | . 0 | . 0 | 0 | | | - 0 | 0 | 1 . |
| otal | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 3 | 3 | 1 | 1 | | | • | 15 | () |
| 10 MIH | NUTES AFT | ER TES | T PERIOD | | | | , . | | RANGE (| eters) | | | , | • | • ` | | | , | , |
| | |)—1 | 1 | l-2 | . 2 | ~3 | , | - 4 | - | 4-5 | | 5-6 | 2 | 6-7 | T | otal - | CHI- | SQUARE I | VALUES |
| raće UD e | Ray | uF | Rau | WF | Rau | HF | Rau | WF | Rate | | Res | | Rau | | | BH HF | - FOR | TEST I | PERIC |
| <u> </u> | 1 | 7 | 0 | 0 | 0 | | D | | 2 | 3 | 1 | 1 | 0 | 0 | | 1 11 | L.S | 0.143 | |
| L | 0 | . 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | . 0 | • | 9 0 | SL | 1.000 | 1.00 |
| C | . 🛰 o | . 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 2 | . 3 | 2 | 2 | . 1 | | : : | 5 6 | NC ' | 1.285 | 1.00 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 | D | . 0 | 0 | ø | 0 | 0 | · 0 | 0 | • | • • | ш | | · • |
| otal | 1 | Ť | 0 | 0 | 0 | , | 0 | 0 | .4 | 6 | > | > | 1 | 1 | -; | 17 | TOTAL | 0.600 | 3.2 |
| HI – SQUA -HAT | RRE C |)-1 <u> </u> | 1 | 1-2 | 2 | -3 | | -4 | | 4-5 | | 5-6 | | 6-7 | | | CHI - | SQUARE . | - 3.0 |
| S L C | Rau 1 0 | HF 4 0 | Rau O | HF 0 | Rau O D | MF O D | Rau 1 | MF 1 0 | Ran 1 | LIF 2 | Rau 2 1 | 1 UF 2 1 | Res | | | | ₹ el pi | ha | (\$> |
| OTAL | 0 0 1 | . 0 | 000 | 0 | . 0 0 | 0 | . O | 0 | 2 0 3 | 3 0 4 | 1 0 3 | 9 9 | 1 0 1 | 1 0 1 | | | | | |
| HISQUA RLUES | NP.E |)-1 | | 1-2 | 2 | -3 | 3 | -4 | | 4-5 | | 5-6 | | 6-7 | | | | | |
| 5 L | 1.000 | 7.000 | Rau | WF | Rau | HF | 1.000 | 2.000 | 2-000 | 3.000 | Ran 0.333 1.000 | | Ras | 4 HF | | | | | |
| S L C | | | | | | == | | | 0.333 | 0.200 | 2.000 | 2.000 | 0.000 | 0.000 | | | | | |
| DTAL | 1.000 | 7.000 | | | - | | 1.000 | 2.000 | 1.000 | 2.000 | 0.000 | 0.000 | 0.000 | 0.000 | | | `• | | ٠ |

Table E50. Indian Point hammer test monitoring using 6 degree vertical transducer located at unit 3, intake 36.

| * | | | | dal Pt | | t 104 (| ti de | | Duration Treats | n of Te | pe: | 10 mln | her 3 or | uslu | Test C | 1 me | 3/04/88 0550 | |
|---------------------|----------------|--------------|---------------------|--------------|--------------------------|----------------|----------------|---------------------------------|---------------------|---------|----------------|----------|---------------|--------------|--------|------------|-----------------|------------------------------|
| | | | ST PERIOD | | : 11 ii 1 ii | | | ا بد بدن سان در) | RAMBE (m | oters> | | ***** | | ******* | | to ka na : | | • |
| | 0- | 1 | 1- | | 2 | -3 | 3- | -4 | | 4-5 | ! | 5-6 | 1 | 6-7 | To | ies | | QUARE F-HAT TEST PERIODS |
| race upe | Rau | WF | | WF | Rau | WF | Rau | WF | Ran | WF | Rass | MF | Rau | NF | : Ra | u HF | Rau | uf |
| 5 | 2 | 14 | 2 | 9 | 2 | 5 | ° 1 | 2 | 2 | 3 | 11 | 14 | 0 | 0 | 20 | 47 | 10 | 24 |
| iL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 |
| IC | 0 | 0 | 0 | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | 0 | 1. | 1 | | 1 1 | 1 | 2 |
| 4H | . 0 | 0 | 0 | 0 | D | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | |) 0 | 0 | 0 |
| retel | 2 | 14 | . 2 | 9 | 8 | 5 | 1 | 2 | . 8 | 3 | 11 | 14 | . 1 | 1 | i 21 | 49 | 11 | 26 |
| 10 NI NUT | TES AFTE | R TESI | r PERIOD | | | | | | RANGE CH | rters> | | | | | | | | ٠ |
| race | 0- | | 1- | .2 | 2 | -3 | 3- | -4 | | 4-5 | | 5-6 | | 6-7 | To | tal | CHI-S | QUARE VALUES TEST PERIODS |
| Type | Ray | uf | Ran | UF | Raw | MF | RAH | MF | Ray | MF | Rass | WF | Rau | WF | . R4 | MF | | Rass W |
| .5 | , • | 9 | • | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | . 0 | 0 | • | 0 | LS | 20.000 47.00 |
| SL . | . 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Q | • | 0 | SL | |
| 16 | - O | • | 0 | 0 | 1 | 3 | 0 | 0 | 0 | Ò | 0 | O | D | 9 | 1 | L ,3 | NC | 0.000 1.00 |
| 4H | 00 | 0 | 0 | 0 | 0 | 0 | 0 · | 0 | 0 | 0 | 0 | 0_ | 0 | 0 | | 0 | uu uu | |
| [etal | 0 | ò | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ž 1 | 1 2 | TOTAL | . 18.182 39.70 |
| HI-SQUARI | E 0- | 1 | 1- | -2 | 2 | -> | 3- | -4 | | 4-5 | | 5-6 | | 6-7 | | | | QUARE - 3.841 |
| L S 5L 4C | Rass 1 0 | MF 7 0 | Rass 1 0 0 | MF S O | Rau 1 0 1 | HF 0 | Ra44 1 0 | MF 1 0 | Rase 1 0 0 | WF 2 0 | Rass 6 0 | WF 7 0 0 | Rau O D | WF 0 0 | | • | | - 105> |
| TOTAL | i | ř | ĭ | 9 5 | 2 | 4 | ĭ | ĭ | ĭ | 2 | ě | ř | ĭ | ĭ | * | | | |
| HI —SQUARE MLUES | E | 1 | 1- | 2 | 2 | -3 | 3- | -4 | | 4-5 | | 5-6 | | 6-7 | , | | | |
| | 2.000 14 | -000 | 2.000 1 | .000 | | 5.000 5.000 | 1.000 a | 2.000 | 2.000 | 3.000 | 11.000 | 14.000 | Ram | 1.000 | | | | |
| illi Teral 2 | 2.000 14 | .000 | 2.000 1 | -000 | | D.500 | 1.000 | 2.000 | 2.000 | J.000 | 11.000 | 14.000 | 1.000 | 1.000 | | | | |

APPENDIX F:

Hammer Tests Monitored By

Bottom 6°x12° Horizontal Transducer

Table F1. Indian Point hammer test monitoring using bottom orientated 6m12 degree horizontal transducer located at unit 3, intake 36.

| S HINU Trace Type LS | ITES DUR1 | ING TEST | PERIOD | -10 UF 0 2 | 10 Raid 1 | 0-15 | | 15-20 UF | RANGE (Met | ters> | Fot | tsl | # # # # # # # # # # # # # # # # # # # | |
|-------------------------------|-------------------------|-------------------------|---------------------------------|-------------------------------|--------------------------------|---|--|---|-------------------------------|--|--|-----------------------------------|---------------------------------------|---|
| Type L\$ SL | Raw 0 0 1 | 0 0 | RAH O 1 | UF 0 2 | Яви 1 3 | MF 1 | Rau | WF | | | | | | |
| LS SL | 0 0 1 | 0 | 0 1 16 | 0 | 3 | 1 | | | | | | | | |
| SL | 0 1 0 | 0 | 1 16 | 2 | 3 | | - | 2 | | | 5 | | | , |
| NC | 0 | 4 | 16 | | - | | 2 | 2 | 0 | 0 | . 6 | _ | | ŗ |
| n. | 0 | | | | 20 | 24 | 8 | 7 | 4 | 3 | . 49 | - | | ŗ |
| ни | <u>-</u> | | | 0 | 4 | 5 | 9 | 8 | 2 | 2 | 15 | | | , |
| Total | | 4 | 17 | 32 | 28 | <u></u> | 21 | 19 | | | 75 | | • | , |
| S HINU | JTES AFTE | ER TEST | FERIOD ' | | | | | ı | RANGE (met | iers> | | | | 1 |
| | 0- | -5 | 5- | -10 | 11 | 0-15 | 1 | 15-20 | 20 |)-25 | To | tal | | ľ |
| Trace Tupe | Rau | ИF | Rau | HF | Rau | HF | Rase | HF | Rau | NF | : Rai | н ИF | | , |
| LS | 1 | 4 | 0 | 0 | 3 | | 4 | 4 | 3 | 2 | 11 | 14 | | ļ |
| SL. | o | 0 | 0 | 0 | 1 | 1 | 2 | 2 | 0 | o | 3 | 3 | | ļ |
| HC | 0 | 0 | 5 | 9 | 12 | 14 | 7 | 6 | 1 | 1 | 25 | 30 | | I |
| ни | 0 | o | , 2 , | 4 | o | 0 | 2 | 2 | , o | o ´ | <u> </u> | 6 | | I |
| Fotal | 1 | 4 | 7 | 13 | 16 | 19 | 15 | 14 | 4 | 3 | 43 | 53 | | ļ |
| CHI-SQUA F-HAT | | -5 | | -10 | 10 | 0-15 | | 15-20 | |)-25 | FOR 2 | UARE F-HAT FEST PEPIODS | | I |
| LS SL NC NU TOTAL | Rau 1 0 1 0 | HF 2 0 2 | Rau 0 1 11 11 12 | HF 0 1 20 2 23 | Rau 2 2 16 2 22 | UF 3 19 27 | Rau 3 2 9 6 | UF 3 2 7 5 17 | Paul 3 0 3 1 6 | UF 2 0 2 | Rau E S 37 : 10 | HF 10 6 49 11 | | |
| CHI-SQUA VALUES | | -s | | -10 | | 0-15 | | 15-20 | 20 |)-25 | | UARE VALUES TEST PERIODS | | |
| LS SL HC HH FOTAL | 1.000 | 4.000 4.000 4.000 | | 1.308 4.000 3.022 | 1.000 2.000 4.000 | HF 1.800 1.800 2.632 5.000 4.245 | Rau 0.667 0.000 0.067 4.455 1.400 | NF 0.667 0.000 0.077 3.600 0.758 | 1.900 1 2.000 2 | NF 0.000 1.000 2.000 1.600 | Rau : 2.250 : 1.000 : 7.784 : 6.368 : 8.678 | 4.263 2.273 14.735 3.657 | | |

Table F2. Indian Point hammer test monitoring using bottom orientated 6H12 degree horizontal transducer located at unit 3, intake 36.

| 5 HIM | | | ST PERIO | | | | | • | RANGE (ne | | |) # # # # # # # # # # # # # # # # # # # | | •, |
|------------------|-------------|----------------|------------------|---------|----------|---------------------|-----------|-------------|---------------|----------|--------------------|---|----------|----|
| • | 1 |)~S | • | 5-10 | | 10-15 | , | 5-20 · | | 0-25 | Tota | | | |
| race upe | Rau | MF | Rau | UF | Rau | | Rau | MF | Rau | HF | : Rau | HF | | |
| 5 5 | 0 | 0 | 0 | 0 | 1 | 1 | 14 | 13 | 6 | <u> </u> | 21 | 19 | | |
| _ / | 0 | 0 | 0 | 0 | 6 | 7 | 1 | 1 | 0 | ٥ | : 7 | 8 | | |
| : | 2 | 7 | 19 | 36 | 14 | 17 | 3 | 3 | 0 | 0 | 38 | 63 | | |
| 4 | 1 | 4 | 4 | • | 4 | 5 | 3 | 3 | 0 | 0 | 12 | 20 | | |
| otal | 3 | 11 | 23 | 44 | 25 | 30 | 21 | 20 | 6 | Б | 78 | 110 | | |
| . HINU | ITES AFT | TER TES | T PERIOD | | | • | | | | | | | . • | |
| | | | | | | | ` . | | RRNGE CHE | ters> | | • | | |
| -ace | |)~5 | | -10 | | 10-15 | 1 | 5-20 | 2 | 0-25 | Tota | | ~ | |
| /P+ | Rau | | Rau | HF | Rau | uf | Rau | uf | Rau | uf | _:Rau _: | up | | |
| 5 | 0 | 0 | 0 | 0 | 4 | . 🗸 🕏 | . | 6 | . 1 | 1 | 12 | 12 | | |
| - | 0 | . 0 | 11 | 21 | 10 | 12 | 4 | 4 | · 1 | | : 26 : | . 38 | | |
| - | 3 | 11 | 7 | 13 | 7 | 8 | 3 | 3 | • | 0 | 20 | 35 | | |
| H | <u> </u> | | 20 20 | | 1 | <u> </u> | | | 2 | <u>2</u> | <u> </u> | 11 | | |
| tal | • | 11 | 20 | 38 | 22 | 26 | . 18 | 71 | 4 | 4 | : 67 | 96 | | |
| II ~SQUF -HAT | |)- 5 | | -10 | | 10-15 | 1 | 5-20 | 20 | 0-25 | | RE F-HAT ST PERIODS | | |
| = | Raw | HF 0 | Ran | HF | Rau 3 | HF 3 | Rau 11 | ИF 10 | Rass | HF 3 | 1 Reu 1 17 | HF 16 | | |
| 5 = | ŏ | ā | Ē | . 11 | 8 | 1Õ | 3 | 3 | 1 | 1 | : 17 | 23 | | |
| 3 | 1 | 9 | 13 | 25 6 | 11 | 13 | 3 | 3 | 0 | 0 | : 29 : 11 | 49 16 | | - |
| TAL | 3 | 11 | 22 | 41 | 24 | 28 | 20 | 19 | Š | 5 | 1 73 | 103 | | |
| II —SQUA | |)~S | | i-10 | | 10-15 | . 1 | 5~20 | 21 | 0-25 | CHI -SQUE | RE VALUES | | |
| | | UF | | | | | | | | UF | :FOR 2 TE | EST PERIODS | . | |
| S | RAH | | Rau | HF | 1.800 | и г 2.667 | 2.333 | UF 2.579 | Д₩ Э.571 : | 2.667 | : Rau : 2.455 | UF 1.581 | | |
| | | | 11.000 | | 1.000 | 1.316 | 1.800 | 1.800 | 1.000 | 1.000 | :10-939 | 19.565 | | |
| | 1.000 | 0.889 4.000 | 5.538 (0.667 | 1.333 | 2.333 | 3.240 2.667 | 0.000 | 0.000 | 2.000 | 2.000 | : 5.586 : 0.429 | 8.000 2.613 | | |

Table F3. Indian Point hammer test monitoring using bottom orientated 6m12 degree horizontal transducer located at unit 3, intake 36.

| 0-5 4 WF 4 0 7 | 8 1 6 | 10 HF 15 | Rass 7 | 10-15 UF | Rau | 15-20 | | 20-25 | Total | <u> </u> | |
|----------------------------|--------------|---|---|---|--|------------|--------------|---|----------------------|--|--|
| 4 0 7 0 | 8 | 15 | | | Rau | | | | | | |
| 0 7 0 | 1 | | 7 | | | HF | Rau | HF | E Rase | HF | |
| 7 | 1 6 | 2 | | 8 | 2 | 2 | 1 | 1 | 19 | 30 | |
| 0 | 6 | | 0 | 0 | 1 | 1 | 1 | 1 | : 3 | 4, | |
| | | 11 | 5 | 6 | 2 | 2 | 0 | 0 | 15 | 26 | |
| 44 | 3 | 6 | 3 | 4 | 1 | 1 | 0 | 0 | 7 | 11 | |
| 7.1 | 18 | 34 | 15 | 18 | 6 | 6 | 2 | 2 | 44 | 71 | - |
| TER TEST | PERIOD | | | | • | | | | | - | • . |
| | _ | | | | | | | | | _ | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| _ | - | | _ | _ | _ | | _ | | : | | |
| | _ | _ | _ | _ | _ | _ | | | 1 | | |
| - | - | | - | _ | _ | _ | - | • | | | |
| <u>-</u> | | <u>-</u> | | | | <u>-</u> - | | | 41 | | |
| - | | | | _, | <u> </u> | _ | _ | | - | | |
| 0-5 | 5 | | 1 | 10-15 | | 15-20 | | 20-25 | CHI-SQUA FOR 2 TE | RE F-HAT ST PERIODS | |
| | Rau | MF | Rau | ME | Rau | HF | Rau | WF | Rau | NF 25 | • |
| 2 | i | 2 | Ō | Ò | 1 | 1 | 1 | 1 | : 3 | 6 | |
| Ō | • | 6 | 3 | 4 | Ž | ž | ø | Ō | : 8 | 12 | |
| | • | | | 20 | • | • | - | | | | |
| 0-5 | 5 | -10 | <u>, , , , , , , , , , , , , , , , , , , </u> | 10-15 | | 15-20 | | 20-25 | | | |
| | Rax 0_067 | UF 0.143 | Rau 0.333 | UF 0-286 | | | Rau a_con | ¥F 0-000 | : Rau | NF | |
| 4.000 | 0.000 | 0.000 | | | 1.000 | 1.000 | 0.000 | 0.000 | : 0.000 | 0.818 | |
| | 0-S 4 | 0 7 4 1 4 7 0 3 8 18 0-5 5 4 4F Rau 2 8 2 1 6 7 0 3 10 18 0-5 5 4 4F Rau 4.000 0.067 4.000 0.0067 | 0-S 5-10 4 HF Raw HF 0 7 13 4 1 2 4 7 13 0 3 6 8 18 34 0-S 5-10 4 HF Raw MF 2 8 14 2 1 2 6 7 12 6 7 12 0 3 6 10 18 34 0-S 5-10 4 HF Raw MF 2 1 2 6 7 12 7 12 7 12 8 14 8 14 9 14 9 14 9 14 9 15 9 16 10 18 34 | 0-S 5-10 1 4 HF Raw HF Raw 0 7 13 S 4 1 2 0 4 7 13 6 0 3 6 3 8 18 34 14 0-S 5-10 1 4 HF Raw HF Raw 2 1 2 0 6 7 12 6 0 3 6 3 10 18 34 15 0-S 5-10 1 4 HF Raw HF Raw 2 1 2 0 6 7 12 6 0 3 6 3 10 18 34 15 | 0-S 5-10 10-15 4 HF Raw HF Raw HF 0 7 13 S 6 4 1 2 0 0 4 7 13 6 7 0 3 6 3 4 8 18 34 14 17 0-S 5-10 10-15 4 HF Raw HF Raw HF 2 8 14 6 7 2 1 2 0 0 6 7 12 6 7 0 3 6 3 4 10 18 34 15 18 0-5 5-10 10-15 4 HF Raw HF Raw HF 2 1 2 6 7 0 3 6 3 4 10 18 34 15 18 | 0-S | 0-S | D-S 5-10 10-15 15-20 2 4 HF Raw HF | D-S | D-S 5-10 10-15 15-20 20-25 Total | ## Raw MF RAW MF |

Table F4. Indian Point hammer test monitoring using bottom orientated 6m12 degree horizontal transducer located at unit 3, intake 36.

| | | · · · · · · · · · · · · · · · · · · · | | ridal Pi | 1 | ou tid | | | Treatmen | nt Tup | t: 5 min, -: 10 sec | on. 20 sec | Test Date c off Test Time | : |
|-----------------|----------|---------------------------------------|----------|----------|----------------|----------------|----------------|-------|-----------|--------------|------------------------|-------------------------|------------------------------|---|
| | | | ST PERIO | | | | | | RANGE (no | | | | *,- | |
| | | 0-5 | ļ | 5-10 | 1 | 0-15 | 1 | 5-20 | 2 | 0~25 | Tota | 1 | | |
| Trace Type | Rass | WF | Rau | HF | Rau | UF | Rau | HF | Rau | WF | Reu | UF | • | |
| LS | 0 | 0 | 3 | 6 | 5 | 6 | 2 | 2 | 1 | 1 | 11 | 15 | | |
| SL, | 0 | 0 | . 0 | . 0 | 5 | 6 | 0 | 0 | 0 | Ò | : 5 | 6 | | |
| MC | 3 | 11 | 8 | 15 | 6 | 7 | 1 | 1 | 0 | o | 18 | 34 | | |
| MIN | 0 | 0 | 2 | . 4 | • | . 0 | 0 | 0 | 0 | 0 | 2 | 4 | | |
| Total | 3 | . 11 | 13 | 25 | 16 | 19 | 3 | 3 | 1 | 1 | : 36 | 69 | | |
| S HI | MUTES AF | TER TES | T PERIOD | | | | , | 1 | RANGE (no | ters) | | | | |
| _ | | 0-5 | | 5-10 | 1 | 10-15 | 1 | 5-20 | 2 | 0~25 | . Tota | 1 | | |
| Trace | Rau | HF | Rau | MF | Rau | WF | Rau | HF | Rau | HF | t Rau | WF | | |
| LS | 0 | 0 | 1 | 2 | 5 | 6 | 1 | 1 | 0 | 0 | 7 | 9 | | |
| SL. | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0, | 0 | .1 | 2 | • | |
| NC | 3 | 11 | 6 | 11 | 3 | 4 | 0 | 0 | 1 | 1 | 13 | , 27 | • | |
| 1414 | 0 | 0 | 2 | 4 | > | 4 | 1 | 1 | 0 | 0 | 66 | 99_ | | |
| Total | 3 | 11 | 10 | 19 | 11 | 14 | 2 | 2 | 1 | 1 | 27 | 47 | | |
| CHI-SQ F-HAT | UARE | 0-5 | ! | 5-10 | 1 | 10-15 | : | 5-20 | 2 | 0~25 | | RE F-HAT ST PERIODS | | |
| | Rasi | | Rau | иF | Rau | HF | Rau | HF | Res | HF | Rey | HF | | |
| LS SL | Õ | 0 | 2 1 | 1 | 5 | , 5 | Š | õ | Õ | ģ | : 3 | 12 _4 | • | |
| NC NC | 3 | 11 0 | 7 2 | 13 | . 5 | 6 2 | 1 | i | 1 0 | 1 0 | : 16 : 4 | 3 <u>1</u> | | |
| TOTAL | • > | 11 | 12 | 22 | 14 | 17 | 3 | 3 | 1 | 1 | : 32 | 53 | • | |
| VALUES | | 0-5 | | 5-10 | 1 | 10-15 | 1 | 5-20 | 2 | 0~25 | | RE VALUES ST PERIODS | • | |
| | Ras | | Rau | MF | Rau | UF | Rau | MF | RaH | HF | : Rau | WF | | |
| LS SL | | | 1.000 | 2.000 | 5.000 | 6.000 | | 0.333 | ERR | 1.000 ERR | | 1.500 2.000 | • | |
| NC | 0.000 | 0.000 | 0.286 | 0.615 | 1.000 3.000 | 0.818 4.000 | 1.000 1.000 | 1.000 | ERR | 1.000 ERR | : 2,000 | 0.803 1.923 | | |
| TOTAL | 0.000 | v.000 | 0.391 | 0.916 | 0.926 | 0.750 | 0.200 | 0.200 | 0.000 | 0.000 | 1.286 | 1.358 | - | |

3/3 040

Table FS. Indian Point hammer test monitoring using bottom orientated 6412 degree horizontal transducer located at unit 3, intake 36.

| | | | | | | Phase: | 1 | hr before ou tide | | | Tre | ATHE | nt Tupe: | 5 min, 10 mec | on, 2 | O sec off | Test Dat Test Tim |
|---------------------|----------|--------------|---------------|---------------|----------------------------------|----------------------|-------------|---|-----------------|---|--------|------------------------|--------------------|---|---|-----------------|----------------------|
| | | | | PERIOD | | ***** | | 2 14 4 4 4 4 14 4 14 4 14 4 14 14 14 14 1 | | | RANGE | | | | # - 9 - 4 - 4 - 4 | | |
| | . 0 | - 5 | | 5 | -10 | | 1 | 0-15 | | 15-20 | | 2 | 0-25 | Tota | ı | | |
| Trace Tupe | Ran | W | • | Rau | HF | Ŕ | | NF · | Rau | ИF | | Rau | HF : | Ran | MF | - | |
| LS | 0 | | 0 | 1 | | : | 4 | <u> </u> | 2 | 2 | | 0 | 0 | 7 | 9 | ***** | 11 10 |
| SL. | ٥ | | 0 | 0 | 0 | ı | 1 | 1 | 0 | 0 | | ٥ | 0 : | 1, | 1 | | |
| NC . | 2 | | 7 | 1 | 2 | : | 4 | 5 | 0 | ٠ ۵ | ı | o | 0 | 7 | 14 | | • |
| MM | 0 | | 0 | 1 | 2 | : | 1 | 1 | 0 | 0 | ı | 0 | 0 | 2 |) | | • |
| Total | 2 | | 7 | 3 | 6 | 1 | 0 | 12 | 2 | 2 | | 0 | 0 : | 17 | 27 | | |
| S HIMUI | res Aft | ER I | FEST | PERIOD | | | | | | • | RANGE | (He | ters> | | | | |
| _ | |)-5 | | 5 | -10 | | 1 | 0-15 | | 15~20 | | 2 | 0-25 | Tota | 1 | | |
| Trace Type | Rau | NF | • | Reu | uf | Ä | 24 | NF | Rass | ИF | • | Ran | uf : | Rau | HF | | |
| LS | ō | | 0 | 2 | | - | 1 | 1 | 1 | 1 | | 1 | 1 | 5 | 7 | | |
| SL | 0 | | 0 | 0 | 0 |) | 0 | a | 0 | a | ı | 0 | 0 | Đ | 0 | | • |
| NC | 1 | | 4 | 3 | 6 | • | 2 | 2 | 0 | đ | ŀ | 0 | 0 | 6 | 12 | | |
| HH | 1 | | 4 | 1 | 2 | : | 0 | Ö | 0 | 0 | 1 | 0 | 0 | 2 | 6 | | |
| Total | 2 | | 8 | 6 | 12 | | 3 | 3 | 1 | 1 | • | 1 | 1 : | 13 | 25 | • | |
| CHI –SQUAI F—HAT | |)- 5 | . • | 5 | -10 | | 1 | 0-15 | | 15~20 | | 2 | 0-25 | CHI-SQUA FOR 2 TE | | | |
| LS SL | Rau O | 1 | HF O O | Rau 2 0 | HF 3 | , | 3 1 | UF 3 | Rau 2 0 | 11F | ! | Rau | 1 2 0 2 | Rau 6 1 | MF 8 | | |
| NC HH TOTAL | 1 2 | | 2 | 2 1 5 | 29 | | 5 1 7 | 1 6 | 0 | 0 | • | 0 0 1 | 0 : | 7 2 15 | 13 5 26 | | |
| CHI –SQUA VALUES | |)-S | _ | 5 | -10 | _ | 1 | 0-15 | | 15-20 | | 2 | 0-25 | CHI-SQUA | | | - |
| HH : | Rau | 0.00 4.00 | - 18 00 | 1.000 | 0.667 2.000 0.000 2.000 | 1.80 1.00 0.66 | 07 | 1.000 1.286 1.000 | Rau | 0.553 0.533 | | Raid 100 100 | 1.000 1.000 | Rau 0.333 1.000 0.077 0.000 | 0.250 1.000 0.154 1.000 0.077 | · - | |
| | | | | | | CHI-S | QUA | RE - 3.641 | į, | <d.f.< td=""><td>- 1, 4</td><td>1 pha</td><td>05></td><td></td><td></td><td></td><td></td></d.f.<> | - 1, 4 | 1 pha | 05> | | | | |

Table F6. Indian Point hammer test monitoring using bottom orientated 6H12 degree horizontal transducer located at unit 3, intake 36.

| 5 HIN | UTES DU | RING TE | ST PERIO | Ď | | | | | RANGE CH | ters) | | | |
|-----------------------------|-----------------------|----------------------|----------------|----------------|--------------|-------------|-------|-------|----------|-------------|--------------------|-------------------------------------|---|
| | • | D- S | . ! | 5-10 | | 10-15 | 1 | 15-20 | 2 | 25 | Tot | al | • |
| upe upe | Rau | MF | Rau | ИF | Rau | WF | Rau | HF | Rau | NF | : Reu | uf | |
| 5 | 1 | 4 | 1 | 2 | . 2 | 2 | 0 | q | 0 | 0 | : 4 | 9 | |
| _ | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | : 1 | 4 | |
| C | 2 | 7 | 8 | 15 | . 1 | 1 | . 0 | 0 | 0 | 0 | 11 | 23 | |
| H | 0 | 0 | 2 | 4 | Q . | 0 | 0 | 0 | 0 | 0 | 2 | 4 | |
| otal | 4 | 15 | 11 | 21 | 3 | 3 | 0 | 0 | 0 | 0 | 18 | 39 | |
| S MIN | UTES AFT | TER TEST | r PERIOD | | | | | | RANGE (m | | | | • |
| | |)-S | 1 | 5-10 | | 10-15 | • | 15-20 | | to-25 | Tot | | |
| race ype | Res | uf. | Rau | | Rau | | Rau | HF | Rau | | 1 Ran | | |
| s | 0 | 0 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | | 5 | |
| L, | 0 | 0 | 0 | 0 | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| C | 1 | . 4 | | 2 | . 0 | 0 | O | 0 | 0 | 0 | 2 | 6 | |
| H . | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | |
| otal | 1 | 4 | 3 | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 13 | |
| HI —SQU -HA T | |) - 5 | -1 | 5-1 0 | | 10~15 | 1 | 15-20 | 4 | to-25 | CHI-SQU FOR 2 T | ARE F-HAT EST PERIODS | |
| | Rau | HF | Rau | HF 2 | Rau | HF 2 | Rau | MF | Rau | HF | : Reu | MF 7 | |
| S L | 1 | 2 2 | . 0 | ō | Š | ō | 0 | Ó | 0 | 0 | 1 | Ž | |
| C W | Š | 6 | 5 | 9 | 1 | å | Ó | 9 | . 0 | ô | : 7 | 15 25 | |
| OTAL | . 3 | 10 | 7 | 14 | . 2 | 2 | 1 | 1 | 1 | 1 | : 13 | 26 | |
| HI —SQU RLUES | | 0-5 | • | 5-10 | • | 10-15 | : | 15-20 | | 20~25 | CHI -SOU | ARE VALUES | |
| s | Rau 1.000 1.000 | HF 4.000 4.000 | 0.000 | 0.000 | Rau 0,233 | UF 0.333 | 1.000 | 1.000 | 1.000 | HF 1.600 | : Ray : 0.000 | EST PERIODS UF 0-692 4-000 | |
| Ē C | 0.333 | 0.818 | 5.444 | 9.941 | 1.000 | 1.000 | | | | | : 6,231 | 9.966 | |
| OTAL | 1.800 | 6.368 | 0.333 4.571 | 0.667 8.333 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | : 0.333 | 0.667 13.000 | |

Table F7. Indian Point hammer test monitoring using bottom orientated 6m12 degree horizontal transducer located at unit 3, intake 36.

| = 114.5 | 0169 90 | KING IE: | ST PERIO | | | | | 1 | RANGE CHE | ters> | | | |
|---------------|----------|----------|----------|-------|-------|-------------|--------------|-------------|--|----------|----------------------|-------------------------|---|
| race | | 0-5 | ! | 5-10 | | 10-15 | | 15-20 | 2 | 0-25 | Total | 1 | |
| toe Lece | Rau | WF | Rau | HF | Rau | HF | Rau | WF | Rau | WF | : Rau | HF | |
| E | 0 | 0 | 0 | 0 | 1 | 1 | a | 0 | 0 | ٥ | 1 | 1 | |
| - | . 0 | 0 | 0 | 0 | 0 | 0 | , 0 | ٥ | 0 | 0 | . • | Q | |
| : | Š | 11 | 2 | 4 | 0 | 0 | 1 | 1 | 0 | 0 | 6 | 16 | |
| . | 1 | 4 | 5 | 4 | ٥ | 0 | Ô | ٥ | 1 | 1 | 44 | 9 | |
| tal | .4 | 15 | 4 | 8 | 1 | 1 | 1 | 1 | 1 | 1 | 11 | 26 | |
| MIN | NITES AF | TER TES | r PERIQO | | | | | 1 | RANGE <me< td=""><td>tors></td><td></td><td></td><td>•</td></me<> | tors> | | | • |
| | | 0-5 | , | 5-10 | | 10-15 | 1 | 15-20 | 2 | 0-25 | Tota: | 1 | |
| race LD+ | Rass | MF | Rau | NF | Rau | WF | Rau | uf | Rau | uf . | 3 Rass | UF | |
| ———- i | 0 | 0 | 2 | 4 | 1 | 1 | 1 | 1 | 0 | <u>_</u> | | 6 . | |
| L | 0 | 0 | 0 | 0 | 0 | 0 | o o | 0 | 0 | 0 | | 0 | |
| 2 | 4 | 15 | . 4 | 8 | 1 | 1 | ò | ٥ | 0 | 0 | 9 | 24 | |
| | . 0 | o · | ٥ | o | 0 | 0 | ٥ | Q | 0 | 0 | . 0 | 0 | |
| rtal | 4 | 15 | 6 | 12 | 2 | 2 | 1 | 1 | 0 | 0 | 1) | 30 | |
| T-SQU | | 0-5 | | 5-10 | | 10-15 | | LS-20 | 2 | 0-25 | CHI-SQUA FOR 2 TE | RE F-HAT ST PERIODS | |
| i | Rau | | Rau | | Rau | MF | Rau | UF 1 | Rau | HF | Rau | HF | |
| | ŏ | Ŏ | Õ | Š | Š | 0 | 0 | ō | Ŏ | Õ | : O | 0 | |
| | 1 | 13 | . 3 | 6 | 0 | 0 | 0 | 0 | 0 | i | 8 2 | 20 5 | |
| etal. | 4 | 15 | 5 | 10 | 2 | 2 | . 1 | 1 | 1 | 1 | : 12 | 28 | • |
| I-SQL LUES | | 0-5 | | 5-10 | | 10-15 | - ; | 15-20 | 2 | 0-25 | | RE VALUES ST PERIODS | |
| E | Ran | WF | 2.000 | 4.040 | 0.000 | NF 0.000 | Rau 1.000 | UF 1.000 | Rau | WF | : Rau : 1.600 | HF 3.571 | |
| | 0.143 | 0.615 | 0.667 | 1.333 | 1.000 | 1.000 | 1.000 | 1.000 | | ==: | : ERR | ERR 1.600 | |
| TAL. | 1.000 | 4.000 | 2.000 | 4.000 | 0.333 | 0.333 | 0.000 | 0.000 | | 1.000 | : 4.000 | 9.000 9.000 0.286 | |

Table F8. Indian Point hammer test monitoring using bottom orientated 6m12 degree horizontal transducer located at unit 3, intake 36.

| | | | | idal Pi | 3 | to win tid | • | | Duration Treatme | mt Tupe: | 10 sec | hers 1,345 on, 20 sec | off | Test Dat Test Tim |
|---------------------|----------|----------------|----------|-------------|----------------|-------------|--------------|-------------|---------------------|----------|----------------|--------------------------|-----|----------------------|
| | | | T PERIOD | | | | | | RANGE Cod | | | • 4 <u>.</u> | | |
| <i>,</i> | . 0- | -5 | 5 | -10 | : | 10-15 | 1 | L5-20 | 2 | 20-25 | Tota | 1 | | |
| Trace . Type | Rau | WF | Rau | HF | Rau | WF | Rau | HF | RaH | NF : | Rau | uf | | |
| LS | 0 | 0 | 0 | 0 | 4 | 5 | 1 | 1 | 1 | 1 | 6 | 7 | | |
| SL | 0 | 0 | . 0 - | 0 | 0 | a | ,o | .0 | 0 | 0 : | 0 | ø | | |
| NC · | 2 | 7 | 3 | 6 | 1 | 1 | Ö | 0 | 0 | 0 | • | 14 . | | |
| HH | 1 | 4 | 2 | • | o | 0 | O | 0 | 1 | | . 4 | 9 . | | |
| Total | 3 | 11 | 5 | 10 | 5 | 6 | 1 | 1 | . 2 | 3 ; | 16 | 30 | | |
| S HINUT | res afte | R TEST | PERIOD | | • | , | | | RANGE CH | eters) | | | | |
| • . | 0- | -5 | . 2 | -10 | ; | 10-15 | 1 | LS-20 | . 8 | 20-25 | Tota | | | |
| Trace | Rau | WF | Rau | UF | Rau | uf | Rau | ЦF | Rau | HF : | Rau | UF | | ٠. ر |
| LS | 0 | 0 | 1 | 2 | 1 | 1 | 0 | 0 | 1 | 1 | > | 4 | | |
| SL. | 0 | ø | 0 | 0 | 0 | 0 | . 0 | • | 0 | 0 | 0 | G | * | • |
| MC | . 3 | 11 | 1 | 2 | . 0 | Đ | 0 | . 0 | 0 | 0 | 4 | 13 | | * |
| HH | 0 | D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | <u> </u> | | |
| Total | 3 | 11 | 2 | | 1 | 1 | 0 | 0 | 1 | 1 : | 7. | 17 | | |
| CHI-SQUAI F-HAT | | -Б | · . | -10 | · . | 10-15 | | 15-20 | | | | RE F-HAT | | |
| | Rau | LIF O | ReH | ИF | Rau | HF | Rau | ur 1 | Rass | MF : | Ray | UF 6 | | |
| LS SL NC | . 0 | ŏ | ò | 0 | 3 | - 3 | ō | â | ò | ô | 5 0 | õ | | |
| NC: | ` 3 | 9 | . 2 | 4 | 1 | 1 | Ŏ | 0 | ó | 9 : | Ś | 14 | | ** |
| TOTAL | . 3 | 11 | 4 | 2 7 | 9 | . 4 | ĭ | ĭ | 2 | ż i | 12 | .5 24 | | |
| CHI-SQUAL VALUES | | -5 | 5 | -10 | | 10-15 | · | LS-20 | | to-25 | CHI-SQUA | RE VALUES ST PERIODS | | |
| 1.5 | Rau | MF | 1.000 | UF 2.000 | Rau- 1.800≏ | 4F 2.667 | 24H 1-000 | MF 1.000 | 0.000 | UF : | Rau | NF 0.818 | - | |
| LS SL | | | | | | | | | | : | ERR | ERR | • | |
| | | 3.889 4.000 | | 4.000 | 1.000 | 1.000 | | | 1,000 | 1.000 | 0.400 4.000 | 0.037 9.000 | • | |
| | | 0.000 | | 2.571 | 2.667 | 3.571 | 1.000 | 1.000 | | 0.333 : | | 3.596 | | |

Table F9. Indian Point hammer test monitoring using bottom orientated 6H12 degree horizontal transducer located at unit 3, intake 36.

| 5 MIN | IUTES DI | KING T | EST PERI | OD O | | | | | RANGE CHE | ters> | | | ~ | | | | |
|------------------|----------|--------|----------|----------------|----------|-----------|-------|----------|-----------|---------|--------------------|----------------|---------------|---|---|---|---|
| · | | 0-5 | | S-10 | | 10-15 | | 15-20 | 2 | 0-25 | Tot | :al | | | | • | |
| 'race | Rai | HF. | Rai | 4 UF | | ИF | Rau | HF | Rau | HF | Ran | HF | | | | | |
| .s | 1 | | 1 | 2 | 1 | 1 | 0 | <u>-</u> | 0 | 0 | -: | 7 | | | • | | |
| L | 0 | 0 | • | 0 | 0 | 0 | 0 | 0 | 0 | 0 | : 0 | ٥ | | | | | |
| c | . 2 | 7 | 3 | 6 | 0 | 0 | 1 | 1 | . 0 | 0 | 6 | 14 | • | | | | |
| М | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | . 0 | 0 | | 2 | | | • | | |
| otal | | 11 | 5 | 10 | 1 | 1 | 1 | 1 | 0 | 0 | 10 | 23 | • | | | | |
| S HIN | IUTES A | TER TE | ST PERIO |) | ÷ | | | | 50405 | | | | | | • | | |
| | | 0-5 | | E 10 | | 46-45 | | 15-00 | RANGE (ne | | | | | | | | |
| FACE | | | | S-10 | | 10-15 | | 15-20 | | 0-25 | | | | | | | |
| up• | Rai | | Rai | | Rан | | Rau | | | HF | -i <i>-</i> | . HF | | | | | • |
| .\$ -, | 0 | 0 | - | 2 | • | 0 | 0 | 0 | 0 | 0 | 1 | 2 | | ٠ | | | |
| iL *^ | | _ | - | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | | | | | |
| IC Hu | | 0 | | 8 | 2 | 2 | 0 | 0 | . 0 | 0 | 7 | . 14 | | | | | |
| otal | | 4 | | 16 | | 2 | | | | 0- | <u>2</u> | 22 | _ | | | | |
| | - | _ | • | | - | _ | • | • | _ | . • | • | | • | | | | |
| HI –SQL F—HAT | irre | 0~5 | | 5-10 | | 10~15 | | 15-20 | 2 | 0-25 | CHI-SQU FOR 2 I | ARE F-I | HAT R1 ODS | | | | |
| .5 | Rai | ı KF | Re | 4 HF | Ran 1 | HF | Rau | UF O | Rau | HF O | : Rau | MF 5 | | | | | |
| iL . | 0 | ٥ | 1 | 1 | Ü | ្ | ŏ | Õ | Ō | Ö | 1 | 1 | | | | | |
| ic im | 2 | 6 | | 7 | 1 | ò | ò | 1 0 | 0 0 | 0 | . 2 | . 14 | | | | | |
| OTAL | 2 | 8 | Ť | 13 | 2 | 2 | 1 | i | Ō | Ō | 11 | 23 | | | | | |
| HI –SQU ALUES | IARE | 0-5 | ÷ | 5-10 | | 10-15 | | 15-20 | 2 | 0-25 | CHI -SQL | IARE VAI | LUES | | | | |
| | Rai | | Ras | | Rau | uF | Rau | | 9 | UF | FOR 2 T | | | | | | |
| S . | 1.000 | 4.000 | 0.000 | 0.000 | 1.000 | 1.000 | | | | | : 1.000 | 2.779 | | | | | |
| L | 0.333 | 0.818 | 1.000 | 2.000 0.286 | 2.000 | 2.000 | 1-000 | 1.000 | | | : 1.000 | 2.000 0.000 | | | | | |
| iŭ. | U. 223 | 0.010 | 0.333 | 0.667 | 2.000 | 2.000 | 1.000 | 1.000 | | | 6.333 | 0.667 | | | | | |

Table F10. Indian Point hammer test monitoring using bottom orientated 6x12 degree horizontal transducer located at unit 3, intake 36.

| 5 HIMU | | | | | | | | • | RANGE (He | C41 -> | | | | |
|--|--|---|---|--|--|---|--|--|--|--|--|--|-------------|--------------|
| race | 0- | -5 | 5 | -10 | 1 | 0-15 | 1 | 5-20 | 2 | 0-25 | Tot | al . | | |
| up e | Rası | HF | Rass | HF | Rau | HF | Rau | ИF | Rau | HF | Rass | μF | | |
| .5 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 5 | 4 | 8 | 7 | | |
| iL. | 1 | 4 | 3 | 6 | 2 | 2 | 0 | 0 | 1 | 1 | 7 | 13 | | |
| IC . | 1 | · • | 1 | 2 | 1 | 1 | 1 | 1 | . 0 | 0 | • 4 | 9 | | |
| IM | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 5. | 2 | 2 | 4 | 4 | | |
| otal | 2 | 8 | 4 | 8 | 4 | 4 | 5 | 5 | 8, | 7 | 23 | 32 | | |
| S HIMU | ITES DURI | ING TES | T PERIOD | | ` | | | _ | | | | | | |
| | | - | | - 10 | | - 45 | | | RANGE CHA | ters) 0-25 | | - * | | |
| rece | Rau | -5 | | -10 | Rass | 10-15 | Rau | 5-20 UF | Ran | UF UF | Tot | | | |
| 'upe .5 | | . . | Reu 1 | | | | Kan | | | | -: | 14 | | |
| .= iL | 0 | 0 | 7 | 13 | ں ج | 7 | • | r 5 | o | 2 | 19 | 25 | | |
| ic | • | 4 | | 15 | - | 5 | 5 | 5 | 2 | 2 | : | 25 31 | | |
| | • | _ | • | 73 | - | • | | - | Æ | | : 20 | 31 | | |
| | ^ | | • | • | _ | | - | • | | • | : . | • | | |
| otal | TES AFTI | 0 4 ER TESI | 1 17 PERIOD | <u>2</u> 32 | <u>4</u> 14 | 17 | 21 | 19 | 9 | 7 | 62 | 79 | | • |
| otal | 1 ITES AFTI | 4 ER TEST | 17 PERIOD | 32 | | 17 | 21 | 19 | PANSE CHE | ters> | : 62 | 79 | | • |
| otal B HIHU Trace | I UTES AFTI | 4 ER YEST | 17 PERIOD 5 | 32 | | 17 | 21 | 19 5-20 | 9 RANGE (110 | 7 | Fot | 79 61 | | • |
| otal B MIHU Tace Upe | 1 UTES AFTI 0- Rau | 4 ER YEST | 17 PERIOD S Rau | 32 -10 HF | Rau | 17 10-15 14F | 21 | 19 15-20 NF | RANGE CHO | 7 (0-25 MF | Fot | ol UF | | - |
| otal 5 MIHU Frace Tupe | O Reu | 4 ER YEST | 17 PERIOD S Rau | 32 -10 UF 2 | Rau | 17 10-15 14F | 21 Rau | 19 15-20 NF | 9 RANGE CHO 2 Rau 4 | 7 (0-25 MF | Tot | 01 UF | | |
| otal B MINU Frace Type S | DITES AFTI | 4 ER YEST -5 14F 0 | PERIOD S Rau 1 | 32 -10 WF 2 8 | Rau O O | 17 10-15 14F 0 | 21 Rau 11 | 19 15-20 UF 10 | RANGE CHO | 7 (0-25 MF | Tot: Ren | 0F 15 13 | | |
| otal B MINU Trace upe .5 SL | TO RAW 0 | 4 ER YEST -5 UF 0 0 | 17 PERIOD S Ram 1 4 5 | 32 -10 WF 2 8 | Rau 0 3 | 17 10-15 14F 0 4 | 21 Rau 11 ,1 | 19 15-20 UF 10 | 9 RANGE < | 7 20-25 MF 3 | Tot: Res | 15 13 | | - |
| Frace Fupe S S S S S S S S S S S S S S S S S S S | O Rau | 4 ER YEST -5 -6 0 0 | 17 PERIOD 5 Rau 1 4 5 | 32 -10 WF 2 8 9 | Rau 0 3 4 5 | 17 LO-15 MF O 4 5 | 21 Rau 11 ,1 ,2 | 19 15-20 UF 10 1 | 9 RAMSE < 100 2 Ram 4 0 1 | 7 0-25 MF 3 0 | Tot Resi | 15 13 17 | | - |
| Fotal Frace Type S S S S S N Total | ORANIO O O O O | 4 ER YEST -5 UF 0 0 | 17 PERIOD S Ram 1 4 5 | 32 -10 WF 2 8 | Rau 0 3 | 17 10-15 14F 0 4 | 21 Rau 11 ,1 ,2 0 | 19 15-20 16 10 1 2 0 | 9 RANGE < | 7 20-25 MF 3 | Tot Res | 15 13 17 9 | | - |
| Frace Tupe S L C H Total CHI-SQUA | TES AFTI | 4 ER YEST S MF O O O | 17 PERIOD S Ram 1 4 5 1 11 | 32 -10 MF 2 8 9 2 | Рен О З 4 5 | 17 10-15 14F 0 4 5 - 6 | 21 Rau 11 ,1 ,2 0 | 19 15-20 UF 10 1 2 0 13 | 9 RANGE < | 7 20-25 MF 3 0 1 1 5 | Tot RAM 16 16 12 7 43 CHI-SQU FOR 3 T | 15 15 13 17 9 54 PARE F-HAT EST PERIOOS | | - |
| Frace Fupe LS FL HC HH Fotal CHI—SQUA | TES AFTI | 4 ER YEST S UF O O O | 17 PERIOD 5 Ram 1 4 5 1 11 5 Ram 11 | 32 -10 MF 2 8 9 2 | Rau 0 3 4 5 | 17 LO-15 HF 0 4 5 | 21 Rau 11 ,1 2 0 14 18 | 19 UF 10 1 2 0 | RANGE CHO | 7 0-25 MF 3 0 1 | Tot | AL UF 15 13 17 9 SAL PERIODS UF 12 | | |
| Fotal Frace upe S L IC IC IN Otal CHI-SQUA -HAT | O RAM O O O RAM O O O O O O O O O O O O O O O O O O O | S LUF O O O O O O O O O O O O O O O O O O O | 17 PERIOD S Rai 1 4 5 1 11 5 Rai 15 | 32 -10 WF 2 8 9 2 21 -10 | Rau 0 3 4 5 12 | 17 10-15 14 0 4 5 6 15 10-15 14F 0 | 21 Rau 11 ,1 2 0 14 18 | 19 UF 10 1 2 0 15 15 20 UF 7 | 9 RANGE CHO 2 Rasi 4 0 1 1 6 | 7 0-25 MF 3 0 1 1 5 0-25 | Tot | #F ### ############################### | | |
| F HINU Frace upe S L C M otal HI-Saun -HAT S L C C K K K K K K K K K K K K K K K K K | O RAM O O O O O O O O O O O O O O O O O O O | 4 ER YEST 0 0 0 0 0 0 0 0 1 3 0 0 1 3 0 0 0 1 3 0 0 0 1 3 0 0 0 0 | 17 PERIOD SRAM 1 4 5 1 11 RAM 15 5 1 | 32 -10 HF 2 8 9 2 21 -10 | Rau 0 3 4 5 12 | 17 10-15 14F 0 4 5 6 15 10-15 | 21 Rau 11 1 2 0 14 1 Rau 7 2 3 1 | 19 UF 10 1 2 0 13 15-20 UF 7 2 | 9 RANGE < | 7 20-25 MF 3 0 1 1 5 0-25 | Tot Rem 16 18 12 7 43 CHI - Squ FOR 3 T Rem 111 12 6 | 15 15 13 17 9 54 PARE F-HAT EST PERIOUS | | |
| race upe S L IC INI Otel HI-SQUA -NAT S L IC IC IC IC IC IC IC IC IC IC IC IC IC | O RAM O O O O O O O O O O O O O O O O O O O | 4 ER YEST 0 0 0 0 0 0 1 3 1 3 1 3 1 3 1 3 1 3 1 3 | 17 PERIOD 5 Raid 1 4 5 1 11 5 Raid 5 5 | 32 -10 WF 2 8 9 2 21 -10 WF 1 9 9 | Rau 0 3 4 5 12 | 17 LO-15 HF O 4 5 6 15 | 21 Rau 11 ,1 2 0 14 18 | 19 15-20 UF 10 1 2 0 15-20 UF 7 2 | RANGE CHO 2 Rau 4 0 1 1 6 Rau 5 0 1 | 7 0-25 MF 3 0 1 1 5 | Tot Rem 16 18 19 19 CHI - Squ FFR 3 T | 15 13 17 9 9 S4 MRE F-HMT EST PERIOOS 4F 12 17 | | - |
| Frace Fupe LS FL HC HH Fotal CHI-SQUA SL HC HC HC HC HC HC HC HC HC HC HC HC HC | O C C C C C C C C C C C C C C C C C C C | 4 ER YEST 0 0 0 0 0 0 0 0 1 3 0 0 1 3 0 0 0 1 3 0 0 0 1 3 0 0 0 0 | 17 PERIOD S Raid 1 4 5 11 5 Raid 11 11 | 32 -10 HF 2 8 9 2 21 -10 | Rau 0 3 4 5 12 Rau 0 4 3 3 | 17 LO-15 HF O 4 5 6 15 LO-15 HF O 4 4 4 4 4 | 21 Rau 11 2 0 14 Rau 7 2 3 11 | 19 UF 10 1 2 0 13 15-20 UF 7 2 | 2 Rass 4 0 1 1 6 2 Rass 5 0 1 1 1 6 | 7 20-25 MF 3 0 1 1 5 0-25 | Tot Rem 16 18 19 19 CHI - SQU FOR 3 T 11 12 6 42 CHI - SQU | AL UF 15 13 17 9 ARE F-HAT EST PERIODS WF 12 17 18 7 54 ARE VALUES | | - |
| Trace Tupe LS SL NC HH Total CHI-SQUA LS SL NC HH TOTAL CHI-SQUA CHI-SQUA | O C C C C C C C C C C C C C C C C C C C | 4 ER YEST S O O O O IMF O IMF IMF IMF | 17 PERIOD S Raid 1 4 5 11 5 Raid 15 5 11 5 Raid 15 5 11 15 Raid 15 5 11 | 32 -10 WF 2 8 9 2 21 -10 WF 1 20 -10 | Rau 0 3 4 5 12 Rau 0 4 3 3 10 | 17 LO-15 WF 0 4 5 6 15 LO-15 WF 0 4 4 4 12 LO-15 | 21 Rau 11 1 2 0 14 Rau 7 23 13 1 Rau Rau | 19 15-20 UF 10 1 2 0 13 15-20 UF 7 2 3 1 12 | RAMSE CHO 2 Ram 4 0 1 1 6 2 Ram 5 0 1 1 8 | 7 0-25 MF 3 0 1 1 5 0-25 MF 4 0 1 1 6 | Tot Rem 16 18 19 19 CHI Squ FOR 3 T Rem 10 11 12 6 CHI SQU CHI SQU CHI SQU Rem 10 11 12 11 12 13 14 15 16 17 Rem 18 18 18 18 18 18 18 18 18 1 | ol UF 15 13 17 9 54 ARE F-HAT EST PERIODS UF 12 17 18 54 ARE VALUES EST PERIODS UF | | - |
| Total F MINU Trace Tupe LS SL NC HH Total CHI-SQUA F-NAT LS SL NC HH TOTAL CHI-SQUA | TES AFTI ORAM OO ORAM OO ORAM OO OO RAM OO OO OO OO OO OO OO OO OO OO OO OO OO | 4 ER YEST 0 0 0 0 0 0 1 3 0 4 4 -5 | 17 PERIOD S Ram 1 4 5 1 11 5 Ram 10 0.000 | 32 -10 WF 2 8 9 2 21 -10 WF 1 9 9 1 20 | Rau 0 3 4 5 12 Rau 4 3 3 10 | 17 10-15 14 5 6 15 10-15 10-15 10-15 10-15 | 21 Rau 11 1 2 0 14 1 Raue 7 2 3 13 13 Raus 5.714 | 19 15-20 10 1 2 0 13 15-20 WF 7 2 3 1 12 15-20 WF 7 2 3 1 1 2 | RAMSE CHO 2 Ram 4 0 1 1 6 2 Ram 5 0 1 1 8 | 7 20-25 MF 3 0 1 1 5 0-25 MF 3 0 1 1 6 | Tot RAM 16 18 19 19 19 19 11 19 11 12 19 11 19 11 19 11 19 11 11 | AT THAT EST PERIODS UF 13 17 9 54 ARE F-HAT 12 17 18 7 54 ARE VALUES EST PERIODS UF 3.167 | | |
| Frace Fupe LS FL HC HH Fotal CHI-SQUA F-HAT LS SL HC HI-SQUA HI FOTAL CHI-SQUA | O C C C C C C C C C C C C C C C C C C C | 4 ER YEST S O O O O IMF O IMF IMF IMF | 17 PERIOD 5 Rau 1 4 5 1 11 5 Rau 1 5 1 11 5 Rau 0.000 0.800 0.800 0.800 | 32 -10 WF 2 8 9 2 21 -10 WF 1 20 -10 | Rau 0 3 4 5 12 Rau 0 4 3 3 10 | 17 LO-15 WF 0 4 5 6 15 LO-15 WF 0 4 4 4 12 LO-15 | 21 Rau 11 2 0 14 Rau 5.714 11.500 | 19 15-20 UF 10 1 2 0 13 15-20 UF 7 2 3 1 12 | RAMGE < Me 2 Ram 4 0 1 1 6 2 Ram 5 0 1 1 6 2 Ram 2 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 1 0 1 | 7 0-25 MF 3 0 1 1 5 0-25 MF 4 0 1 1 6 | Tot Rem 16 18 19 19 CHI Squ FOR 3 T Rem 10 11 12 6 CHI SQU CHI SQU CHI SQU Rem 10 11 12 11 12 13 14 15 16 17 Rem 18 18 18 18 18 18 18 18 18 1 | ## 15 | | - |

(d.f. = 2, alpha = .05)

CHI-SQUARE = 5.991

Table F11. Indian Point hammer test monitoring using bottom orientated 6m12 degree horizontal transducer located at unit 3, intake 36.

| e uik | UTES OURI | 74 I R.S | . PEKIUU | | | | | 1 | RANDE (me | ters> | • | | | | |
|----------------|--------------------|-----------|--------------|-------------|--------------|-------|--------------|-------------|--------------|-------------|----------|----------|-----------------------|-----|---|
| race | 0- | 5 | 5 | -10 | 1 | 0-15 | _ | 5~20 | 2 | 0-25 | T | otal | | | |
| Abe. | Rau | LIF | Rau | ЦF | Rau | HF. | Rau | ИF | Ram | uf | : . | tau (| 4F | | |
| \$ | 0 | 0 | 4 | 6 | 6 | 7 | 10 | 9 | 4 | 3 | | :4 | 27 | | |
| - | 0 | 0 | 1 | 2 | . 0 | . 0 | 0 | .0 | 0 | 0 | • | 1 , | 2 | | |
| : | 2 | 7 | 4 | · 😩 | 4 | 5 | 1 | 1 | Û | 0 | <u> </u> | 11 | 21 | • ' | |
| l | 0 | 0 | 1 | 2 | 1 | 1 | 0 | 0 | O . | 0 | | 2 | 3 | | |
| tal | 2 | 7 | 10 | 20 | 11 | 13 | 11 | 10 | 4. | > | : 3 | 99 | 53 | | • |
| MIN | UTES AFTE | R TEST | PERIOD | | | | | 1 | RANGE CHA | ters> | | | | | |
| *+C# | . 0- | 5 | 5 | -10 | 1 | 0-15 | 1 | 5~20 | 2 | 0-25 | 1 | otal | | | |
| p• | Rau | HF | Rau | MF | Rau | HF | Rau | uf. | Rau | NF | : . | 1445 | WF . | · | |
| 3 | 0 | 0 | 6 | 11 | 4 | * * | 2 | 2 | 4 | 3 | • | 16 | 21 | | |
| • | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Ö | į | 0 | 0 | | |
| : | . 2 | 7 | | 9 | 1 | 1 | 0 | 0 | 0 | O | • | 8 | 17 | | |
|] | 6 | 22 | 2 | 4· | 2 | 2 | 0 | 0 | 0 | 0 | 1 | 10 | 28 | | |
| tal | 8 | 29 | 13 | 24 | 7 | 8 | 2 | 2 | 4 | 3 | :: | 34 | 66 | | |
| II —SQU HAT | IARE O- | 5 | 5 | -10 | 1 | 10-15 | 1 | S-20 | 2 | 0-25 | | TES | E F-HAT T PERIODS | | |
| ; | Rau O | HF O | Rau 5 | NF 10 | Rau 5 | . HF | Rau 6 | . HF | Rau 4 | HF 3 | R | P4 20 | NF 24 | | |
| | Ō | ě | 1 5 | 1 9 | ŏ | Ŏ, | Ŏ | Ŏ | 9 | . õ | = | í lo | 19 | • | |
| TAL | 2 5 5 | 1 1 18 | 2 12 | 22 | 2 | 11 | Õ | ě | . 0 | ŏ | : ' | 6 | 16 60 | | |
| 1 –5QU | _ | 10 | | | • | | • | | ~ | | | - | | | • |
| LUES | 0- | -5 | 5 | -10 | 1 | 0-15 | 1 | 5-20 | 2 | 0-25 | | | E VALUES T PERIODS | | , |
| | Rau | WF | Rau 0.400 | ИF 0.474 | Rau 0.400 | 9.333 | Raн 5.333 | HF 4.455 | Ra4 0.000 | MF 0.000 | 1.60 | N4 | NF ,750 | | |
| | | -000 | 1.000 | 2.000 | | 2.667 | 1.000 | 1.000 | == | | 1.00 |)O 2 | .000 .421 | • | |
| TAL | 6.000 2 3.600 1 | 2.000 | 0.333 | 0.667 | | 0.333 | 6.231 | 5.333 | | 0.000 | | 33 20 | | | |

Table F12. Indian Point hammer test monitoring using bottom orientated 6H12 degree horizontal transducer located at unit 3, intake 36.

| | | | | fidal F | 1 | 20 min | • | | Trea | tner | t Tupe: | 7 min | , hers 1,345 continuously | Te | est Date: | 1643 |
|---------------------|-----------|--------------------|----------|---------|---------------------------------------|---------|---------------|---------------|-----------------|------------|--------------|---------------|------------------------------|--------------------------|-----------|--|
| | CUTES DUR | | | | · · · · · · · · · · · · · · · · · · · | | -4-0-2-4-0-1 | | RANGE | | | . | ************* | 7 2 2 2 2 2 2 | | +6/4 ##2 ################################# |
| _ | 0 | -\$ | 9 | 5-10 | ; | 10-15 | | 15-20 | | 20 |)-25 | Tot | e 1 | | | |
| Trace Type | Rau | MF | Rau | ИF | Rau | HF | Rase | ЦF | R | | WF : | Rate | HF | | | |
| LE | 0 | o | 2 | 4 | 3 | 4 | 3 | <u></u> | | 0 | 0 | 8 | 11 | | | • . |
| šL | . 0 | 0 | 0 | ٥ | 0 | 0 | 0 | 0 | 1 | 0 | 0 | ٥ | 0 | | | - |
| 40 | 4 | 15 | 2 | 4 | 0 | 0 | C | 0 | 1 | 0 | o | 6 | 19 | | | |
| MB | 0 | 0 | 1. | 2 | 0 | 0 | 0 | 0 | , | 0 | 0 | 1 | 2 | | | |
| Tetal | 4 | 15 | 5 | 10 | 3 | 4 | | 3 | , | 0 | 0 | 15 | 32 | | | |
| E MI | SUTES AFT | ER TES | T PERIOD | | | | | | RANGE | · · · · · | | | | | • | |
| | • | -5 | | 5-10 | | 10-15 | | 15-20 | MINOE | | 1-25 | Tot | •3 | | | = |
| Trace Tipe | | WF | Rau | uf | Rau | WF | Rase | | . <u>.</u> | | ur : | Rau | | | | • |
| LE | 1 | _ ``` | 1 | 2 | 2 | | 1 | 1 | | | 0 | 5 | | | | |
| SL. | 0 | | 0 | 0 | | 0 | 0 | - | | 0 | 0 | | 0 | • | • | |
| NC | 0 | 0 | 1 | 2 | 0 | a a | 0 | 0 | | 0 | 0 | 1 | 2 | | | * * * * * * * * * * * * * * * * * * * |
| 46 | 0 | 0 | 0 | 0 | a | 0 | 0 | 0 | 1 | - 0 | o | 0 | 0 | | | • |
| Total | 1 | 4 | 2. | 4 | 2 | 2 | 1 | 1 | | 0 | 0 | 5 | 11 | | | |
| CH_SQI | | _ | | | | | | | | | | CHI-SQU | ARE F-HAT | | | |
| FHAT | | -5 | | 5-10 | | 10-15 | · | 15-20 | - | |)-2 5 | | EST PERIODS | | | |
| LE | Rau 1 | MF. | Rau 2 | HF 5 | Rau 3 | HF 3 | Rau 2 0 | 2 | ; | ан . О | MF : | Ray | MF 10 | | • | |
| SL NC | 20 | 8 | . 2 | 9 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 11 | | | |
| HI TOTAL | 9 | 0 10 | 14 | 1 P | 9 | 9 | 0 | 0 | | 0 | 0 | 11 | 1 22 | | | 4. |
| CHI ~SQI VILUES | | -5 | | 5-10 | , | 10-15 | - | 15–20 | | | -25 | CUT COI | ARE VALUES | | | • |
| | Ray | UF | ~~~~ | UF | - | WF | | | · - | | | FOR 2 T | EST PERIODS | • | | |
| LE | | 4.000 | 0.333 | 0.667 | 0.200 | 0.667 | 1.000 | 1.000 | | a H | | 0.692 | | | | |
| SL NC | 4.000 1 | 5.000 | 0.333 | 0.667 | | | | | • == | | | 3.571 | 13.762 | | | |
| ui T CFAL | 1.600 | 6.3 6 8 | 1.000 | 2.000 | 0.200 | 0.667 | 1.000 | 1.000 | | | | 1.000 | 2.000 10.256 | | | |
| | | | | | CHT - 501H | RE - 3 | .941 | Cd_6_ | - 1 . al | nha | = .05) | | • | | | |

Table F13. Indian Point hammer test monitoring using bottom orientated 6m12 degree horizontal transducer located at unit 3, intake 36.

| | | | ST PERI | | | | | | RANGE (H4 | | | | | |
|-------------------|-----------------------|----------------|--|---|----------|---------|-------------------------|----------------|-----------|---------|---|---|-----|------|
| | |)~ 5 | 9 | 5 ~10 | | 10-15 | | 15~20 | 2 | 25-25 | Tota | 1 | | |
| race ype | Rau | ЦF | Rau | НF | Rau | ИF | Ran | HF | Rau | WF | : Rau | ИF | | |
| 5 | 1 | 4 | 1 | 2 | 0 | 0 | 2 | 2 | 1 | 1 | 5 | 9 | | a-eo |
| - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | | • |
| 3 | 4 | 15 | 4 | . 8 | 0 | 0 | 1 | ` 1 | 0 | 0 | 9 | 24 | | |
| н | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | | • |
| otal | 5 | 19 | 6 | 12 | 0 | 0 | Э | 3 | 1 | 1 | 15 | 26 | | |
| O HI | NUTES AF | TER TES | T PERIO | 0 | | | | ı | RANGE (ne | ters | _ | | | • |
| • | |)~ 5 | , | 5-10 | | 10-15 | | 15-20 | 2 | 20-25 | Tota | 1 | | |
| ipe -ace | Rau | HF | Ran | HF | Rau | ИF | Rase | HF | Rass | UF | : Rau | WF | | |
| ; | 0 | 0 | 1 | 2 | 1 | 1 | 4 | 4 | 1 | 1 | 7 | 8 | . , | |
| - | 0 | 0 | 1 | 2 | ٥ | 0 | 0 | 0 | 0 ~ | • • | 1 | 2 | | |
| 2 | 3 | 11 | 0 | 0 | 0 | 0 | 0 | O | 0 | a | | 11 | | |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | | |
| tal | > | 11 | 2 | 4 | 1 | 1 | 4 | 4 | 1 | 1 | 11 | 21 | | |
| II –SQUI HAT | |) -5 | | 5-10 | | 10-15 | | 15-20 | 2 | 10-25 | CHI-SQUA FOR 2 YE | RE F-HAT ST PERIOD | ·s | |
| 5 | Rau | HF | Rau | ИĘ | Rau 1 | HF 1 | Rau | HF | Res | NF 1 | Rey | HF | | |
| | Ô | 20 | ī | 1 | ĝ | ó | Ō | ŏ | ó | Ô | 1 1 | 1 18 | | |
| C M | 5 | 13 0 15 | 2 | 1 | 0 | Ō | 0 | ġ | ĕ | ě | | 1 | | |
| DTAL | | 15 | • | 8 | | 1 | 4 | • | • | . • | : 13 | 20 | | • |
| HI –SQUI RLUES | |)-S | 1 | 5-10 | | 10-15 | | 15-20 | . 2 | 25 | CHI-SQUA | RE VALUES | | • |
| S L C U | Rau 1.000 0.143 | 4.000 0.615 | Rau 0.000 1.000 4.000 1.000 2.000 | UF 0.000 2.000 8.000 2.000 4.000 | 1.000 | 1.000 | 0.667 1.000 0.143 | 0.667 1.000 | 0.000 | 0.000 | Rau : 0.333 : 1.000 : 3.000 : 1.000 | 0.059 2.000 4.829 2.000 3.500 | - | |

This F14. Indian Point hanner test monitoring using bottom orientated 5x12 degree horizontal transducer located at unit 3, intake 36.

| | | | | | | ou tide | • | | Treatme | nt Tupe | : 10 min | : on, 20 | 1,345 sec off | Test Date Test Time |
|--------------------|-----------|-------------------------|---|----------------------------------|----------------------------------|---|-------------------------|--------------------|---------------|----------------|--|---|------------------|------------------------|
| | | | T PERIOD | | | | | | RANGE (ne | | | , | | |
| _ | | -5 | 5 | ~ 10 | : | LO-15 | | 5-20 | 2 | 0-25 | Tota | 1 | | |
| Trace Type | Rau | ИF | Rau | HF | RaH | WF | Rau | ИF | Rau | ИF | : Rau | UF | | |
| | 0 | 0 | 6 | 11 | 2 | 2 | 1 | 1 | 2 | 2 | 11 | 16 | | |
| SŁ | 1 | 4 | 0 | 0 | 0 | 0 | 0 | o | . 0 | 0 | 1 | 4 | | |
| NC | 4 | 15 | 3 | 6 | 1 | 1 | 0 | G | . 0 | 0 | 8 | 22 | | |
| 14L | 0 | 0 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 3 | 1 | |
| Total | 5 | 19 | 10 | 19 | 4 | 4 | 1 | 1 | 2 | 2 | 22 | 45 | | |
| E HINUT | ES AFT | ER TEST | PERIOD | | | | | į | RANGE (He | ters> | | | | |
| | 0 | -5 | 5 | -10 | | 10-15 | . 1 | 15-20 | 2 | 0~25 | Tota | 1 | | • |
| Trace Type | Rau | WF | Rau | HF | Rau | WF | Rau | MF | Rau | WF | I Ram | MF | | |
| LE | 0 | | 6 | 11 | 1 | 1 | <u>-</u> - | 0 | 1 | 1 | . 8 | 15 | | |
| SL | 0 | 0 | 0 | 0 | 1 | 1 | 0 | Ģ | . 0 | ۵ | 1 | 1 | | |
| NC | 2 | 7 | 3 | 6 | . 0 | 0 | 0 | 0 | 0 | 0 | 5 | 13 | | |
| HL | 0_ | 0 | 4 | 8 | 1 | . 1 | 0. | 0 | 0 | 0 | 5 | 9 | | |
| Teal | 2 | 7 | 13 | 25 | 3 | 3 | 0 | 0 | 1 | 1 | 19 | 36 | | |
| CH -SQUAR F-HAT | E O | ı - 5 | 9 | 5~10 | | 10-15 | 1 | 15-20 | 2 | 0-25 | CHI-SQUE FOR 2 TE | RRE F-HA EST PERI | COS | - |
| LE' SL | RaH O- | и г 0 2 | Ress 6 0 | MF 11 | . 2 | HF 2 1 | R ан 1 - 0 | HF | Ra4 2 0 | 4F 2 0 | : Rau : 10 : 1 | HF 15 | | |
| NC NL | 3 | ıĭ O | 3 | . 6 | . 1 | 1 | Ö | Ô | 0 | 0 | 7 4 | 18 6 | | |
| TOPAL | 4 | 13 | 12 | 22 | 4 | 4 | ĭ | 1 | 2 | 2 | 21 | 41 | | |
| CH ~SQUAR VÆUES | |)- 5 | | 5-10 | | 10-15 | 1 | 15-20 | | 0-25 | CHI-SQUE | EST PERI | ES ODS | |
| NC C | | 4.000 2.909 5.538 | Rau 0.000 0.000 1.800 0.391 | 0.000 0.000 3.600 0.818 | 0.333 1.000 1.000 0.000 | UF 0.333 1.000 1.000 0.000 0.143 | 1.000 | 1.000 1.000 | | 0.333 0.333 | Rau 1 0.474 2 0.000 1 0.692 1 1.266 2 0.220 | NF 0.310 1.800 2.314 3.000 1.000 | | |

Table F15. Indian Point hammer test monitoring using bottom orientated 6w12 degree horizontal transducer located at unit 3, intake 36.

| | | | | idəl P | | 46 min low tid | • | | Auration Treatme | nt Type: | : 10 sec | , hers 1,365 on, 20 sec off | Test Date Test Time |
|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|----------------|-------------------|----------------|--------------|---------------------|--------------|-------------------------|--------------------------------|------------------------|
| | | | ST PERIOD | | | | | | tange (no | | | | |
| | 0 | -S | S | -10 | | 10-15 | 1 | 5-20 | 2 | 0-25 | Tota | 1 | |
| Trace Type | Rau | MF | Rau | HF | Rau | ИF | Rau | HF | Rau | WF | Rass | WF | |
| LS | 0 | 0 | 1 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 5 | 6 | |
| 5L | 0 · | 0 | O - | 0. | 0 | 0 | 0 | 0 | G | 0 | . 0 | • | |
| MC | 1 | 4 | 3 | 6 | • | O | 0 | 0 | . • | ٥ | 4 | 10 | |
| ни | 1 | 4 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 3 | 7 | |
| Total | 2 | 8 | 5 | 10 | 2 | 2 | 2 | 2 | 1 | 1 | 12 | 23 | |
| 5 MINU | TES AFT | ER TES | r PERIOD | , | | | | | RANGE (no | ters) | | | |
| - | 0 | -5 | 5 | i - 10 | | 10~15 | 1 | 5-20 | 2 | 0~25 | Tota | 1 | |
| Trace Type | Rau | MF | Rau | NF | Rau | HF | Rau | HF | Rau | MF | Rau | WF | |
| LS | 0 | 0 | 1 | 2 | 1 | 1 | 2 | 2 | 0 | 0 | 4 | 5 | • , |
| SL | 0 | 0 | 0 | 0 | 0 | o | 0 | 0 | 0 | 0 | 0 | 0 | |
| NC | 1 | 4 | ٥ | o | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | |
| uni | • | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | |
| Total | 1 | 4 | 3 | 6 | 1 | 1 | 2 | 2 | 0 | 0 | 7 | 13 | |
| CHI —SQUA F—HAT | | s | . 5 | -10 | | 10-15 | 1 | LS-20 | 2 | 0-25 | CHI-SQUE FOR 2 TE | RE F-HAT | |
| LS SL | Rau | HF 0 | Rass 1 0 | HF 2 0 | Rase 1 0 | ИF 1 0 | Rass 2 0 | ИF 2 0 | Rass 1 0 | ИF 1 0 | Rau 5 | HF 6 0 | |
| NC | ĭ | . 4 | 2 | 3 | Ŏ | Ŏ | O | ă | Ŏ | ã | 3 | 7 | |
| HH TOTAL | 1 2 | 2 6 | 2 | 3 | 1 2 | 1 2 | 0 2 | 0 2 | 1 | 0 1 | 10 | 1 6 | |
| CHI-SQUA VALUES | |)-S | 5 | 5-10 | | 10-15 | | 15-20 | 2 | :0-25 | | RE VALUES | |
| LS Si | Rau | MF | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1-000 | HF 1.000 | Rau 0.111 | UF 0.091 | |
| SL NC NH TOTAL | 0.000 1.000 0.333 | 0.000 4.000 1.333 | 3.000 0.333 0.500 | 6.000 0.667 1.000 | 1.000 | 1.000 | 0.000 | 0.000 | 1.000 | 1.000 | 1.800 0.200 1.316 | 2.571 0.818 2.778 | |

CHI-SQUARE - 3.041

Table Fig. Indian Point hammer test monitoring using bottom orientated 6x12 degree horizontal transducer located at unit 3, intake 36.

| | | | ST PERIO | | | | | | ANGE CHO | , | | | | |
|--------------------|--------------|---------|----------|-------------|----------------|-------|-------|-------|----------|-------|--------------------|------------------------|------------|-------------|
| _ | | 0-5 | 9 | 5-10 | | 10-15 | . 1 | 5-20 | 20 | 0-25 | Tot | a l | | |
| i lace Libe | Rau | HF | Rau | HF | Rau | 4 | Rau | WF | Rass | HF | E Ran | uf | | |
| . F | 0 | 0 | 2 | 4 | 2 | 2 | 1 | 1 | 1 | 1 | 6 | 8 | | |
| iL | Ö | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | | |
| łC | 2 | 7 | 3 | 6 | 0 | 0 | 0 | 0 | Ο, | 0 | 5 | 13 | | |
| 41. | 0 | 0 | 0 | 0 | . 0 | 0 | O | 0 | 0 | 0 | | Û | | |
| del | 2 | 7 | 5 | 10 | 2 | 2 | 1 | 1 | 1 | 1 | 11 | 21 | | |
| E MEI | IUTES RF | TER TES | T PERIOD | | | | | 9 | ANGE (ne | ters | | • | | • |
| | | 0-5 | • | 5-10 | , | 10-15 | . 1 | | | 0-25 | Tot | al . | | • |
| race Type | Rau | | Rau | | Rau | MF | Ress | HF | Rau | ₩F | | ИF | | |
| LE | - | 0 | 2 | 4 | 0 | 0 | 1 | 1 | 1 | 1 | • | 6 | | |
| SŁ | 1 | . 4 | 0 | 0 | 0 | 0 | 0 | o | 0 | • | 1 | 4 | | • |
| NC | 0 | 0 | o | 0 | 1 | 1 | 0 | 0 | 0 | ó | . 1 | 1 - | | |
| ue. | 0 | 0 | 0 | . 0 | 3 | 4 | 0 | 0 | | 0 | 3 | 4 | | |
| [dal | 1 | 4 | 2 | 4 | 4 | 5 | 1 | 1 | 1 | 1 | 9 | 15 | | |
| CHI —SQI F-HAT | JARE | 0-E | ! | 5-10 | ; | 10-15 | 1 | 5-20 | . 20 | 0-25 | CHI-SQU FOR 2 T | RRE F-HAT EST PERIO | os | |
| LE . | Rau | | Rau | Ш | Rau | W | Rau | uf | Rau | WF | E Rau | uf 7 | | |
| 5L | . 1 | 0 2 | 2 | 9 | ò | 0 | 0 | ō | 0 | ò | : 1 | 2 | | |
| NC NC | 0 | - 5 | 2 | 2 | . 2 | 1 2 | . 0 | ģ | ģ | 9 | : 3 | ž | | |
| TOTAL. | . 2 | 6 | 4 | 7 | > | 4 | 1 | 1 | . 1 | 1 | : 10 | 10 | | |
| CHI —SQU VILUES | IARE | 0-5 | | E-10 | | 10~15 | | 5-20 | 20 | 0-25 | CHI -50U | ARE VALUES | S _ | |
| | Ras | HF | Rau | | Ran | UF | Rau | ИF | Rass | MF | # Rass | EST PERIO | 35 | |
| LE SL | 1.000 | 4.000 | 6.000 | 0.000 | 2.000 | 2.000 | 0.000 | 0.000 | 0.000 | 0.000 | : 0.400 | 0.286 4.000 | | |
| 4C | 2.000 | 7.000 | 3.000 | 6.000 | 1.000 3.000 | 1.000 | | | | | | 10.286 | | |
| TOTAL | 0.333 | 0.818 | 1.286 | 2.571 | 0.667 | 1.206 | | 0.000 | 0.000 | 0.000 | : 0.200 | 1.000 | | |

Table F17. Indian Point hammer test monitoring using bottom orientated 6m12 degree horizontal transducer located at unit 3, intake 36.

| | UTES DUR | | | | | | • | ! | RANGE (ma | ters> | | | | | | |
|-------------------------------|---------------------------|---|--|---|--|--|--|---|---|----------------------------------|--|-----------------------------------|---|---|----------|---|
| race | 0 | -S | ! | 5-10 | 1 | l0+15 | 1 | 15-20 | 2 | 20-25 | Tat | | | | | |
| up+ | Rau | ИF | Rau | ИF | Rau | HF | Rau | WF | Rau | ИF | : Rew | uF | | | | |
| .s | 1 | 4 | 1 | 2 | 4 | 5 | 10 | 9 | . 5 | 4 | 21 | 24 | | | _ | |
| iL. | 1 | 4 | . 5 | 9 | 5 | 6 | . 1 | 1 | 0 | 0 | : 12 | 20 | | | | |
| ic , | 1 | 4 | 6 | 11 | . 9 | 11 | 9 | 8 | 1. | 1 | 26 | 35 | ; | | | |
| 114 . | 0 | 0 | 8 | 15 | 23 | 29 | 16 | 14 | 5_ | 4 | 52 | 61 | | | | • |
| otal | > | 12 | 20 | 37 | 41 | 50 | 36 | 32 | 11 | 9 | 111 | , 1-10 | _ | | | : |
| 5 MIN | UTES AFT | ER FEST | PERIOD | | | | | | RANGE CHA | rters) | | | | | | · |
| | 0 | -5 | , | 5-10 | 1 | 10-15 | į | 15-20 | 1 | 20-25 | Tot | al | | | | |
| ype 'ype | Rau | ИF | Rau | ИF | Rau | WF | Rau | HF | Rau | HF | : Rau | | | | | |
| <u></u> | 1 | 4 | | 15 | 18 | 22 | 25 | 23 | 10 | 14 | 70 | 78 | | | - | |
| L. | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | .0 | : 2 | 3 | | | • | - |
| c | 8 | 30 | 11 | 21 | 12 | 14 | 2 | 2 | > | 2 | 36 | 69 | ı | | | |
| М | 2 | 7 | 13 | 24 | | 10 | 6 | 5 | 3 | 2 | : 32 | 48 | | | | • |
| otal | 11 | 41 | 33 | 62 | 38 | 46 | 34 | 31 | 24 | 18 | 140 | 190 | _ | | | |
| HI –SQU –HAT | | -5 | <u>!</u> | 5-10 | 1 | 10-15 | | 15-20 | 2 | 20-25 | CHI-SQU FOR 2 T | | | | | |
| .S il ic iu otal | Rau 1 S 1 7 | UF 4 2 17 4 27 | Rau 5 3 9 11 27 | HF 9 6 16 20 50 | Rau 11 3 11 16 40 | NF 14 3 13 19 40 | Rau 18 1 6 11 35 | иг 16 1 5 10 32 | Rau 12 0 2 4 | นร 9 0 2 3 | R4u : 46 : 7 : 31 : 42 : 126 | 4F 51 12 52 55 169 | | • | | • |
| HT-SQU PALUES | | -5 | | 5-10 | 1 | 10-15 | 1 | 15-20 | | 20-25 | CHI-SQU | | | | | |
| .S iL iC iH TOTAL | 1.000 5.444 1 2.000 | HF 0.000 4.000 9.882 7.000 5.868 | Rau 5.444 2.667 1.471 1.190 3.189 | 9.941 4.455 3.125 2.077 6.313 | Ram 8.909 5.000 0.429 7.258 0.114 | HF 10.704 6.000 0.360 8.526 0.167 | Rau 6.429 0.000 4.455 4.545 0.057 | WF 6.125 0.000 3.600 4.263 0.016 | Rau 7.348 1.000 0.500 4.829 | 9.556 0.333 0.667 3.000 | Rau :26.385 : 7.143 : 1.613 : 4.762 : 3.351 | NF 28.588 12.565 | | | | |

Table F18. Indian Point hammer test monitoring using bottom orientated 6m12 degree horizontal transducer located at unit 3, intake 36.

| S HIN | UTES DUR | ING TES | IT PERIO | D | | - | | 1 | RANGE (m | ters> | | | | | | | |
|-----------------|----------|------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|---------|-------|------------|--------------------|-------|---|---|---|
| | G | -5 | | 5-10 | | 10-15 | ; | 15-20 | | 0-25 | • | Tot | al | | | | |
| upe upe | Rass | . NF | Rau | HF | Rau | HF | Rau | MF | Reu | NF | _: | Rau | MF | | | | |
| S | 1 | 4 | 7 | 13 | 22 | 26 | 29 | 26 | 16 | 12 | | 75 | 8 1 | | | | |
| L | 0 | 0 | 3 | • | 1 | 5 | 0 | 0 | 0 | 0 | : | 7 | 11 | | | • | |
| C | 4 | 15 | 7 | . 43 | .2 | 2 | 0 | 0 | 1 | 1 | į | 14 | 31 | | | | |
| 14 | ٥ | 0 | . 5 | 9 | 8 | 10 | 4 | 4 | . 0 | 0 | • | 17 | 23 | | | | |
| otal | 5 | 19 | 22 | 41 | 36 | 43 | 23 | 30 | 17 | 13 | 3 | 113 | 146 | | | | |
| S HIN | UTES AFT | ER TESI | PERIOD | | | | | | RANGE (m | tore) | Ŀ | | | | | | |
| | c |)-S | | 5~1ô | | 10-15 | | 15-20 | 4 | 20-25 | | Tot | .al | | | | |
| race upe | Rau | HF. | Rau | | Rau | | Rau | uf | Rau | uF | | Rau | | | | | • |
| <u></u> - | 1 | 4 | 3 | | 14 | 17 | 10 | | 10 | | | 30 | 44 | | | | |
| L | 1 | 4 | 2 | 4 | 7 | 8 | 0 | 0 | 1 | ., 1 | • | 11 | 17 | | - | | |
| c · | 2 | 7 | 3 | 6 | 7 | 8 | 3 | 3 | 2 | 2 | : | 17 | 26 | | | | |
| H4 | 1 | 4 | 3 | 6 | 6 | 7 | 6 | 5 | 1 | 1 | . I | 17 | 23 | | | | |
| otal | 5 | 19 | 11 | 55 | 34 | 40 | 19 | 17 | 14 | 12 | : | 63 | 110 | | | | |
| HI —SQU —HAT | |) - 5 | | 5-10 | | 10-15 | | 15-20 | 2 | 0-25 | | | RRE F-H EST PER | | | | |
| | Rau | WF | Rau | HF | Rau | HF | Rau | HF | Rau | MF | | LL Res | HF | | | | |
| 5 . L | 1 | 4 2 | 5 | 10 5 | 19 6 | 22 7 | 20 | 18 0 | 13 | 10 1 | = | 57 9 | 63 14 | | | | |
| iC M | 3 | 1 <u>1</u> 2 | 5 | 10 | 5 | Ś | 2 5 | 2 5 | · 2 | 2 | 2 | 16 17 | 29 23 | | | | |
| OTAL | · Š | 19 | 17 | 32 | 35 | 42 | 26 | . 24 | 16 | 13 | • | 98 | 128 | | | | |
| HI-SQU ALUES | | ı~ 5 | | 5-10 | | 10-15 | | 15-20 | | 20-25 | CHI | -590 | ARE VAL | UES | | | |
| | Rau | uF | Ran | UF | Rau | WF | | | Rau | HF | | 2 T Rau | EST PER UF | 1 ODS | | • | |
| S L | 0.000 | 0.000 4.000 | 1.600 | 2.579 | 1.778 | 1.884 | 9.256 | 0.257 | 1.385 | 0.800 | : 12. | 115 | 10.952 | | | · | |
| C | 0.667 | 2.909 | 1.600 | 2.579 | 2.778 | 3.600 | 3.000 | 3.000 | 0.333 | 0.333 | : 0. | 290 | 0.439 | | | | |
| U OTAL | 1.000 | 4.000 0.000 | 0.500 3.667 | 0.600 5.730 | 0.286 0.057 | 0.529 0.108 | 0.400 3.769 | 0.111 3.596 | 1.000 0.290 | 1.000 | : 4. | 000 | 0.000 5.063 | | - | | |

Table F19. Indian Point hawner test monitoring using bottom orientated 5m12 degree horizontal transducer located at unit 3, intake 36.

| ***** | | ****** | | ridel P | 1 | hrs b | • | | Treatm | ent Type | : 20 | min, hars i sec on, 20 | sec off | Test Date: Test Time: |
|-------------------------------|---|----------------------------------|--|---|---------------------------|---|---|---|--|--|---|--|---------|--------------------------|
| | | | ST PERIO | | | | | | RANGE CH | | | | | |
| _ | | 0-5 | | 5-10 | 1 | 10-15 | : | 5-20 | 4 | 20-25 | r | otal | | |
| Trace Type | Rau | uf | Rau | HF | Rau | HF | Rau | uF | Rau | KF | : R | au HF | | |
| LS | 2 | 7 | 6 | 11 | 6 | 7 | 1 | 1 | 2 | 2 | 1 | 7 28 | | |
| SL | 0 | 0 | 16 | 30 | 10 | 12 | 9 | 8 | 3 | 2 | : 30 | 9 52 | | |
| NC | 5 | 19 | 10 | 19 | 2 | 2 | 3 | 3 | 4 | 3 | 2. | 4 46 | | |
| HH | 0 | 0 | | 15 | 15 | 18 | 14 | 13 | 2 | 2 | , s | 9 48 | | |
| Total | 7 | 26 | 40 | 75 | 33 | 39 | 27 | 25 | 11 | 9 | 110 | | | |
| E MI | WTES AF | TER TES | T PERIOD | | | | | _ | | | | | | |
| | | | | | | | | | RANGE Cou | | _ | | | |
| Trace | | 0-5 | | 5-10 | | 10-15 | | 15-20 | | 20-25 | | otal | | |
| Tupe | | HF | | | Rau | HF | Rан | | Rau | HF | -: | M HF | | |
| LS SL | 0 | 0 | 2 6 | 4 | 12 | 14 | 3 | 3 | 1 | . 5 | 1 1 | - | | • |
| NC NC | 1 | 19 | 8 | 11 15 | 19 | 23 | 19 | 16 | - | _ | \$ 5. 2 | | • • | |
| uu uu | 0 | | 9 | 17 | 3 11 | 13 | 8 | 5 7 | 2 | 2 | | · | | |
| Total | <u>-</u> | | | - | | ^ 54 | | | | 10 | 12 | | | |
| | • | , | | | 43 | | | | ′ | | • | | | |
| CHI —50l F—HAT | | 0-5 | | 5-10 | _1 | 10-15 | | 5-20 | | 20-25 | | DUARE F-HAT TEST PERIC | | |
| LS SL NC WW TOTAL | Rau 1 1 5 0 7 | NF 4 2 19 0 | Rau 4 11 9 9 | NF 8 21 17 16 61 | Rau 9 15 3 13 | HF 11 18 3 16 47 | Ray 2 14 5 11 31 | HF 2 12 10 28 | Rau 2 5 3 3 | HF 24 3 20 | R 44 | 8 25 5 56 4 46 5 44 | | |
| CHI -SQI VALUES | | 0-5 | | 5-10 | 1 | 10-15 | ; | 15-20 | | 20-25 | | QUARE VALUE TEST PERIO | | |
| LS SL NC UU TOTAL | Ran 2.000 1.000 0.000 0.077 | 7.000 4.000 0.000 0.184 | Rau 2.000 4.545 0.222 0.059 3.462 | UF 3.267 8.805 0.471 0.125 6.426 | 2.793 0.200 0.615 | UF 2.333 3.457 0.667 0.806 2.419 | 1.000 3.000 1.000 1.636 1.032 | NF 1.000 2.667 0.500 1.800 0.643 | Rau 0.333 1.600 0.667 0.200 0.167 | UF 0.333 1.286 0.200 0.000 | Rai 0.025 1.895 0.006 0.916 | u UF 9 0.720 9 0.441 0 0.011 4 0.931 | | |
| | | | | | CHI-SQU | RE - 3 | .041 | (d.f. = | i, alpha | 05 | • | | | |

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Table F20. Indian Point hammer test monitoring using bottom orientated 6x12 degree horizontal transducer located at unit 3, intake 36.

| E MIN | UTES DUR | ING TES | T PERIOD | | | | | | RANGE CHA | | | | | | | |
|-------------------|------------|----------------|----------|-------------------------|-----------------|--------|--------|--------|--|-------|-------------------------------|------------------|---------------|---|----------------|---|
| | 0- | -5 | 5 | -10 | | 10-15 | | 15-20 | 2 | 0-25 | Tot | al | | , | | |
| race We | Rau | UF | Rau | WF | Rau | WF | Яан | HF | Rass | ИF | ; Reu | HF | | | | |
| £ | 4 | 15 | > | 6 | 20 | 24 | > | 3 | 3 | 2 | | 50 | | | | |
| L | 1 | 4 | 7 | 13 | 1 | 1 | 0 | 0 | 0 | 0 | : 9 | 18 | | | | |
| c | 7 | 26 | 5 | 9 | 0 | 0 | Đ | 0 | 1 | 1 | 13 | 36 | | - | | |
| ₽. | 0 | 0 | 10 | 19 | 14 | 17 | > | 3 | 0 | 0 | 27 | 39 | | | | |
| ctal | 12 | 45 | 25 | 47 | 35 | 42 | 6 | 6 | 4 | | 82 | 143 | • | | | |
| E MTM | UTES AFTI | CD TEST | PERTOR | | | | | | | | | _ | | | • | |
| | O(E# IN 1) | LR 1631 | FEREUG | | | 7 | | | RANGE <me< td=""><td>ters></td><td></td><td></td><td></td><td></td><td></td><td></td></me<> | ters> | | | | | | |
| 780 | 0 | -5 | 5 | -10 | | 10-15 | | 15-20 | 2 | 0-25 | Tot | al | | _ | ÷ | |
| 1 0+ | Rau | MF | Rau | ИF | Ran | HF | Rau | ИF | Rau | HF | Ray | ИF | | | _ | |
| £ | 3 | 11 | 13 | 24 | 6 | 7 | 1 | 1 | 1 | 1 | 24 | 44 | | | - , | |
| L | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | | ,* | |
| c | , € | 22 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 26 | | | | |
| b | Ö | 0 | 4 | 8 | 2 | 2 | 0 | 0 | 0 | ٥ | 6 | 10 | _ | | | |
| ctal | 9 | 33 | 19 | 36 | 8 | 9 | 1 | 1 | 1 | 1 | : 38 | 80 | | | | • |
| HAT | | - s | , . S | -10 | | 10-15 | 1 | 15-20 | 2 | 0-25 | CHI-SQU FOR 2 T | ARE F- EST PE | HAT RI GDS | | | |
| _ | Rau | ЫF | Rau | uf. | Rau | MF | Rau | WF | Rau | uf . | E Rau | HF | · | | _ (| |
| £ L | 1 | 13 | 9 | 15 | . 15 | 16 | 2 | 2 0 | Š | . 3 | 29 | 47 | | (| • | |
| F | 7 | 24 | 4 7 | 7 14 | 0 | - 10 | 0 2 | 0 2 | 0 | Ò | 11 | 31 25 | | • | | |
| CTAL. | 11 | 39 | 22 | 42 | 22 | 26 | 4 | 4 | 3 | 2 | : 60 | 112 | | | | |
| H –SQU ILUES | | -5 | 5 | -10 | | 10-15 | 1 | 15~20 | 2 | Q-25 | CHI-SQU | ARE UA | LUES | | • | |
| £ | Rau | MF | Rau | uf 0 | Ran | UF | Rau | WF | Rau | uf. | # Ram | ИF | | | | |
| L | 1.000 | 0.615 4.000 | 6.250 I | 3.000 | 7.538 1.000 | 9.323 | 1.000 | 1.000 | | 0.333 | : 9.000 | | | | | |
| iC IL TOTAL | | 0.333 1.846 | 2.571 | 1.923 4.481 1.458 | 9.000 16.953 | 11.842 | 3.000 | 3.000 | | 1.000 | : 1.190 :13.364 :16,133 | | | | | |

Table F21. Indian Point hawner test monitoring using bottom orientated 6w12 degree horizontal transducer located at unit 3, intake 36.

| S MINU | TES DU | ING TE | ST PERIO | | | | | | RANGE (m | | ******* | | |
|----------------------|-------------|-------------|----------------|----------------|----------------|--------|-------|-------------|----------|-------------|---------|------------------------|---------------|
| | • | -5 | | 5-10 | ; | 10-15 | | 15-20 | | 20-25 | Tota | 1 | |
| lrace lype | Rau | ИF | Rau | ИF | Rau | KF | Rau | uF | Rau | uF | : Reu | uf . | • |
| LS | 1 | 4 | 5 | 9 | 5 | 6 | 2 | 2 | 1 | 1 | -: | 22 | |
| 54. | 0 | 0 | . 2 | 4 | ` 0 | 0 | 0 | 0 | 0 | 0 | : 2 | 4 | • |
| 4C | 2 | 7 | 1 | 2 | 4 | 5 | · o | 0 | 0 | ٥ | 7 | 14 | |
| 464 | Ò | 0 | 7 | 13 | o | 0 | 1 | 1 | ٥ | e 0 | | 14 | |
| Fotal | > | 11 | 15 | 20 | 9 | 11 | 3 | > | 1 | 1 | 31 | 54 | |
| 2 NIMU | TES AF1 | ER TES | T PERIOD | • | | | r | | RANGE (n | eters) | •, | | |
| - | |)-S | | 5-10 | | 10-15 | | 15-20 | | 20-25 | Tota | 1 | |
| Trace Type | Rass | UF | Rau | WF | Rass | HF | Rau | WF | Ram | WF | I Rau | | |
| .s | | 0 | | 9 | 2 | . 2 | ! | 1 | 1 | 1 | -! | 12 | - |
| 5L | 0 | . 0 | • | 0 | ٥ | 0 | 0 | 0 | 0 | 0 | i | 0 | |
| NC | 2 | 7 | 4 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | . 6 | ts | |
| 414 | 0 | 0 | 3 | 6. | 1 | 1 | 0 | 0 | 0 | 0 | . 4 | 7 | |
| Total | 2 | 7 | 11 | 22 | > | 3 | 1 | 1 | 1 | 1 | 10 | 34 | |
| CHI —SQUA F—HAT | |)- 5 | 9 | 5~ 10 | | 10-15 | | 15-20 | ; | 20-25 | | RE F-HAT ST PERLODS | |
| LS | Rase | UF | Rau | MF | Rau | ИF | Rau | | Rau | | Reu | ue ue | |
| 5L | Ŏ | 2 0 | 5 | 9 2 | - 0 | 40 | 5 | Š | 1 0 | 0 | 11 | 17 2 | |
| NC MU TOTAL | 2 0 3 | 7 0 9 | 3 5 13 | 10 25 | 2 1 6 |) 1 | 0 1 2 | 0 1 2 | . 0 | 0 0 1 | 6 | 15 11 44 | |
| - | _ | 7 | 13 | «> | | r | * 2 | 2 | _ | | 25 | 44 | |
| CHI — SQUA VALUES | | -5 | | 5-10 | · ·: | 10-15 | | 15-20 | | 20-25 | | RE VALUES | • |
| | Raw | UF. | Rau | WF | Rau | HF | Rau | NF | Ran | | 3 Rau | ST PERIODS | |
| SL | 1.000 | 4.000 | 0.111 2.000 | 4.000 | 1.206 | 2.000 | 0.333 | 0.223 | 0.000 | 0.000 | : 2.000 | 2.941 4.000 | • |
| NC : | 0.000 | 0.000 | 1.800 1.600 | 3.600 2.579 | 4.000 1.000 | 5.000 | 1.000 | 1.000 | | | : 0.077 | 0.034 2.333 | |

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Table F22. Indian Point hanner test monitoring using bottom orientated 6x12 degree horizontal transducer located at unit 3, intake 36.

| | | | 7022-6 | | Tidal F | | 30 min low tic | ie | | Duration Treatne | nt Tup | •: 10 ı | din cont | inuousī u | Test Date: Test Time: |
|-------------------------------|----------------------------------|-------------|------------------------------|----------------------------------|----------------------------------|---|-------------------------|------------------------------|-----------------------------|------------------------------|------------------------|----------------------------------|---------------------------------------|---------------|--------------------------|
| 5 MIN | WTES (| WRI | NG TES | T PERIO | D _. | • | | | • | RANGE (ne | ters> | | • | | |
| Trace | _نـ | 0- | 5 | ! | 5-10 | | 10-15 | · 1 | L5~20 | 2 | 0-25 | Te | ntal | | |
| Type | R | M | MF, | Rau | HF | Ra | M HF | Rau | WF | Rau | HF | : R | M HF | | |
| LS | |) | 0 | 2 | 4 | 1 | 1 | 2 | 2 | 2 | 2 | : | 7 9 | | |
| SL | • |) | 0 - | ó | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | : (| 0 0 | ı | |
| NC | • |) | 0 | 2 | 4 | 1 | 1 1 | 0 | 0 | 0 | 0 | • | 5 | • | |
| HH | • | • | 0 | 0 | ٥ | 9 | • | 0 | 0 | 0 | 0 | | | | |
| Total | (|) | 0 | 4 | 8 | 2 | 2 | 2 | 2 | 2 | 2 | 1 10 | 14 | | |
| 5 HIN | IUTES F | AFTE | R TEST | PERIOD | | | | | | RANGE (ne | tors> | | | | · |
| | | 0~ | 5 | | 5-10 | | 10-15 | . 1 | L5~20 | | 0-25 | Т | otal | | |
| Trace Tupe | R | nee | HF. | Ran | HF | Ra | u UF | Rau | uf | Ran | WF | ; R | bu WF | | • |
| LS | | ` | 0 | 3 | 6 | | 5 | 0 | 0 | 1 | 1 | -: | 12 | | |
| SL. | 1 | l. | 4 | 0 | 0 | 1 | 1 | 0 | 0 | . 0 | 0 | • | 2 5 | | |
| NC | | • | 15 | 1 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | : : | r 19 | | |
| 44 | 1 | l. | 4 | 2 | 4 | 1 | . 1 | 0 | o o | 0 | ø | : | 1 9 | | |
| Total | | • | 23 | 6 | 12 | 7 | a | 1 | 1. | 1 | 1 | 2 | 1 45 | | |
| CHI —SQU F—HAT | ARE | 0- | _ | | 5~10 | | 10-15 | | 15-20 | 2 | 0-25 | CHI-SI FOR 2 | QUARE F- TEST PE | HAT RI ODS | |
| LS SL NC UH TOTAL | | 1 2 1 | HF 0 2 8 2 12 | Rau 3 0 2 1 5 | MF 5 0 3 2 10 | Ra 1 | 1 1 | Rau 1 0 1 0 2 | UF 1 0 1 0 2 | Rau 2 0 0 0 2 | UF 2 0 0 0 | : | 9 11 1 3 5 12 2 5 | | |
| CHI -SQU VALUES | IRRE | 0~ | 5 | | 5-10 | . == | 10-15 | | 15-20 | 2 | 0-25 | CHI-S | RUARE VA TEST PE | LUES RIOOS | |
| LS SL NC HH TOTAL | 1.000 4.000 1.000 6.000 | 15 | .000 .000 .000 | 0.200 0.333 2.090 0.400 | 0.400 0.667 4.000 0.800 | 1.800 1.800 0.000 1.000 2.776 | 2.667 1.000 0.000 | 1.000 0.333 | 2.000 1.000 0.333 | == | 0.333 0.333 | 2.000 1.600 4.000 3.900 | H HF 7 0.429 0 5.000 0 8.167 | | |

3/4/88 0510

Table F23. Indian Point hammer test monitoring using bottom orientated 6m12 degree herizontal transducer located at unit 3, intake 36.

| | | | | ridai P | | ou tide | >efore } ********* | | Duration Treatme | of Tes nt Typ | t: 10 min e: 10 min modamaman | , hwr > only continuous! massassassass | y Te | est Date: est Time: | 3/4/88 0530 |
|-------------------------------|----------|-------------------------------|---|--|-------------|-------------------------------|--------------------------|----------------|---------------------|--------------------|--|--|------|------------------------|----------------|
| 2 UIM | UTES DUR | ING TES | T PERIO | D | | | | 1 | RANGE (He | ters> | | | | •,• | |
| 7 . | 0 | -5 | | 5-10 | 10 |)-1S | 1 | 5-20 | . 2 | 0-25 | Tota | i. | | | |
| Trace Type | Raw | HF | Rau | WF | Rau | uf . | Rau | NF | Rau | HF | : Rau | WF | | | |
| .5 | 0 | 0 | 3 | 6 | 4 | 5 | 5 | 5 | 2 | 2 | 14 | 18 | | | |
| ăL. | 0 | 0 | 0 | 0 | 0 | 0 | . 0 | 0 | ٥ | 0 | : 0 | • | * | | |
| NC | 3 | 11 | 4 | 0 | 2 | 2 | 1. | 1 | . 0 | / O | 10 | 22 | | | |
| ии | · O | 0 · | 4 | 9 | 2 | 2 | 0 | 0 | 0 | . 0 | 6 | 10 | | | |
| Total | 3 | 11 | 11 | 22 | 8 | 9 | 6 | 6 | 5 | 2 | 30 | 50 | | | |
| 5 HIM | UTES RFT | ER TEST | PERIOD | | | | | ٠. | RANGE (ne | ters> | | | | | |
| race | 0 | -5 | | 5-10 | 10 |)-1 5 | í | 5-20 | 2 | 0-25 | Tota | 12 | | • | |
| yp. | Rau | ИF | Rau | ИF | Rau | UF | Rau | HF | Rass | HF | : Rau | WF | | | • |
| LS | 1 | 4 | 3 | 6 | 5 | 6 | 2 | 2 | 1 | 1 | 15 | 19 | | | |
| 5L | 1 | 4 | 2 | 4 | 0 | 0 | ٥ | 0 | ý 0 | .0 | . 3 | 8 | | | |
| NC | 1 | 4 | 2 | 4 | 1 | 1 | 0 | 0 | 0 | . 0 | 4 | 9 | | | |
| 4H | . 0 | 0 | 4 | | 2 | 2 | 0 | .0 | 0 | 0 | 6 | 10 | | | |
| Total | 3 | 12 | - 11 | 22 | 8 | 9 | 2 | 2 | 1 | 1 | : 25 | 46 | | | • |
| CHI-SQUI F-HAT | | ~S | | 5-10 | 10 |)-15 | 1 | 5-20 | 2 | 0-25 | | RE F-HAT | | | |
| | Rau | uf 2 | Rau | HF 6 | Rau | NF 6 | Rau | HF. | Rau 2 | UF 2 | : Rau | UF 19 | | | |
| LS SL NC | i . | 2 8 | 1 | 2 6 | Ō | Õ | 3 | . 6 | Ĉ | ô | 2 7 | 16 | | | |
| UŬ TOTAL | Ş | , 12 | | 22 | 2 2 8 | 2 2 9 | ĝ | Ó | 0 | 0 | 28 | 10 48 | | | |
| CHI~SQU | - | LA | •• | | • | • | . | | - | - | . 20 | 70 | | | |
| VALUES | | -5 | | 5-10 | 10 |)-1 5 | 1 | 5-20 | _ | 0-25 | | RE VALUES ST PERIODS | | | |
| LS SL NC NH TOTAL | 1.000 | UF 4.000 4.000 3.267 | Ray 0.000 2.000 0.667 0.000 | uf 0.000 4.000 1.333 0.000 | 0.333 (| NF 0.091 0.333 0.000 | 1.000 | 1.286 1.000 | 0.333 | 0.333 0.333 | Rau : 0-154 : 3-000 : 2-571 : 0-000 : 0-455 | 0.027 8.000 5.452 0.000 0.167 | | | |

Table F24. Indian Point hanner test monitoring using bottom orientated 6H12 degree horizontal transducer located at unit 3, intake 36.

| | | | | idal Pi | hase: At | 1 ou t | :i de | | Duration Treatme | of Test nt Type | : 10 min : 10 min | , her 3 | only wously | | Date: Time: | 3/4/88 0550 |
|-------------------------------|------------|-------------------------|-------------------------|---|-------------------------------|--|-------|-----------|---------------------|--------------------|--|---|----------------|---------------------------|----------------|----------------|
| 5 MIN | NTES DURI | NO TES | T PERIOD | | | | | | RANGE (ne | pasesus tare) | 2000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 ;; 424 2 4 | | | ··· | ****** |
| | 0- | ·s | . 5 | -10 | 10 | - 15 | 1 | 5-20 | | 0-25 | Tota | 1 | | - | | |
| Trace Type | Rau | | Rau | HF | Rau | MF | Rau | ИF | | NF | | HF | . * | | | |
| .s | 2 | 7 | . 0 | 0 | 1 | 1 | 2 | 2 | 9 | 9 | : 5 | 10 | | | | |
| iL. | 3 | 11 | 1 | 2 | 1 | . 1 | Q | 0 | . • | 0 | : 5 | 14 | | | | |
| IC . | 8 | 19 | 6 | 11 | 2 | 2 | 0 | 0 | . 0 | ٥ | 13 | 32 | | | | • |
| 454 | 0 | 0 | > | 6 | 2 | 2 | 0 | 0 | 0 | 0 | 5 | 8 | | | | |
| Total | 10 | 37 | 10 | 19 | 6 | 6 | 5 | 2 | 0 | o | 28 | 64 | | | | |
| 5 MIN | WIES AFTE | R TEST | F PERIOD | | | | | 1 | RANGE (ne | tors> | | | | | | |
| | · 0- | ·s | S | - 10 | 10 | - 15 | | 5-20 | | 0-25 | Tota | 1 | | | | |
| Trace Tupe | Rau | HF | Rau | HF | Ran | NF | Rau | HF | Rau | UF | 2 Ran | ЦF | | | | |
| .s | 1 | 4 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 7 | 11 | | غيد مور سه جد. | | |
| 5 L . | 0 | ò | 1 . | 2 | 0 | o | 0 | 0 | 0 | ٥ | . 1 | 2 | | • | | |
| NC | 1 | 4 | 3 | 6 | 1 | 1 | Q | 0 | O | . 0 | : : 5 | 11 | | | | |
| ни | 1 | 4 | > | 6 | 5 | 6 | • | 0 | 0 | O | . 9 | . 16 | | | | |
| rotal | 3 | 12 | 8 | 16 | 8 | 9 | 5 | 2 | 1 | 1 | 22 | 40 | | | | |
| CHI —SQU F—HAT | IARE O- | ·\$ | · S | -10 | |)-1 5 | . 1 | 5-20 | 2 | 0-25 | CHI-SQUA FOR 2 TE | RE F-HF ST PERI | T ODS | | | |
| _ | Rau | HF | Rau | HF | Rau | ИF | Rau | HF. | Rau | HF | Ray | HF | | | | |
| . S 5 L | 2 | 6 | · <u>i</u> | 2 | 2 | - 1 | 8 | 9 | 0 | 0 | 5 5 | 11 | | | | |
| NC HH | · 3 | 12 | . 5 | . 6 | 4 . | 2 | .0 | 0 | 0 | . 0 | 7 | 22 12 | | · · | | |
| TOTAL | | 25 | 9 | 18 | , 7 | 8 | 2 | 2 | | . 1′ | : 25 | 52 | | | | |
| CHI —SQL VALUES | JARE G- | ·s | 5 | -10 | 10 |)- 15 | 1 | 5-20 | 2 | 0-25 | CHI-SQUA | | | • | | |
| LS SL NC NN TOTAL | | 1.000 1.783 1.000 | 0.000 1.000 0.000 | HF 2.000 0.000 1.471 0.000 0.257 | 1.000 1 0.333 0 1.286 2 | HF 1.333 1.000 1.333 2.000 | == | 0.000 | === | 1.000 | Rau : 0.333 : 2.667 : 3.556 1 | uf 0.048 9.000 0.256 2.667 5.538 | | | | |

CHI-SQUARE = 3.841

APPENDIX G: Quarry Hammer Test

APPENDIX G: Quarry Hammer Test

G.1 Introduction

After the hydroacoustic sampling had ended at Indian Point Power Plant Unit 3, an additional test was conducted at a nearby rock quarry by NYPA and Normandeau Associates, Inc. personnel. The quarry, located a mile downstream of the Indian Point Nuclear Power Plants, was used to perform an open-water test of the avoidance response of white perch to underwater hammer devices. Observations were visual, from above the water surface. The test took place on March 11, 1988.

G.2 Methods

The quarry has a maximum depth of about 100 ft, is 1/2-mile across and irregularly shaped. At the test site, the bottom is muddy and the depth is about 8-10 ft. The hammer was hanging off an underwater wall, and positioned about 3 ft deep. A fish trap was always directly in front of the hammer.

White perch were collected off the IP2 Ristroph screen at about 0800 h and transported shortly thereafter to the quarry, where they were placed in 3-ft by 3-ft by 6-ft box traps. The fish were held in the box traps for about 5 hours. Live fish were then transferred to a single box trap for testing. The trap was generally orientated with the 6-ft side horizontal. The fish depth remained about 3 ft. During hammer tests, the trap was placed at different distances from the hammer. It started out at a position 10 ft from the hammer, then was moved closer. To check for a vertical response, the trap was also orientated with the 6-ft side vertical.

The test fish were those that could maintain their position in the middle of the box trap while it was being moved. Fish that bumped into the sides of the trap during moving were ignored during hammer tests, as were fish that were apparently highly stressed.

Water temperature was 4.5° C. The quarry contains very clear freshwater. Testing was conducted from approximately 1500 h to 1600 h, with a clear sky.

Two hundred test fish were used in this hammer test. Test fish lengths are presented in Table G1.

G.3 Results

When the fish were within about 10 ft of the operating hammer, they consistently oriented away from the hammer and moved to the far side of the box trap. The same response was elicited if the hammer was right up next to the net, or if the net was 4 ft from the hammer, which gives a total distance of 10 ft from the hammer at the outside wall of the trap (4 ft + 6-ft trap length). At more than 10 ft, there was not much of a response.

No vertical response was observed, even when the trap was oriented vertically with a 6-ft depth.

It was not until about 2 or 3 beats of the hammer that most of the fish turned and moved away. In other words, the response was not instantaneous for all of the fish that moved.

G.4 Discussion

It is not known whether the behavior in the quarry was artificial due to the possibility of fish receiving visual cues off the net walls of the box trap.

Quarry results do not account for other possible factors which could have affected the effectiveness of the hammers at the power plant, such as flow velocity, lower water temperature, salinity, etc.

Quarry tests did show a response within 10 ft of the hammer, demonstrating that the hammers could elicit an avoidance response in an acoustically different environment than the sampling tank at Ontario Hydro. To rate success, it is necessary to concentrate on the hydroacoustic data from the near-hammer ranges at the power plant.

Table 1. Numbers and lengths of white perch used in quarry hammer test, March 11, 1988.

| Fis | h# L(mm) | Fish # | L (mm) | Fish # | L (mm) | Fish # | L (mm) |
|-----|--------------|----------|----------|------------|--------------|------------|-----------|
| 1 | 78 | 51 | 85 | 101 | 76 | 151 | 84 |
| | 83 | 52 | 104 | 102 | 60 | 152 | 77 |
| 2 | 84 | 53 | 92 | 102 | 76 | 153 | 85 |
| 4 | 79 | 54 | 81 | 104 | 61 | 154 | 75 |
| 3 | 69 | 55 | 71 | 105 | 82 | 155 | 71 |
| 7 | 82 | 56 | 82 | 106 | 78 | 156 | 84 |
| } | 73 | 57 | 71 | 107 | 82 | 157 | 92 |
| 8 | 70 | 58 | 76 | 108 | 77 | 158 | 95 |
| و ا | 82 | 59 | 83 | 109 | 59 | 159 | 84 |
| 1 | | 60 | 80 | 110 | 84 | 160 | 88 |
| l î | 74 | 61 | 80 | 111 | 83 | 161 | 76 |
| l î | | 62 | 79 | 112 | 73 | 162 | 78 |
| 1 | | 63 | 65 | 113 | 74 | 163 | 66 |
| 1 | | 64 | 85 | 114 | 76 | 164 | 65 |
| 1 | 5 79 | 65 | 76 | 115 | 75 | 165 | . 73 |
| 1 | 6 85 | 66 67 | 72 | 116 | 57 | 166 | 69 |
| 1 | 7 89 | 67 | 70 | 117 | 76 | 167 | 76 |
| 1 | 8 95 | 68 | 78 | 118 | 78 | 168 | - 77 |
| 1 | | 69 | 90 | 119 | 75 | 169 | 68 |
| 2 | | 70 | 86 | 120 | 76 | 170 | 70 |
| 2 | | 71 | 79 | 121 | 74 | 171 | 84 |
| 2 | | 72 | 90 | 122 | 77 | 172 | 54 |
| 2 | | 73 | 115 | 123 | 74 | 173 | 64 |
| 2 | | 74 | 121 | 124 | 63 | 174 | 70 |
| 2 | | 75 | 85 | 125 | 84 76 | 175 | 61 71 |
| 2 2 | | 76 | 64 | 126 127 | 76 80 | 176 177 | 71 72 |
| 2 | | 77 78 | 84 62 | 127 | 86 | 178 | 77 |
| 2 | | 79 | 92 | 129 | 83 | 179 | 77 |
| 3 | | 80 | 69 | 130 | 72 | 180 | 74 |
| 3 | | 81 | 78 | 131 | 55 | 181 | 64 |
| 3 | 2 84 | 82 | 81 | 132 | 70 | 182 | 88 |
| š | | 83 | 77 | 133 | 70 | 183 | 85 |
|] 3 | | 84 | 77 | 134 | 77 | 184 | 72 |
| 3 | | 85 | 70 | 135 | 77 | 185 | 89 |
| 3 | 6 72 | 86 | 73 | 136 | - | 186 | 83 |
| 3 | 7 84 | 87 | 76 | 137 | - | 187 | 65 |
| 3 | | 88 | 85 | 138 | - | 188 | 68 |
| 3 | 9 77 | 89 | 76 | 139 | | 189 | 63 |
| 4 | | 90 | 86 | 140 | 68 | 190 | 66 |
| 4 | | 91 | 58 | 141 | 77 | 191 | 54 |
| | 2 80 | 92 | 78 | 142 | 82 | 192 | 77 · |
| | 3 65 | 93 | 74 50 | 143 | 76 | 193 | 79 |
| | 4 75 | 94 | 59 | 144 | 85 | 194 | 74 |
| | 5 83 | 95 | 77 | 145 | 84 | 195 | 74 |
| | 6 80 | 96 | 71 | 146 147 | 83 74 | 196 197 | 82 78 |
| | 7 78 | 97 | 79 66 | 147 | 67 | 197 | 78 86 |
| 4 | | 98 99 | 66 85 | 148 | , 67 89 | 199 | 79 |
| | 9 75 0 64 | 100 | 83 82 | 150 | 72 | 200 | 81 |
| 1 3 | U 04 | 1 ,00 | 04 | 1.30 | 12 | 200 | OT. |
| | | I | | | | | |

EVALUATION OF DURABILITY, DEBRIS RETENTION, AND CLEANABILITY OF FINE MESH PANELS ON A RISTROPH-MODIFIED THROUGH-FLOW TRAVELING WATER INTAKE SCREEN AT INDIAN POINT UNIT NO. 2

Prepared for

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R-13363.000

February 1996

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EVALUATION OF DURABILITY, DEBRIS RETENTION, AND CLEANABILITY OF FINE MESH PANELS ON A RISTROPH-MODIFIED THROUGH-FLOW TRAVELING WATER INTAKE SCREEN AT INDIAN POINT UNIT NO. 2

1.0 INTRODUCTION

Recent advances in the design of fish-saving features of Ristroph-modified through-flow traveling water intake screens (Fletcher 1990a) outfitted with conventional-sized mesh (e.g. 3/8" sq.; 1/4x1/2" rect.) for purposes of reduction of impingement mortality prompted consideration of the use of similarly modified screens outfitted with fine mesh as a means to reduce entrainment mortality. However, uncertainty of the reliability of fine mesh panels on water intake screens (Fletcher 1990b) mandated tests of mechanical aspects of screen baskets outfitted with fine mesh prior to investigations of fish-saving potentials. A test program was implemented to evaluate the durability, debris retention and cleanability of alternative sizes of fine mesh installed on Ristroph-modified through-flow traveling water intake screen baskets at the Indian Point Unit No. 2 Generating Station.

Durability of fine mesh was of special concern because of reported failings, particularly at the attachment points to basket frames (Fletcher 1990b). Failings in a number of incidences had appeared as material fatigue brought about by the periodic flexing of the mesh within the frames as they were exposed to intake water pressures first on one side and then the other as the baskets rotated in an endless loop around the sprockets of the machine.

Debris retention by fine mesh, particularly the retention of filamentous algae (e.g. Lyngbia sp.), was also of special interest in the study. Historically, the types of debris most frequently observed at the Indian Point Station consist primarily of marsh grasses, tree leaves, eel grass and algae. Average daily quantities collected from individual screens range from a few gallons to nearly 200 gallons (Appendix A). Occasionally, filamentous algae is present in bloom-type conditions and may be washed from the screens in substantially greater quantities (1985 Indian Point Impingement Monitoring Program, unpublished data). One species of algae, Lyngbia sp., is particularly troublesome because its filamentous strands readily entwine on the wires of the mesh, and is removed only with great difficulty by the high pressure spray

wash system. When it is present, substantial intake water head losses can occur across the intake screens as a result of the entwinement of algae on the mesh.

In 1985, observations made during a post-impingement viability study of a Ristroph-modified through-flow screen at Indian Point Unit No. 2 indicated that the filamentous algae could entangle fish collected in screen basket rails and hinder their return alive to the source water. The present study was designed to evaluate filamentous algae retention as a function of screen mesh size. Retention by matting on the surface was considered to be desirable because it would enhance the potential for removal by a front-mounted high-pressure spray wash system. Entwinement, however, was considered to be undesirable, because removal by the high pressure wash might be difficult.

Cleanability of the mesh by the screen's front-mounted high pressure spray wash system was also of interest. Uncertainty existed as to whether the fine mesh in conjunction with a coarse backing mesh would disrupt the spray and reduce its effectiveness in removing debris from the mesh.

This report summarizes the test plan and observations of performance of the mechanical aspects of the twelve of fine mesh panels installed on a Ristroph-modified throughflow screen at Indian Point Unit No. 2.

2.0 MATERIALS AND METHODS

The Ristroph-modified through-flow traveling water intake screen no. 26 at Indian Point Unit No. 2 was selected for use in this fine mesh screen basket evaluation. It is situated in a 13.4' wide by 27' deep (at mean sea level) water intake, and consists of 52 baskets, which measure 2 ft high by 12 ft long. Each basket is outfitted with a fish recovery rail that measures approximately 12 ft long by 3 inches deep by 5 inches wide, and holds approximately 9 gallons of water. The conventional mesh on these baskets has 1/4"x1/2" clear openings woven with 0.08" diameter stainless steel wire. The mesh provides 65% open area.

Circulating water is drawn through the intake at seasonally adjusted rates of 84,000 gpm and 140,000 gpm. At the reduced flow rate, which occurs generally from December through April, intake water approach velocities are approximately 0.5 fps. At full flow, which occurs generally from May through November, approach velocities are approximately 0.9 fps. Approach velocities vary slightly depending on the stage of the tide, the range of which is approximately 3 ft. Debris is filtered from the intake water by the screen, which under normal operation rotates continuously at 2.5 fpm. One revolution requires approximately 42 minutes. Debris is removed from the mesh with a front-mounted high pressures (90 psig.+/-) spray wash system. Fish are removed from the screen rails with a low pressure (10 psig) spray wash system mounted on the rear side of the machine. A secondary high pressure (90 psig) spray wash system located below the fish spray system removes any debris that may remain after the screen baskets have rotated through both the front-mounted high pressure wash and the low pressure fish spray wash system.

Prior to performance of the present study, improvements were made in the manner of attachment of fine mesh panels to screen basket frames by the screen manufacturer. Fine mesh panels were pretensioned for attachment to a screen basket by first binding them to a coarse backing mesh (1" sq.) that had, itself been tensioned by being bowed along its longitudinal centerline (Figure 1). The binding consisted of first placing the top and bottom edges of both meshes into a U-shaped channel of light gauge stainless steel that was then pressed into an S-shaped profile. Pretensioning was expected to reduce panel flexing, while the S-shaped binding was expected to alleviate the mechanical stress of a fixed attachment point such as that formed when a mesh panel is clamped directly to the screen basket frame. The final assembly of fine and coarse mesh was bolted to the screen basket frame (Envirex 1993).

Three sizes of fine mesh in two types of material were selected for evaluation of durability, debris retention and cleanability, particularly during periods when filamentous algae was present. Mesh sizes were 1mm, 2mm, and 3mm. The two types of material were selected for evaluation: stainless steel and polyester. The synthetic material was selected for testing because in other evaluation programs, it withstood flexing somewhat better than metallic mesh, although it was more susceptible to punctures and cuts from sharp-edged objects (Fletcher

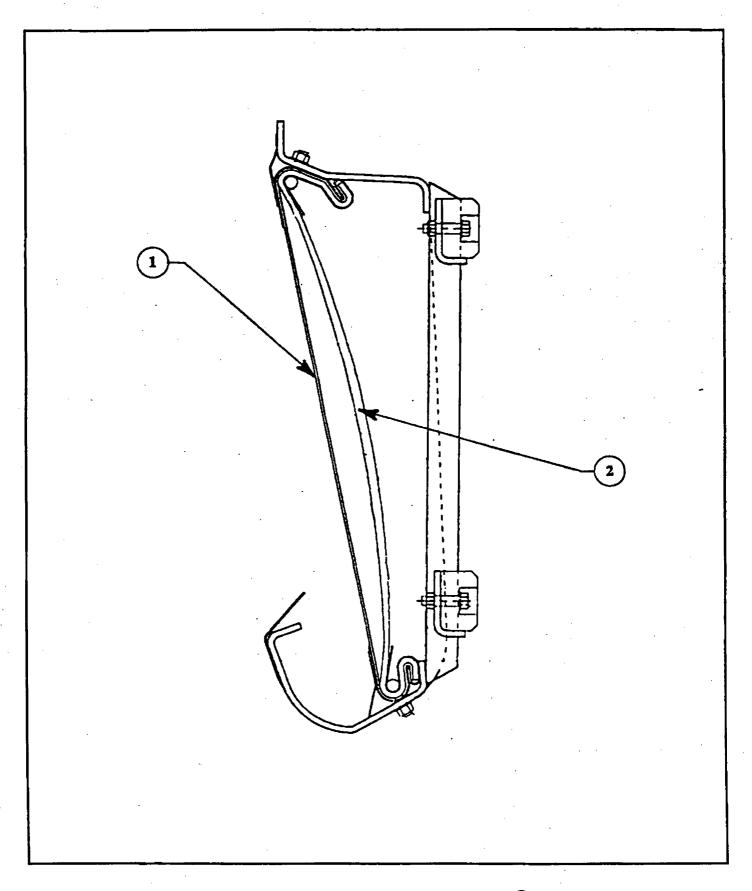


Figure 1. Cross section of Ristroph screen fine mesh panel. 1 Fine mesh panel. 2 Bowed 1x1 inch stainless steel mesh.

1990b). The type of fine mesh and order of installation of test panels on Ristroph-modified through-flow Screen No. 26 at Indian Point Unit No. 2 in March 1993 are delineated in Table 1.

TABLE 1. TYPE AND ORDER OF INSTALLATION OF FINE AND STANDARD MESH PANELS ON THE RISTROPH-MODIFIED THROUGH-FLOW TEST SCREEN NO . 26 AT INDIAN POINT UNIT NO. 2.

| MATERIAL | MESH SIZE (mm) | WIRE SIZE (mm) | PERCENT OPEN AREA | NUMBER OF PANELS |
|-----------------|-------------------|-------------------|----------------------|---------------------|
| Stainless Steel | 2x2 | 0.63 | 56 | 3 |
| Stainless Steel | 6.3x12.7 | 2.03 | 65 | 10 |
| Stainless Steel | lxl | 0.46 | 51 | 3 |
| Stainless Steel | 6.3x12.7 | 2.03 | 65 | 10 |
| Stainless Steel | 3x3 | 0.63 | 52 | 3 . |
| Stainless Steel | 6.3x12.7 | 2.03 | 65 | 10 |
| Pecap Polyester | 1x1 | 0.50 | 45 | 3 |
| Stainless Steel | 6.3x12.7 | 2.03 | 65 | 10 |

Analyses of the durability, debris retention, and cleanability of the 12 fine mesh panels, as well as that for the conventional mesh panels on the test screen, were made through direct observation during the interval May 1993 through November 1994. Photographs of fine mesh and adjacent 1/4 x 1/2 inch mesh panels were taken during periodic inspections as the basket rotated out of the water intake. The 35 mm waterproof camera was fitted to the end of a specially designed extension arm and shutter release that facilitated photographing the mesh panels while the screen was operating. All photographs were of the same general section of each mesh panel (approximately a 2 foot square area approximately 2 feet from the left hand end of the 12 foot long buckets) over the entire evaluation period. In addition to the still photographs, a camcorder was used to make VCR tapes of the panels as they rotated on 4 August 1993, 22 November 1993, and 15 July 1994. During observation periods, the front high pressure spray was operated at approximately 90 psi and the low pressure spray operated

at approximately 10 psi. The front mounted high pressure wash was turned off to facilitate observations and the taking of photographs. The screen panels rotated at 2.5 ft/minute almost continuously throughout the test period. Intake water flow velocities averaged approximately 0.9 fps for approximately 75% (15 months) of the 20 month study and approximately 0.5 fps during the remaining 25% (5 months). Approximately 20,000 revolutions of the traveling screen were made during the study period, which reflects the approximate number of cycles of the fine mesh flexing back and forth as the screen rotated around the machine.

During the approximately 20 month long study at Indian Point Unit No. 2, filamentous algal blooms did not develop, and, as a consequence, assessments of the potential for algal entwinement about the wires of the mesh, and efficiency at which it could be removed by the spray wash system could not be directly assessed. On none of the days when the screen panels were inspected was debris loading rates found to be substantial. Evaluations focused on the durability of this screen mesh, particularly with respect to breaks that might have been caused by flexing, or from punctures by heavy debris. The screen panels were inspected for stretching (blousing) of mesh material, which could also increase the potential for flexing at points of attachment to the screen basket frame. The potential for stretching existed because the mesh was exposed to inflow water pressure on first one side of the panels as the basket rose out of the intake bay and then on the opposite side as they descended down the backside of the machine into the bay. The following are synopses of observations of screen condition during each inspection:

18 May 1993

The first observations were made in May 1993, after the panels had been installed for two months. There was no evidence of breaks, tears or punctures in any of the panels. Debris loads were very light. None of the panels showed any blousing and all attachment points for all panels were intact. The 1/4x1/2 mesh on the standard panels that separated the test panels appeared to be in excellent condition and free of any breaks, tears or other damage.

2 June 1993

Three months after installation there was no evidence of breaks, tears, punctures in any of the panels. None of the panels showed any blousing and all attachment points for all panels were intact. Debris loads were light, and the debris present washed cleanly off of all panels as they rotated past the rear high pressure wash onto the back side of the screen. The fine mesh panels did not appear to impede the cleaning ability of the rear spray wash system. The standard 1/4x1/2 mesh panels were also cleaned by the spray system with no problems.

4 August 1993

There was no evidence of breaks, tears, blousing or punctures in any of the panels five months after installation. The light debris present was washed off cleanly by the high pressure spray. The flap seal appeared to be properly positioned and in good condition.

22 November 1993

By November of 1993 the panels had been installed for eight months. No breaks, tears, or punctures were observed in any of the panels and all attachment points for all panels were intact. Some blousing was observed in the second panel of the 1x1 mm synthetic mesh; the mesh no longer appeared to be tightly stretched within the basket frame.

29 March 1994

The panels had been installed for 12 months by March of 1994. Attachment points on all panels were intact and there were no breaks, tears or punctures. Small amounts of debris were present and all debris washed cleanly off of all panels. Blousing was observed in the second 1x1 mm synthetic mesh panel. In addition, slight blousing was observed in the second panel of 2x2 mm stainless steel.

10 June 1994

Fifteen months after installation, some blousing was observed on the second 1x1 mm synthetic panel and the second 2x2 mm stainless steel panel. No blousing, tears, breaks or punctures were observed on any other panel.

15 July 1994

Sixteen months after installation, all three 1x1 synthetic panels exhibited moderate blousing. At the center of the panels there was approximately a 25 mm gap between the synthetic mesh and the stainless steel support mesh. The center panel of the 2x2 mm stainless steel mesh also showed slight blousing. All other fine mesh panels were intact with no blousing, breaks, tears, or punctures. The 1/4x1/2 inch mesh panels also appeared to be in excellent condition (see photographs, Appendix B).

23 November 1994

No significant changes in the conditions of the fine mesh panels were observed between July 1994 and November 1994. Twenty months after installation a 25 mm gap was present between all the synthetic mesh panels and the stainless steel support mesh. The center panel of the 2x2 mm stainless steel mesh also showed slight blousing. All other fine mesh panels were intact with no blousing, breaks, tears, or punctures. The 1/4x1/2 inch mesh panels also appeared to be in excellent condition.

21 September 1995

A follow-up inspection be Con Edison at approximately 28 months of service disclosed that all panels of each of the three sets of stainless steel mesh appeared to be in excellent condition. All bindings appeared to be tight, and there was no signs of punctures, tears, or breaks in any of the panels. Slight blousing was observed in one panel of 1 mm

stainless steel mesh. Slight blousing observed in one panel of 2 mm stainless steel mesh at 12 months of service, noted above, did not appear to have increased. The polyester mesh appeared to have continued to stretch, although it was still fully intact and had no observable cuts, tears or breaks. The gap between the polyester mesh and its support mesh appeared to be approximately 75 mm at the center of the panel.

3.0 DISCUSSION

The fine mesh panels on Screen No. 26 were inspected for durability, debris retention, and cleanability on eight occasions over a 20 month evaluation period. During this period, test panels experienced approximately 20,000 cycles (rotations) between the front and the rear side of the machine at an approximate rate of one cycle every 42 minutes. During each revolution, the mesh was subjected to intake water pressure first on one side and then on the opposite, which caused flexing in one direction and then the opposite as the baskets rotated around the sprockets. Installation of the fine mesh panels on a backing mesh appeared to limit inward flexing on the front side of the baskets, but did not prevent outward flexing when the baskets were on the backside of the machine.

At the end of the test period, all panels, as well as the adjacent conventional panels, were found to essentially free of any form of damage such as breaks in wires due to flexing, or tears or punctures such as those that might occur from contact with sharp-edged objects (Photograph sets A through E). Although not discernible from examination of the photographs, the polyester mesh in all three test panels lost its original tension in the screen basket frame as a result of stretching after approximately 8 months of service (8,300 cycles). This condition was considered undeniable. Excessive stretching could accelerate the deterioration of mesh. A slight amount of stretching of the 2x2mm stainless steel mesh occurred in one of the three test panels after approximately 12 months of service (12,500 cycles). In laboratory tests, the screen manufacturer, Envirex, Inc., exposed 2x2mm pretensioned stainless steel mesh mounted in a 10 ft long by 2 ft wide screen basket to a periodic pressure equivalent to a 1 ft water head differential and found no significant mechanical deterioration after 270,000 flex cycles (Envirex 1993).

Debris loading during inspection periods was "light" to "normal", which, based on records of debris accumulations at the station (Appendix A), was equivalent to approximately 0.02 to 0.05 gallons (1/4 to 1 cup) per screen basket rail per rotation through the intake water column. Assessments of filamentous algae retention as a function of mesh size, as well as cleanability by the high pressure wash system, could not be accomplished because the algae was never observed in bloom-type quantities during the study period. The fact that accumulations of any types of debris were not entwined in the mesh of test panels suggested that cleanability had not been impaired by any of the three fine mesh sizes plus respective backing (tensioning) meshes tested.

4.0 REFERENCES

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- Fletcher, R.I. (1990b). A Review of Reported Fine Mesh Screen Applications for High Volume Water-Intake Systems, and Recommendations for Further Investigations. Report to Consolidated Edison Company of New York, Inc.
- Envirex, Inc. (1993). A Report on TWS Basket Endurance Test No. 13., 10' Tensioned Mesh @ 1' D.P. Project No. RD94015-06D.

APPENDIX A

INDIAN POINT GENERATING STATION DEBRIS DATA TRAVELING WATER SCREENS 21-25

| YEAR | | | | DEBRIS IN GALI | LONS, FIVE MBINED | SCREENS | |
|------|--------|----------------|-----------------|----------------|----------------------|---------|---------|
| | MONTH* | NO. OF DAYS | TOTAL/ MONTH | MAX/DAY | MIN/DAY | AVG/DAY | TYPE |
| 89 | JAN | 31 | 1,673 | 120 | 15 | 54 | 1, 4 |
| 89 | FEB | 28 | 709 | 50 | 4 | 25 | 1, 4 |
| 89 | MAR | 18 | 386 | 70 | 5 | 21 | 1, 4 |
| 89 | JULY | 28 | 3,473 | 320 | 30 | 124 | 2 |
| 89 | AUG | 31 | 3,242 | 260 | 10 | 105 | 2 |
| 89 | SEPT | 29 | 5,190 | 520 | 60 | 179 | 2 |
| 89 | OCT | . 30 | 3,560 | 355 | 30 | 119 | 2 |
| 89 | NOV | 30 | 2,920 | 280 | 25 | 97 | 2, 4 |
| 89 | DEC | 29 | 763 | 100 | 5 | 26 | 1 |
| 90 | JAN | 29 | 656 | 60 | . 2 | 23 | 1 |
| 90 | FEB | 26 | 1,495 | 175 | 5 | 58 | 1, 4 |
| 90 | JUNE | 14 | 840 | 200 | 5 | 60 | STKS |
| 90 | JULY | 31 | 1,338 | 185 | 3 | 43 | STKS |
| 90 | AUG | 31 | 2,745 | 225 | · 25 | 89 | 2, STKS |
| 90 | SEPT | 29 | 2,865 | 325 | . 5 | 99 | 2 |
| 90 | OCT | 31 | 2,110 | 220 | 10 | 68 | 2 |
| 90 | NOV | 29 | 3,325 | 600 | 5 . | 115 | 2, 4 |
| 90 | DEC | . 30 | 1,695 | 255 | 10 | 56 | 1, 4 |

^aMissing months - Unit was out of service, debris collections were not recorded.

4-leaf litter

2-eel grass

5-Other

3-Spartina

STKS-sticks

^b1-aigae

^{13363.000/1}P2.DOC (marine r95-2) Con Ed February 6, 1996

INDIAN POINT GENERATING STATION DEBRIS DATA **TRAVELING WATER SCREEN 26**

| | | | | DEBRIS IN GALI | LONS, FIVE MBINED | SCREENS | |
|------|--------|----------------|-----------------|----------------|----------------------|---------|------|
| YEAR | MONTH* | NO. OF DAYS | TOTAL/ MONTH | MAX/DAY | MIN/DAY | AVG/DAY | TYPE |
| 89 | JAN | 31 | 208 | 20 | 1 | 7 | 1, 4 |
| 89 | FEB | 28 | 106 | 12 | • 1 | 4 | 1, 4 |
| 89 | MAR | 19 | 88 | 10 | 1 | 5 | 4 |
| 89 | JULY | 26 | 200 | ن 20 | 2 | 8 | 2 |
| 89 | AUG | 31 | 296 | 35 | 1 | 10 | 2 |
| 89 | SEPT | 29 | 317 | 60 | 2 | 11 | 2 |
| 89 | OCT | 30 | 479 | 50 | 2 | 16 | 2 |
| 89 | · NOV | 30 | 814 | 80 | 1 | 27 | 2, 4 |
| 89 | DEC | 29 | 338 | 40 | 4 | 12 | 1 |
| 90 | JAN | 29 | 286 | . 35 | 3 | 10 | 1 |
| 90 | FEB | 28 | 293 | 35 | . 2 | 10 | 1, 4 |
| 90 | JUNE | 18 | 372 | 90 | 5 | 21 | 1, 4 |
| 90 | JULY | 22 | 283 | 30 | 3 | 13 | 2 |
| 90 | AUG | 27 | 931 | 175 | 1 | 34 | 2 |
| 90 | SEPT | 29 | 498 | 45 | 1 | 17 | 2 |
| 90 | OCT | 17 | 398 | 150 | 1 | 23 | 2,4 |
| 90 | NOV | 20 | 819 | 195 | 5 | 41 | 4 |
| 90 | DEC | . 28 | 440 | 150 | 1 | 16 | 1, 4 |

^aMissing months - Unit was out of service, debris collections were not recorded.

4-leaf litter

5-Other

STKS-sticks

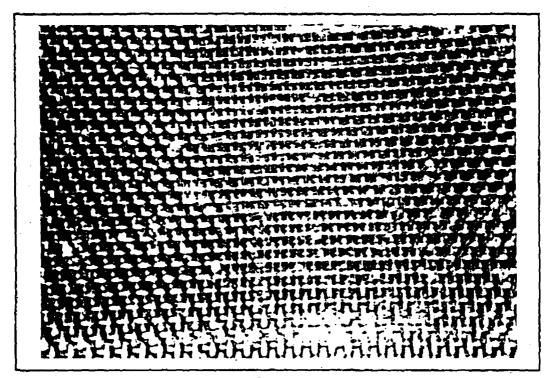
^b1-algae

²⁻eel grass

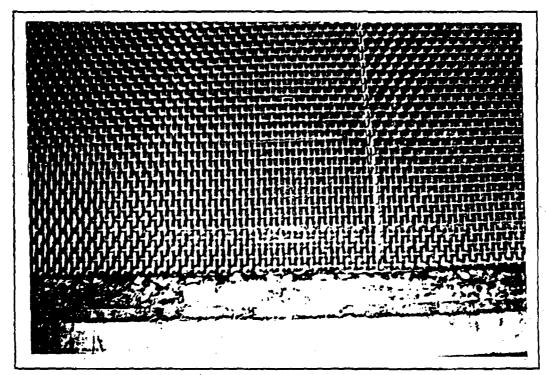
³⁻Spartina

APPENDIX B

Photographs of fine mesh and conventional mesh panels on Intake Screen No. 26 of Indian Point No. 2, May 1993 through November 1994.



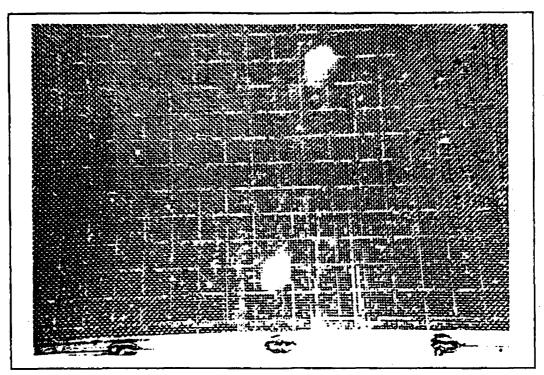
A. May, 1993



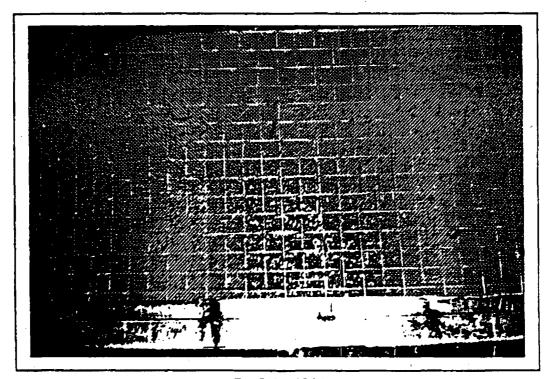
B. July, 1994

Photo Set A.

Photographs of 1/4x1/2 inch standard stainless steel mesh panels.



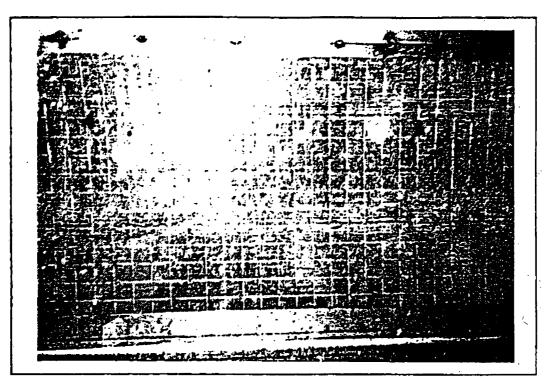
A. May, 1993



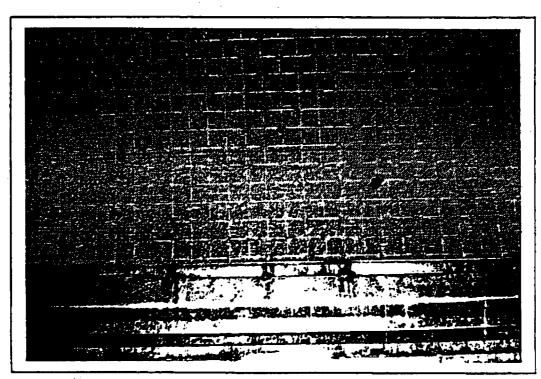
B. July, 1994

Photo Set B.

Photographs of $2x^2$ mm stainless steel mesh panels.



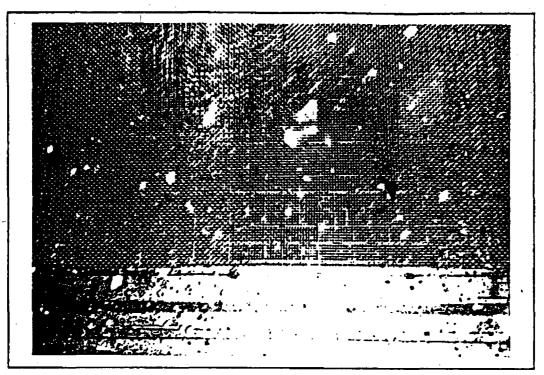
A. May, 1993



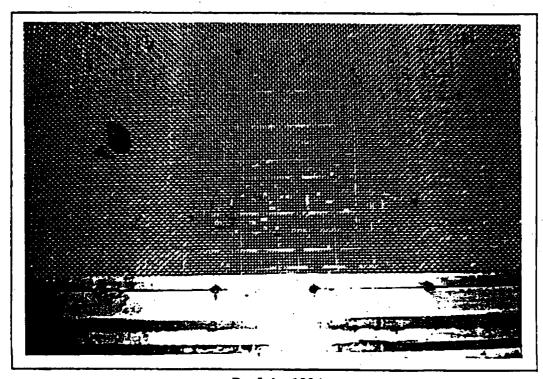
B. July, 1994

Photo Set C.

Photographs of lx1 mm stainless steel mesh panels.



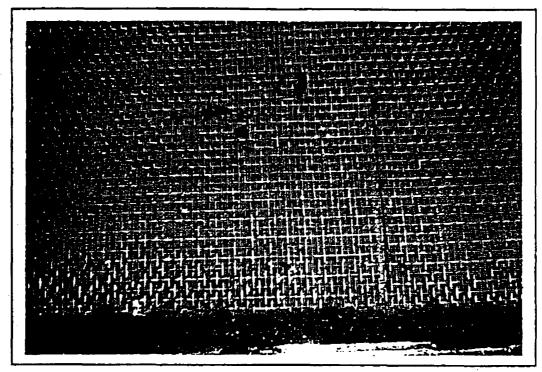
A. May, 1993



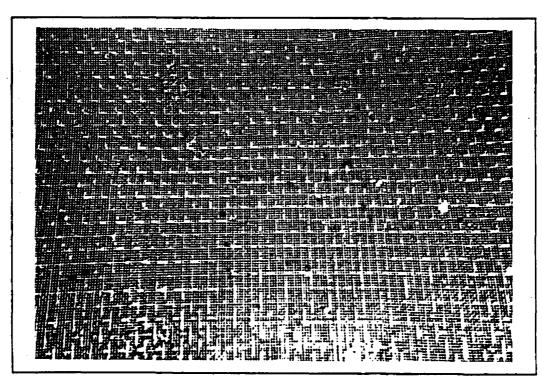
B. July, 1994

Photo Set D.

Photographs of 3x3 mm stainless steel mesh panels.



A. May, 1993



B. July, 1994

Photo Set E.

Photographs of 1x1 mm Pecap polyester mesh panels.

Flows and Fish Behavior: Large Double-Entry Screening Systems

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Great Salt Bay Experimental Station Damariscotta, Maine 04543, USA

Abstract. - Facilities that draw water in large quantities from natural sources are commonly equipped with mechanically driven barrier screens for removing indrawn debris and captive fish. Owing to the mistransport of debris into the works of the facility by the cyclic action of conventional screening apparatus, many plant operators favor the refitting of intake systems with alternative devices called dual-flow screens, whose manner of operation precludes the deposition of debris downstream of the screen location. Fish-catching devices, otherwise suited to the flows and mechanics of a conventional screen, are often attached without alteration to the screen panels of a dual-flow machine in the hopes of rescuing entrapped fish. Dual-flow machines are thought to be superior to conventional intake screening systems in saving impounded fish, but the full-scale experiments reported here show why the flow patterns and water speeds associated with a (doubleentry) dual-flow screen are actually more adverse to live fish recovery than flows through a conventional screen. Owing to flow separations at the entries of these devices and the resulting concentration of flow over a restricted portion of the screening, fluid speeds comparable to flows of 30 and 45 cm/s through conventional screens increased to 90 and 140 cm/s at free-flow regions of the screenfront. In experiments with two species of juvenile fishes, survival without injury was nil. Flow trajectories were mapped by streak photography, and details of fish behavior were recorded on videotape and 35-mm film. Equations for the flow distributions were resolved from two-component vector measurements of water velocities. Also shown is an experimental apparatus (a frontwall fairing) that eliminates the flow separations, resulting in a redistribution of the inflow across the full width of the available screening.

Electricity generating stations and other facilities that divert or withdraw large volumes of water from natural sources in their operations are commonly equipped with mechanically active barrier screening. The screens have the principal function of halting and removing debris from the inflowing water, but they also collect and kill entrapped fish, often in large numbers. A conventional water intake system consists usually of several sumps, each supplied from a free-surface forebay and each fitted with a motor-driven machine that moves a set of linked screen panels around sprockets in the manner of an endless chain, as indicated by Figure 1. The inflowing water is drawn directly through the ascending and descending halves of the traveling screen assembly; indrawn matter not otherwise extruded through the screen mesh is forced onto the upward moving screen by the inflow, then carried above the water surface for disposal.

Material captured and raised from the water by the screen is forcibly removed by one or more rows of directed, high-pressure water jets that blow through the screening from locations above the machinery deck and between the moving halves of the screen. Very often, such indrawn matter as plastic bags and filamentous macrophytes, in being stapled into the screenmesh, is not completely removed by the spraywash. In consequence, the unremoved debris is carried back to the water by the descending side of the screen and released into the sump by the force of the main water flow. In some cases, the transport, or carry-over, of unwanted debris into the sumps of a water intake system (and hence into the plant works by way of the water pumps) is great enough to degrade the operating efficiency of the facility or to require increased maintenance.

Owing to the annovances connected with the mistransport of debris by conventional rotating screens, many plant operators favor the refitting of intake systems with alternative devices, called dual-flow screens, whose manner of operation precludes the downstream deposition of debris. Although consisting of linked panels and driven around sprockets in a conventional fashion, a dualflow screen is placed at an attitude 90° to the approaching flow, water passing through its moving halves according to either of two configurations, one called a double-entry, single-exit screen (as in Figure 2b) and the other a single-entry, doubleexit screen. The double-entry arrangement is the design more often employed, and it was the design adopted for the experimental work reported here.

In contrast to the straight-through flow geom-

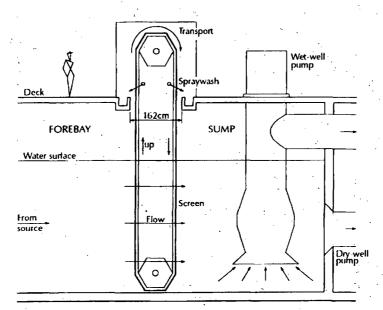


FIGURE 1.—Arrangement of a large water intake system equipped with a conventional rotating screen. Typical water speeds through the screen range from 30 to 60 cm/s, and a typical elevation speed is 5 cm/s. Pump capacities (of either the wet well or dry well configuration) range from 260,000 to 530,000 L/min.

etry of a conventional rotating screen (Figure 2a), water drawn through a double-entry screen arrangement must bifurcate around a plate or frontwall (which closes off the upstream side of the machine) and pass through the ascending and descending halves of the screening by way of two alley-like portals at the sidewalls of the forebay. The flow then enters the sump area through a nar-

row penstock, at the rear of the machine, which is no more than the open framework between the moving halves of the screen. As shown by the studies reported here, the peculiarities of the flow approaching and passing into the screen pose special problems in the mechanics of live fish recovery

Although the problem of fish kills by various

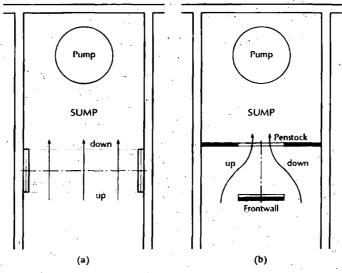


FIGURE 2.—(a) Plan of typical intake channel equipped with a conventional rotating screen, as in Figure 1. (b) Conversion of the intake channel to a double-entry, single-exit rotating screen.

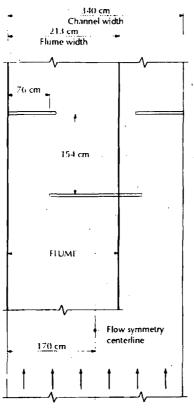


FIGURE 3.—Relationship between the width of the laboratory flume and the geometry of a typical dual-flow screen conversion for a standard-width intake channel.

intake screening systems has received considerable attention over the years from regulatory agencies, fishermen, citizen's action groups, the power industry, and screen manufacturers, little work has been done in the past in the way of direct observations of the full-scale flow patterns and fish behavior associated with any screening system. Costly apparatus meant to rescue entrapped fish, or to divert them in some way from encounters with the screening, is manufactured and installed with scant foreknowledge of its likelihood of succeeding or failing. Such intuitively derived schemes and devices as sound generators, electric barriers, dangling chains, bubble clouds, angled screens, horizontally traveling screens, and fish-scooping devices, although promising in concept, have not proven to be very effective in reducing fish kills at large water intake systems (see Fletcher 1985 for a list of representative references). The poor performances of these fish-saving appliances can often be traced to imperfect understandings of fluid flows and the related responses of fish to currents and obstacles. As shown in a recent study of a device known as a Ristroph screen (Fletcher 1990a), casual suppositions about the nature of complex fluid flows can be so misleading that one is apt to anticipate an outcome wholly at odds with reality. In the case of the Ristroph screen experiments, once the actual interactions between fish and flows were observed, alterations to the device that conformed to reality followed and fish kills were reduced.

For the dual-flow experiments reported here, a full-scale entry portal and frontwall of a dual-flow screen, typical of the double-entry configuration, were installed in a large hydrodynamics flume. Flow patterns and velocity fields were retrieved from vector-resolving current measurements and from two flow-marking schemes, one of particle motion recorded on videotape and one of particle streaking by time exposures on 35-mm film. Test fish were also released upstream and their dispositions in the flow fields were recorded on videotape and 35-mm photographs. As in the Ristroph screen study, this research was meant to discover and clarify those peculiarities of flows and fish behavior that instruct both the biologist and the design engineer.

Experimental Apparatus

In the usual circumstance where conventional rotating screens are replaced with dual-flow machines, the overall breadth of the device is limited by the width of the access slot, or well opening, in the machinery deck of the facility (see Figure 1), the standard dimension being 1.62 m (5 ft, 4 in). The long dimension of the well opening corresponds to the width of the intake channel. A common dimension is 3.4 m (11 ft, 2 in), but intake channels range in width from 2.74 m to 3.96 m. Short of altering the civil works of a plant, these dimensions effectively limit the arrangements of dual-flow machines designed expressly to replace conventional screens. The experimental apparatus for the work reported here was configured around the basic dual-flow geometry prescribed by the manufacturers of such devices and installed in the Royce hydrodynamics flume in Houston, Texas.

The Royce flume is equipped with underwater viewing ports, an overhead camera gantry, flow-measuring instruments, fish-releasing cages, and fish-holding tanks. The flume and its equipment were more fully described by Fletcher (1990a). Although the 340-cm width of a typical intake channel is greater than the 213-cm width of the labo-

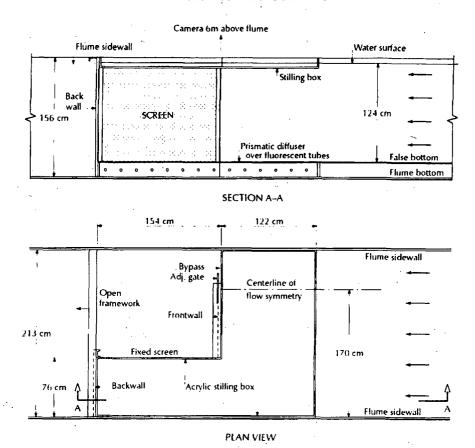


FIGURE 4.—Plan and section of experimental apparatus, as arranged in the laboratory flume for the flow-marking and fish behavior experiments. The location of the stagnation streamline was controlled by means of the frontwall bypass and adjustable gate. For the flow-marking experiments, slot lighting through underwater viewing ports was employed. All filming was done from an overhead gantry.

ratory flume, duplications of full-scale flow fields were still possible by virtue of the mechanical and fluid dynamical symmetries characteristic of the dual-flow screen geometry. The relationship of those symmetries to the configuring of the flume for the experimental work is indicated by Figure 3. which shows the flume width superimposed on the layout typical of a full-scale dual-flow screen. That portion of the dual-flow apparatus falling within the boundaries of the laboratory flume (the frontwall of the screen and one entry portal) was built and installed in the flume, and the location of the stagnation streamline (the flow centerline indicated on the figure) was controlled by means of a bypass and gate located at the far end of the screen frontwall.

The arrangement of the laboratory flume for this work is more fully described by Figure 4. For the fish behavior experiments, the bottom of the flume in the vicinity of the modeled dual-flow machine was lighted by rows of sealed fluorescent tubes, covered over with a prismatic diffusing plate, which allowed for overhead silhouette filming of fish movements. As an aid to the overhead video and photographic work, an L-shaped stilling box, constructed of a clear plastic material and containing a layer of water, was clamped in place at the flume water surface, directly over the bottom lighting. Because the purpose of the research did not extend to the testing of any proposed or existing fish-rescuing attachments, none of the mechanism for actually moving the entry screen was needed for the work, so the screening itself was merely fixed in place, as indicated on the figure

Flume calibration.—All experiments were repeated at two mean upstream flow speeds, 30 and 45 cm/s—testing standards recommended by the Electric Power Research Institute. The free-flow distribution in the laboratory flume is controlled

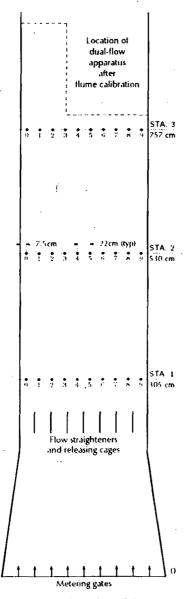


FIGURE 5.—Channel portion of the laboratory flume showing locations of reference stations for calibrating the free-flow geometry. Water velocities were measured at each station on a vertical reference grid of 70 points (7 rows, 10 columns). The 98 metering gates were adjusted until the desired flow pattern was achieved.

by 98 metering gates, located in the bulkhead of the inlet chamber, which were set in a pattern, prior to installation of the dual-flow apparatus, that put the (offset) core of the unobstructed flow along a line corresponding to the symmetry centerline of a 340-cm-wide intake channel. The selected flow geometry was meant to simulate the

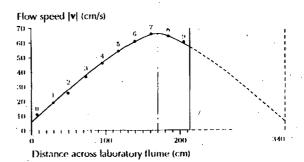


FIGURE 6.—Velocity distribution across the laboratory flume, middepth at station 3, with the upstream flow set at 45 cm/s before installation of the dual-flow apparatus. Points denote instrument values. Velocity profile in the 213-cm-wide flume simulates flow in a 340-cm-wide open channel.

flow typical of an open, elongated channel, which takes on a characteristic nonuniform distribution where the fluid speed at the core of the flow may be four to five times the speed near the channel boundaries (see Sellin 1970 or White 1986). Thus, the 120-cm vertical distance from the flume bottom to the underside of the stilling box (Figure 4) represents a like-size section across the core (and below the surface) of a deep channel.

For the flume calibrations, an electromagnetic current meter was attached to a digital converter, with input to a microprocesser, which gave threedimensional displays of the corresponding velocity vectors at the three flume stations indicated in Figure 5. At each of those reference stations, velocity measurements were taken on a vertical reference grid of 70 points distributed over the width and depth of the flume. A representative crosschannel distribution from those measurements is shown by Figure 6. The velocity pattern for each of the mean test speeds was calculated from a normalized distribution and the metering gates of the flume were set accordingly. Following the flume calibrations, the dual-flow apparatus was installed in the flume; the correct location of the offset, flow-symmetry centerline was maintained by means of a gated bypass located in the front wall of the dual-flow apparatus. The centerline of the unobstructed flow became the stagnation streamline of the flow into the dual-flow apparatus. The complete velocity measurements from the flume calibrations are given in the laboratory report (Fletcher 1990b).

Exceptions to the experimental conditions.—In circumstances where the intake channels of a facility open onto a flowing water source (as in a

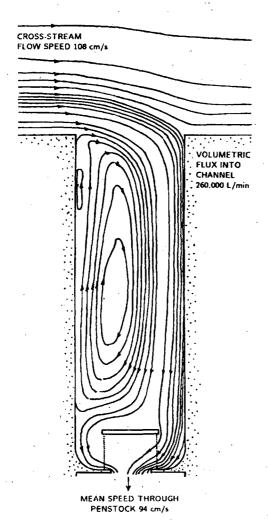


FIGURE 7.—Calculated transport trajectories at Arthur Kill Generating Unit 2 (Staten Island, New York), showing the influence of a tidally driven and wind-enhanced crosscurrent on the flow into a typical intake channel of the plant. Channel width is 3.4 m and water depth in the sump varies from 3.6 m to 6.4 m with the tide. (From Fletcher 1988.)

river), the realized flow distributions may differ somewhat from the flow patterns employed in the experiments here, owing to the influence of the crosscurrent at the channel entries. In the case of a conventional screening arrangement (as portrayed in Figures 1 and 2a), an asymmetric forcing of the intake flow is not especially deleterious to the operation of the intake system, but in the case of a double-entry system, the flow speeds through one portal may be elevated significantly above design limits (and, consequently, to speeds even greater than those recorded in the flume experi-

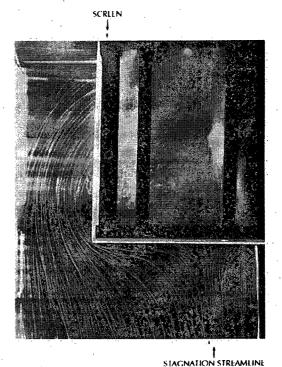


FIGURE 8.—Pathline streaks in the vicinity of the experimental apparatus, at the 30-cm/s mean flow setting, as delineated by reflective flow markers (which were illuminated by slot lighting through underwater viewing ports). At the corner of the entry portal, the main flow separates from the frontwall and passes through the screenmesh a distance downstream from the corner, thus creating a gyre of reverse flow through the upstream portion of the screening.

ments here). Figure 7 shows the transport trajectories of just such a case. The unbalanced flow through the penstock created an adverse pump condition called pre-swirl, which was partly corrected by the attachment of vertical guide vanes at the penstock exit. Downstream flow corrections, however, do not readily ease the upstream hydraulic heads or the asymmetric burdens of momentum on the screen structure occasioned by such severely skewed and accelerated approaching flows. In the winter of 1992-1993, for example, a double-entry test screen at the Roseton generating station on the Hudson River was collapsed by a storm surge, while the conventional rotating screens in the proximate intake channels of the plant suffered no apparent harm.

Flow Trajectories and Velocity Fields

Pathlines of the flows in the vicinity of the modelled dual-flow screen were recorded on videotape

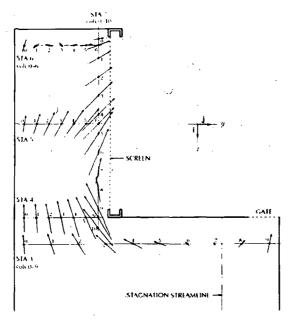


FIGURE 9.—Plot of velocity vectors at middepth, at the 45-cm/s mean flow setting, as measured with a component resolving current meter. The points of measurement lie at the arrow midpoints. The length of a vector arrow corresponds to water speed (to velocity magnitude); the orientation of the arrow corresponds to the instantaneous direction of flow at the reference point. See Table 1 for component values.

and 35-mm photographs. The cameras were equipped with telephoto lenses and located 6 m above the flume (an arrangement for reducing visual parallax). Pathline trajectories for the streak photography were delineated by small, neutrally buoyant plastic particles released 5 m upstream of the dual-flow apparatus. For each such release, six successive exposures were made at 1.2-s intervals with shutter speeds of 0.6 to 0.9 s. Streak lines typical of that technique are shown in Figure 8. Because the flows were steady and the mass of a plastic particle was very small, the pathline streaks can also be viewed as velocity streamlines. As indicated by Figure 8, the flow along the frontwall of a dual-flow screen must turn 180° to enter the screening. Owing to the high momentum of the fluid in that turning region, a large standing flow separation occurred at the upstream corner of the screen entry. In consequence of the displacement of flow past the separation, the main efflux of water through the screen was concentrated over the downstream portion of the screening at both of the employed test speeds.

Flow separations like that of Figure 8 are not usually perceived at the surface of a channel flow when the intake pump is located deep in the water column. Unlike a purely gravity-driven flow, where the high-speed core commonly occurs at or near

Table 1.—Middepth velocity measurements (cm/s) corresponding to the vector field shown in Figure 9. The symbol |v| signifies flow speed (velocity magnitude); symbols v_x and v_y denote the measured cartesian components of fluid velocity v according to the orientation indicated on Figure 9.

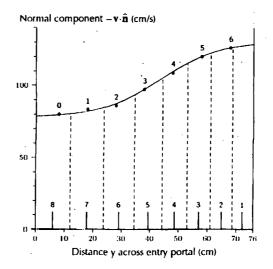
| Velocity compo- | | | | | Instrum | ent location | ocation (column) | | | | | | |
|--------------------|------|-------------|------|------|---------|--------------|------------------|------|-----|------------|------|--|--|
| nent | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 - | | |
| | | | | | Stat | tion 3 | | | | | | | |
| ν_{x} | - 57 | -62 | -64 | -52 | -27 | -14 | -11 | -9 | -21 | -55 | | | |
| v _y | -4 | - 20 | - 39 | -57 | -53 | - 37 | -11 | -1 | 18 | 11 | | | |
| ۱۷I | 57 | 65 | 75 | 77 | 59 | 39 | 15 | 9 | 28 | 56 | | | |
| | | | | • | Stat | tion 4 | | | | | | | |
| v_{x} | -80 | -83 | -88 | -97 | - 109 | -120 | -126 | | | | | | |
| v _v | -2 | -7 | -17 | -23 | - 34 | -57 | -80 | | • | | | | |
| | 80 | 83 | 89 | 100 | 114 | 133 | 149 | | | | | | |
| | | | | | Stat | tion 5 | | | | | | | |
| v _x | ~ 50 | - 57 | -66 | -74 | ~ 80 | -86 | - 92 | | | | | | |
| v _y | 9 | 18 | 32 | 41 | 57 | 74 | 92 | | | | | | |
| l¥1 | 51 | 60 | 73 | 85 | 98 | 113 | 130 | | | | | | |
| | | | | | Stat | tion 6 | | | • | | | | |
| v _x | 34 | 14 | -5 | -14 | 5 | -5 | -23 | | | | | | |
| v _y . | -11 | - 20 | - 20 | 1-11 | 18 | 34 | 66 | | | | | | |
| ĺ₹I | 36 | 24 | 21 | 18 | 19 | . 34 | 70 | | | | | | |
| | | | | • | Stat | tion 7 | | | | | | | |
| v_{x} | -6 | - 30 | - 55 | -80 | - 103 | -125 | -135 | -76 | -75 | -149 | -107 | | |
| vy | 32 | 66 | 80 | 91 | 94 | 83 | 57 | 15 | -11 | -70 | -87 | | |
| (v) | 33 | 72 | 97 | 121 | 138 | 150 | 146 | . 77 | 76 | 165 | 138 | | |

the free surface, the main, high-speed region of a pumped channel flow is drawn to greater depths, and a retarded or even reversed flow at the surface is not an unusual feature. Again, the laboratory flows were meant to be representative of the main flow regimes of such distributions. The flow separations (the breaking away of flow pathlines from solid boundaries) that attend the higher-speed regions beneath the surface of deep channels are no less real than the separation evident in the photograph of Figure 8.

For quantifying the flow pattern around the dualflow apparatus, velocity measurements were taken at the reference stations indicated in Figure 9. The measurements at each station were made on a location grid of 7 rows and n columns (n = 10 for station 3, n = 7 for stations 4, 5, and 6, and n =11 for station 7). The vector diagrams of Figure 9 portray the instrument readings from middepth (row 4) when the 45-cm/s flow setting was used; the corresponding component values are given in Table 1. The complete velocity data for the 30and 45-cm/s settings are contained in the laboratory report (Fletcher 1990b).

The length and direction of a vector arrow in Figure 9 indicates the magnitude of water velocity and the instantaneous direction of flow at the arrow midpoint (the point of measurement). That is, any vector arrow of Figure 9 lies tangent to the (curving) velocity steamline that passes through the corresponding point of measurement. Owing to the extreme crowding of the main flow streamlines in passing through the narrow entry portal and around the corner separation, the water velocities at the screen (and the corresponding momenta of flow) were greatly elevated. Velocity magnitudes at the screen were on the order of 140 cm/s at the 45-cm/s setting and 90 cm/s at the 30cm/s setting. The asymmetric nature of the flow through the entry portal and screening is more clearly defined by Figures 10-12. The separation of the main flow from the corner of the entry portal effectively blocked off 50% of the screen area to the main flow at the 45-cm/s setting and 38% at the 30-cm/s setting. In each case, the clockwise circulation of the corner separation created backflow in the upstream portion of the screening.

As shown variously by Figures 9-12, the geometry of the flow associated with a conventional cross-channel screen (Figure 6) is drastically altered by the substitution of a dual-flow screen. The high-speed core of the unobstructed flow through a conventional screen becomes the upstream region of lowest fluid speed, and the main transport



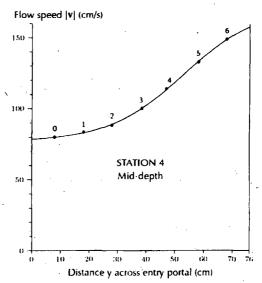
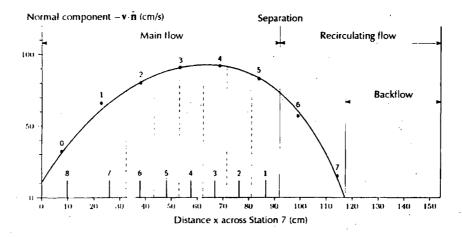


FIGURE 10.—Top panel: distribution graph at station 4 of normal component $-v \cdot f$ at the 45-cm/s mean flow setting. Points are instrument values; see v_x values in Table 1. Area under the graph is volumetric transport Q^{\bullet} through station 4. Equal areas bounded by dashed lines correspond to the eight numbered transport trajectories of Figure 12. Bottom panel: distribution graph of corresponding velocity magnitudes at station 4; see |v| values in Table 1.

of water is deflected away from the center of the channel to the narrow entry portals at the channel sidewalls. At the entry portal, fluid speed is greatest at the corner of the frontwall, corresponding to the velocity maximum along the boundary of the flow separation and into the center of the screening.

The distribution graphs of fluid transport and



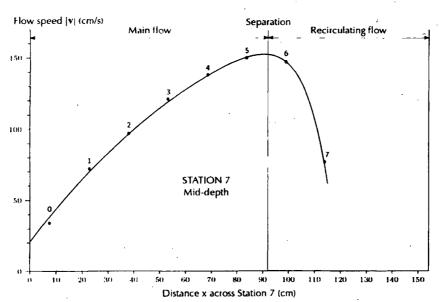


FIGURE 11.—Top panel: distribution graph of normal component $-v \cdot h$ at the 45-cm/s mean flow setting, station 7 (8 cm upstream of screen). Points are instrument values; see v_y values in Table 1. Area under the graph is volumetric transport Q^* through station 7. Equal areas bounded by dashed lines correspond to the eight numbered transport trajectories of Figure 12. Region to the right of the separation is transport of secondary flow. Bottom panel: distribution graph of corresponding velocity magnitudes; see |v| values in Table 1.

velocity magnitudes at station 4 (across the entry portal) and station 7 (just upstream of the screenmesh) are shown in Figures 10 and 11. The data points on the graphs of velocity magnitude $|\mathbf{v}|$, as well as the lengths of the vector arrows in Figure 9, are given by the relationship $|\mathbf{v}| = (v_X^2 + v_y^2)^{1/2}$, while the graph points of scalar quantity $-\mathbf{v} \cdot \mathbf{\hat{n}}$ correspond to the normal components of flux across the reference station. That is, the area under the graph of $-\mathbf{v} \cdot \mathbf{\hat{n}}$ is Q^* , volumetric flux of water per centimeter of depth through the reference station. The cartesian axes indicated on Figure 10 and 11.

ure 9 (x positive towards the inlet end of the flume and y positive from left to right when one faces downstream) were chosen for their conveniences in representing these transport and velocity distributions. In most general terms, the volumetric rate of flow Q through an arbitrary region R of an area A is

$$Q = -\iint_{\Omega} \mathbf{v} \cdot \hat{\mathbf{n}} \ dA,$$

 $\hat{\mathbf{n}}$ being an (outward) unit normal over region R. In the present case, velocity $\mathbf{v} = \mathbf{v}_x \, \mathbf{i} + \mathbf{v}_y \, \mathbf{j}$, where

 $v_x = v_x(y)$ and $v_y = v_y(x)$ at the reference stations, both v_x and v_y being time independent because the flow is steady. At station 4, the unit normal $\hat{\mathbf{n}}$ over the (vertical) surface R represented by the grid of instrument points is simply the unit basis vector i. Consequently, the normal components of flow across station 4 are $-\mathbf{v} \cdot \hat{\mathbf{n}} = -v_x$, and the volumetric flux of water (per centimeter of depth) through the entry portal becomes

$$Q^* = -\int_{v=0}^{76 \text{ cm}} v_x \, dy.$$

which must also be equivalent to the upstream transport. For the 30-cm/s flow setting, Q^* would be 5,100 cm²/s (or 30 cm/s × 170 cm, the breadth of the upstream flow). For the 45-cm/s setting, Q^* is 7,650 cm²/s, which is the area under the distribution curve of $-\mathbf{v} \cdot \mathbf{\hat{n}}$ in Figure 10. At station 7, just ahead of the screen, $\mathbf{\hat{n}} = \mathbf{i}$, hence

$$Q^* = \int_{x=0}^S v_y \, dx,$$

where limit S signifies the location of the separation boundary where it crosses station 7. That is, Q^* in this case sums to the total 30- or 45-cm/s transport rate at the separation boundary. The excess transport to the right of the separation (as in Figure 11) is a consequence of the backflow of water through the upstream half of the screen.

In Figures 10 and 11 the eight equal-valued areas under the distribution graphs of $-\mathbf{v} \cdot \hat{\mathbf{n}}$ correspond to the numbered flux lines of Figure 12, whose locations were resolved by partitioning the Q^* integrals at reference stations 3, 4, 5, and 7. The distribution graphs of v_x , v_y , and $|\mathbf{v}|$ were resolved from the autonomous differential equation

$$z' + az^2 + bz + c = 0, (1)$$

which permits of nondimensionalizing and its adaptation to volumetric rates of flow and apparatus dimensions that differ from those treated here. In equation (1) the rate of change in quantity z (in ν_x , ν_y , or |v|) is strictly a function of the magnitude of z, independent of the independent variable (dimension x or y). The independent variable is specified in the solution and the boundary conditions.

At station 4, the fitted solution of equation (1) for the distribution of fluid speed across the entry portal at the 45-cm/s mean flow setting became

$$|\mathbf{v}| = \frac{78 + 2.9e^{0.077y}}{1 + 0.0169e^{0.077y}} \tag{2}$$

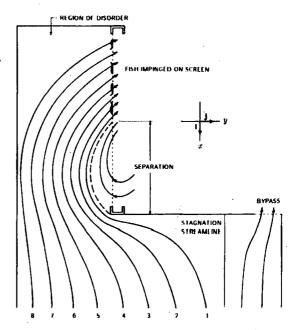


FIGURE 12.—Plot of equal-valued transport trajectories at the 45-cm/s mean flow setting. Each trajectory represents a volume transport of ~956 cm²/s per centimeter of depth. The corner separation extended to 50% of the screenmesh width at the 45-cm/s setting and to 38% at the 30-cm/s setting.

(y in cm, |v| in cm/s), which is the curve in the lower graph of Figure 10. Close to the left sidewall boundary, the flow speed |v| was 79 cm/s; it rose to twice that value, or 158 cm/s, at the corner of the entry portal. The distribution across the entry portal of the normal component of flow (which is $-v_x$ here) became

$$-\mathbf{v} \cdot \hat{\mathbf{n}} = \frac{78 + 1.9165e^{0.0967y}}{1 + 0.0147e^{0.0967y}},$$
 (3)

which is the curve in the upper graph of Figure 10. The boundaries of the eight transport areas under the graph of $-\mathbf{v} \cdot \hat{\mathbf{n}}$ were located by numerically integrating equation (3) in eight partition steps, each of 956 cm²/s in value.

At station 7 the separation imposes a nonlinearity on the flow geometry more severe than that of governing equation (1). Therefore, for that circumstance I employed the linear terms of equation (1) and matched its (outer) solution to perturbation terms. The result for the distribution of the |v| data points at the 45-cm/s setting became

$$|\mathbf{v}| = 244(1 - 0.9139e^{-0.0109x}) - 183e^{(x-120)0.10764}$$
 (4)

 $(x \text{ in cm}, |\mathbf{v}| \text{ in cm/s})$, which is the curve in the

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lower graph of Figure 11. In turn, the distribution across station 7 of the normal component of flow (v_p) here) became

$$-\mathbf{v} \cdot \hat{\mathbf{n}} = 134(1 - 0.9105e^{-0.025x}) - 131e^{(x - 118)0.03817},$$
 (5)

which is the curve in the upper graph of Figure 11. The eight equal-valued transport partitions under the distribution curve were resolved in the same manner as those of Figure 10, but here the right boundary was determined by setting the Q^* integral of equation (5) to 7,650 cm²/s, the known volumetric transport of the main flow, and numerically resolving the upper limit S. The location of S at 92 cm from the backwall of the dual-flow screen coincided with the location of maximum |v| at the separation boundary (as it should have). Solution methods for equations (2)–(5) are given as an appendix.

The flux lines of Figure 12 portray the complex nature of the flow through the dual-flow screen. The corner separation blocks off the forward portion of the screening to the main flow, which passes through the rear portion of the screening at an angle so sharp that over a distance of 8 cm (the distance between station 7 and the screenmesh) the separation boundary is displaced from the 92cm location at station 7 (Figure 11) to about 75 cm at the screenmesh, which is an angle of attack of approximately 60° (the angle away from a perpendicular to the plane of the screenmesh). At lower inflow speeds (at lower pumping rates), the separation recedes but the angle of attack increases (the flow at the separation becomes more nearly parallel to the screenmesh).

As indicated on Figure 12 and the upper graph of Figure 11, the recirculation of water through station 7 (and the screenmesh) was a consequence of a trapped eddy that was shear-driven by the passage of the main flow around the corner separation. In the recirculation zone, the flow through the screen (and station 7) reverses direction. Note the sign change in the normal component v_v between columns 7 and 8 of Table 1 for station 7, which in turn corresponds to the zero value of the $-\mathbf{v} \cdot \hat{\mathbf{n}}$ graph in Figure 11. The velocity magnitude |v| at that point does not fall to zero, however, because the flow is parallel to the screen (and to station 7; note the values of tangential component v_x in Table 1). In the region of backflow, fluid velocities are high, although reversed in direction, as indicated by the elevated values of |v| in columns 8, 9, and 10 of station 7 on Table 1. These flow complications influenced the dispositions of fish drawn to the screen. The flow reversal and asymmetric distribution of fluid momentum also imposes a cross-stream moment on the screen structure.

Fish Behavior Experiments

The fish used in the behavior experiments were 246 juvenile striped bass Morone saxatilis of Hudson River origin, 5.9 cm in mean length, and 240 each of golden shiners Notemigonus crysoleucas 5.6 cm and 7.2 cm in mean lengths. The striped bass were shipped by air to Houston and the shiners were obtained from a local fish farm. We employed the golden shiners as representatives of tender species having moderate endurance and swimming strength, in contrast to the striped bass, which are strong swimmers, hardy, and not so readily damaged.

The fish were held apart by size and species in large fish tanks until used in the experiments. Tank water was aerated, filtered, and monitored for temperature, pH, ammonia concentration, and conductivity. The flume water was continuously filtered and circulated; temperature, pH, and conductivity were measured between experiments. For each behavior experiment, the fish of a sample were released 5 m upstream of the dual-flow apparatus by species, size, and water speed.

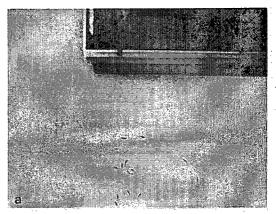
At each of the 30- and 45-cm/s mean flow settings, the striped bass were released in five sample batches of 20 and one batch of 15; 8 other fish were released one at a time (a total of 28 trials with 246 fish). Golden shiners of each size were released at each of the flow settings in four batches of 25 and one batch of 10; 10 other fish were released one at a time (a total of 60 trials with 480 fish). For the silhouette photography, a video camera and a 35-mm camera were located 6 m above the stilling box (see Figure 4). During an experiment the video camera ran continuously. The mounted 35-mm camera, which was equipped with a motor-driven shutter and film advance, was operated at will, at the rate of three frames per second, by the observer on the camera gantry. For all of the fish behavior photographs reproduced here, the shutter speed of the 35-mm camera was set at 1/1000 s and the video camera was equipped with a 1/100 s digital clock, which was imaged on the video frames. All of the behavior experiments were carried out after dark, the only light in the flume building being the flume bottom lighting in the vicinity of the dual-flow apparatus, an arrangement that allayed our worries over the unknown influences on the fish of surface reflections

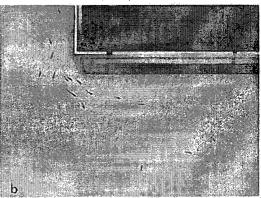
and other visual disturbances during daylight hours.

The discussion here of the findings from the behavior experiments is aided by the several photographs of fish locations reproduced in this section, but they should be viewed in their relationships to the flow patterns and velocity vectors depicted in Figures 8, 9, and 12. A velocity vector in Figure 9 indicates the (instantaneous) direction of flow at its midpoint; the comparative lengths of the vector arrows give an indication of the differences in fluid speeds from location to location across a station, or from station to station in the flow. The streak lines of Figure 8 indicate the paths taken by the flowing water, and the flux lines of Figure 12 correspond to the transport of water along those paths of motion. The flow accelerates along any flux line; the closer together flux lines are, the greater the speed of flow. Along flux line 1 in Figure 12, for example, the fluid speed is about 30 cm/s where it crosses station 3 (compare with Figure 9 and Table 1). Over the short distance between that point and station 4 at the entry portal, however, the fluid speed along flux line 1 increases fivefold to 150 cm/s, a speed maintained through station 7 and into the screening. The dispositions of fish in the vicinity of the dual-flow apparatus were governed by these fluid accelerations and patterns of flow.

A typical episode of fish being drawn into the vicinity of the dual-flow apparatus and through the entry portal is shown by the three (successive) photographs of Figure 13. The fish are large golden shiners of a batch of 25 released upstream at the 30-cm/s setting. The elapsed time was 2.25 s between frames (a) and (b), and 1.87 s between (b) and (c). Individuals were identified and their paths of motion were tracked by matching the 35-mm photographs with the videotape (viewed frame by frame, with time increments read from the imaged camera clock).

In frame (a) of Figure 13, the fish are being transported into view by the flow at about 50 cm/s. The net downstream movement of fish, despite their apparent orientations in the photograph, followed generally along the lines of flow indicated in Figure 12. All of the fish appearing in frame (a) were drawn rapidly into the vicinity of the dualflow apparatus, as indicated in frame (b), with the exception of the individual in the lower center of frame (b), which arrived slightly later. Few fish (of either tested species) were observed to orient themselves directly into the flow until they were close upon the frontwall of the apparatus or the





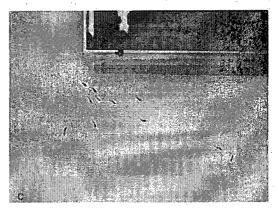
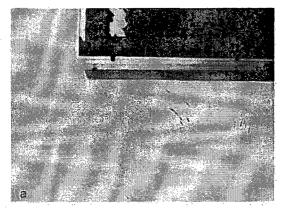


FIGURE 13.—Successive positions of large golden shiners drawn to the dual-flow apparatus at the 30-cm/s mean flow setting. The time interval was 2.25 s between frames (a) and (b), and 1.87 s between frames (b) and (c).

corner of the entry portal. Despite furious swimming efforts, few of the individuals transported to the high-speed corner region of the entry portal were able to keep station beyond a few seconds, but most significantly, these were usually the only fish arriving at the entry portal that did make at-

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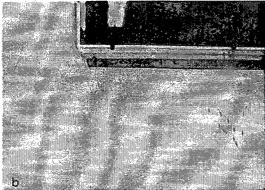


FIGURE 14.—Successive positions of small golden shiners converging on the stagnation streamline at the 30-cm/s mean flow setting. The time interval between frames (a) and (b) was 3.7 s.

tempts at maintaining station. As a rule, fishes drawn to the entry portal some distance from the frontwall corner were swept passively downstream to a sudden encounter with the screening.

Seven of the fish in the region of the frontwall corner in frame (b), plus two individuals already out of camera view, were carried downstream to the screen, in random orientations, at about 85 cm/s, the speed of the flow itself. Their paths of motion coincided with the flux lines shown in Figure 12, indicating little voluntary motion on the part of any individual. Three of the fish close upon the frontwall corner exhibited vigorous tail beats and were able, momentarily, to stem the flow (which was about 95 cm/s at that location), but they were suddenly swept from view, also at the approximate speed of the flow. Four of the fish in frame (c) held out somewhat longer, but only one individual in the high-speed corner region made any significant progess away from the apparatus. The three fish in the middle ground of frame (c),

just upstream of the frontwall corner, were late arrivals (if 1.87 s can be called late). They were transported, swiftly and passively, through the entry portal at the speed of the flow, but one of the three reappeared and swam close along the sidewall of the flume a distance of half a meter or so upstream of the entry portal, where it remained for some time. That behavior was repeated by individual fish when released to the far left of the flume center.

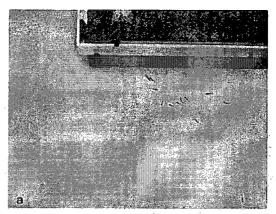
At 10 s after the first appearance of the fish in frame (a), the only members of the released sample remaining in camera view were the one fish at the flume sidewall and the two rightmost fish of frame (c)—joined by one late arrival—in the region of the stagnation streamline. Two fish of the 25 released were not observed on camera, but at the conclusion of the experiment we found them upstream, swimming along the sidewall of the flume, an occurrence less typical of the shiners than of the striped bass.

The two rightmost fish in frame (c) of Figure 13 were swimming in the (symmetric) velocity gradients on either side of the stagnation streamline and more or less holding station in the flow, a distance removed from any solid boundaries. That behavior was observed several times in experiments with both the shiners and the striped bass. Some fish of a released sample, if they arrived at the dual-flow apparatus in the slower current to the right of the entry portal, turned about and converged on the stagnation streamline. Schooling behavior was also strongest in that region, in contrast to the small evidence of schooling tendencies in regions of swifter flows. The tendency to school in the vicinity of the stagnation streamline is indicated in the photographs of Figure 14. In that experiment, a sample of 25 small golden shiners was released more to the right of the flume center than usual; 13 of the 25 were ultimately carried through the entry portal and impinged (flattened against the screening), but five fish were transported to the apparatus on the right side of the stagnation streamline (the five fish to the right in frame a of Figure 14), and seven of those arriving to the left of the stagnation streamline reversed direction in the vicinity of the flume frontwall and joined the other five, as indicated by frame (b). This behavior is especially worthy of note, because it demonstrates the tendencies of fish to respond to the velocity gradients, as opposed to responding directly to the stationary obstacles or solid surfaces that actually induce the gradients into the flow.

Although juvenile striped bass exhibited similar behavior in the region of the stagnation streamline, they were also more active as individuals than golden shiners of either size. In the swifter regions of flow, the striped bass were generally transported to the screening somewhat less directly along the flux paths of the water transport than the shiners; individuals made darting motions, seemingly at random and independent of one another. More striped bass of a given release found the upstream sidewalls of the flume (or, more explicitly, the slow-speed boundary layer at the flume wall) than did golden shiners of a similar release. And being much the stronger swimmers, the striped bass were able to stem the flow at the entry portal for longer periods, particularly at the 30-cm/s mean flow setting. At the 45-cm/s setting, however, few of the striped bass (and none of the shiners) were able to keep station at the corner of the entry portal, the fluid speed in that region being about 150 cm/s.

The liveliness (or excitability) of the striped bass juveniles is captured in the two (successive) photographs of Figure 15. In frame (a), 13 individuals of an upstream release of 20 had just arrived in the vicinity of the dual-flow apparatus at the 45cm/s mean flow setting. Fluid speeds in the vicinity of the dual-flow apparatus were considerably greater in this experiment than the fluid speeds at the 30-cm/s setting of Figures 13 and 14, so events transpired more rapidly. Note the absence of schooling and the random orientations of individual fish in both frames of Figure 15. The time interval between the two frames was only 1.12 s, but owing to the independent darting motions of individuals, the relative positions of fish changed rapidly, although their net paths of motion towards the entry portal were still a consequence of the pattern and speed of the flow directly upstream of the dual-flow frontwall. In frame (b), at least five fish had responded to the fluid acceleration at the entry corner by aligning themselves headmost into the flow. Despite the furious swimming efforts of these individuals, all except two were carried backwards (still swimming furiously) during a 1.87-s interval after frame (b) and flattened against the screening.

Without exception, fish transported through the entry portal and impinged on the screenmesh struck the screening well aft of the corner separation—as did the flow markers when released upstream at any location between the stagnation streamline and the left sidewall of the flume. At site installations of dual-flow screens, similar im-



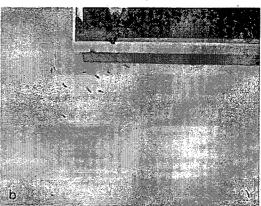


FIGURE 15.—Successive positions of juvenile striped bass drawn to the dual-flow apparatus at the 45-cm/s mean flow setting. The time interval between frames (a) and (b) was 1.12 s. At 1.87 s after frame (b), all fish but two had been carried out of camera view to the screen. The lone fish in the lower right corner of each photograph is a large golden shiner left over from a previous experiment and holding station along the stagnation streamline.

pingements of fish on the downstream portion of the screening have also been observed but not understood (E. Radle, New York State Department of Environmental Conservation, personal communication).

At each of the experimental flow settings, all impinged fish suffered death or injury, although the duration of an experiment, from release of the sample to shutdown of the flow, never exceeded 3 min. Owing to the streamline crowding of the main flow in passing through the entry portal and around the corner separation, fluid speeds at the screenmesh were greatly elevated over the 30- and 45-cm/s mean upstream velocities. At the 30-cm/s setting, the speed |v| of the flow distributed across station 7 ranged from 50 to 100 cm/s; at the 45-

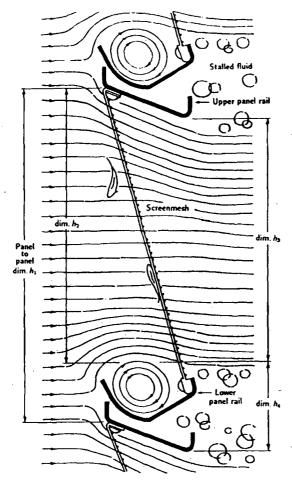


FIGURE 16.—Vertical section through a typical panel of a traveling screen, showing pathlines of water flow. Dimension h_1 is panel-to-panel distance; dimension h_2 is the region of sensible free flow through the screenmesh; dimension h_4 is the projected frontal height of the screen rails; ratio h_3/h_1 governs the streamline compression.

cm/s setting, |v| ranged from 80 to 150 cm/s. The pressure forces of these high-speed flows against impinged fish were great enough to impose mortal injuries to shiners and striped bass alike. In view of the findings from previous laboratory and field experiments on other screening systems, these wholesale injuries were unexpected. As reported in another work (Fletcher 1990a), injuries to impinged fish were not extensive at fluid speeds to 50 cm/s through a conventional cross-flume screen equipped with a smooth-woven screenmesh, and injuries were only slightly greater when the screen was fitted with the same standard crimped mesh employed here. Apparently, the risk of mortality

to impinged fish increases sharply in the range of fluid speeds between 50 and 80 cm/s.

Influence of Structural Components

Owing to the presence of the crossrails and screen troughs of a working dual-flow screen, the realized water speeds through the screenmesh would be somewhat greater for a given flow setting than the speeds recorded here. As opposed to the unobstructed screenmesh of the experimental apparatus, a traveling dual-flow screen of the kind most often employed in water intake systems is composed of linked, rectangular screen panels whose horizontal framing members offer significant impedence to the approaching flow. The influence of the crossrails of one such panel configuration is shown in Figure 16. The illustrated flow pattern was traced from the photographs of dyed pathlines taken during full-scale experiments on a variety of screen panels. The increase in sensible speeds at the screenmesh is determined by the (vertical) breadths of the panel rails and by the influences on the main flow of such secondary blocking flows as the trough vortices shown in the figure. Dimension h₄ of Figure 16 determines the true projected frontal area of the illustrated panel railings, and the ratio of dimensions h_3 and h_1 determines the actual streamline compression of the flow passing through the screen panel.

The rail profiles and corresponding details of flow through a screen panel differ somewhat from one manufacturer's design to another, but the ratio of the sensible free-flow area at the screenfront (dimension h_2 of Figure 16) to the overall panel dimension h_1 is typically 80% or less at a standard panel spacing of 61 cm (24 in). Therefore, since continuity, for a given volumetric flux Q, requires that $h_1V_1 = h_2V_2$ (V_1 being the mean speed of flow at the unobstructed screen and V_2 the mean speed of flow at the panel screening), then the 90cm/s unobstructed screen speeds of the 30-cm/s flow settings would increase to about 110 cm/s if standard height screen panels were employed, and the 140-cm/s speeds through the unobstructed screen would increase to about 170 cm/s in the case of the 45-cm/s mean flow setting.

The concave rails of the screen panels shown in Figure 16 are meant to capture and rescue impounded fish as the screen structure ascends through the water column. They represent one manufacturer's version of the so-called Ristroph troughs often found on conventional cross-channel screens. In a series of flow studies on Ristroph screen panels (Fletcher 1990a), the longitudinal

trough vortices depicted in Figure 16 were found to be typical of all manufacturer's trough designs known at the time of the work. Fish caught in these shear-driven vortices were swirled about and severely battered. At moderate flow speeds, the associated injuries and mortalities were greater than the damages imparted to fish by simple impingements against the screen mesh.

When a Ristroph apparatus is employed in the manner of a conventional cross-channel screen (as in Figures 1 and 2a), captured fish are raised from the water on the upstream side of the (upward) moving screen, then dumped into a sluice for their return to the source waters as each panel overturns on its rotation over the uppermost sprocket of the machine. These trough-equipped screens are also employed, without significant modification, as dual-flow screens and offered by their makers as putative fish-conserving devices. Aside from the adverse flow conditions characteristic of the Ristroph troughs, such adaptations are ill-suited to the workings of a dual-flow screen. Owing to the double-entry configuration, water and fish are drawn to both the ascending and descending halves of the moving screen. The fish troughs on the descending side are inverted and travel downwards. which negates their intended fish-catching function. Although the problem of the trough vortex has been ameliorated by at least one new design (Fletcher 1990a, 1992), no known Ristroph device is really suited to the peculiar functionings of a dual-flow screen.

Flow Correction

As shown by the flume experiments reported here, the elevated flow speeds and increased fish kills associated with dual-flow screen conversions are owed in part to the concentration of the inflow over restricted portions of the available screen width. Because the flow approaching the machine must turn nearly 180° around the frontwall to enter the screenmesh, the flow separates from the frontwall corner in the manner illustrated by the various diagrams of this report. By reducing the turning angle (by whatever means), the separation is reduced and the area of the screenmesh receiving the inflow is increased. To that end, I experimented with fairing shapes for the frontwall that reduced the turning angle by 90°. The most successful shape has the elliptical curvature shown in Figure 17, whose formulation is

$$x^2 + (1 - \epsilon^2)y^2 = a^2$$
, (6)

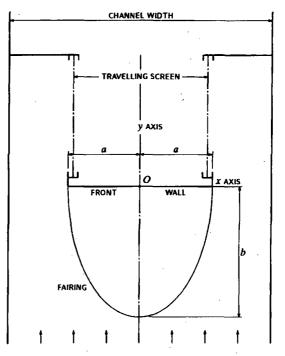


FIGURE 17.—Design of an elliptical frontwall fairing for a dual-flow machine.

where 2a is the frontwall width (quantity a being the semi-minor axis of the elliptical curve). Quantity ϵ is the elliptical eccentricity and it governs projection b (the semi-major axis) in the relation

$$b=\frac{a}{\sqrt{1-\epsilon^2}}.$$

Within certain limits, the greater the projection dimension b, the smoother the flow deflection. For mean upstream flow speeds to 50 cm/s, I found the minimum effective relation of projection b to dimension a to be about a/b = 0.56 (an eccentricity ϵ of 0.83). Shapes with smaller values of ϵ failed to eliminate the flow separation at the higher test speeds.

Figure 18 shows the realized pattern of flow into the entry portal of the laboratory apparatus when a fairing of eccentricity 0.83 was attached to the frontwall. Experimental fairings of the same shape and constructed of reinforced fiberglass have recently been installed on two of the dual-flow machines at the Arthur Kill steam generating plant on Staten Island. To what extent the corrected flows may lessen the fish mortalities otherwise associated with those machines will be determined by a 2-year testing program.

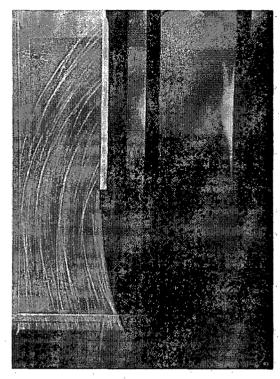


FIGURE 18.—Pathlines of flow into the entry portal of the laboratory apparatus when a fairing of eccentricity 0.83 was fitted to the frontwall, photographed through the stilling box at the water surface. Mean upstream flow speed was 45 cm/s.

Concluding Remarks

If the flows through each portal of a doubleentry screen were perfectly distributed over the whole extent of the available screenmesh, fluid speeds would be dramatically lower than those observed. That perception of (ideal) flow distribution is apparently the motivation for mistaken beliefs about the potential fish-conserving merits of dual-flow screens, as typified by the following statement from a publication of the Electric Power Research Institute (EPRI; Lawler, Matusky & Skelly 1989):

The principles that make the dual-flow screen advantageous for debris handling may also make it a good system for decreasing fish impingement impacts by increasing survival. The greater screen filtration area allows lower through-screen velocities, which lowers stress on impinged organisms; the faster operating speeds decrease impingement exposure time, especially for organisms impinged on the ascending side.

At least for the arrangement and size of the device examined here, the dual-flow geometry is probably the worst of all screen configurations for retrieving entrapped fish by mechanical means and returning them undamaged to the source waters. While some rectification of the streamline crowding (and corresponding high fluid speeds) at the screenface is achievable by means of flow guides or by fairing the frontwall in the manner shown here, no practical fish-rescuing apparatus suited to the descending side of the screen has yet been devised (a shortcoming acknowledged, at least implicitly, in the quoted passage above). In the summary section of the EPRI report, the author seems to express a genuine puzzlement over failed expectations with the following lines:

The hydraulic changes associated with the installation of dual-flow screens may result in higher impingement survival; however, information currently available does not indicate any real increase over conventional traveling screens. . .

In fact, the "hydraulic changes" associated with dual-flow screens virtually guarantee increased fish kills. Nevertheless, the debris-excluding virtues of dual-flow screens have such appeal to plant operators that many conversions of the intake systems of power plants have already been made, and many more are planned. Regulatory agencies concerned with fish conservation are sure to stall the permitting process, at least in some locations, if the swapping of screening systems threatens to increase fish kills to magnitudes greater than those imposed by the systems replaced. Some practical fish-saving apparatus, better adapted than Ristroph troughs to the peculiar functionings of dual-flow screens, is obviously needed.

As an added caution to plant operators contemplating conversions from conventional throughflow screens to dual-flow screens, the flow issuing from the narrow dual-flow penstock and into the sump region of the intake system is apt to create sump conditions deleterious to pump operation. The penstock flow takes on the character of a highly turbulent and unstable jet. Consequently, the water behind the backwalls, on either side of the penstock, will be in a state of stall, and the inflow jet, being unstable, will tend to attach itself to one sidwall of the sump. As I discovered in hydraulic modeling for a typical plant conversion (Fletcher 1988), the flow asymmetry just described created pre-swirl extremely adverse to the (axial-radial) pump. I also found evidence of vapor core vortices, drawn from the sump floor into the pump bellmouth, thus increasing the likelihood of impeller cavitation and hammering of the shaft bearings. The adverse flows were partially corrected with an assembly of adjustable guide vanes located behind the penstock entry to the sump.

Acknowledgments

This research was supported by a grant from the Hudson River Foundation for Science and Environmental Research, New York, New York. Richard Ewbank of Houston, Texas, built the apparatus for the project and assisted with all the experiments.

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> Received November 8, 1993 Accepted June 6, 1994

Appendix: Solution Methods for Text Equations (2)-(5)

Differential equation (1) is suited to virtually any flow distribution at the entry portal of a dual-flow machine. In the z,z' phase plane, equation (1) is a parabolic curve where z'=0 at the quadratic roots r_1,r_2 of az^2+bz+c , which project to the asymptotes of the solution graph as indicated in Figure A.1. Provided roots r_1,r_2 are real, the general solution form of equation (1) is

$$(z-r_1)/(z-r_2)=C_0e^{at(r_2-r_1)}, (A.1)$$

where independent variable t is dimension x or y in the fitted solutions (2) and (3), and C_0 is the integration constant. The solution graph of equation (A.1) may be monotonic increasing (as in Figure 10) or monotonic decreasing (as it would be at the right entry portal) according as

$$m=\frac{b^2}{4a}-c$$

is positive or negative. Quantity m is the extremum value of z' of equation (1) in the

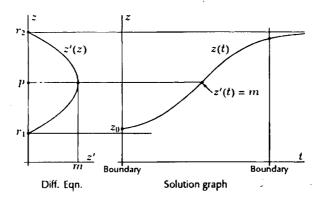


FIGURE A.1.—Graph trajectories of differential equation (1) and its general solution (equation A.1).

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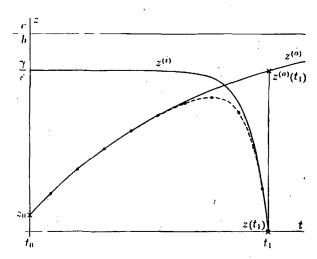


FIGURE A.2.—Graph of outer solution $z^{(0)}$ (equation A.2), inner solution $z^{(i)}$ (equation A.4), and composite solution z(t) (equation A.6), whose trajectory is denoted by the dashed curve. Boundary values satisfied by z(t) are $z(t_1)$ on the right and z_0 at t_0 on the left. Dots along the dashed curve represent fitted data points.

phase plane, corresponding to the slope of solution (A.1) at its inflection point p, which occurs at $z=(r_1+r_2)/2$ in both the phase and solution planes. Therefore, with the exception of the boundary condition, all the parameters for fitting the solution graph to datum points can be resolved in terms of z and z' in the phase plane, independent of the independent variable t, with the aid of a routine numerical method for estimating z'(z) from the measures of Δz . The relationship between z(t) and t in the solution plane is then resolved by specifying the boundary condition z_0 (that is, by determining its value from the best fit to the t, z data values), as was the case in equation (2) from the (y, |y|) data and in equation (3) from the (y, y_x) data.

Owing to the effects of the flow separation, each distribution of $|\mathbf{v}|$ and $-\mathbf{v} \cdot \hat{\mathbf{n}}$ downstream of the entry portal exhibits an extremum between two lesser boundary values, as portrayed by the graphs of Figure 11. The perturbation imposed on the flow geometry by the presence of the separation imposes in turn a perturbation on the general distribution equation (1). The altered solution trajectories (4) and (5) for station 7 were determined by matching a general outer solution

$$z^{(o)}(t) = \left(z_0 + \frac{c}{b}\right)e^{-bt} - \frac{c}{b} \tag{A.2}$$

of the linear portion of equation (1), which is

$$z' + bz + c = 0,$$
 (A.3)

to an inner solution

$$z^{(i)}(t) = z^{(o)}(t_1) - z^{(o)}(t_1)e^{(t-t_1)\xi} + z(t_1)e^{(t-t_1)\xi}$$
(A.4)

of the first two terms of a perturbation expansion

$$z' = \gamma + \epsilon z, \tag{A.5}$$

 γ being a constant of convenience and ϵ the perturbation factor. Graph trajectories of inner and outer solutions (A.2) and (A.4) are shown in Figure A.2.

As portrayed in Figure A.2, the composite solution z(t) has the boundary values $z(t_0)$ on the left and $z(t_1)$ on the right, either of which may be zero or nonzero. Outer solution $z^{(o)}(t)$ satisfies the left boundary condition (symbolized z_0 in equation A.2, where, without loss of generality, $t_0 = 0$), while inner solution $z^{(i)}(t)$ satisfies the right boundary

condition (which is quantity $z(t_1)$ in equation A.4). The quantity $z^{(o)}(t_1)$ is the value of the outer solution at t_1 (the location of the right boundary). In equation (A.4), $z^{(o)}(t_1)$ replaces γ/ϵ with small error. The composite solution is recovered by combining the inner and outer solutions and eliminating the overlap, or

$$z(t) = -\frac{c}{b} \left[1 - \left(\frac{bz_0}{c} + 1 \right) e^{-bt} \right] - \left[z^{(o)}(t_1) - z(t_1) \right] e^{(t-t_1)\xi}, \tag{A.6}$$

which is the form taken by the distribution equations (4) and (5). In the region near the left boundary where the outer solution is valid, the constants c and b of equation (A.2) can be resolved from the measures of Δz in the z,z' plane where governing equation (A.3) has a straight-line graph. The boundary value z_0 can then be determined by fitting outer solution (A.2) to the t,z data points in that region. A similar procedure can sometimes be followed for resolving perturbation parameter ϵ with equation (A.5), but when the distribution of interest drops off sharply at the boundary, the data points in the boundary region are often too few to suit that procedure. In most cases, ϵ is more accurately resolved in the composite solution (A.6).

NOTES

The Failure and Rehabilitation of a Fish-Conserving Device

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Abstract.—A flow spoiler designed for attachment to the fish-catching rails of large water-intake screens was previously reported as being successful in reducing injuries to fish during the capture process. That spoiler and rail configuration failed to function as intended when applied to screens equipped with superfine screencloth. The desired fluid dynamical properties of the spoiler were restored by a change in the spoiler's geometry.

In a recent article (Fletcher 1990) I reported the results of laboratory and field testings of some improvements made to the fish-conserving apparatus of screening systems commonly installed in large water pumping facilities. From detailed studies in a laboratory flume, a flow spoiler had been devised that damped out certain vortex actions found deleterious to fish captured by the cross rails of rotating debris barriers known as Ristroph screens. The rail-mounted spoilers served to retard the actions of a harmful, secondary circulation within the rails by introducing a turbulent wake between the rail water and the shearing action of the main flow over the rail, an effect depicted in Figure 8 of the cited report. Although that rail and spoiler configuration proved effective in applications to coarse-mesh wire screening, it unexpectedly failed when the screen panels were fitted with fine-mesh overlays.

That discovery was made while experimenting with other innovations related to screening apparatus equipped with superfine mesh—work funded by the Consolidated Edison Company of New York and other Hudson River utilities as a hoped-for means of preventing excessive entrainments into power plant cooling systems of eggs, larvae, early juveniles, and small invertebrates. This note is meant to caution others about unexamined applications of the reported rail and spoiler to screening systems fitted with fine mesh (especially of gauges ranging from 0.5 mm to 3 mm in pore size), and also to report on the properties of an improved spoiler that did function satisfactorily in fine-mesh trials.

The general flow conditions associated with the

unrevised spoiler and a mesh of fine gauge are illustrated by Figure 1. The test apparatus is mounted in a large hydrodynamics flume and viewed from underwater ports, as described in Fletcher (1990). The pathlines of flow are marked by the transport of small, neutrally buoyant plastic particles, recorded by time exposures on 35-mm film. The flow geometries portrayed were similar for approaching flow speeds of 15, 30, and 45 cm/s, although the angular speed of the rotating vortex increased with increasing speed of the main flow. As revealed in the top photograph of Figure 1, the desired wake does not develop and the main flow penetrates deep into the rear of the rail owing to the influence of the fine mesh in reordering the near-field pressure distribution along the screenface. In consequence, the shearing force of the main flow over the rail drives the rail water into the form of an ordered, longitudinal vortex like that originally observed in tests of conventional fish rails without spoilers. Organisms caught in these rail vortices are swirled about and killed or damaged from the effects of forcible contact with the rail and screen boundaries.

The change in flow properties attributable to the increased resistance of superfine screencloth calls for a spoiler of a more severe geometry (Figure 2). The restoration of a turbulent wake being shed from the trailing edge of the revised spoiler can be seen in the top photograph. The main flow does not penetrate as far into the rail confines and the turbulence proceeding aft of the spoiler again separates the rail water from the direct shearing action of the main flow. Some disordered water motion within the trough occurs, owing to the transport of vorticity across the wake, but captured fish are able to maintain reasonably stable swimming attitudes (Figure 2, bottom photo). The fish depicted are striped bass Morone saxatilis of Hudson River origin, 5.6 cm in mean length.

In arriving at the spoiler shape portrayed here, other constraints had to be taken into account as well: the frontal area of the device and its increased blockage of the main flow, an entry space between the spoiler and screenface sufficient to encourage the entry of fish, the geometric restrictions associated with the articulation of the hinged

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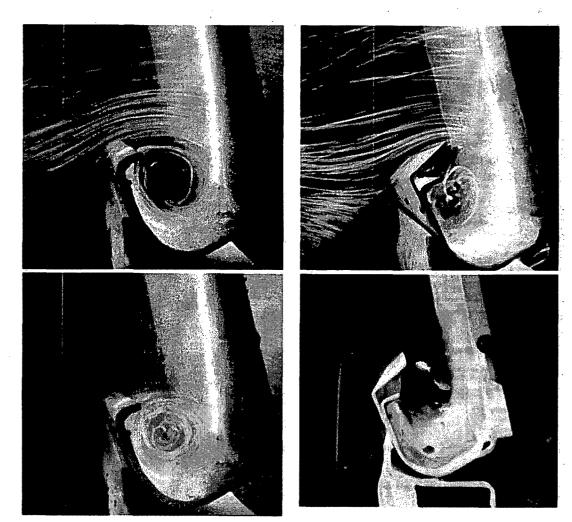


FIGURE 1.—Streaklines of flow in the vicinity of screen panels overlayed with 1-mm nylon mesh and equipped with the fish rail and spoiler described by Fletcher (1990). Speed of approaching flow is 30 cm/s and proceeds from left to right. Top: geometry of the main flow through the screen panel. Bottom: particles introduced directly into the fish rail delineate the shear-driven (and clockwise spinning) vortex that develops when the screen panels are fitted with superfine mesh.

screen panels in passing around the sprockets of the machine, and finally, ease of manufacture. Although other, more radical designs can be envisioned, the downstream consequences of surface shaping and boundary effects are not simple to predict, and, as a parting reminder to industry biologists, nothing takes the place of direct, empirical verification of one's assumptions.

FIGURE 2.—Top: streaklines of the main flow and the random motion of water in the rail of a fine-mesh panel equipped with the reconfigured spoiler. Speed of the approaching flow is 30 cm/s. Bottom: attitudes of sheltered striped bass (5.6 cm mean length) captured by the reconfigured fish rail and subjected to flow conditions identical to those of the top photo.

Acknowledgments

This research was supported by Envirex, Inc. of Waukesha, Wisconsin. I was assisted in the experiments by Donald Gass and James Ehleiter.

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Flume Study
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Double-entry Screening Systems of
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Report of results to the HUDSON RIVER FOUNDATION March 1990

R. Ian Fletcher
Great Salt Bay Experimental Station

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1. Introduction

Electricity generating stations and other facilities that withdraw large volumes of water from natural sources in their operations are commonly equipped with mechanically active barrier screening, which has the principal function of halting and removing debris from the inflowing water, but indrawn fish are also collected and killed by the screens, often in large numbers. A conventional water intake system consists of one or more sumps, each supplied from a free-surface reservoir, or forebay, which in turn is fitted with a motor driven machine that moves a set of linked screen panels around sprockets in the manner of an endless chain, as indicated by Figure 1. The inflowing water is drawn directly through the ascending and descending halves of the travelling screen assembly; indrawn matter not otherwise extruded through the screen mesh is forced onto the upward moving screen structure by the inflow, then carried above the water surface for disposal.

Material captured and raised from the water by the screen is forcibly removed by one or more rows of directed, high-pressure water jets that blow through the screening from locations above the machinery deck and between the moving halves of the screen. Very often, such indrawn flotsam as plastic bags and filamentous macrophytes, in being stapled into the screenmesh, is not completely removed by the spraywash. In consequence, unremoved debris is carried back to the water by the descending side of the screen and released into the sump by the force of the main water flow. In some cases, the transport, or carry-over, of unwanted debris into the sumps of a water intake system (and hence into the plant works by way of the water pumps) is great enough to degrade the operating efficiency of the facility or require increased maintenance.

Owing to the annoyances connected with the mistransport of debris by conventional rotating screens, many plant operators favor the refitting of intake systems with alternative devices, called dual-flow screens, whose manner of operation precludes the downstream deposition of debris. Although consisting of linked panels and driven around sprockets in a conventional fashion, a dual-flow screen is placed at an attitude 90° to the approaching flow, water passing through its moving halves according to either of two configurations, one called a double-entry, single-exit screen (as indicated by Figure 2(b)) and the other a single-entry, double-exit screen. The double-entry arrangement is the design more often employed, and it was the design adopted for the experimental work reported here.

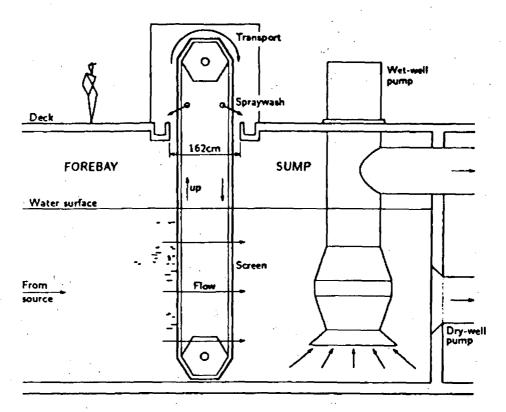


FIGURE 1.—Arrangement of a large water-intake system equipped with a conventional rotating screen. Water speeds through the screen range from 30 to 60 cm/s, and a typical elevation speed is 5 cm/s. Pump capacities (of either the wet-well or dry-well configuration) range from 265,000 L/min to 530,000 L/min.

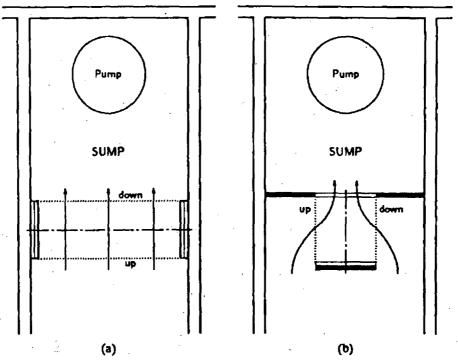


FIGURE 2.—(a) Plan of a typical intake channel equipped with a conventional rotating screen (as in Fig. 1). (b) Conversion of the intake bay to a double-entry, single-exit rotating screen.

In contrast to the straight-through flow geometry of a conventional rotating screen (Figure 2(a)), water drawn through a double-entry screen arrangement must bifurcate around a plate or frontwall (which closes off the upstream side of the machine) and pass through the ascending and descending halves of the screening by way of two alley-like portals at the sidewalls of the forebay. The flow then enters the sump area through a narrow penstock, at the rear of the machine, which is no more than the open framework between the moving halves of the screen. As shown by the studies reported here, the peculiarities of the flow approaching and passing into the screen pose special problems in the mechanics of large, flexible linkages subjected to asymmetric loadings, and special problems in the mechanics of live fish recovery.

Although the problem of fish kills by various intake screening systems has received considerable attention over the years from regulatory agencies, fishermen, citizen's action groups, the power industry, and screen manufacturers, little work has been done in the past in the way of direct observations of the full-scale flow patterns and fish behavior associated with any screening system. Costly apparatus meant to rescue entrapped fish, or to divert them in some way from encounters with intake screening, is manufactured and installed with virtually no foreknowledge of its likelihood of succeeding or failing. Such intuitively-derived schemes and devices as sound generators, electric barriers, dangling chains, bubble clouds, angled screens, horizontally-travelling screens, and fish scooping devices, although apparently promising in concept, have not proven to be very effective at reducing fish kills to the levels of natural mortality (see Fletcher 1985 for a list of representative references). The poor performances of these fishsaving appliances can be traced, almost invariably, to imperfect understandings of fluid flows and the related responses of fish to currents and obstacles. As shown in a recent study of a commonly employed device known as a Ristroph screen (Fletcher 1990), one's casual suppositions about the nature of complex fluid flows can be so misleading that one is apt to anticipate an outcome wholly at odds with reality. In the case of the Ristroph screen experiments, once the actual transactions between fish and flows were observed and recorded, alterations to the device that conformed to reality followed and fish kills were reduced.

For the dual-flow experiments reported here, a full-scale entry portal and frontwall of a dual-flow screen, typical of the double-entry configuration, was installed in a large hydrodynamics flume. Flow patterns and velocity fields were retrieved from vector-resolving current measurements and from two flow marking schemes, one of particle motion recorded on video tape and one of particle streaking by time exposures on 35 mm film. Test fish were also released upstream and their dispositions in the flow fields were recorded on video tape and 35 mm photographs. Richard Ewbank of the McGinnis/Royce Corporation built the apparatus for this project and assisted with all the experiments. As in the Ristroph screen study, these researches were meant to record and clarify those peculiarities of fish and flows that instruct the designer and separate the probable from the impossible.

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2. The experimental apparatus

In the usual circumstance where conventional rotating screens are replaced with dual-flow machines, the overall breadth of the device, and hence of the screening itself, is limited by the width of the access slot, or well opening, in the machinery deck of the facility (see Figure 1), the standard dimension being 162 cm (5 ft 4 in). The long dimension of the well opening corresponds to the width of the intake channel, which is usually 340 cm (11 ft 2 in), although some intake channels are narrower. Short of altering the civil works of a plant, these dimensions effectively prescribe the basic geometry and dimensions of those dual-flow machines designed expressly for replacing conventional screens, irrespective of the manufacturer. The experimental apparatus for the work reported here was configured around that basic dual-flow geometry and installed in the Royce hydrodynamics flume in Houston, Texas.

The Royce flume is equipped with underwater viewing ports, an overhead camera gantry, flow-measuring instruments, fish releasing cages, and fish holding tanks. The flume and its equipment are more fully described by Figure 3. Although the 340-cm width of a typical intake channel is greater than the 213-cm width of the laboratory flume, duplication of full scale flow fields were still possible, by virtue of the mechanical and fluid dynamical symmetries characteristic of the basic dual-flow screen geometry. The relationship of those symmetries to the configuring of the flume for the experimental work is indicated by Figure 4, which shows the flume width superimposed on the layout of a dual-flow screen designed for replacing a conventional screen. That portion of the dual-flow apparatus failing within the boundaries of the laboratory flume (the frontwall of the screen and one entry portal) was built and installed in the flume, and the location of the stagnation streamline (the flow centerline indicated on the figure) was controlled by means of a screened bypass and adjustable gate located at the far end of the screen frontwall.

The arrangement of the laboratory flume for this work is more fully described by Figure 5 (page 7). The bottom of the flume in the vicinity of the modelled dual-flow machine was lighted by rows of sealed fluorescent tubes, covered over with a prismatic diffusing plate, which allowed for overhead silhouette filming of flow trajectories and fish movements. For the video and photographic work, an L-shaped stilling box, constructed of a clear acrylic material, was fixed in place at the water surface, directly over the bottom lighting. Because the purpose of the research was not meant to extend to the testing of any proposed or existing fish-rescuing attachments, none of the mechanism for actually moving the entry screen was needed for the work, so the screening itself was merely fixed in place, as indicated on the figure.

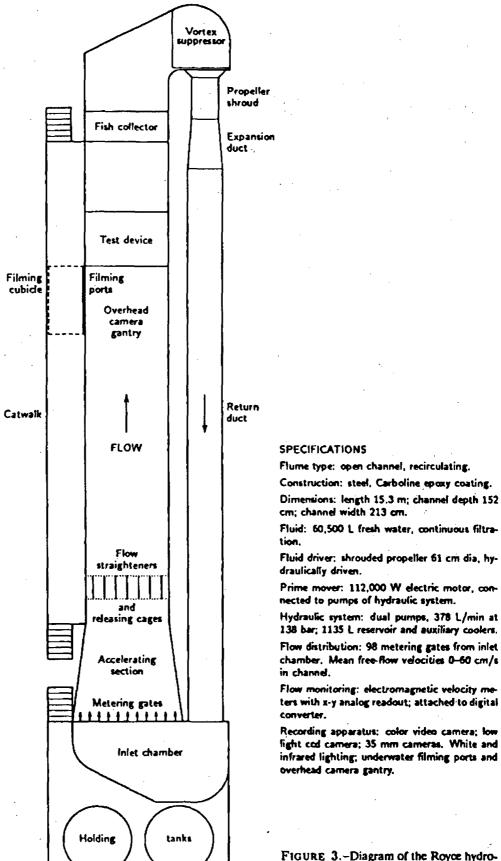


FIGURE 3.-Diagram of the Royce hydrodynamics flume.

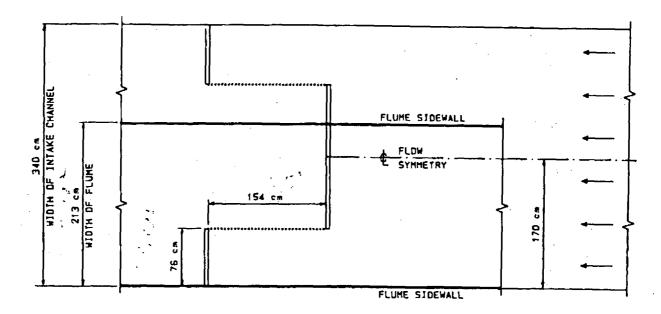
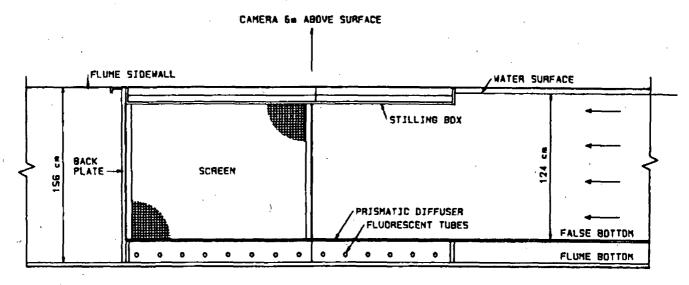


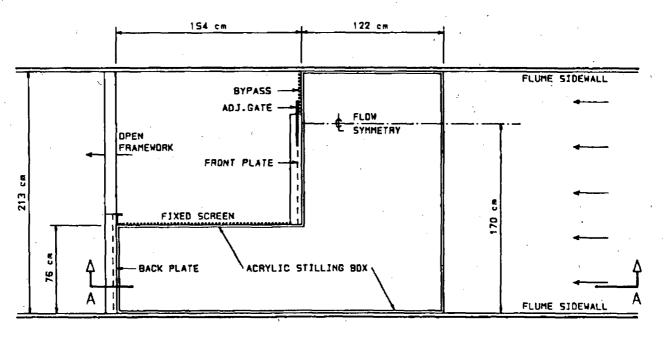
FIGURE 4.- Relationship between the width of the laboratory flume and the geometry of a typical dual-flow screen installation.

All experiments were repeated at two mean upstream flow speeds—30 and 45 cm/s—in conformity with the testing standards recommended by the Electric Power Research Institute. The free-flow geometry of the Royce flume is controlled by 98 metering gates, located in the bulkhead of the inlet chamber (see Figure 3), which were set in a pattern that put the (offset) core of the unobstructed flow along a line corresponding to the symmetry centerline of a standard, 340-cm wide intake channel. Calibrating the flume in this manner was necessary before the dual-flow apparatus was placed in the flume, because the free-flow of water in an open channel takes on a characteristic, nonuniform distribution where the fluid velocity at the core of the flow may be four to five times the velocities near the channel boundaries. See, for example, the open-channel flow diagrams in White (1986) and Sellin (1970). We appealed to those reference sources as a guide to setting the free-flow velocity distributions in the laboratory flume.

For the flume calibrations we employed a Marsh-McBurney model 511M electromagnetic current meter attached to a digital converter, with input to a microprocesser, which gave us 3D displays of the corresponding velocity vectors at the three reference stations indicated on Figure 6(a). At each of the reference stations, velocity measurements were taken on a cross-section grid of 70 points, distributed over the width and depth of the flume. A representative cross-channel distribution from those measurements is shown by Figure 6(c). The comparative distribution shown by Figure 6(b) was calculated from the normalized velocity diagrams given in White (1986). Following the flume calibrations the dual-flow apparatus was installed in the flume; we maintained the correct location of the offset, flow-symmetry centerline by means of a gated bypass located in the front plate of the dual-flow apparatus. The centerline of the unobstructed flow became the stagnation streamline of the flow into the dual-flow apparatus. The complete velocity measurements from the flume calibrations are given in Appendix A.

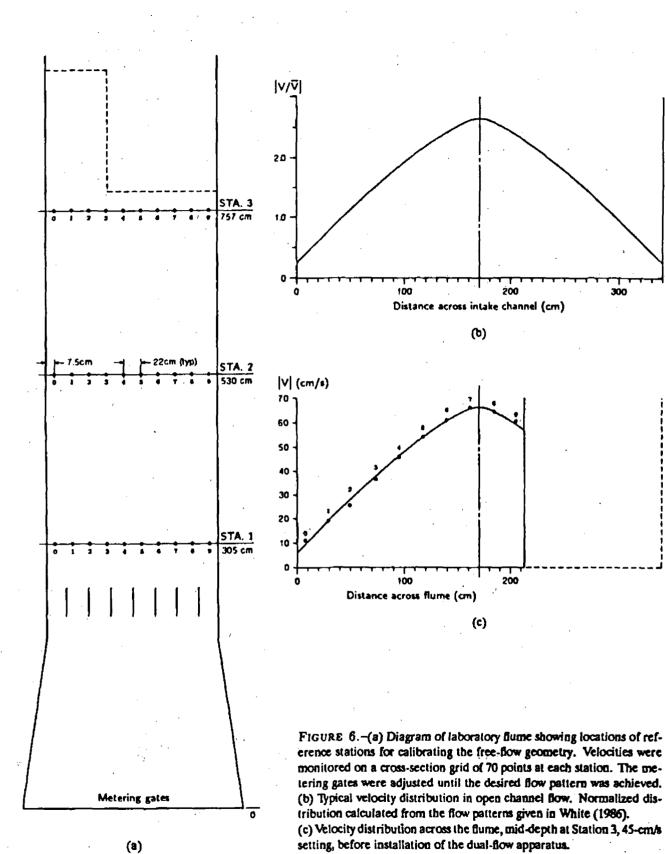


SECTION A-A



PLAN VIEW

FIGURE 5.— Plan and section of the experimental apparatus, as arranged in the flume for the flow marking and fish behavior experiments. The location of the stagnation streamline in the flow approaching the modelled dual-flow machine was controlled by means of the frontwall bypass and gate. Filming was done from an overhead gantry and through viewing ports located in the near sidewall of the flume.



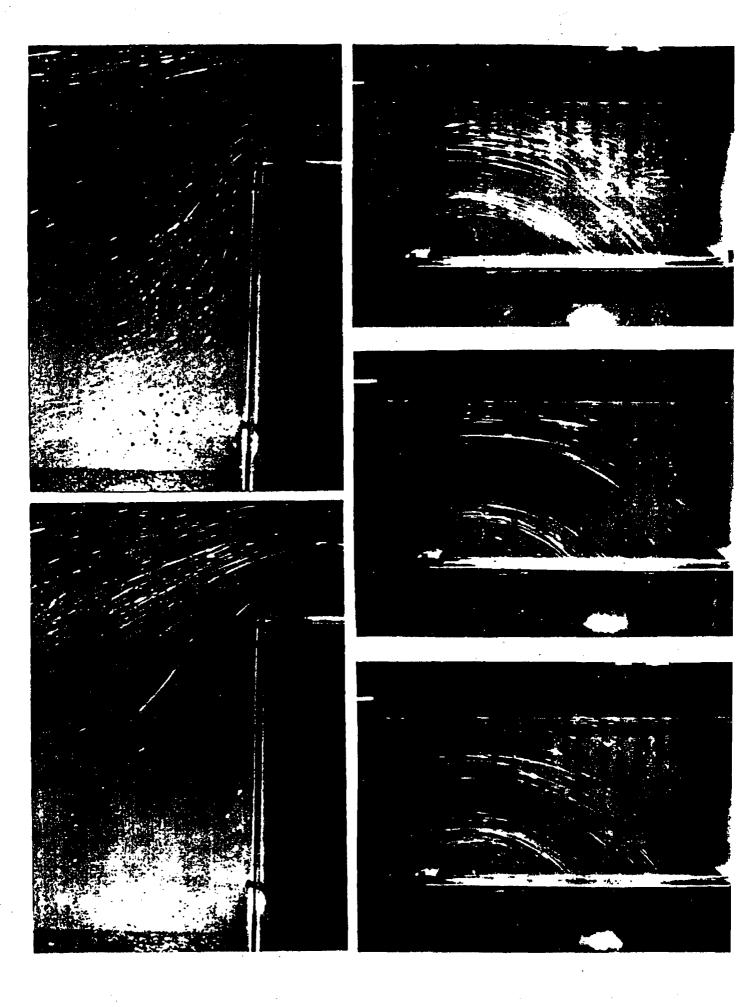
3. Flow trajectories and velocity fields

Pathline trajectories of the flows in the vicinity of the modelled dual-flow screen were recorded on video tape and 35 mm photographs. The cameras were equipped with telephoto lenses and located 6 m above the flume (an arrangement that helped to reduce visual parallax). For the video work, submerged flow markers, in the form of pre-wetted charcoal bits, were released, en masse at mid-depth, 5 m upstream of the apparatus. The charcoal bits were very nearly neutrally-buoyant. Their mean falling time from release (measured over a fall of 50 cm in a 10 cm cylinder) was 0.3 cm/s.

The pathline trajectories for the 35 mm photographs were delineated by reflective Mylar confetti, also released at mid-depth 5 m upstream of the dual-flow apparatus. For each such release, six succesive exposures were made at 1.2 sec intervals, with shutter speeds of 0.6 to 0.9 sec. Streak trajectories typical of that technique are shown in Figure 7. Because the flows were steady and the mass of a Mylar particle was very small, the pathline streaks can also be viewed as velocity streamlines. As indicated by the photographs of Figure 7, the flow along the frontwall of a dual-flow screen must turn 180° to enter the screening. Owing to the high momentum of the fluid in that turning region, a large, standing separation occurred at the upstream corner of the screen entry. In consequence of the displacement of flow past the separation, the main efflux of water through the screen was concentrated over the downstream half of the screening, at both of the employed test speeds.

The surface effects of the corner separations are shown in Figure 8 (the stilling box having been removed). The geometry of the separation was essentially a function of the volumetric flux (hence, the velocity) of water received by the entry portal. The fillet plate appearing in one of the photographs is a feature employed by one screen manufacturer, more as an aid to the mechanical stability of the dual-flow machine than any perceived benefit to the distribution of flow through the screening. Aside from slight streamline crowding at the downstream end of the screening, the effects of the fillet on the corner separation and the main flow were negligible. With or without the fillet, the flow trajectories at the surface conformed to the orientation of flow at depth. The surface disorder apparent in the photographs is the (minor) effect of backwash from the sidewall and backwall boundaries. The water immediately behind the front plate of the apparatus remained in a state of stall. A diver wearing a weight belt was able to stand erect in that area without effort.

FIGURE 7-(overleaf) Typical flow pathlines in the vicinity of the modelled dual-flow screen, produced by time exposures of reflective flow markers.



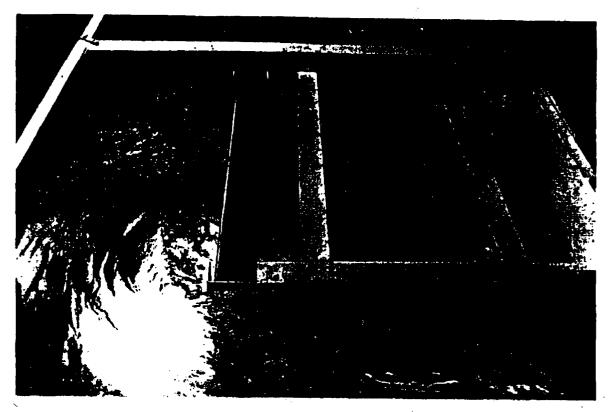




FIGURE 8.—Top photo: surface configuration of flow at the screen entry, 45-cm/s mean flow setting. Depth of the depression at the center of the separation gyre was 21 cm below the free surface. Bottom photo: surface configuration at the 30-cm/s setting. Surface backwash in both photos obscures the true geometry of the main flow through the screen.

TABLE 1.-Velocity measurements (in cm/sec) corresponding to the vector field shown in Figure 9. The symbol |v| signifies velocity magnitude; symbols v_x and v_y denote the measured cartesian components, where $v = v_x i + v_y j$ according to the orientation indicated on Figure 10.

| | Col | 0 | 1 | 2 | 3 | _4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----|----------------|-----------|-----|-----|-----|------|------|------|-----|------------|------|------------|
| Г | Station 3 | | | | | | | | | | | |
| } | v_x | -57 | -62 | -64 | -52 | -27 | -14 | -11 | -9 | -21 | -55 | • |
| L | vy | · -4 | -20 | -39 | -57 | -53 | -37 | -11 | -1 | 18 | 11 | |
| 1_ | V | 57 | 65 | 75 | 77 | 59 | 39 | 15 | 9 | 28 | 56 | |
| Γ | | Station 4 | | | | | | | | | | |
| J | v_x | -80 | -83 | -88 | -97 | -109 | -120 | -126 | | | | |
| ì | v _y | -2 | -7 | -17 | -23 | -34 | -57 | -80 | | | | |
| | v | 80 | 83 | 89 | 100 | 114 | 133 | 149 | | | | _ \ |
| Г | Station 5 | | | | | | | | | | | |
| 1 | v_x | -50 | -57 | -66 | -74 | -80 | -86 | -92 | | • • | | |
| Ĺ | v_y | 9 | 18 | 32 | 41 | 57 | 74 | 92 | | | × | ĺ |
| | v | 51 | 60 | 73 | 85 | 98 | 113 | 130 | | | | |
| | Station 6 | | | | | | | | | | | |
| l | v_x | 34 | 14 | -5 | -14 | -5 | -5 | -23 | | | | |
| 1 | v_y | -11 | -20 | -20 | -11 | 18 | 34 | 66 | | | , | |
| L | V | 36 | 24 | 21 | 18 | 19 | 34 | 70 | | | | |
| Γ | | Station 7 | | | | | | | | | | |
| | v_x | -6 | -30 | -55 | ~80 | -103 | -125 | -135 | -76 | -75 | ~149 | -107 |
| Į | v_y | 32 | 66 | 80 | 91 | 94 | 83 | 57 | 15 | -11 | -70 | –87 |
| L | v | 33 | 72 | 97 | 121 | 138 | 150 | 146 | 77 | 76 | 165 | 138 |

We took velocity measurements of the entry flows at the reference stations shown in Figure 9. The measurements at each station were made on a location grid of 7 rows and n columns (n = 10 for station 3, n = 7 for stations 4, 5, and 6, and n = 11 for station 7). The vector diagram of Figure 9 was constructed from the instrument readings taken at mid-depth (row 4) at the 45 cm/s setting, the corresponding component values are given on Table 1. The complete velocity data for the 30- and 45-cm/s settings are contained in Appendix A.

The length and direction of a vector arrow in Figure 9 indicates the magnitude of water velocity and the instantaneous direction of flow at the arrow midpoint (the point of measurement). That is, any vector arrow of Figure 9 lies tangent to the (curving) velocity steamline that passes through the corresponding point of measurement. Owing to the extreme crowding of the main flow streamlines in passing through the narrow entry portal and around the corner separation, the water velocities at the screen (and the corresponding momenta of flow) were greatly elevated. Velocity magnitudes at the screen were on the order of 120 cm/sec (4 fps) at the 45-cm/s setting and 80 cm/s (2.6 fps) at the 30-cm/s setting.

The asymmetric nature of the flow through the entry portal and screening is more clearly indicated by Figures 10—12. The corner separation effectively blocked off 50% of the screen area to the main flow at the 45-cm/s setting, and 38% at the the 30-cm/s setting. In each case, the clockwise circulation of the corner separation created backflow in the upstream portion of the screening.

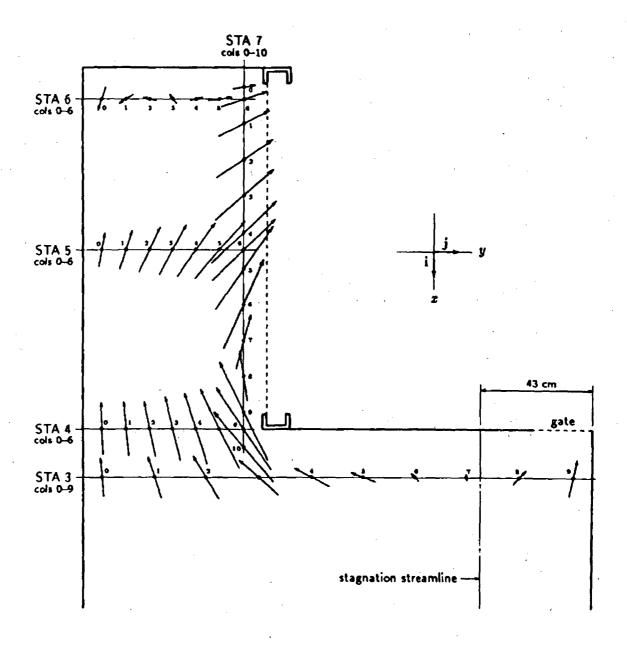


FIGURE 9.—Plot of velocity vectors at mid-depth, 45-cm/s setting, as measured with a component-resolving current meter. The points of measurement lie at the arrow mid-points. The length of a vector arrow corresponds to velocity magnitude; the direction of an arrow corresponds to the instantaneous direction of flow at the reference point. See Table 1 for component values.

As shown by Figures 7–12, the geometry of the flow approaching and passing through a conventional cross-channel screen (which resembles the open channel flow depicted by Figure 6(b)) is drastically altered by the substitution of a dual-flow screen. The high-speed core of the unobstructed flow (or the flow through the conventional screen) becomes the upstream region of lowest fluid speed, and the main transport of water is deflected away from the center of the forebay to the narrow entry portals at the forebay sidewalls. At the entry portal, fluid speed is greatest at the corner of the frontwall, corresponding to the velocity maximum along the boundary of the separation and into the center of the screening.

The distributions graphs of fluid transport and velocity magnitudes at station 4 (across the entry portal) and station 7 (just upstream of the screenmesh) are shown in Figures 10 and 11. The data points on the graphs of velocity magnitudes |v|, as well as the lengths of the vector arrows in Figure 9, are given by the relationship

 $|\mathbf{v}| = \sqrt{v_x^2 + v_y^2},$

while the graph points of quantities -v \hat{n} correspond to the normal components of flow across the reference station, the area under the graph being Q° , volumetric flux per cm of depth through the reference station. The cartesian axes indicated on Figures 9 and 12 (x positive towards the inlet end of the flume and y positive from left to right when facing downstream) were chosen for their conveniences in representing these transport and velocity distributions.

In general, the volumetric rate of flow Q through an arbitrary region R of area A is

 $Q = -\iint\limits_{\mathbf{R}} \mathbf{v} \cdot \hat{\mathbf{n}} \ dA,$

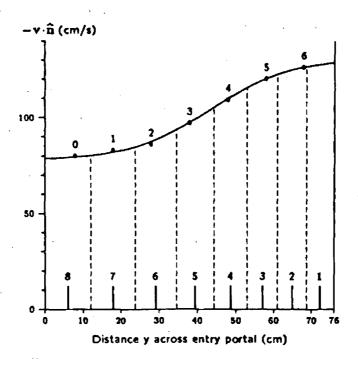
 \hat{n} being an (outward) unit normal vector over region R. In our case here, velocity $\mathbf{v} = v_x \mathbf{i} + v_y \mathbf{j}$, where $v_x = v_x(y)$ and $v_y = v_y(x)$ at the reference stations, both v_x and v_y being time independent, since we have steady flow. At station 4, the unit normal \hat{n} over the (vertical) surface R represented by the grid of instrument points is simply the unit basis vector $\hat{\mathbf{i}}$. Consequently, $-\mathbf{v} \cdot \hat{\mathbf{n}} = -v_x$ at station 4, and the volumetric flux of water (per cm of depth) through the entry portal is

$$Q^{\bullet} = - \int_{v=0}^{76 \text{ cm}} v_x dy,$$

which must be equivalent, of course, to the upstream transport. For the 30-cm/s setting, Q^* would be 5100 cm²/s (or 30 cm/s × 170 cm, the breadth of the upstream flow). For the 45-cm/s setting, Q^* is 7650 cm²/s, which is the area under the distribution curve of $-\mathbf{v} \cdot \hat{\mathbf{n}}$ in Figure 10. At station 7, just ahead of the screen, $\hat{\mathbf{n}} = -\mathbf{j}$, hence

 $Q^* = \int_{x=0}^{S} v_y dx,$

where limit S signifies the location of the separation boundary where it crosses station 7. That is, Q^* in this case sums to the total 30 or 45-cm/s transport rate



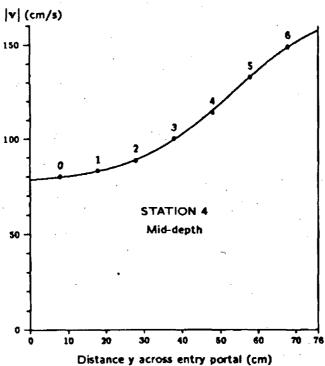
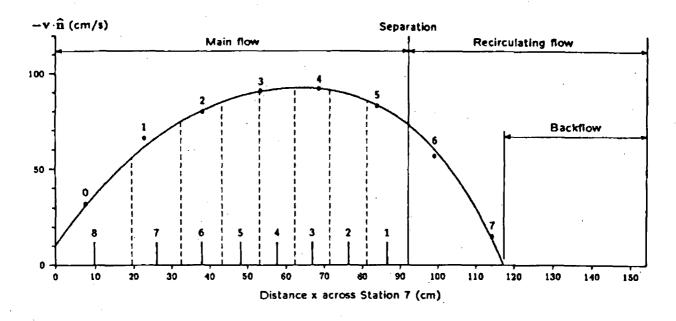


FIGURE 10.—Top panel: distribution graph of $-\mathbf{v} \cdot \hat{\mathbf{n}}$ at mid-depth, reference station 4. Instrument values are denoted by (*); see v_x values, Table 1. Area under the graph is volumetric transport per egs unit of depth through station 4. Equal areas bounded by dashed lines correspond to the eight transport trajectories of Figure 12. Bottom panel: distribution graph of velocity magnitudes at mid-depth, station 4; see $|\mathbf{v}|$ values, Table 1.



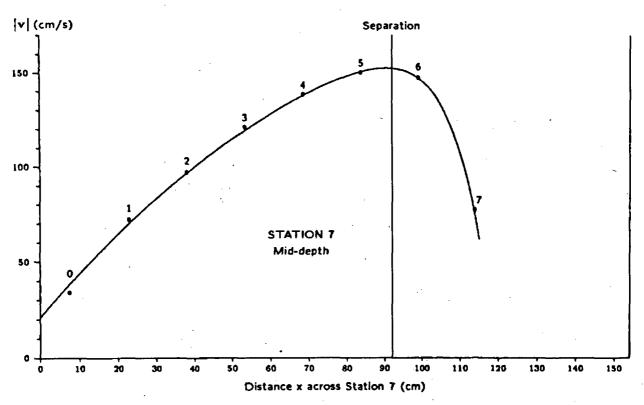


FIGURE 11.—Top panel: distribution graph of $-\mathbf{v} \cdot \hat{\mathbf{n}}$ at mid-depth, reference station 7 (8 cm upstream of screen). Instrument values are denoted by (•); see v_y values, Table 1. Area under the graph is volumetric transport per egs unit of depth through station 7. Equal areas bounded by dashed lines correspond to the eight transport trajectories of Figure 12. Region to the right of the separation is transport of secondary flow. Bottom panel: distribution graph of corresponding velocity magnitudes; see $|\mathbf{v}|$ values, Table 1.

at the separation boundary, the excess transport to the right of the separation (as in Figure 11) being a consequence of the recirculation of water through the upstream half of the screen.

In Figures 10 and 11 the eight equal-valued areas under the distribution graphs of $-\mathbf{v} \cdot \hat{\mathbf{n}}$ correspond to the numbered flux lines of Figure 12, whose locations were resolved by partitioning the Q^* integrals at reference stations 3, 4, 5, and 7. The distribution graphs of v_x , v_y , and $|\mathbf{v}|$ were resolved from the general autonomous form

$$z' + az^2 + bz + c = 0, (1)$$

which permits of nondimensionalizing and its adaptation to volumetric rates of flow and apparatus dimensions that differ from those treated here. In equation (1) the rate of change in quantity z (in v_x , v_y , or |v|) is strictly a function of the magnitude of z, independent of the independent variable t (dimension x or y). The independent variable appears solely in the boundary or side conditions. Provided the roots of equation (1) are real, its general solution z(t) is

$$(z-r_1)/(z-r_2)=C_0e^{at(r_2-r_1)}, \qquad (2)$$

where C_0 is the integration constant and r_1 , r_2 are the quadratic roots of (1), which also become the asymptotes of solution (2).

At station 4, the fitted solution form (2) for the distribution of fluid speed across the entry portal at the 45-cm/s mean flow setting became

$$|\mathbf{v}| = \frac{78 + 2.9 \, e^{0.077y}}{1 + 0.0169 \, e^{0.077y}} \tag{3}$$

(y in cm, |v| in cm/s), which is the curve in the lower graph of Figure 10. Close to the left sidewall boundary, the flow speed |v| = 79 cm/s, which rises to twice that value, or 158 cm/s, at the corner of the entry portal.

The distribution across the entry portal of the normal component of flow (which is $-v_z$ here) became

$$-\mathbf{v} \cdot \hat{\mathbf{n}} = \frac{78 + 1.9165 \, e^{0.0967y}}{1 + 0.0147 \, e^{0.0967y}},\tag{4}$$

which is the curve in the upper graph of Figure 10. The boundaries of the eight transport areas under the graph of $-\mathbf{v} \cdot \hat{\mathbf{n}}$ were located by numerically integrating equation (4) in eight partition steps, each of 956 cm²/s in value.

At station 7 the separation imposes a nonlinearity on the flow geometry more severe than that of governing equation (1). Therefore, for that circumstance I employed the linear terms of (1) and matched its (outer) solution to perturbation terms. The result for the distribution of the |v| data points at the 45-cm/s setting became

$$|\mathbf{v}| = 244(1 - 0.9139 e^{-0.0109x}) - 183 e^{(x - 120)0.10764}$$
 (5)

(x in cm, |v| in cm/s), which is the curve in the lower graph of Figure 11. In turn, the distribution across station 7 of the normal component of flow (v_y here) became

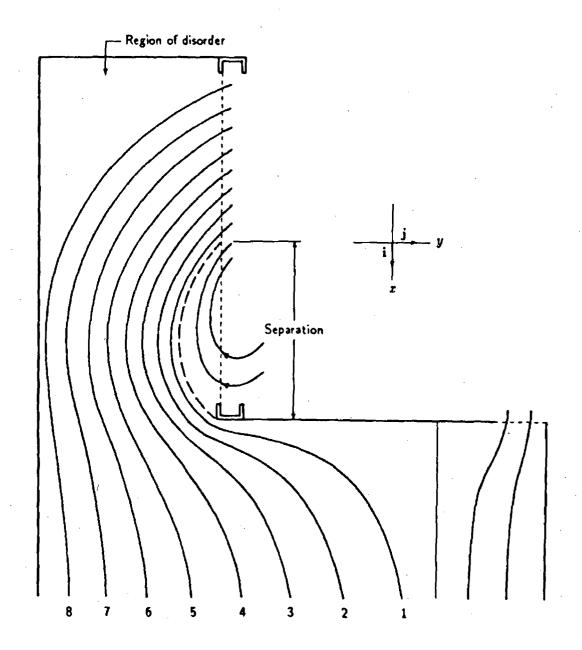


FIGURE 12.—Plot of equal-valued transport trajectories, 45-cm/s setting. Each trajectory represents a volume transport of \sim 956 cm²/s per cm of depth. The corner separation extended to 50% of the screen width at the 45-cm/s setting and 38% at the 30-cm/s setting.

$$-\mathbf{v} \cdot \hat{\mathbf{n}} = 134(1 - 0.9105 e^{-0.025x}) - 131 e^{(x-118)0.03817}, \tag{6}$$

which is the curve in the upper graph of Figure 11. The eight equal-valued transport partitions under the distribution curve were resolved in the same manner as those of Figure 10, but here the right hand boundary was determined by setting the Q^* integral of equation (6) to 7650 cm²/s, the known volumetric transport of the main flow, and numerically resolving the upper limit S. The location of S at 92 cm from the backwall of the dual-flow screen coincided with the location of maximum |v| at the separation boundary (as it should have).

The flux lines of Figure 12 portray the complex nature of the flow through the dual-flow screen. The corner separation blocks off the forward portion of the screening to the main flow, which passes through the rear portion of the screening at an angle so sharp that over a distance of 8 cm (the distance between station 7 and the screenmesh) the separation boundary is displaced from the 92 cm location at station 7 (Figure 11) to about 75 cm at the screenmesh, which is an angle of attack of $\sim 60^{\circ}$ (the angle away from a perpendicular to the plane of the screenmesh). At lower inflow speeds (at lower pumping rates), the separation recedes but the angle of attack increases (the flow at the separation becomes more nearly parallel to the screenmesh).

As indicated on Figure 12 and the upper graph of Figure 11, the recirculation of water through station 7 (and the screenmesh) was a consequence of a trapped eddy that was shear-driven by the passage of the main flow around the corner separation. In the recirculation zone, the flow through the screen (and station 7) reverses direction. Note the sign change in the normal component v_y between columns 7 and 8 of Table 1 for station 7, which in turn corresponds to the zero value of the $-v \cdot \hat{n}$ graph in Figure 11. The velocity magnitude |v| at that point does not fall to zero, however, because the flow is parallel to the screen (and to station 7; note the values of tangential component v_x on Table 1). In the region of backflow, fluid velocities are high, although reversed in direction, as indicated by the elevated values of |v| in columns 8, 9, and 10 of station 7 on Table 1. These flow complications influenced the disposition and behavior of fish drawn to the screen. The flow reversal and asymmetric distribution of fluid momentum also imposes a cross-stream torque on the screen structure.

Solution methods

In the z, z' phase plane, governing equation (1) is a parabolic curve where z'=0 at the quadratic roots r_1, r_2 of az^2+bz+c , which project to the asymptotes of (2) in the solution plane, as indicated in Figure 13. The solution graph of (2) may be monotonic increasing (as in Figure 10) or monotonic decreasing (as it would be at the right hand entry portal) according as

$$m=\frac{b^2}{4a}-c$$

is positive or negative. Quantity m is the maximum (or minimum) value of z' of (1) in the phase-plane, corresponding to the slope of solution (2) at its inflection point p, which occurs at $z = (r_1 + r_2)/2$ in both the phase and solution planes.

Therefore, with the exception of the boundary condition, all the parameters for fitting the solution graph to datum points can be resolved in terms of z and z' in the phase plane, independent of the independent variable t, with the aid of a routine method for estimating z'(z) from the measures of Δz (see Appendix B). The relationship between z(t) and t in the solution plane is then resolved by specifying the boundary condition z_0 (that is, by determining its value from the best fit of solution (2) to the t, z data values).

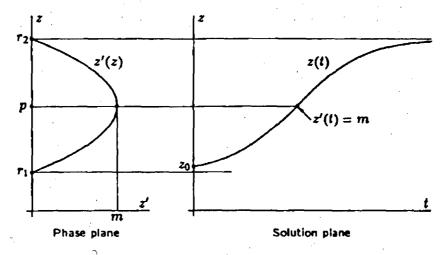


FIGURE 13.-Graph trajectories of differential equation (1) and its solution (2).

Owing to the effects of the flow separation, the distributions of |v| and $-v \cdot \hat{n}$ downstream of the entry portal each exhibits an extremum between two lesser boundary values, as portrayed by the graphs of Figure 11. The perturbation imposed on the flow geometry by the presence of the separation imposes in turn a (mathematical) perturbation on the general distribution equation (1) and its solution graph (2). The altered solution trajectories (5) and (6) for station 7 were determined by matching a general outer solution

$$z^{(o)}(t) = \left(z_0 + \frac{c}{b}\right)e^{-bt} - \frac{c}{b} \tag{7}$$

of the linear portion

$$z' + bz + c = 0 \tag{8}$$

of (1) to an inner solution

$$z^{(i)}(t) = z^{(o)}(t_1) - z^{(o)}(t_1)e^{(t-t_1)e} + z(t_1)e^{(t-t_1)e}$$
(9)

of the first two terms of a perturbation expansion

$$z' = \gamma + \varepsilon z,\tag{10}$$

where γ is a constant and ε is the perturbation factor. Graph trajectories of equations (7) and (9) are shown in Figure 14.

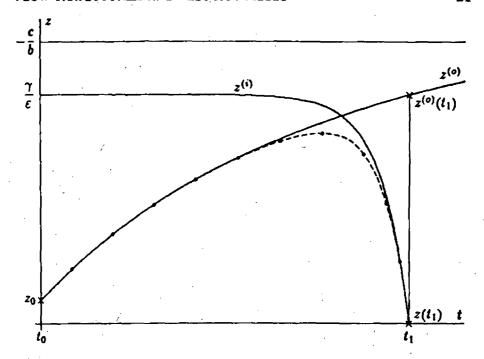


FIGURE 14.—Graphs of outer solution $z^{(0)}$ (equation 7), inner solution $z^{(i)}$ (equation 9), and composite solution z(t) (equation 11), whose trajectory is denoted by the dashed curve. Boundary values satisfied by z(t) are $z(t_1)$ on the right and z_0 at $t_0 = 0$. Symbols (•) represent fitted data points.

As portrayed in Figure 14, the composite solution z(t) has the boundary values $z(t_0)$ on the left and $z(t_1)$ on the right, either of which may be zero or nonzero. Outer solution $z^{(o)}(t)$ satisfies the left hand boundary condition (symbolized z_0 in equation 7), where, without loss of generality, $t_0 = 0$), while inner solution $z^{(i)}(t)$ satisfies the right hand boundary condition (quantity $z(t_1)$ in equation 9). The quantity $z^{(o)}(t_1)$ is the value of the outer solution at t_1 (the location of the right hand boundary). In equation (9), $z^{(o)}(t_1)$ replaces γ/ε with small error. The composite solution is recovered by combining the inner and outer solutions and eliminating the overlap, or

$$z(t) = -\frac{c}{b} \left[1 - \left(\frac{bz_0}{c} + 1 \right) e^{-bt} \right] - \left[z^{(o)}(t_1) - z(t_1) \right] e^{(t-t_1)c}, \tag{11}$$

which is the form taken by the distribution equations (5) and (6). In the region near the left hand boundary where the outer solution is valid, the constants c and b of (7) can be resolved from the measures of Δz in the z, z' plane where governing equation (8) will have a straight line graph. The boundary value z_0 can then be determined by fitting outer solution (7) to the t, z data points in that region. A similar procedure can sometimes be followed for resolving perturbation parameter ε with equation (10), but when the distribution of interest drops off sharply at the boundary, the data points in the boundary region are often too few to suit that procedure. In most cases, ε is more accurately resolved in the composite solution (11).

4. Fish behavior experiments

The fish used in the behavior experiments were 246 juvenile striped bass Morone saxarilis of Hudson River origin, 5.9 cm in mean standard length, and 260 each of golden shiners Notemigonus crysoleucas 5.6 cm and 7.2 cm in mean standard lengths, obtained from a local fish farm. The striped bass were shipped by air to Houston. Of the 250 received, four were judged unfit for use (owing to erratic swimming behavior). We employed the golden shiners as representatives of tender species having moderate endurance and swimming strength, in contrast to the striped bass, which are typical strong swimmers, hardy, and not so readily damaged.

The fish were held apart by size and species in large fish tanks until used in the experiments. Tank water was acrated, filtered, and monitored for temperature, pH, ammonia concentration, and conductivity. The flume water was continuously filtered and circulated; temperature, pH, and conductivity were measured between experiments. For each behavior experiment, the fish of a sample were released 5 m upstream of the dual-flow apparatus by species, size, and water speed.

At each of the 30- and 45-cm/s mean flow settings, the striped bass were released in five sample batches of 20, one batch of 15, and eight of one fish at a time (a total of 28 trials). The two sizes of shiners were released at each of the flow settings in four batches of 25, one batch of 10, and ten of one fish at at time (a total of 60 trials with the shiners). For the silhouette photography, a video camera and a 35 mm camera were located 6 m above the stilling box (see Figure 5) while an observer viewed the fish through the sidewall ports of a darkened cubicle (see Figure 3). During an experiment the video camera ran continuously. The mounted 35 mm camera, which was equipped with a motor-driven shutter and film advance, was operated at will, at the rate of three frames per second, by the observer on the camera gantry. The two observers were equipped for communication with earphones and voice-activated transmitters. A few trial experiments were conducted during daylight hours, with the flume upstream of the stilling box covered over with black plastic sheeting, but we abandoned that procedure early on. All of the behavior experiments discussed here were carried out after dark, the only light in the flume building being the flume bottom lighting in the vicinity of the dual-flow apparatus, an arrangement that allayed our worries over the unknown influences on the fish of surface reflections and other visual disturbances.

The discussion here of the findings from the behavior experiments is aided by the several photographs of fish locations reproduced in this section,

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which should be viewed in their relationships to the flow patterns and velocity vectors depicted in Figures 7, 9, and 12. A velocity vector of Figure 9 indicates the (instantaneous) direction of flow at its midpoint; the comparative lengths of the vector arrows give an indication of the differences in fluid speeds from location across a station, or from station to station in the flow. The streak lines of Figure 7 indicate the paths taken by the flowing water, and the flux lines of Figure 9 (or those shown on the diagrams of this section) correspond to the gross transport of water along those paths of motion. The flow accelerates along any flux line; the closer together they are, the greater the speed of flow. Along flux line 1 in Figure 12, for example, the fluid speed is about 30 cm/s where it crosses station 3 (compare with Figure 9 and Table 1). Over the short distance between that point and station 4 at the entry portal, however, the fluid speed along flux line 1 increases fivefold to 150 cm/s, a speed maintained through station 7 and into the screening. The dispositions of fish in the vicinity of the dual-flow apparatus were governed by these fluid accelerations and patterns of flow.

A typical episode of fish being drawn into the vicinity of the dual-flow apparatus and through the entry portal is shown by the three (successive) photographs of Figure 14 and the accompanying tracings of Figure 15. The fish are large golden shiners of a batch of 25 released upstream at the 30 cm/s setting. The elapsed time was 2.25 s between frames (a) and (b), and 1.87 s between (b) and (c). Individuals were identified and their paths of motion tracked by matching the 35 mm photographs with the video tape. The flow pattern at the 30 cm/s mean flow setting (Figure 15) differs somewhat from the flow pattern at the 45 cm/s setting (Figure 12).

In frame (a) of Figure 14, the fish are being transported into view by the flow, at about 50 cm/s. The net downstream movement of fish, despite their apparent orientations in the photograph, followed generally along the lines of flow indicated in Figure 15. All of the fish appearing in frame (a) were drawn rapidly into the vicinity of the dual-flow apparatus. Fishes 1, 2, and 3 of frame (b) arrived slightly later than those numbered 4 to 16 in Figure 15. Few fish (of either tested species) were observed to orient themselves directly into the flow until they were close upon the frontwall of the apparatus or the corner of the entry portal. Despite furious swimming efforts, few of the individuals transported to the high speed corner region of the entry portal were able to keep station beyond a few seconds, but most significantly, these were usually the only fish arriving at the entry portal that did make attempts at maintaining station. As a rule, fishes drawn to the entry portal some distance from the corner were carried almost passively downstream to a sudden encounter with the screening.

Fishes 12-16 in frame (b), plus two individuals already out of camera view, were swept downstream to the screen, in apparent random orientations, at about 85 cm/s, the speed of the flow itself. Their paths of motion coincided with the flux lines shown in Figure 15, indicating little voluntary motion on the part of any individual. The speed of transit in that region of the screen portal was so great, however, that net departures from the flow trajectories were difficult to detect. Fishes 8, 10 and 11, which exhibited vigorous tail beats, were able, momentarily, to stem the flow (which was about 95 cm/s at the locations of fishes

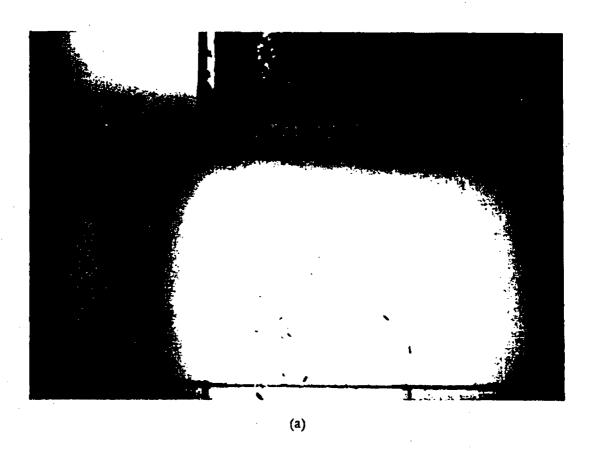
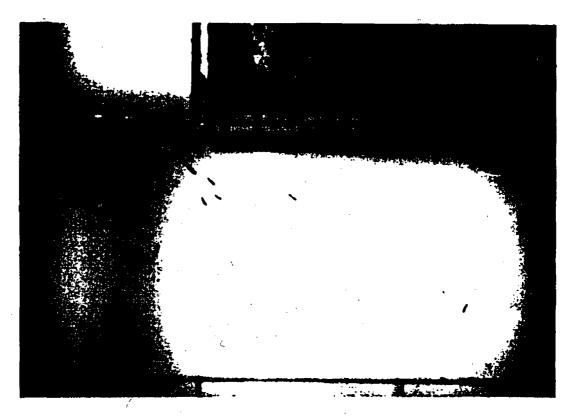
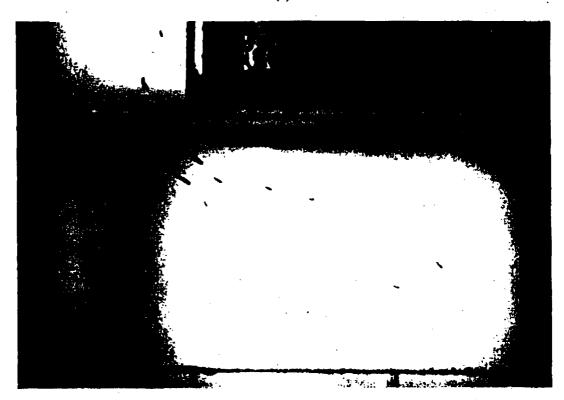


FIGURE 14.—Successive positions of large golden shiners drawn to the dual-flow apparatus at the 30 cm/s mean flow setting. The time interval was 2.25 s between frames (a) and (b), and 1.87 s between (b) and (c). Individual fish and their paths of motion are identified in Figure 15.



(c)



(b)

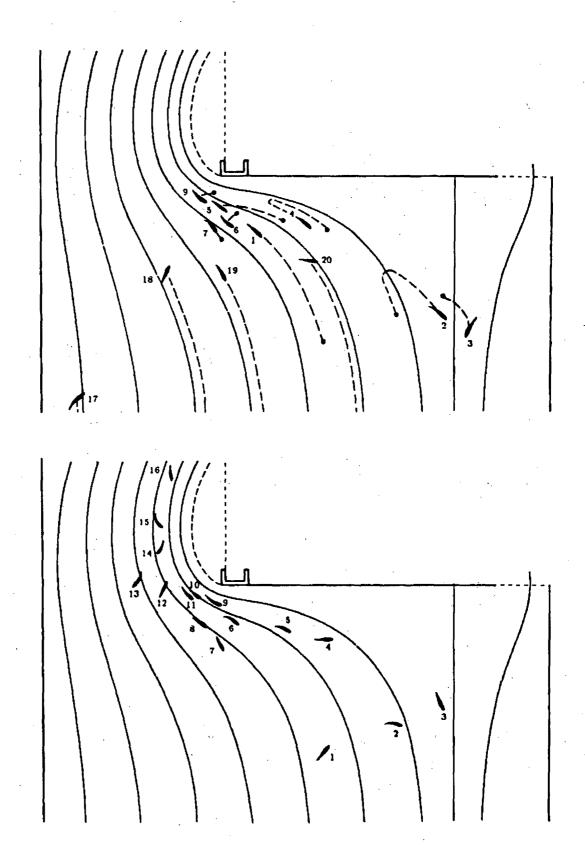


FIGURE 15.—Diagram of flux lines (30 cm/s setting) and identities of the fish appearing in photographs (b) and (c) of Figure 14. The flume outline and fish locations have been adjusted for camera parallax.

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9-11), but they were suddenly swept from view, also at the approximate speed of the flow. Fishes 5, 6, 7, and 9 held out somewhat longer, but fish 4 was the only individual in the high speed region that made any significant progess away from the apparatus. The later arrivals 17, 18, and 19 of frame (c) were transported, swiftly and passively, through the entry portal at the speed of the flow, but fish 17 reappeared and swam close along the left sidewall of the flume a distance of a meter or so upstream, where it remained for some time. That behavior was occasionally repeated by individual fish when released to the far left of the flume center. Fish 20, on arriving at the entry corner, exhibited the orientation and vigorous swimming behavior typical of many fish (such as numbers 5-11 of the experiment) when transported through that high speed region.

At ten seconds after the first appearance of the fish in frame (a), the only members of the released sample remaining in camera view were fish 17 at the flume sidewall, fishes 2 and 3, joined by one late arrival, in the region of the stagnation streamline, and fish 4, which had moved some distance to the right into the more slowly moving flow. Two fish of the 25 released were not observed on camera, but at the conclusion of the experiment we found them upstream, swimming along the sidewall of the flume, an occurrence less typical of the shiners than of the striped bass.

The behavior of fishes 2 and 3 in Figure 14 was observed several times in experiments with both the shiners and the striped bass. Some fish of a released sample, if they arrived at the dual-flow apparatus in the slower current to the right of the entry portal, would turn about and converge on the stagnation streamline. Schooling behavior was also strongest in that region, in contrast to the small evidence of schooling tendencies in the (observed) regions of swifter flows. The photographs of Figure 16 show small golden shiners schooling and converging on the stagnation streamline. In this experiment a sample of 25 shiners was released more to the right of the flume center than usual; 13 of the 25 were ultimately carried through the entry portal and impinged (flattened against the screening), but 5 were transported to the apparatus on the right side of the stagnation streamline (the five fish to the right in frame (a)), while 7 of those arriving to the left of the stagnation streamline reversed direction in the vicinity of the flume frontwall and joined the other five, as indicated by frame (b) of Figure 16. This behavior is especially worthy of note, because it demonstrates the tendencies of fish to respond to the peculiarities of the fluid flow itself, as opposed to responding directly to the stationary obstacles or surfaces (such as the flume sidewall) that actually induce the peculiarities into the flow.

Although juvenile striped bass also exhibited similar behavior in the region of the stagnation streamline, they were also more active as individuals than either size of golden shiners. In the swifter regions of flow they were generally transported to the screening somewhat less directly along the flux paths of the water transport than the shiners, individuals making darting motions, seemingly at random and independent of one another. More striped bass of a given release would find the upstream sidewalls of the flume (or, more explicitly, the slow-speed boundary layer at the flume wall) than those of a similar release of golden shiners. And being much the stronger swimmers, they were able to stem the flow

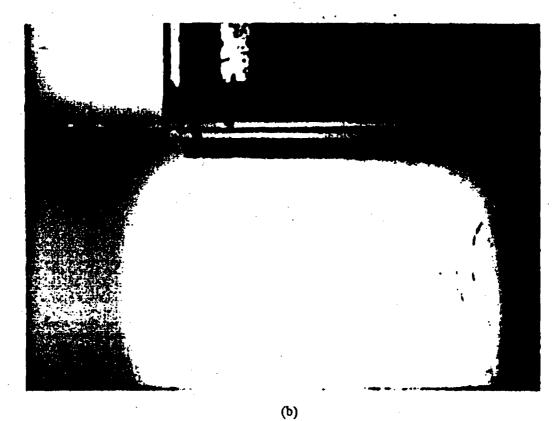


FIGURE 16.—Successive positions of small golden shiners converging on the stagnation streamline at the 30 cm/s mean flow setting. The time interval was 3.7 s between frames (a) and (b).

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at the entry portal for longer periods, particularly at the 30 cm/s mean flow setting. At the 45 cm/s setting, however, few of the striped bass (and none of the golden shiners) were able to keep station at the corner of the entry portal, the fluid speed in that region being about 150 cm/s.

The liveliness (or excitability) of the striped bass juveniles is captured in the three (successive) photographs of Figure 17. In frame (a), 13 individuals of an upstream release of 20 have just arrived in the vicinity of the dual-flow apparatus at the 45 cm/s mean flow setting. Fluid speeds in the vicinity of the dual-flow apparatus were considerably greater in this experiment than the fluid speeds at the 30 cm/s setting of Figures 14 and 15, so events transpired more rapidly. Note the absence of schooling and the random orientations of individual fish in frames (a) and (b) of Figure 17. The time interval between frames (a) and (b) was only 1.12 s, but owing to the independent darting motions of individuals, the relative positions of fish changed considerably, although their net paths of motion towards the entry portal were still a consequence of the pattern and speed of the flow directly upstream of the dual-flow frontwall. In frame (b), at least five fish have responded to the fluid acceleration at the entry corner by aligning themselves headmost into the flow. Despite the furious swimming efforts of the individuals that did respond in that manner, all except two, during the 1.87 s interval between frames (b) and (c), were carried backwards (still swimming (uriously) and flattened against the screening. The lone fish appearing in the lower right hand corner of each photograph is a large golden shiner, swimming in the vicinity of the stagnation streamline, that was left over from a previous experiment.

With virtually no exceptions, fish transported through the entry portal and impinged on the screenmesh struck the screening well alt of the corner separation—as did plant matter and the charcoal markers when released upstream at any location between the stagnation streamline and the left sidewall of the flume. A typical transport of fish through the entry portal and to the screening is shown in the photograph and accompanying diagram of Figure 18. All of the fish of the photograph were moved along the flux line paths to the downstream portion of the screen (to the far right in the photograph). Fish already impinged can be seen in that vicinity of the screening.

At both of the experimental flow settings, impingement was fatal to all tested fish. Owing to the streamline crowding of the main flow in passing through the entry portal and around the corner separation, fluid speeds at the screen-mesh were greatly elevated over the 30- and 45-cm/s mean upstream velocities. At the 30-cm/s setting, the speed |v| of the main flow across station 7 ranged from 50 to 100 cm/s (corresponding, say, to about the order of 80 cm/s at the screen). At the 45-cm/s setting, the speed of the main flow across station 7 ranged from 80 cm/s to 150 cm/s (corresponding to the order, say, of 120 cm/s at the screen). The pressure forces of these high-speed flows against impinged fish were great enough to impose death or mortal injuries to shiners and striped bass alike. Typical (external) damages exhibited by impinged fish are described on Table 2.

In view of the findings from previous laboratory and field expariments, these wholesale mortalities were unexpected. As reported in another work on

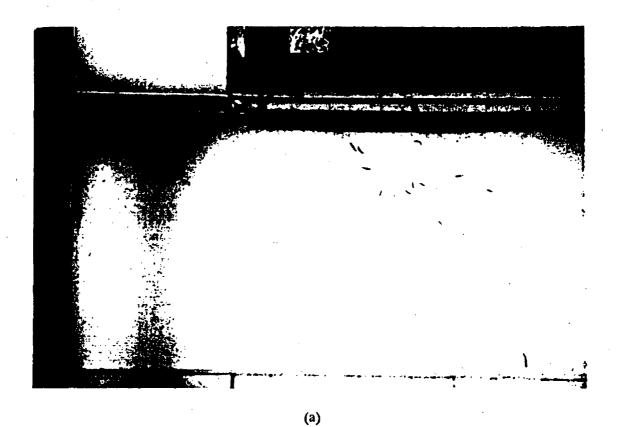
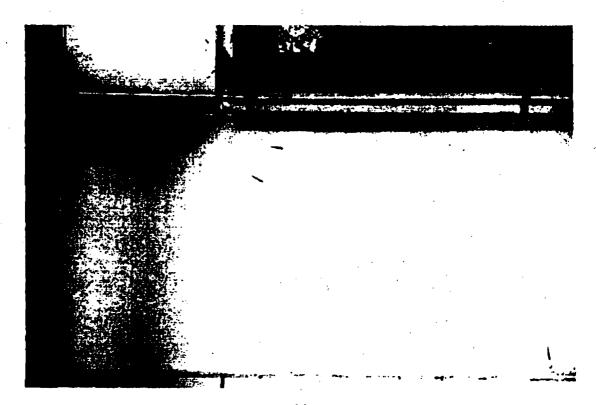
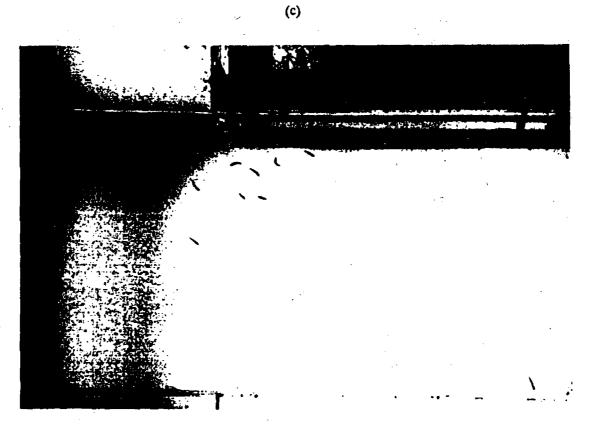


FIGURE 17.-Successive positions of juvenile stiped bass drawn to the dual-flow apparatus at the 45 cm/s mean flow setting. The time interval was 1.12 s between frames (a) and (b), and 1.87 s between (b) and (c).





(p)

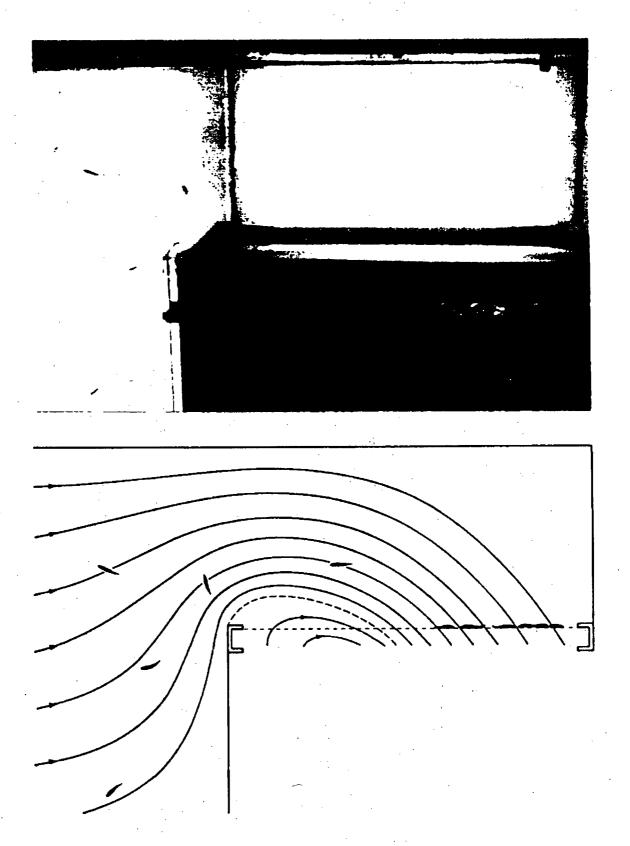


FIGURE 18.—Small golden shiners transported through the entry portal and impinged on the acreenmesh at the 30 cm/s mean flow setting. The diagram shows the positions of the fish in the photograph and the corresponding flux lines of flow, adjusted for camera parallax.

TABLE 2.—Injuries typical of fish collected from the test screen at the conclusions of experiments. Durations of impingements ranged from 6 to 15 minutes. Standard length Lin cm.

| # | Std L | Damage |
|----|-------|---|
| • | | Striped bass, 30 cm/s setting |
| 1 | 6.3 | 10% descaled, operculum torn, body crushed. |
| 2 | 5.2 | Telson split, body crushed. |
| 3 | | Operculum torn, telson avulsed. |
| 4 | 6.7 | 15% descaled, body crushed. |
| 5 | 6.6 | Operculum torn, head and body crushed. |
| 6 | 5.6 | Telson split, body crushed. |
| 7 | 5.6 | 10% descaled, eye avulsed, head crushed. |
| 8 | 5.9 | 15% descaled, head and body crushed. |
| 9 | 6.0 | Operculum torn, body crushed. |
| 10 | 5.4 | 10% descaled, operculum torn, head crushed. |
| | | Small golden shiners, 45-cm/s setting |
| 1 | 5.8 | 60% descaled, body crushed. |
| 2 | 5.6 | 20% descaled, body crushed, |
| 3 | 5.0 | 40% descaled, body crushed. |
| 4 | 5.7 | 20% descaled, head and body crushed. |
| 5 | 6.0 | 60% descaled, head 90% avulsed. |
| 6 | 6.0 | 20% descaled, eye avulsed, body crushed. |
| 7 | 5.6 | 40% descaled, head crushed. |
| 8 | 5.1 | 50% descaled, operculum torn, body crushed. |
| 9 | 5.5 | 40% descaled, body crushed. |
| 10 | 5.4 | 40% descaled, operculum torn, body crushed. |
| | | Large golden shiners, 45-cm/s setting |
| 1 | 7.0 | 20% descaled, body crushed. |
| 2 | 7.2 | 40% descaled, body crushed. |
| | 6.9 | 60% descaled, body crushed. |
| 4 | 6.8 | 50% descaled, head 90% avulsed. |
| 5 | - | 80% descaled, telson avulsed. |
| 6 | 7.2 | 60% descaled, body crushed. |
| 7 | 7.4 | 40% descaled, body crushed. |
| 8 | 7.6 | 80% descaled, body crushed. |
| 9 | 7.2 | 40% descaled, body crushed. |
| 10 | 6.9 | 60% descaled, head 50% avulsed, body crushed. |

screening systems (Fletcher 1990), injuries to impinged fish were not extensive at fluid speeds to 50 cm/s through a conventional cross-flume screen equipped with a smooth-surface screen mesh, and only slightly greater when fitted with the same standard mesh employed in the dual-flow experiments. Apparently then, in the range of fluid speeds between 50 and 80 cm/s at the screenmesh the risk of mortality to impinged fish increases sharply.

Also, the fluid speeds at the screenmesh of a working, linked-panel screen would actually be greater, for a given flow setting, than those of the experiments reported here. As opposed to the unobstructed screenmesh of the experimental apparatus, a travelling dual-flow screen of the kind most often employed in large water intake systems is composed of linked, rectangular screen panels whose horizontal framing members offer significant impedence to the approach-

Fluid Sp. 10 most imp. Factorin mort. Maybe J. F. 15 Fluid Sp. in Flune was much greate than as Dunkirk

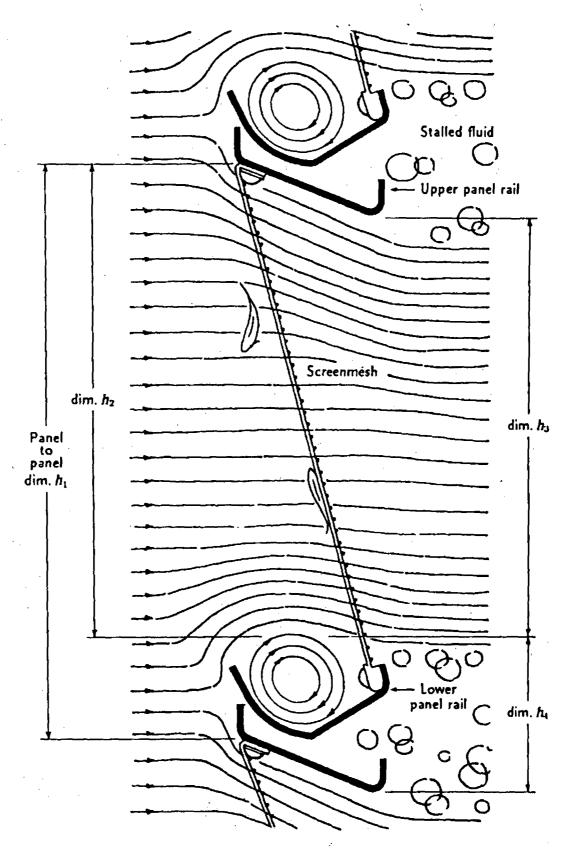


FIGURE 19.—Vertical section through typical panel of a travelling screen showing pathlines of flow. Dimension h_1 is panel-to-panel spacing; dimension h_2 is the sensible freeflow area at the screenmesh; dimension h_3 is the effective free-flow area through the panel structure; dimension h_4 is the projected (dynamic) frontal area of the screen railings.

FISH BEHAVIOR 35

ing flow. The influence of the cross-members, or rails, of one manufacturer's panel design is indicated in Figure 19. The flow pattern shown on the diagram was traced from the photographs of dyed pathlines recovered in (full-scale) experiments on screen panels by Fletcher (1990). The sensible flow at the screen-mesh of any such panel configuration is determined by the (vertical) breadths of the panel rails and by the influences on the main flow of such secondary blocking flows as the trough vortices shown in the figure.

The rail profiles and details of flow through the mesh of a screen panel differ somewhat from one manufacturer's design to another, but the ratio of the sensible free-flow area at the screenmesh (dimension h_2 of Figure 19) to panel spacing h_1 is typically 80% or less at a standard panel spacing of 61 cm (24 in). Therefore, since continuity, for a given volumetric flux Q, requires that $h_1V_1 = h_2V_2$ (V_1 being the mean speed of flow at the unobstructed screen and V_2 the mean speed of flow at the panel screening), then the 80-cm/s unobstructed screen speeds of the 30-cm/s mean flow experiments would increase to about 100 cm/s if standard height screen panels were employed, and the 120-cm/s order of magnitude speeds through the unobstructed screen would increase to about 150 cm/s in the case of the 45-cm/s mean flow setting.

The concave rails of the screen panels shown in Figure 19 are meant to capture and rescue impounded fish as the screen structure ascends through the water column. They represent one manufacturer's version of the so-called Ristroph concept often found on conventional cross-channel screens. In a series of flow studies on Ristroph screen panels (Fletcher et al. 1988, and Fletcher 1990), the longitudinal trough vortices depicted in Figure 19 were found to be typical of all manufacturer's Ristroph designs known at the time of the work. Fish caught in these shear-driven trough vortices were swirled about and severely battered; the associated injuries and mortalities were greater than those imparted to fish by simple impingements against the screen mesh (at moderate flow speeds).

When a Ristroph apparatus is employed in the manner of a conventional cross-channel screen (Figures 1 and 2(a)), captured fish are raised from the water on the upstream side of the (upward) moving screen, then dumped into a sluice for their return to the source waters as each panel overturns on its rotation over the uppermost sprocket of the machine. Ristroph screens are also employed, without modification, as dual flow screens, and offered by their makers as putative fish-conserving devices. Aside from the adverse flow conditions characteristic of Ristroph troughs, these adaptations are ill-suited to the workings of a dual-flow screen. Owing to its dual-entry configuration (Figure 2(b)), water and fish are drawn to both the ascending and descending sides of the moving screen. The fish troughs on the descending side are inverted and travel downwards, which negates their intended fish-catching function. Although the problem of the trough vortex has been resolved by at least one new design (Fletcher 1990), no known Ristroph device is really suited to the peculiar functionings of a dual-flow screen.

For mechanical purposes and the calculations of moments and pressure forces, dimension h_4 of Figure 19 represents the true projected frontal area of

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the illustrated panel railings, and the ratio of dimensions h_3 and h_4 determine the actual streamline compression of the flow passing through the screen panel. These effects are clearly visible in the dye-marking photographs reproduced in Fletcher (1990).

5. References

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Appendix A Velocity measurements.

The velocity measurements tabulated here were read directly from the two-component analog gauges of a model 511M Marsh-McBirney electromagnetic current meter (see Figure 9 for the x-y coordinate orientation in the flume). Units of the tabulated component values are cm/s. Velocity magnitude $|\mathbf{v}|$ at a measurement point can be calculated from the corresponding x, y components as $(v_x^2 + v_y^2)^{1/2}$.

Flume calibrations. For the calibrations of the free-flow conditions at the 30-and 45-cm/s mean velocity settings, the cross-flume velocity distributions were set in patterns like that shown in Figure 6(c). The x and y components of fluid velocities were measured at the reference stations 1, 2, and 3 identified in Figure 6(a). A suite of instrument measurements at each station consisted of 70 pairs of component values taken on a vertical grid of 70 points arrayed in 7 rows spaced over the depth of the flume and 10 columns (numbered 0 to 9) across the breadth of the flume.

Dual-flow measurements. For the velocity distributions of the flows approaching and entering the dual-flow screen, the x and y velocity components were measured at stations 3 and 4 (70 grid points each), stations 5 and 6 (49 grid points each), and station 7 (77 grid points); see Figure 9 for station locations. At either of the (30- or 45-cm/s) mean flow settings, the volumetric flux of water through the flume with the dual-flow apparatus in place was equal to that of the corresponding free-flow calibration.

Flume calibration, 30 cm/s mean flow setting

| STAT | I NOT | | <u></u> | | | Colu | ממונ | | | | |
|--------------|----------------|--|-------------|--------------|----------|----------|----------|-------------|--------------|-----------------|------------|
| Row | Comp. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | v_x | -15 | -20 | -24 | -27 | -30 | -38 | -40 | -42 | -42 | -38 |
| | v_y | 3 | 3 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 2 |
| 2 | v _x | -14 | -18 | -22 | -26 | -32 | -38 | -42 | -43 | -39 | -40 |
| | v_y | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 3 | v_x | -15 | -16 | -20 | 23 | -30 | -36 | -42 | -44 | -44 | -40 |
| | v_y | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 4 | vs | -14 | -15 | -20 | -22 | -30 | -36 | -42 | -44 | -40 | -38 |
| | v_y | _2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 |
| 5 | v_{z} | -10 | -12 | -17 | -22 | -28 | -34 | -42 | -44 | -41 | -38 |
| · | v_y | 4 | 2 | 4 | 4 | 4 | 2 | 4 | 2 | 2 | 2 |
| 6 | v_x | -10 | -10 | -14 | -16 | -24 | -30 | -38 | -42 | -40 | -40 |
| L | v_y | 2 | 2 | 4 | 2 | 2 | 2 | 4 | 4 | 2 | 2 |
| 7 | Uz | ~8 | -12 | -16 | -16 | -20 | -26 | -36 | -38 | -40 | -40 |
| <u> </u> | v_{y} | 2 | 4_ | 2 | 4 | 2 | 2 | 2 | 2 | 2 | 2 |
| STAT | TON 2 | | | | | Colu | ממט | | | | |
| Row | Comp. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | v_x | -13 | -18 | -24 | -27 | -31 | -41 | -44 | -50 | -42 | -39 |
| | v_y | 2 | 2 | 3 | 3 | 3 | 4 | 4 | _4 | 4_ | 3 |
| 2 | v_{x} | -11 | -16 | -21 | -26 | -31 | -38 | -42 | -46 | -4 0 | -40 |
| <u> </u> | v_y | 2 | 1_ | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 |
| 3 | v_x | -12 | -16 | -21 | -26 | -32 | -37 | -42 | -43 | -4 0 | -38 |
| | v_y | 2 | <u> </u> | 2 | 3 | 3 | 4 | - 4 | 3 | 3 | 3 |
| 4 | v_{x} | -10 | -16 | -18 | -26 | -32 | -37 | -42 | -44 | -42 | -40 |
| | v_y | 2 | 2 | 2 | 2 | 4 | 4 | 4_ | 4 | 4 | 4 |
| 5 | v_x | -10 | -14 | -20 | -24 | -30 | -33 | -42 | -48 | -40 | -40 |
| ļ | บ | 2 | 2 | 2 | 0 | 3_ | 2 | 3 | 3 | 3_ | 3 |
| 6 | v_x | -8 | -12 | -15 | -19 | -24 | -30 | -44 | -46 | -42 | -40 |
| | vy | .2 | 2 | 0 | 0 | 2 | 2 | 4 | 0 | 4 | 4 |
| 7 | U _F | -8 | -10 2 | -14 0 | -16 0 | -24 2 | -30 2 | -36 2 | -38 2 | -42 2 | -40 2 |
| STAT | TON 3 | | | _ | | Colu | | <u> </u> | _ <u>-</u> - | == | |
| | | _ - | | | | | | | | | |
| | Comp. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|] 1 . | v _s | -12 | -18 | -24 | -26 | -32 | -40 | -44 | -50 | -48 | -42 |
| | υ _y | 2 | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 2 |
| 2 | v _s | -16 | -19 | -26 | -29 | -39 | -42 | -43 | -48 | -43 | -43 |
| <u></u> | v _y | 2 | 0 | 0 | 0 | 4 | 2 | 2 | 4 | 4 | 2 |
| 3 | v _e | -12 | -17 | -20 | -26 | -36 | -40 | -44 | -50 | -48 | -46 |
| | Uy | 0 | 0 | 0 | 0 | 2 | 4 | 4 | 2 | 4 | 6 |
| 4 | v_x | -13 | -19 | -22 | -27 | -38 | -40 | -45 | -48 | -47 | -42 |
| | บพ | 0 | 0 | 0 | 0 | 2 | | 4 | 2 | 4. | . 6 |
| 5 | v_{x} | -11 | -16 | -22 | -28 | -34 | -40 | -44 | -46 | -46 | -42 |
| <u></u> | v_y | 0 | 0 | 0 | 0 | 0 | 4 | 2 | 0 | 0 | 4 |
| 6 | v _z | -10 | -16 | -20 | -26 | -34 | ~38 | 40 | -47 | -48 | -40 |
| _ | vy | 0 | 0 | 0 | 0 | 0 | - 0 | 0 | 0 | 0 | 4 |
| 7 | U _z | -11 | -12 | -20 | -18 | -34 | -39 | -42 | -50 | 41 | -42 |
| <u></u> | v_y | 0 | 2 | 0_ | 0 | 2 | 2 | 2 | 2 | 2 | 2 |

Flume calibration, 45 cm/s mean flow setting

| STAT | TON I | | <u> </u> | | | Colu | ma | | | | |
|------------|------------------|--------------|-------------|-----------------|--------------|----------|-----------------|----------|-----------------|-----------|-------------|
| Row | Comp. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | V _x | -18 | -29 | -35 | -38 | -46 | -58 | -61 | -61 | -59 | -59 |
| • | v_y | -10 | 6 | 6 | 6 | 6 | 6 | 6 | 8 | 8 | 4 |
| 2 | v_x | -16 | -26 | -29 | -38 | 47 | -56 | -61 | -62 | -61 | -59 |
| | υ _ν | . 4 | 4 | 6 | 8 | 6 | 6 | 6 | 6 | 6 | 4 |
| 3 | v _r | -16 | -23 | -27 | -35 | -44 | -53 | -64 | -64 | -60 | -59 |
| | v_y | 2 | 4 | 4 | 6 | 4 | 4 | 4 | 4. | 4 | 4 |
| 4 | v_r | -14 | -21 | -26 | -29 | -44 | -53 | -61 | -65 | -61 | -59 |
| l | v_y | 4 | 6 | 6 | 6. | 5 | 6 | _6 | 6 | 6 | 5_ |
| 5 | v. | -11 | -17 | -24 | -30 | 41 | -49 | -60 | -65 | -61 | -56 |
| | v_y | 6 | 4 | 6_ | 6. | 6 | 4 | 6 | 4 | 4 | 4 |
| 6 | v _z | -10 | -15 | -24 | -24 | -38 | -45 | -58 | -60 | -60 | -59 |
| | v_y | 4 | 4 | 6_ | 4 | 4_ | 4 | 5 | 5 | 4 | 4 |
| 7 | v_x | -8 | -18 | -21 | -29 | -36 | -40 | -52 | -53 | -54 | -53 |
| <u> </u> | v_y | 4 | 6 | | 6 | 4_ | 4_ | 4 | 4 | | 2 |
| STA | TION 2 | | | | | Colu | ពេលព | | | | |
| Row | Comp. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | v_x | -14 | ~20 | -28 | -31 | -46 | -50 | -53 | -60 | -60 | -58 |
| <u></u> | v_y | 4 | 4 | 6_ | 6 | 6 | 6 | 6 | 0 | 6_ | 6 |
| 2 | v _z | -14 | -23 | -29 | -38 | -44 | -56 | -65 | -65 | -59 | -59 |
| | v_y | 4 | 2 | _4 | 4 | 0 | 6 | 6 | 6 | 6 | 6 |
| 3 | v_{z} | -20 | -23 | -29 | -35 | -44 | -53 | -62 | -63 | -59 | -56 |
| <u> </u> | v _y | 4 | 4 | 4 | 6 | 0 | 4 | 6 | 6 | | 6 |
| 4 | v ₌ | -14 | -23 | -26 | -33 | -44 | -53 | -64 | -64 | -59 | -59 |
| <u> </u> | v_ | 4 | | 4 | 4 | 4 | <u>6</u> -47 | 6 | -59 | -59 | <u>5</u> |
| 5 | U. | -12 4 | -20 4 | -29 4 | -34 2 | -42 6 | 0 | -61 6 | -34 6 | -39 | -59 6 |
| 6 | v | -11 | -18 | -21 | -26 | -36 | -44 | -61 | -68 | -62 | -60 |
|) ° | v _z | -2 | -10 4 | 2 | - <i>2</i> 0 | ~30 2 | 4 | 4 | -06 | -02 2 | -sc |
| 1-7 | vy_ | -11 | -15 | -21 | -27 | -32 | 41 | -55 | -55 | -60 | -58 |
| 1 ′ | v _x | 2 | 4 | 2 | 2 | 4 | 4 | - 0 | _ <u></u> 0 | 4 | - 4 |
| STA | TION 3 | - | | | | Colu | ma | | | | |
| } - | | - | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| <u></u> | Comp. | 0 | | | | | | | | | |
| 1 | v _z | -16 | -22 | -30 | -38 | -50 | -59 | -62 | -69 | -64 | -57 |
| 1- | v _y _ | 4 | 2 | -28 | <u>4</u> | -46 | -58 | -64 | <u>2</u> -66 | - 2 | -60 |
| 2 | v _r | -12 | -23 | - <i>Z</i> 5 | -36 2 | -40 6 | -38 4 | -04 4 | ~00 6 | ;-64 6 | -ou 4 |
| 1- | v _y _ | 12 | 2 | -28 | -33 | -42 | -53 | -62 | -64 | -61 | -57 |
| 3 | v≠ " | -13 2 | -20 0 | - <i>2</i> 0 | -33 2 | 2 | -J3 | 4 | 8 | -01 | -5 <i>1</i> |
| 4 | v _y | -12 | -19 | -25 | -36 | -46 | -54 | 61 | -66 | -64 | -60 |
| • | v≠ vy | 2 | 0 | 2 | 2 | 4 | 6 | 6 | -4 | -6 | 8 |
| 5 | v _z | -12 | -21 | - 24 | -34 | | -57 | -63 | -67 | -67 | -62 |
| 1 | v _y _ | 2 | 2 | 0 | -2 | -2 | 2 | -2 | 0 | 2 | 2 |
| 6 | v _r | -12 | -18 | -23 | -33 | -46 | -56 | -62 | -69 | -67 | -64 |
| | * # | | | | | -2 | <i>-</i> 2 | -2 | 0 | 2 | 6 |
| 1 | v |] 2 | 2 | . 0 | -2 | -2 | - 4 | -4 | v | - | v |
| 7 | v _y | -12 | -14 | -24 | -34 | -44 | | -62 | -71 | -65 | -63 |

Dual-flow apparatus, 30 cm/s mean flow setting

| STAT | TON 3 | | ius, o | | | Colu | mn | | | | |
|---------|------------------|-----------|--------|------------|------------|------|-----|-------------|-----|-----|-----|
| Row | Comp. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | v_x | -33 | -35 | -38 | -42 | -30 | -14 | -8 | -4 | -14 | -33 |
| | υy | -1 | -19 | -22 | -25 | -36 | -32 | -9 | -2 | 6 | 2 |
| 2 | v _z | -34 | -35 | -40 | -42 | -30 | -16 | -7 | -3 | -14 | -36 |
| | v_y | -2 | -17 | -23 | -25 | -37 | -34 | -9 | -2 | 7 | 2 |
| 3 | v_x | -33 | -37 | -41 | -43 | -32 | -15 | -6 | 4 | -11 | -36 |
| | v_y | -4 | -18 | -23 | -27 | -37 | -33 | -8 | -3 | 9 | 0 |
| 4 | v_x | -33 | -37 | -40 | -42 | -32 | -15 | -7 | 4 | -12 | -36 |
| | v_y | -1 | -18 | -23 | -27 | -38 | -33 | -8 | -3 | 9 | 2 |
| 5 | vr | -32 | -36 | -40 | -43 | -32 | -15 | -6 | -5 | -12 | -35 |
| | υy | -1 | -16 | -22 | -27 | -38 | -33 | -9 | -3 | 9 | 2 |
| 6 | v_x | -33 | -37 | -42 | -44 | -34 | -14 | -7 | 4 | -12 | -37 |
| | v_y | -2 | -16 | -20 | -26 | -38 | -34 | -8 | -,4 | 9 | 2 |
| 7 | v_x | -33 | -35 | -40 | -42 | -36 | -12 | -5 | -3 | -11 | -32 |
| | v_y | 0 | -19 | -21 | -23 | -39 | -30 | -10 | -3 | 8 | · 2 |
| STAT | TON 4 | | | | | Colu | තය | | | | |
| Row | Comp. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | | |
| 1 | v_x | -48 | -54 | -60 | -63 | -68 | -74 | • | | | |
| | บุ | -5 | -9 | -13 | -20 | -29 | -38 | | | | |
| 2 | v_x | -50 | -54 | -60 | -66 | -69 | -78 | -80 | | | |
| | v_y | 3 | -6 | -11 | -18 | -27 | -35 | -46 | | | |
| 3 | \overline{v}_x | -53 | -55 | -60 | -67 | -71 | -78 | -84 | | | |
| | v_y | -2 | -5 | -11 | -17 | -24 | -33 | -46 | | | |
| 4 | v _r | -54 | -56 | -61 | -65 | -73 | -80 | -84 | | | |
| | บ _y | -1 | -4 | -10 | -15 | -23 | -33 | -45 | | | |
| 5 | vx | -54 | -55 | -59 | -66 | -73 | -79 | -84 | | | |
| | υy | 0 | -4 | -9 | -16 | -23 | -32 | -46 | | | |
| 6 | v_{x} | -54 | -57 | 60 | -66 | -73 | 80 | -85 | | | |
| | v_y | -1 | -5 | -10 | -16 | -22 | -30 | <u>-44</u> | | | |
| 7 | v _x | -56 | -58 | -61 | -67 | -74 | -78 | -83 | | | |
| | vy | -3 | 8 | -13 | -18 | -23 | -30 | _44 | | | |
| STAT | TON 5 | <u> </u> | | | | Colu | ឃេប | | | | |
| | Comp. | 0 | 1 | 2 | 3, | | 5 | 6 | | | |
| 1 | v_x | -30 | -39 | -43 | -50 | -54 | -58 | -60 | | | |
| <u></u> | v_y | <u></u> | 12 | 16 | 23 | 30 | 42 | 57 | | | |
| 2 | v_{x} | -33 | -38 | -42 | -51 | -55 | -59 | -63 | | | |
| | υy | 8 | 13 | 18 | 23 | 32 | 42 | 58 | | | |
| 3 | v_{z} | 34 | -39 | -42 | -50 | -55 | -60 | -63 | | | |
| | v_y | 7 | 13 | 18 | 26 | 32 | 42 | 58 | | | |
| 4 | v_x | -33 | -38 | -42 | -50 | -54 | -58 | -62 | | | , |
| | vy | 8 | 13 | 19 | 26 | 33 | 41 | 58 | | | |
| 5 | v _z | -32 | -38 | -41 | -49 | -55 | -58 | -62 | | | |
| L | vy | 8 | 14 | 19 | 25 | 33 | 42 | 58 | | | |
| 6 | v _x | -33 | -40 | -42 | -48 | -54 | -56 | -62 | | | |
| | บ | 8 | 12 | 20 | 26 | 32 | 41- | | | | |
| 7 | v _z | -37 | -41 | 44 | -51 | -55 | -57 | -61 | | | |
| Щ. | v_y | <u></u> | . 12 | - 17 | 23 | 31 | 39 | | | | |

Dual-flow apparatus, 30 cm/s mean flow setting

| STAT | TON 6 | | | | | (| Colum | מנ | | | | |
|------|-------------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------------|------------|
| Row | Сотр. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | | | |
| 1 | v, | 14 | 0 | -14 | 4 | -5 | -8 | -6 | | | | |
| | υy | -2 | _7 | 10 | -4 | -12 | 40 | 42 | | | | |
| 2 | v_x | 14 | -1 | -18 | 8 | -5 | -6 | -6 | | | | |
| | vy | -2 | -8 | 12 | -5 | 14 | 26 | 45 | | | | |
| 3 | v_x | 18 | 3 | -18 | 8 | -3 | -4 | -10 | | | | |
| | v_y | 0 | -12 | 12 | -6 | 15 | 24 | 48 | | | | |
| 4 | v _r | 20 | 3 | -12 | 6 | -2 | -6 | -14 | | | | |
| | v_y | 2 | -12 | 15 | -6 | 13 | 24 | 46 | _ | | | |
| 5 | v _z | 19 | 2 | -20 | 2 | -2 | -3 | -14 | • | | | |
| | v_y | 0 | -10 | 14 | -8 | 10 | 25 | 44 | | | | |
| 6 | v _x | 15 | 0 | -20 | 10 | -8 | -7 | -11 | | | | |
| 1 | _v _y | -2 | 8 | 14 | ~12 | 16 | 20 | 44 | | | | |
| 7 | v_x | 12 -2 | 0 -6 | -23 8 | 15 -22 | -10 16 | -10 18 | -20 37 | | | | |
| STA | TION 7 | | | | | (| Colum | מו | | | | • |
| Row | Comp. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | vr | -12 | -20 | -28 | -35 | ~50 | -63 | -77 | • | * | -105 | -74 |
| | υy | 16 | 32 | 44 | 56 | 58 | 51 | 22 | | | ~29 | -55 |
| 2 | v_x | 4 | -21 | -30 | -39 | -55 | -73 | -86 | -92 | -32 | -106 | -73 |
| | v_y | 19 | 37 | 48 | 58 | 61 | 57 | 46 | 30 | _4 | -28 | -55 |
| 3 | v _z | -4 | -24 | -30 | -36 | -53 | -74 | -88 | -93 | -30 | -106 | -72 |
| | v_y | 18 | 39 | 48 | 58 | 60 | 59 | 47 | 28 | -2 | -28 | -55 |
| 4 | v_x | -3 | -22 | -29 | -38 | -54 | -74 | -89 | -90 | -28 | -105 | -74 |
| | υy | 19 | 39 | 50 | 60 | 62 | 61 | 48 | 26 | 0 | -28 | -55 |
| 5 | v_x | -6 | -20 | -30 | -38 | -52 | -72 | -91 | -94 | -27 | -105 | -74 |
| | v_y | 20 | 39 | 48 | 58 | 60 | 60 | 50 | 23 | _2 | -27 | -56 |
| 6 | v _r | -5 | -23 | -30 | -37 | -52 | -70 | -92 | -92 | -25 | -106 | -73 |
| | | 21 | 37 | 46 | 58 | 60 | 57 | 46 | 25 | -3 | -28 | -57 |
| | _v _y | 61 | | | | | | | | | | |
| 7 | $\frac{v_y}{v_x}$ | -8 18 | -25 35 | -33 42 | -38 55 | -50 52 | 71 55 | -90 44 | -93 25 | -30 -4 | -105 -26 | -74 -59 |

^{*}Water surface depressed below reference point (see Figure 8).

Dual-flow apparatus, 45 cm/s mean flow setting

| STAT | 10N 3 | | | | | Colu | מנחו | | | | |
|----------|------------------|------------|------------|------------|------------|------------|------------|----------------|----|-----------|-------------|
| Row | Comp. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | v _z | -55 | -57 | -55 | -41 | -25 | -14 | -11 | -9 | -25 | -46 |
| | $v_{\mathbf{y}}$ | -9 | -27 | -39 | -53 | -48 | -34 | -23 | 0 | 14 | 4 |
| 2 | v_{x} | -57 | -60 | -60 | -46 | -ප | -14 | -9 | -9 | -25 | -57 |
| | v_y | -9 | -27 | -44 | -57 | -48 | -39 | -14 | -1 | 18 | 9 |
| 3 | v_x | -59 | -62 | -67 | -46 | -23 | -16 | -7 | -7 | -18 | -55 |
| . | v_y | -6 | -25 | -41 | -59 | -53 | -37 | -14 | -1 | 23 | 11 |
| 4 | v_x | -57 | -62 | -64 | -52 | -27 | -14 | -11 | -9 | -21 | -55 |
| <u> </u> | $v_{\mathbf{y}}$ | -4 | -20 | -39 | -57 | -53 | -37 | -11 | -1 | 18_ | 11 |
| 5 | v _± | -55 | -61 | -69 | -57 | -30 | -18 | -7 | -9 | -23 | -55 |
| | v | -7 | -21 | -34 | -53 | -55 | -34 | -11 | -2 | 18 | 9 |
| 6 | v_x | -55 | -62 | -69 | -53 | -30 | -14 | -7 | -9 | -23 | -53 |
| <u> </u> | v_ | -2 | -21 | -37 | -53 | -50 | -39 | -16 | -1 | 16 | 9 |
| 7 | $v_x = v_y$ | -55 -2 | -59 -27 | -64 -46 | -46 -64 | -18 -57 | 9 34 | -4 -14 | 40 | -18 18 | -46 7 |
| STAT | ION 4 | | | | | Colu | | | | | · |
| Row | Comp. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | | |
| 1 | v_x | -66 | -74 | -86 | -93 | -97 | * | * | | | |
| | vy | -9 | -18 | -27 | -41 | -52 | • | • | | | |
| 2 | v_x | -66 | -76 | -90 | -97 | -104 | -115 | -115 | | | |
| 1 | $v_{\mathbf{y}}$ | -5 | -9 | -20 | -32 | -46 | -63 | 80 | | | |
| 3 | บร | -80 | -83 | -91 | -97 | -105 | -115 | -126 | | | |
| | υy | -2 | -10 | -20 | -32 | -45 | -63 | -80 | | | |
| 4 | v _≠ | -80 | -83 | -88 | -97 | -109 | -120 | -126 | | | |
| [_ | Uy | -2 | _7 | -17 | -23 | -34 | -57 | -80 | | | |
| 5 | vz | -80 | -83 | -88 | -97 | -109 | -125 | -126 | | , | |
| | v_y | 0 | -6 | -11 | -23 | -34 | -52 | -75 | | | |
| 6 | v_x | -80 | -86 | -92 | -102 | -110 | -120 | -126 | | | |
| | v_y | -2 | -7 | -11 | -20 | -34 | -52 | -69 | | | |
| 7 | v_x | -86 | -87 | -92 | -97 | -109 | -116 | -126 | | | |
| <u> </u> | v_y | -6 | -16 | -22 | -30 | -35 | -50 | -70 | | | |
| STAT | TON 5 | | | | | Colu | | | · | | |
| | Соптр. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | | |
| 1 | v_z | -45 | -60 | -69 | -75 | -80 | -86 | -87 | | | |
| <u></u> | _v _y | 9 | 18 | 28 | 34 | 48 | 74 | 92 | | | |
| 2 | v _z | -57 | -63 | -67 | -80 | -89 | -92 | -97 | | | |
| <u></u> | Uy_ | 11 | 18 | 25 | 37 | 53 | 74 | 92 | | | |
| 3 | v _z | -46 | -66 21 | -76 27 | -85 20 | -89 52 | -93 -60 | -97 | | | |
| - | v _y | 14 | 21 | 27 | 39 | 52 | 69 | 92 | | | |
| 4 | v_x | -50 9 | -57 18 | -66 32 | -74 41 | -80 57 | -86 74 | -92 92 | | | .! |
| 5 | v _x | -55 | -62 | -65 | -73 | -77 | -80 | -86 | | | |
|] | v_y | 11 | 23 | 32 | 42 | 60 | 75 | 92 | | | |
| 6 | v_x | -55 | -63 | -69 | -71 | -74 | -77 | -81 | | | |
| • | vy | 9 | 21 | 34 | 44 | 55 | 69 | 86 | | | |
| 7 | | -66 | -69 | -73 | -77 | -79 | -81 | -82 | | | |
| | vy | 9 | 14 | 19 | 29 | 46 | 57 | 64 | | | |
| | | | | | | | | | | | |

Dual-flow apparatus, 45 cm/s mean flow setting

| | TON 6 | | | | | | Colur | | | | | ···· |
|----------|------------------|------|------|-----|------|------|-------|------|------|-----|----------|------|
| · | | | | | | | | | | | | |
| Row | Comp. | 0 | . 1 | 2_ | 3 | - 4 | 5 | . 6 | | | | |
| 1 | vz | 21 | -23 | 25 | -11 | -23 | -14 | ,-4 | | | | |
| | v_{y} | -21 | -14 | -7 | 7 | 21 | .30 | 50 | | | | |
| 2 | v_x | 18 | 17 | 0 | -23 | -23 | -18 | -12 | | | | |
| | v_y | -18 | -14_ | -11 | 11 | 23 | 34 | 55 | | | | |
| 3 | v_x | 21 | 21 | 0 | -21 | -18 | -14 | -12 | | | | |
| | บ | -14 | -23 | -11 | _ 11 | 23 | 39 | 69 | | | <i>:</i> | |
| - 4 | v_{z} | 34 | 14 | -5 | -14 | _5 | -5 | -23 | | | | |
| Ĺ | v_y | -11 | -21 | -21 | 11 | 18 | 34 | 66 | | | | |
| 5 | v_x | 34 | 14 | -7 | -14 | -5 | -5 | -21 | | | | |
| | $v_{\mathbf{y}}$ | -1 I | -11 | -11 | 2 | 7 | 37 | 62 | | | | |
| 6 | v_x | 21 | -34 | -39 | -30 | -23 | -23 | -11 | | | | |
| <u> </u> | v_y | -7 | -11 | -2 | 7 | 23 | 37 | 60 | | | | |
| 7: | U _x | -5 | -41 | -23 | -41 | -44 | -34 | -34 | | | | |
| | vy | -5 | 7 | -11 | | 25 | . 30 | 41 | | | | |
| STAT | TON 7 | | | | | | Colun | מח | | | **** | |
| Row | Comp. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | .9 | 10 |
| 1 | v_x | -23 | -39 | -52 | -66 | -81 | -86 | • | * | * | -103 | -86 |
| | vy | _24 | 37 | 55 | 69 | 86 | 29 | | • | • | _57 | -81 |
| 2 | v _r | -7 | -43 | -59 | -80 | -102 | -132 | -120 | -100 | -98 | -149 | -101 |
| | v_y | 30 | 57 | 71 | 78 | 86 | 80 | 62 | 0 | -11 | -71 | -86 |
| 3 | U_ | -2 | -37 | -60 | 79 | -101 | -126 | -133 | -103 | -86 | -149 | -106 |
| | vy | 23 | 64 | 74 | 78 | 82 | 80 | 53 | 17 | 8 | 73 | -85 |
| 4 | v_{z} | -6 | -30 | -55 | -80 | -103 | -125 | -135 | -76 | -75 | -149 | -107 |
| | v_y | 32 | 66 | 80 | 91 | 94. | 83 | 57 | 15 | -11 | _70 | 87 |
| 5 | v_x | -2 | -38 | -56 | 80 | -94 | -117 | -124 | -89 | -86 | -147 | -110 |
| L | v_y | 39 | 69 | 78 | 83 | 88 | 80 | 62 | 14 | -11 | 69 | 86 |
| 6 | n [±] | ~12 | -40 | -57 | -79 | -92 | -110 | -120 | -86 | -80 | -149 | -110 |
| | v _y _ | 39 | 59 | 69 | 80 | 76 | 69 | 62 | 14 | -11 | | -89 |
| 7 | v_x | -35 | -57 | -74 | -80 | -92 | -106 | -110 | -84 | -97 | -147 | -110 |
| <u></u> | υ _ν | 23 | 39 | 46 | 60 | 69 | 62 | 55 | 14 | -14 | -64 | -93 |

^{*}Water surface depressed below reference point (see Figure 8).

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Appendix B

Method for estimating instantaneous rates

Because the general governing equations (1) and (8) of the text are autonomous (the independent variable does not appear), their coefficients, and hence the coefficients of their solution graphs, can often be resolved from phase-plane fittings of the governing equations themselves. Equation (1) has a parabolic trajectory in the z, z' plane (as shown in Figure 13), while equation (2) has a straight line trajectory. For such a procedure, however, values of z' must first be determined from the (t, z) data set. The following method was employed for estimating z' values from the (t, z) measures associated with equations (3), (4), and (5).

Given a set $\{\ldots, (t, z), \ldots\}$ of discrete points measured at regular intervals Δt , we assume that a continuous function F(t) exists such that z = F(t) for all such points. Let $\{(t_1, z_1), \ldots, (t_5, z_5)\}$ be a set of any five sequential points of F(t) and presume that we wish to estimate

$$\frac{dF(t_3)}{dt} \tag{i}$$

when $t_{i+1} - t_1 \ (\equiv \Delta t)$ is constant for i = 1, ..., 4. Three arcs of a degree 2 polynomial are now fitted to the data, three points at a time; (i) is estimated from each of the arcs and the three estimates averaged. Write the polynomial as

$$z = \alpha t^2 + \beta t + \zeta \tag{ii}$$

(a standard position parabola), whose derivative is

$$\frac{dz}{dt} = 2\alpha t + \beta. \tag{iii}$$

Without loss of generality, let $t_3 = 0$ so that

$$t_1 = -2\Delta t,$$

$$t_2 = -\Delta t,$$

$$t_3 = 0,$$

$$t_4 = \Delta t,$$

$$t_5 = 2\Delta t.$$

For the first three points $\{(t_1, z_1), (t_2, z_2), (t_3, z_3)\}$, the corresponding values of z from equation (ii) are

$$z_1 = 4\alpha(\Delta t)^2 - 2\beta \Delta t + \zeta,$$

$$z_2 = \alpha(\Delta t)^2 - \beta \Delta t + \zeta,$$
 (iv)

$$z_3 = \zeta.$$

APPENDIX B 45

From equation (iii) it is clear that we need only find coefficient β , since, in general, we want to determine (i) where $t_3 = 0$. Therefore, by solving equation set (iv) simultaneously for β , we can write

$$\beta = \frac{z_1 - 4z_2 + 3z_3}{2\Delta t} = \frac{dF_1(t_3)}{dt}.$$
 (v)

Similarly, for the second set of points $\{(t_2, z_2), (t_3, z_3), (t_4, z_4)\}$, we have

$$z_2 = \alpha(\Delta t)^2 - \beta \Delta t + \zeta,$$

$$z_3 = \zeta,$$

$$z_4 = \alpha(\Delta t)^2 + \beta(\Delta t) + \zeta,$$

by which the second value of coefficient β becomes

$$\beta = \frac{z_4 - z_2}{2\Delta t} = \frac{dF_2(t_3)}{dt}.$$
 (vi)

For the final set of points $\{(t_3, z_3), (t_4, z_4), (t_5, z_5)\}$,

$$z_3 = \zeta,$$

$$z_4 = \alpha(\Delta t)^2 + \beta \Delta t + \zeta,$$

$$z_5 = 4\alpha(\Delta t)^2 + 2\beta \Delta t + \zeta,$$

and the third value of β becomes

$$\beta = \frac{4z_4 - z_5 - 3z_3}{2\Delta t} = \frac{dF_3(t_3)}{dt}.$$
 (vii)

The desired quantity (i), which is the estimate of z' at $z(t_3)$, is recovered by averaging β over equations (v), (vi), and (vii), or

$$\frac{\widehat{dF}(t_3)}{dt} = \frac{z_1 - 5z_2 + 5z_4 - z_5}{6\Delta t}.$$
 (viii)

The foregoing calculations are incorporated into the Fortran program that follows. The program will yield n-4 sequential estimates of z' for n-many points.

```
DIMENSION T(100), Z(100), DF(100)
1
       1 READ(5,55)N,DT
2
      55 FORMAT(13,F10.0)
3
          DO 3 I=1,N
      3 \text{ READ}(5,33)T(I),Z(I)
5
      33 FORMAT(2F10.0)
6
          WRITE(6,44)
7
     44 FORMAT(' I T(I) Z(I) DF(I)'/)
9
          NN=N-2
          DO 7 I=3,NN
10
          Q=Z(I-2)-5.*Z(I-1)+5.*Z(I+1)-Z(I+2)
11
          DF(I)=Q/6./DT
12
       7 WRITE(6,66)I,T(I),Z(I),DF(I)
13
      66 FORMAT(13,3F12.5)
14
          GO TO 1
15
16
          END
```

N: number of data points.

T: independent variable t (distance x or y).

Z: dependent variable $z (-\mathbf{v} \hat{\mathbf{n}} \text{ or } |\mathbf{v}|)$.

DT: constant distance interval Δt between data points.

DF: the estimate of $dF(t_3)/dt$. Lines 11 and 12: equation (viii).

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Flow Dynamics and Fish Recovery Experiments: Water Intake Systems^{1,2}

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Abstract. - Large water-use facilities are often equipped with vertically travelling debris barriers known as Ristroph screens. Although made in a variety of configurations, all such screens are equipped with some manner of fish-catching troughs or rails, and all operate on the principle of direct contact and active removal of impounded fish and debris. The imposed fish mortalities associated with these machines are commonly attributed to the consequences of impingements (to fish being flattened against the screening by the force of the inflowing water), but the laboratory and field experiments reported here imply that in those circumstances where the screens travel continuously and where water speeds are moderate, the major underwater injuries are attributable instead to buffeting of captured fish within the fish troughs proper. Dye studies of the flows peculiar to various manufacturer's trough designs showed the water within a trough confines to be sheardriven by the main flow, which produced a longitudinal vortex of such strength that captive fish were swirled about and thrust repeatedly against the screen structure. Captured fish often escaped an ascending trough just before its leading edge broke the water surface, and their repeated encounters with the fish recovery apparatus increased the risk of mortality. From flow analyses of reshaped trough and screen profiles, a flow spoiler was devised that eliminates the trough vortex and buffeting of captive fish. The escape of fish at the water surface was eliminated by means of an auxiliary screen affixed to the leading edge of each fish trough. Field experiments revealed other sources of mortality, chief of which was the entanglement of fish in captured debris. As a countermeasure, the order of removing fish and debris was reversed. A reconfigured machine, including the redesigned fish-catching apparatus, was installed and tested at a nuclear generating station on the Hudson River estuary. In tests similar to those on the unimproved machine, injuries and deaths were reduced from 53 to 9% for striped bass Morone saxatilis, from 64 to 14% for white perch Morone americana, from 80 to 17% for Atlantic tomcod Microgadus tomcod, and from 47 to 7% for pumpkinseed Lepomis gibbosus. Striped bass losses to the debris removal system were reduced from 23% of recoveries to zero, white perch losses from 33% to 1.3%, and Atlantic tomcod losses from 20% to 0.3%. Release-recovery experiments with juvenile striped bass and white perch revealed probabilities of capture characteristic of weak and strong swimmers.

Facilities that draw water in large volumes from natural sources are commonly equipped with some form of barrier screens for removing unwanted debris from the indrawn water. Quantities of local organisms are also carried into the screenwells by the inflows and killed. Such small organisms as

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fish eggs, fish larvae, early juveniles, and invertebrates that pass through the meshes of the barrier screening are said to be entrained; fishes flattened against the screening by the force of the flow—generally those larger than 45 to 50 mm in length—are said to be impinged.

The mortalities imposed on fish stocks by entrainments and impingements are often very great. The annual cooling water demand of the Salem nuclear generating plant in New Jersey accounts for an estimated 11% direct reduction in the yearclasses of weakfish Cynoscion regalis of the Delaware River estuary and a 31% direct reduction in those of the bay anchovy Anchoa mitchilli (Versar 1986). In the Hudson River estuary during summer periods of high electric power demands. the water diversions of the several generating plants often exceed the freshwater input to the river, Impingement croppings alone reduce the annual yearclass abundances of Hudson River white perch Morone americana by 20% or more (Van Winkle et al. 1980), and the year-class losses of striped bass Morone saxatilis to entrainments and impingements are 10 to 15% (Barnthouse and Van Winkle 1988; Boreman and Goodyear 1988). The long-term consequences of these annual reductions remain unknown, largely because of the unresolved debates over "compensation" in fish stocks (the hypothesis that reduced mortality among the young ensues from reductions in their abundances) and the difficulties of separating longterm productivity reductions from natural variations in recruitments. In many cases, nonetheless, the effects of continued water withdrawals are believed to pose serious threats to the perpetuation of indigenous species, especially where such facilities as municipal pumping stations, electricity generating plants, pulp mills, pumped storage intakes, and inlets to pumped irrigation canals are located on spawning and nursery grounds.

In the Hudson estuary, some mitigation of entrainment loss has been realized through reductions in withdrawals of power plant cooling water during spring and summer, when the early life stages of most fish species are abundant. This net, seasonal reduction in water usage was one of the settlement provisions of the 1977–1980 adjudicatory proceedings of the U.S. Environmental Protection Agency known as the Hudson River power plant case (Sandler and Schoenbrod 1981; Limburg et al. 1985; Englert et al. 1988).

Reducing impingement losses (which are greatest during winter) has been a more difficult prob-

lem, because few of the intake systems of the Hudson River plants had been designed with fish conservation in mind. The settlement agreement called for replacing the debris screens in the twelve intake bays of the Indian Point nuclear stations (the sources of greatest impingement kills) with angled screens and pumped fish bypasses, and for considerable alterations to the civil works of the plants. Owing, however, to a subsequent analysis that showed the proposed angled screen designs to offer little promise of bringing about significant reductions in impingement kills, the settlement parties ultimately rejected angled screens in favor of "alternative mitigation measures," as allowed by the settlement agreement. The operators of the Indian Point plants (Consolidated Edison and the Power Authority of New York State) then elected to install and test a candidate device, known generically as a Ristroph screen, in one intake bay of Indian Point nuclear unit 2 (the Consolidated Edison plant).

Although virtually every manufacturer of screening devices for water intake systems has its own version of the Ristroph screen, the operating principles and intended functions of each are similar. As originally manufactured by the Royce Equipment Company of Houston, Texas, the trial machine was configured essentially around a standard, continuously travelling, through-flow screen where linked, rectangular screen panels are moved vertically around large sprockets in the manner of an endless chain, the whole being normal to the inflowing water and spanning the width of the intake bay. When the panels of such a screen are fitted with small troughs or concave rails for drawing entrapped fish from the water, the device is commonly regarded as a Ristroph screen, without distinction. The fish-catching rails of the Royce trial machine were semicircular in profile, and the surface of each screen panel was inclined to the flow, a geometry peculiar to the Royce design that proved to be somewhat helpful in reducing injuries to fish once they were impinged (thrust against the screen mesh). In general, as a screen assembly so configured travels around its driving sprockets, the linked screen panels and their attached fish troughs ascend from the water on the upstream side of the machine. As a screen panel rotates over the uppermost sprocket, the fish trough spills out its captive water and fish. The released fish are then meant to fall or slide along the incline of the overturning panel and into a sluice for their return to the source waters. As the screen panels continue

their descent past the fish sluice, debris and fish remaining on the panels are forcibly blown into a debris sluice by a row of high pressure water jets.

The testing bay at Indian Point, like each of the twelve intake bays, is 3.4 m wide, the water depth is about 8 m, depending on the tide, and the overall screenwall depth is 12.8 m from the machinery deck to the floor of the intake bay. These dimensions are fairly typical of power plant intake sumps where steam condensers are cooled by water drawn from natural sources. The trial machine (called screen version 1 here) was operated in a normal fashion in the testing bay over a 3-month period from 16 January to 19 April 1985, during which time opportunistic collections of recovered river fish were made by Normandeau Associates, contractors to Consolidated Edison. The collected samples were examined for deaths and injuries, held for 96 h, examined again, then tallied, measured, and identified. As revealed by this field test (Consolidated Edison 1985), the trial machine imposed high mortalities on several collected species, not unlike the magnitudes of mortality observed at other power plants employing similar screening devices. Owing to its unexceptional performance, the trial machine was judged by certain of the settlement parties (EPA, the Hudson River Fishermen's Association, the Natural Resources Defense Council, and the Department of Environmental Conservation of New York State) to be no more acceptable as the device of choice than the rejected angled screen system.

Failings of Screen Version 1

At the request of the Hudson River Fishermen's Association, I examined the trial screen and its operations with a view to recommending alterations in the design of the machine that might reduce the kills of recovered fish to more acceptable levels. Some of the conditions adverse to fish survival, especially in the functionings of the apparatus above the water surface, were fairly obvious. Those shortcomings and their remedies are reviewed only briefly here. The topics of greater immediate interest are those previously unexamined transactions between fish and flows beneath the water surface and the postulated events governing fish captures and kills that proved erroneous.

Above-Water Fixes

In addition to such easily cured failings as captive fish being stuck fast to the overturning panel troughs, fish otherwise released from the troughs often become entangled in a matrix of screen debris instead of falling into the fish return sluice as intended. Fish so immobilized on the screen panels were carried past the fish sluice into the path of the high-pressure debris jets and killed. Fish lost in this manner accounted for large proportions of the observed mortalities.

The trial machine had been fitted with a directed, low-pressure spray that was meant to aid in freeing fish from the surfaces of the overturning screen panels by spraying water through the screen mesh from a location between the ascending and descending halves of the machine. When the screen was not fouled with debris, the fish spray functioned as intended, but during winter and spring months the Hudson is burdened with a tough, filamentous macrophyte that thoroughly clogs the screening. In being drawn into the plant intakes and stapled into the meshes of the barrier screening by the force of the inflow, the algae form a tangled blanket of matter over the screen panels not easily penetrated by the fish sprays. The problem of debris and fish separation was resolved by reversing the sequence of removal (debris first, fish last). The related alterations to the trial machine (see items E, F, H, J, K, L of Figure 1) were essentially five in number.

- (1) The primary high-pressure debris header was repositioned (to location J) so that its jets blow through the ascending screen panels.
- (2) The primary debris sluice (K) was relocated to the ascending side of the machine.
- (3) Spray deflectors were added to the fish rails for preventing disturbance to captured fish as the ascending rails pass through the relocated debris jets.
- (4) An articulated shield (L) was added for protecting the ascending fish rails against the debris that otherwise falls into the rails as the screen panels pass through the relocated high-pressure debris spray.
- (5) Inside and outside low-pressure fish sprays (E, F) were added and the fish sluice (H) was widened.

In both full-scale flume experiments and site testing, the relocated high-pressure jets removed embedded debris from the screening as intended; fish carried by the fish rails passed undisturbed through the debris spray, and the mistransport of fish to the rear debris sluice was virtually eliminated.

Although the problems of fish and debris separation were remedied by the modifications listed 396

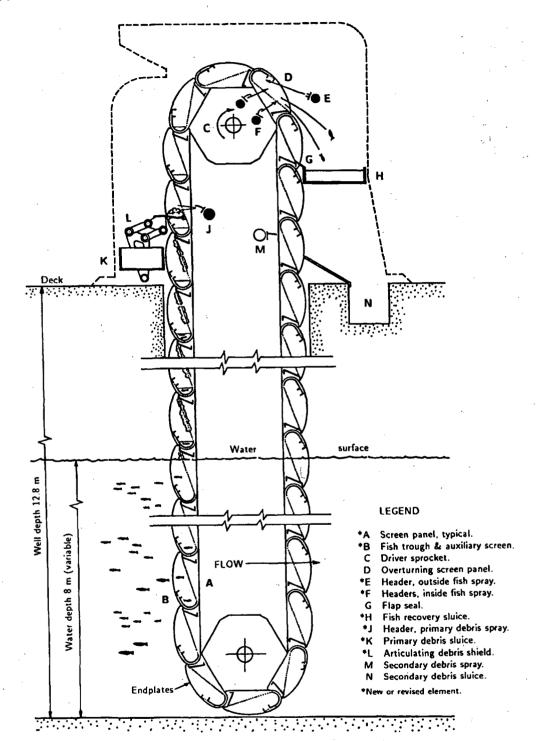


FIGURE 1.—Vertical section of a prototype Ristroph machine showing the modifications incorporated into the reconfigured version. The screening apparatus proper, whose principal function is the protection of an intake sump from water-borne debris, consists of linked, rectangular screen panels that are moved vertically around motor-driven sprockets. Debris and fish captured from the water by a screen panel (A) and its attached fish rail or trough (B) are carried from the water for disposal. As a panel (D) rotates over the uppermost sprocket (C), the fish rail spills out its captive water and fish; released fish fall or slide along the incline of the overturning panel into a fish

above, those remedies were limited to the observable functionings of the screening system above the water surface. Whether the fish rails actively captured entrapped fish or merely lifted impinged fish from the water, and the extent to which the design of the screen and fish-rail system itself might be contributing to death and injury of captured fish, were questions still unresolved.

Fish and Flow Experiments in a Hydrodynamics Flume

Although I searched 30 years' worth of industry and refereed literature, I found no evidence that the flow patterns and fish behavior associated with any of the various Ristroph fish-trough and screen designs had ever been observed. Aside from unsupported suppositions about the mechanics of impingement and fish capture, reported testings of Ristroph machines are limited by custom to black-box field experiments, so to speak, in which only the output signals (the opportunistic appearances of fish and their condition on recovery) are measured. Except for a rare marking experiment, input signals (the rates of fish entrapment and screen encounter) and signal processing (the physical and probabilistic processes governing capture and injury) are not examined.

By good fortune, the manufacturer of the Indian Point trial machine, on receiving notice of the machine's rejection and a copy of the field report to the fishermen, constructed a duplicate of the machine in that company's instrumented hydrodynamics flume in Houston, all of which was made available to me for experimental work, along with the services of a fabricating shop and the assistance of two skilled technicians, Trent T. Gathright and Richard Ewbank. The flume was equipped with underwater filming ports, a color video camera and monitor, 35-mm cameras, and a low-light charge-coupled device (for filming in near darkness). The flume and its equipment are more fully described by Figure 2. In addition to the conve-

niences for developing and testing the above-water improvements already described, the full-scale structure of the flume-installed machine enabled us to study, directly and under laboratory conditions, the nature of subsurface flows and the realistic behavior of fish in contact with the screening and recovery apparatus.

We commenced our underwater experiments by releasing fish upstream in the flume and filming their behavior as they were carried downstream to the operating machine. Most of the fish employed in these early experiments were juvenile golden shiners Notemigonus crysoleucas, a tender species we found useful in detecting sources of injury and descaling. (In later experiments we also employed striped bass and white perch from the Hudson.) We released two sizes of Golden shiners (of 6.5- and 11-cm fork lengths) in batches of 20 to 50, and repeated experiments at two flow speeds (30 and 45 cm/s, speeds representative of large water intake systems). At both water speeds fish behavior was similar, although the smaller fish were less able to stem the flow at either speed. We discovered that actively swimming fish (those able to maintain station ahead of the screen face) were not readily caught by the (upward moving) fish troughs. Virtually all of the test fish that did enter the fish troughs had been forced down the inclined surfaces of the panel screening (an action induced by the oblique attack of the flow) after being impinged (flattened) against the screen mesh. Once in the vicinity of a fish trough, they were caught in a secondary flow, interior to the trough, that swirled them about in rapid orbital motions, as depicted by Figure 3. Fish captured in this fashion were injured less by their motions along the screen mesh (which, in the trial machine, had a smoothwoven surface) than by the battering they received in the fish troughs. We also discovered that captured fish often escaped an ascending fish trough just before the leading edge of the trough broke the surface, as indicated on Figure 3. Apparently, the fish were able to sense their nearness to the

sluice (H) and thence to a conduit for their return to the source waters. In the standard version, debris and fish that remained on the screen panels were blown from the screening into a rear debris sluice (N) by a row of high-pressure water jets (M). In the revised version, debris is removed from the screening by a high-pressure spraywash (J) that blows through the ascending side of the screen. The spray is interrupted by deflectors on the spray sides of the fish rails, which prevent disturbance to the water and fish contained in the rails. Released debris, which would otherwise fall into the fish rails and displace the captured fish, is deflected by a five-pin articulating shield (L) into a relocated debris sluice (K). The standard high-pressure header (M) and debris sluice (N) are retained as secondary devices. New and relocated low-pressure sprays (E and F) aid in the release of fish from the overturning screen panels and fish rails. A redesigned fish rail and an added auxiliary screen (B) lessen the injuries imposed on fish during the capture process.

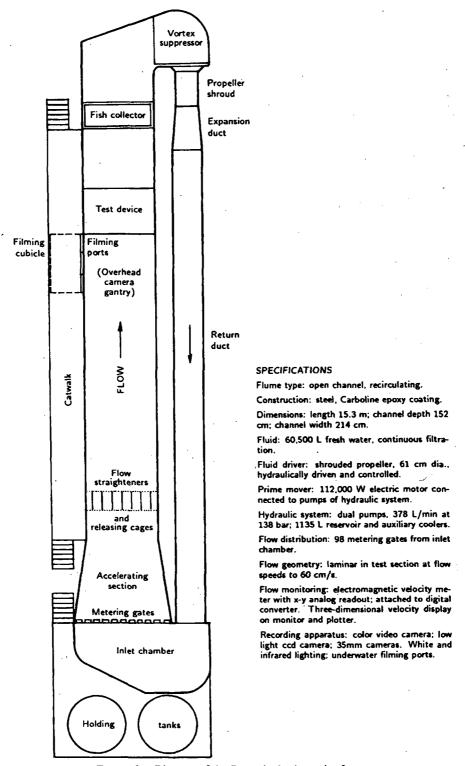


FIGURE 2. - Diagram of the Royce hydrodynamics flume.

water surface; some reacted to it by darting out from the trough confines into deeper water.

The smooth-woven screen mesh employed by the maker of the trial machine differs from the more standard crimped or welded wire mesh customarily employed in water screens. In the interests of completeness, therefore, we fitted panels of our test machine with standard 0.95-cm (%-in) crimped mesh and found that golden shiners impinged on that material suffered considerable descaling in comparison to the near absence of descaling with the smooth-surface mesh.

We also held the screen stationary in the flow and allowed impinged fish to remain flattened against the screen panels (panels equipped with the woven mesh) for increasing periods of time. Fish that died after prolonged immobilization (30 min or longer) apparently suffocated, owing to impairment of opercular movement, but impingement periods of 10 min imposed no apparent trauma on any species of tested fish. Post-event mortalities were no greater over 48-h holding periods than those of control fish (which were generally less than 1%).

In the field testing of the original trial machine (of screen version 1) by Consolidated Edison, collected fish exhibited such injuries as contusions, descalings, anal hemorrhaging, and lacerations. Some of the fish dead on collection bore no visible injuries, and some fish, otherwise without integument damage, appeared to be stunned and exhibited erratic swimming behavior. Such injuries, like those observed in field testings of fish screens at other locations, were presumed to have been the consequences of impingements—of violent, flow-induced encounters with the screening material proper. Our flume observations contradict that assumption.

For the original field testing of screen version 1, the screen panels had been fitted with the smooth-woven mesh, and the screen was rotated continuously (as it was designed to do). At its (vertical) operating speed of 3 m/min, the maximum period of fish impingement could not have exceeded 3 min. Fish that escaped the ascending troughs at (or below) the water surface experienced repeated impingements or captures, of course, thus increasing their injury risks, but in view of the results of the flume experiments, the most probable injury risk to a fish eventually recovered would not have been impingement as such, but rather the battering it was likely to have received after its capture (or repeated capture) by a

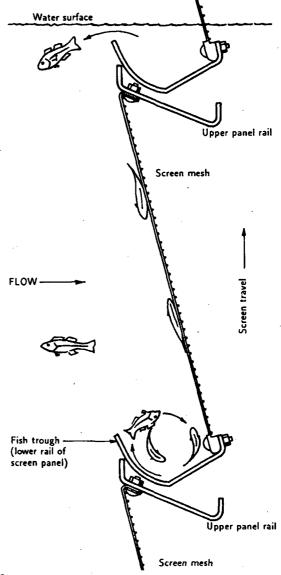


FIGURE 3.—Vertical section through screen panel of the trial machine (screen version 1) indicating the effects of the flow on captured fish. Overall height of each panel is 60 cm. Width of fish trough is 15 cm; depth is 7 cm. Most of the test fish that entered a fish trough had worked their way down the screen mesh after encountering the screen, a net movement induced by the oblique forcing angle between the flow and screen surface. Once in a trough, fish were caught in a secondary flow that swirled them about in rapid orbital motions. Captured fish often escaped just before the leading edge of the trough broke the water surface.

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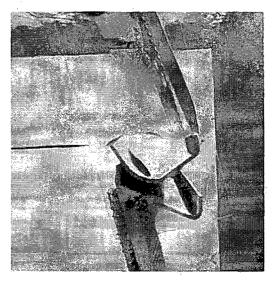
Ristroph trough, the very device meant to rescue the fish from the consequences of impingement.

For more detailed study of flows and fish behavior, we constructed cross-sectional replicates of various manufacturer's trough and panel designs, each with its end nearest the camera capped off with a clear acrylic plate, which allowed direct viewing into the interior of the troughs. Figure 4 shows two such configurations suspended in the flume and the effects of the trough vortices on captured fish. In these experiments, injuries imposed on fish, irrespective of trough shape, were like those observed in Consolidated Edison's field tests.

Flow Mapping

As the means for establishing flow profiles of trough and panel configurations, we injected dye (potassium permanganate) into the main flow at 1-cm vertical intervals, just upstream of the subject, and photographed each dyed pathline (40 to 50 per profile). Two such pathlines of flow are shown by Figure 5. From the photographs we constructed composite pathlines and established the complete flow profiles of various trough and panel designs. Figure 6 shows a typical trough vortex where dye has been injected directly into the trough. The dyed region immediately downstream of the panel rails in Figure 6 reveals a zone of stalled fluid. At the two experimental (mean upstream) flow speeds of 30 and 45 cm/s, the flow geometries of a particular trough and panel section were similar except for the angular velocity of the trough vortex, which increased with increased flow speed. The two water speeds selected for the flume experiments are consistent with those reported for power industry testings of screening systems. At the Indian Point station where the field work was done, the mean upstream water speed in the testing bay varied with the tidal cycle but rarely exceeded 30 cm/s.

Figure 7 depicts the composite pathlines of flow recovered from the dye studies on the trough and panel design of the Royce trial machine (screen version 1). Although panel sections were held stationary in the flow for the dye studies, the vertical speed of a travelling screen is nearly an order of magnitude less than the upstream water speed (and considerably less than the speeds of the accelerated flows around the panel railings and through the screen mesh) and therefore imposes no significant distortion on the flow geometry as depicted.



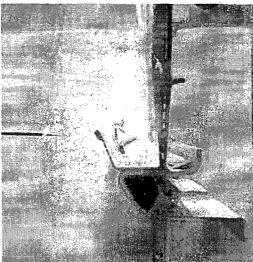
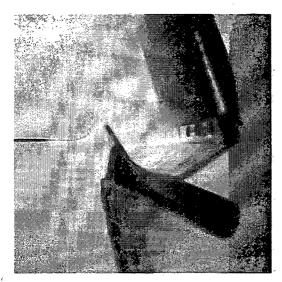


FIGURE 4.—Arrangement in flume of typical crosssectional testing panels showing action of shear-driven trough vortices on captured golden shiners. The trough and panel design of the trial machine is shown above; a more standard Ristroph design is shown below. The main flow was moving from left to right in both views; fish were swirled in a clockwise direction. The upstream flow speed in both photos was 30 cm/s. Note the several fish impinged on the screen mesh in the upper photograph.

Redesigning the Fish Troughs

In addition to wanting a fish-catching trough that reduced the probability of injury to captured fish, we had to accommodate several other constraints in our experiments with alternate designs.



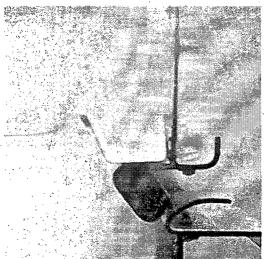


FIGURE 5.—Typical dye marking of flow pathlines, trough and panel section of the trial machine (above) and a standard Ristroph design (below). Complete profiles of flow pathlines consisted of similar dye releases at vertical intervals of 1 cm.

An acceptable trough had to retain water as well as fish during its ascent from the surface of the source water to its overturn at the upper sprocket of the machine. Although panel troughs (or baskets) constructed of wire mesh or having perforated bottoms are furnished by some manufacturers, such designs work against fish survival. Fish tend to flop about in a trough empty of water,

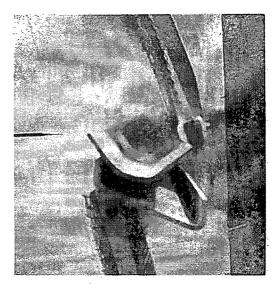


FIGURE 6.—Dye injected directly into fish trough reveals the standing vortex. Speed of the approaching flow was 30 cm/s. The dyed area behind the panel railings reveals a region of stalled fluid; areas above and below have been swept clear of dye by the main flow.

thereby increasing their risks of mechanical injury, and during winter in boreal locales like the Hudson, exposing a small fish to the atmosphere, even for a few minutes, can bring on rapid cooling and drying and the risk of flash freezing. The geometry of any new trough design also had to accommodate the linking of screen panels and their articulation in passing around the driving sprockets of the machine. Most importantly, of course, the troughs had to catch fish, whether impinged or swimming in the vicinity of a moving trough.

Mindful of the foregoing constraints, we devised several trough shapes around two fluid dynamical precepts. Because we wanted the water interior to the trough to be free of motion with respect to the trough boundaries, or nearly so, we either had to devise a compound trough shape that would bring about a flow stall immediately upstream of its entry, or add some feature to the trough that might create a turbulent boundary region between the shearing action of the main flow and the fluid interior to the trough. I elected to try the flow-stalling alternative by way of finite-element modelling of shapes and flows on the computer. Of the various trial geometries analyzed in that manner, the most promising was a G-shaped affair where the stagnation streamline was precisely centered on the trough entry. In flow trials, however, that pre-

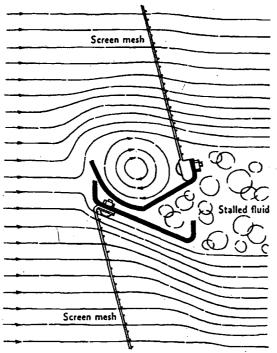


FIGURE 7.—Composite flow profile at the panel railings of the trial machine, reconstructed from photographed dye releases. At (approaching) flow speeds of 30 and 45 cm/s the flow geometries were similar, but the angular velocity of the trough vortex was approximately 7.5 rad/s at the 30-cm/s flow speed and 11 rad/s at the 45-cm/s flow speed. The trough water is independent of the freestream flow through the screen except for turbulent exchange across the (shearing) boundary between the two.

ciseness proved overly crucial to stability. Imposed, upstream perturbations in the approach flow (like those one might expect in natural intake flows) displaced the stagnation streamline and the unwanted vortex appeared inside the trough confines.

In the meanwhile, the technicians were experimenting with trough compositions of their own devisings. Gathright stuck on the simple but successful stratagem of recurving the leading edge of the Royce trough into various angles of attack until he arrived at a configuration that created a trail of disordered flow over the trough of a strength sufficient to separate the shearing action of the main flow from the trough interior. Because of the unstable (or fluctuating) nature of a turbulent wake, the front of the trough was elevated as shown in Figure 8 to prevent intrusions of the wake into the trough interior. Except for turbulent exchange across the wake, the fluid interior to the trough

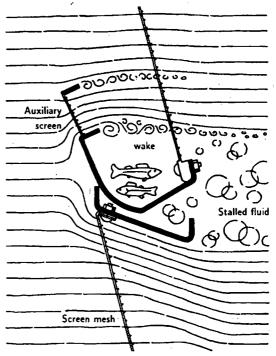


FIGURE 8.—Composite flow profile at the panel railings of the reconfigured machine, reconstructed from photographed dye releases. At test speeds of 30 and 45 cm/s, the flow geometries were similar. The spoiler at the leading edge of the fish trough trips the main flow and creates a trail of disordered, small-scale vortices that separates the shearing action of the freestream flow from the fluid within the trough, leaving the trough interior in an undisturbed state where captured fish are able to maintain stable attitudes. Once captured, fish are prevented from escaping the (upward moving) trough by an auxiliary screen affixed to the flow spoiler. Freely swimming fish did not avoid the turbulent entry behind the auxiliary screen and its supporting bar as consistently as they avoided the accelerated flow over the unimproved fish trough.

was effectively separated from the main flow; captured fish were well sheltered and remained upright in normal swimming attitudes at (approaching) flow speeds to 60 cm/s. In both flume and field tests, deaths and injuries of captured fish were low in comparison to the results of the field tests on screen version 1.

We eliminated the escape of fish at the water surface by attaching a low auxiliary screen to the leading edge of the redesigned trough, as shown in Figure 8. Although the auxiliary screen imparts only minor impedence to free flow, it creates a downstream turbulence, typical of screened flow, that apparently is favorable to fish capture. In flume experiments on the reconfigured machine, many of the test fish that moved into the vicinity of the screen front were observed to dive preferentially behind the auxiliary screen and into the fish trough, as opposed to the active avoidance reactions of fish swimming in the flow above the unmodified troughs.

Flume Tests on the Reconfigured Machine

We fitted the flume machine with the redesigned trough and panel assemblies and reconstructed its above-water portions according to the modifications already described. For the flume tests on the reconfigured machine (called screen version 2 here), 750 white perch and striped bass juveniles of Hudson River origins were shipped by air to Houston. Alosids and like species common to the Hudson were considered too fragile for transport, so we employed the locally obtained golden shiners as representatives of tender species. Fish were held apart by species in tanks until used in the experiments. Tank water was aerated, filtered, adjusted to the pH of the waters of origin with NaHSO₄ and HCl, and monitored for temperature, ammonia concentration, and conductivity. Flume water was continuously filtered and circulated; temperature, pH, and conductivity were measured for each experiment. Flow speeds in the flume were set and monitored with a Marsh Mc-Burney model 511M electromagnetic current meter and a digital converter to 3D velocity field read-outs at three flume cross-sections.

For the underwater portion of the flume tests. the measurement of interest was the empirical probability that a fish, released upstream of the moving screen, would be captured and removed from the water on its first encounter with the screen and recovery apparatus. For each such trial, fish were released 5 m upstream of the operating screen by species, size, and water speed (30 and 45 cm/s), in sample sizes of 20 to 50 fish. The flume was covered and darkened (to simulate the field conditions most common to intake systems); the screen was operated in normal fashion and the observations were recorded on video tape with an ultra-sensitive charge-coupled device (which was also connected to a monitor for remote viewing). Such secular information as times of release, fish residence times, and frequencies of events were extracted from the camera clock (imaged on the video frames). The data were later extracted, usually frame by frame, from the video tapes. In 18 of 26 trials (releases), some fish were lost from camera view (and therefore were not countable as a capture or an escape), but because events occurred so rapidly, visual observations and hand tabulations were too inaccurate for use. Information from these experiments is given by Table 1.

Of the larger golden shiners released, 62% of those observed on camera and not lost from view were captured and retained by the redesigned fish troughs on first encounter with the screen. Of the smaller golden shiners observed, 91% were captured and retained on first encounter, but most of these smaller fish, being less able to swim against the flow, were impinged before capture. The proportions were identical at both water speeds. In the experiments with white perch, 77% of the observed fish were caught and retained on first encounter at the 30-cm/s water speed, and 80% at the 45-cm/s water speed (the 3% difference is statistically insignificant). At both water speeds, many of the white perch were impinged before capture. Recovery rates (the rates at which the fish were removed from the water by the machine) were consistent with the recovery rates in release-recapture field tests on the reconfigured machine. In the flume test with striped bass, 76% of those observed to encounter the screen were caught on first contact, all of which were freely swimming fish.

Other segments of the flume tests on the reconfigured machine were meant to produce information, under controlled conditions, on the several modifications incorporated into the functionings of the apparatus above water. Those experiments and their results are given in Fletcher et al. (1988).

Site Tests on the Reconfigured Machine

During the summer of 1986, the original trial machine (screen version 1) was removed from the Indian Point testing bay and the reconfigured machine (screen version 2) installed in its place. The experiments and tests described here were carried out by field crews of Normandeau Associates from 26 August to 24 October 1986, a test period assigned to us by the plant operators. The supervising biologist for Consolidated Edison was Kenneth Marcellus.

Of the several modifications incorporated into screen version 2, those that influence the transport of fish from the water surface to the fish return sluice on the downstream side of the machine were tested at the Indian Point site in a manner similar to the above-water flume testings. In the site tests on the passage of fish through the front debris spray to the fish return sluice (locations J and H of Figure 1), 641 of 664 test fish were recovered

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Table 1.—Underwater flume experiments; capture of golden shiners^a, striped bass^b, and white perch^b by a reconfigured Ristroph screen (screen version 2). Fish of each trial were released 5 m upstream of the operating screen and filmed at the screenfront through an underwater viewing port. The measurement of interest was the empirical probability that a released fish would be captured and retained by the apparatus on its first contact with the screen. On the table, mean water speed is the mean speed of the water immediately upstream of the test screen, and numbers S in parentheses are sample sizes of test fish.

| | | | | Number | rs of fish | |
|--------------------------|----------------------------|----------------------|-----------------------|-----------|----------------------|----------------|
| Mean fork length (cm) | Mean water speed (cm/s) | Number of trials (S) | Observed by camera | Lost from | Caught on contact | Escaped screen |
| | | Golden shiners, I | 6-18 July 1986, | 24-28℃ | | |
| 6.5 | 30 | 2 (20, 20) | | | | |
| | 45 | 2 (20, 20) | 63 | 6 | 52 | 5 |
| 11.0 | 30 | 6 (20, 20, 20, | | | | |
| | | 50, 50, 40) | 90 | 26 | 40 | 24 |
| | | White perch | , 13 Aug 1986, 2 | B°C | | |
| 5.0 | 30 | 3 (25, 25, 25) | | | | |
| | 45 | 2 (25, 25) | 49 : | 19 | 23 | 7 |
| | | Striped bass, | 14-15 Aug 1986, | 28℃ | | |
| 7.1 | 30 | 1 (25) | | | | |
| | 45 | I (25) | 13 | 2 | 8 | . 3 |
| 7.1 | 45 | 5 (25 each) | 20 | 1 | 15 | 4 |

^{*} Golden shiners obtained from a local fish farm.

from the fish return sluice, none from the primary debris sluice (K of Figure 1), and 23 from the secondary debris sluice (N of Figure 1). Of the 641 from the fish sluice, 35 were stunned (swimming erratically) or missing scales, for a casualty total of 9% (including the 23 misdirected fish).

Release-Recapture Experiments

Recapture experiments with known sample sizes of striped bass and white perch released upstream in the intake bay were meant to provide information on expected recovery rates and the risks of death and injury to fish captured by the reconfigured apparatus. Before and during each of those experiments, a fixed screen was placed at the river entry of the intake bay, not to prevent the released fish from escaping, but to prevent contamination of the collections by fish entering from the river. For reasons not well understood, fish have a greater propensity for entering intake systems than leaving. The samples were released upstream in the intake bay, just behind the fixed screen. On the thesis of random encounter with the escape route (a travelling fish trough in this case) and the success rates of capture (the first-encounter probabilities) observed in the flume experiments, the recovery rates of freely swimming fish were expected to follow Poisson processes, as hypothesized by Fletcher (1985). In such a process, the probability of an event occurring in a time interval is proportional to the duration of the interval, the event in this case being ΔR , the numbers of released fish recovered during a sampling interval. Therefore, should the intervals of observation be adjusted to equal probabilities of the event occurring, then ΔR should be a constant value over each interval. In anticipation of such recapture distributions, returns were collected at the fish sluice on a geometric time scale as a means of reducing sample variance and improving the accuracy of the time-dependent recovery cumulations. The sampling intervals were calculated from the following formulas

Duration of experiment: T = 36 h for allexperiments). Number of observations: n. Sampling index: $j = 1, 2, \ldots, n$. Sampling times: $t_j=t_1,\,t_2,\,\ldots,\,t_n$ $(t_1=0,\,t_n=T).$ Intervals: $\Delta t_i = t_{i+1} - t_i.$ Scaling factor: δ (resolved from Tand n). $T=\delta^n-\delta,$ In general: $t_i = e^{j \log e^{\delta}} - \delta,$ $\Delta t_i = (\delta - 1)e^{j\log_{c^i}}.$

The first collection $(j = 1 \text{ at } t_1 = 0)$ after release of a sample was taken on the first appearance in the collection sluice of any individuals from the release. For those (freely swimming) fishes for

^b Striped bass and white perch came from the Hudson River.

Table 2.—Release—recapture experiments, screen version 2, 4–13 September 1986 at Indian Point nuclear unit 2. Samples were released at the forebay entrance, captured by the test screen, and recovered at the fish sluice over a period of 36 h. Mean water speed in the approaches to the screen was approximately 30 cm/s (varying with the tide), water temperature was $24-25^{\circ}$ C, and conductivity was $5,900-6,500 \,\mu$ S/cm. The vertical travelling speed of the screen was 3 m/min, the water pressure of the primary and secondary debris sprays was 62 kPa, and the fish spray pressure was 2.7 kPa. Key: t_j is elapsed time of fish collection, j corresponding to the (nonlinear) sampling intervals $j = 1, 2, \ldots, 12$; reference time $t_1 = 0$ corresponds to the first appearance in the collection sluice of fish from the released sample; $t_1 - t_0$ is the time between release of a sample and the first collection; $t_{12} = 36$ h; S is the number of fish released and R the number of fish recovered in a sample; Cum R is cumulative numbers of fish recovered; FL is mean fork length of fish in a sample or range thereof; dead 8 h is the number of fish that died during 8-h morbidity observations but exhibited no apparent trauma when collected.

| | | - | | | Time | of sam | ole collec | ction | | | | | Dead on collec- | | Dead |
|---------|----|----------------|-----------------------|-----------|-----------|----------|------------|----------|---------|-----------------------------------|-------------|------|-----------------------|---------|------|
| Measure | 71 | t ₂ | <i>t</i> ₃ | 14 | l5 | 16 | lγ | /g | 19 | t ₁₀ | <i>t</i> 11 | 112 | | Injured | |
| | | | Exp | eriment | 1: stripe | d bass (| FL = 7.6 | cm; S = | 250; /1 | - r ₀ = | 3 min) | | | | |
| R | 10 | 26 | 26 | 12 | 14 | 21 | 25 | 25* | 3 | 38 | 15 | 13 | | | |
| Cum R | 10 | 36 | 62 | 74 | 88 | 109 | 134 | 159 | 162 | 200 | 215 | 228 | 10 | 1 | , i |
| | | | Expe | riment 2: | white p | erch (Fl | _ = 5.0-1 | 5.2 cm; | S = 67; | $t_1 - t_0$ | = 6 mir |) · | | | |
| R | 5 | 19 | 16 | 3 | 2 | 0 | 0 | 1 | 0 | 2 | 3 | . 3 | | | |
| Cum R | 5 | 24 | 40 | 43 | 45 | 45 | 45 | 46 | 46 | 48 | 51 | 54 | 3 | 0 | ı |
| | | | Exp | eriment | 3: stripe | d bass (| FL = 7.6 | cm; S= | 250; / | - to = | 3 min) | | | | |
| R | 1 | 10 | 24 | 9 | 17 | 45 | 22 | 14 | 25 | 29 | 22 | 5 | | | |
| Cum R | ì | 11 | 35 | 44 | 61 | 106 | 128 | 142 | 167 | 196 | 218 | 223 | 5 | 0 | 1 |
| | | | Expe | riment 4: | white p | erch (FI | . = 5.0-1 | 15.2 cm; | S = 66; | $t_1 - t_0$ | = 5 mir | i) ' | | | |
| R | 11 | 17 | 4 | 6 | 1 | 3 | 0 | 0 | 4 | 4 | 3 | 2 | | | |
| Cum R | 11 | 28 | 32 | 38 | 39 | 42 | 42 | 42 | 46 | 50 | 53 | 55 | 1 | . 0 | 1 |
| | | | Exper | iment 5: | white po | erch (FL | = 5.0-1 | 5.2 cm; | S = 250 | ; t ₁ - t ₀ | = 3 mi | n) | | | |
| R | 5 | 100 | 29 | 10 | 8 | 19 | 12 | 16 | 1 | 25 | 0 | 0 | | | |
| Cum R | 5 | 105 | 134 | 144 | 152 | 171 | 183 | 199 | 200 | 225 | 225 | 225 | 1 | 4 | 1 |
| | | | Exper | iment 6: | white pe | erch (FL | = 5.0-1 | 5.2 cm; | S = 250 | ; s ₁ - s ₀ | , = 5 mi | n) | | | |
| R | 11 | 48 | 67 | 21 | 6 | 1 | 13 | 8 | 4 | 23 | 14 | 6 | | | |
| Cum R | 11 | 59 | 126 | 147 | 153 | 154 | 167 | 175 | 179 | 202 | 216 | 224 | 0 | 0 | 0 |

Spraywashes were shut down 15 min during recovery; nine fish killed.

which the random encounter hypothesis holds, recoveries R_i should then accumulate on j as

$$\sum_{i} R_{i} = R_{1} + \Delta R(j-1), \qquad (1)$$

 R_1 being the size of the first collection at j = 1.

In the release-recapture experiments, all apparent injuries and deaths were tallied on recovery, and only those fish *not* exhibiting trauma on collection were held in aquariums for 8-h morbidity observations. These protocols differ somewhat from the standard industry practices for scoring "system efficiencies" (see the discussion at the conclusion of this article). The experimental variables and data from the six release-recapture experiments are given by Table 2. The 36-h limitation on recovery periods was a consequence of the total time we were allowed by the plant operators for holding the fixed screens in place at the river entry of the intake bay.

In the two recapture experiments (1 and 3) with

striped bass (of 7.6 cm mean fork length), each of 250 releases, 228 were recovered in experiment 1 over the 36-h collection period, and 223 in experiment 3. Of the totals collected from both releases, one fish was damaged and 15 were dead (either on collection or during the 8-h morbidity tests), for an observed casualty total of 3%. The observed deaths and injuries were too few for constructing reliable risk distributions, but the empirical probability of imposed trauma (injury or death to an individual fish) was 0.052 in experiment 1 (some of which was owed to a spray failure during collection period t_8) and 0.027 in experiment 3.

The recovery cumulations from experiments 1 and 3 (the striped bass releases) are plotted in Figures 9 and 10. The hypothesis of random encounter is supported by the regression of equation (1) on the cumulative recoveries. Apparently, the striped bass were actively captured by the recon-

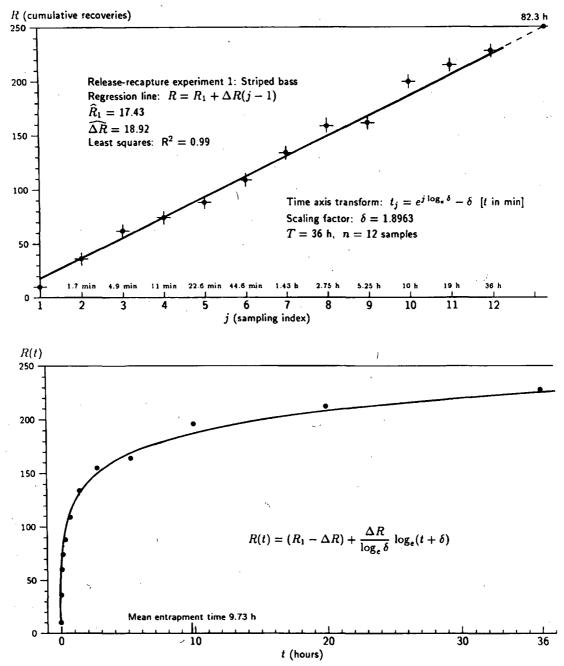


FIGURE 9.—Release—recapture experiment 1; 250 striped bass released in the plant forebay. Duration of the recovery period was 36 h. Upper graph shows cumulative recoveries R against (nonlinear) sampling intervals Δj with sampling times t_j preadjusted for expected ΔR constant. Release time $t_0 = -3$ min. Reference time $t_1 = 0$ corresponds to the first recovery sample at j = 1. Symbols \hat{R}_1 and $\Delta \hat{R}$ denote the regression values (of R on j). The lower graph shows the transformation of the data and the regression to linear time.

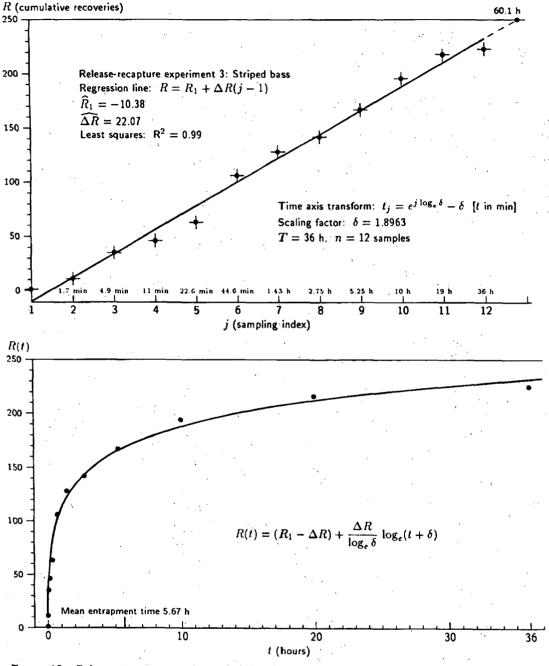


FIGURE 10.—Release-recapture experiment 3; 250 striped bass released in the plant forebay. Duration of the recovery period was 36 h. Upper graph shows cumulative recoveries R against (nonlinear) sampling intervals Δj , with sampling times t_j preadjusted for expected ΔR constant. Release time $t_0 = -6$ min. Reference time $t_1 = 0$ corresponds to the first recovery sample at j = 1. Symbols \hat{R}_1 and ΔR denote the regression values (of R on j). The lower graph shows the transformation of the data and the regression to linear time.

figured fish troughs, few being impinged beforehand. As observed in the Houston flume tests, juvenile striped bass of the sizes employed in these field experiments were capable of sustained swimming at flow speeds greater than the 30-cm/s flow speed in the Indian Point intake forebay. The mean entrapment time before capture was 9.73 h in experiment 1 and 5.67 h in experiment 3, as calculated directly from

$$\bar{t} = \frac{\int_0^T t[S - R(t)] dt}{\int_0^T [S - R(t)] dt},$$
 (2)

S standing for the initial sample size and R(t) the transformed regression (1), or

$$R(t) = (R_1 - \Delta R) + \frac{\Delta R}{\log_{\delta} \delta} \log_{\epsilon}(t + \delta). \quad (3)$$

In the four recapture experiments with 633 white perch (experiments 2, 4, 5, and 6, of sample sizes 67, 66, 250, and 250 and length ranges 5.0-15.2 cm), 556 were recovered during the four 36-h sampling periods, of which 4 were damaged and 7 were dead (on collection or during the morbidity tests), for an observed casualty total of 2%. Unlike the striped bass experiments, the recapture results from all four white perch experiments signify instead a high impingement rate and rapid recovery of small fish unable to swim (or swim very long) at speeds equal to the water speeds at the face of the barrier screen. Each of the white perch releases contained a mixture of fish lengths ranging from 5 to 15.2 cm. Figure 11 illustrates the efflux rate (Q) of the smaller fish over the first 45 min of experiment 2, a pattern typical of all four white perch experiments, when a sudden surge of the smaller perch appeared in the collection sluice shortly after release. Of the total fish recovered in experiment 2, 83% (or 67% of the total release) were recovered in 22.5 min (by i = 5), including 100% of the releases less than 8 cm long. The graph of Figure 11 has the form

$$Q(t) = at^{-2}e^{-h/t^2},$$
 (4)

derived from equations (50) and (52) of Fletcher (1985) for circumstances where a school of fish entrapped by a barrier screen suddenly encounters an escape route (a bypass) by moving a distance along the face of the screen. The analogy here to the Dirac delta distribution in space ($\delta(\Delta x)$ at a reference location x_0) becomes a time interval distribution $\delta(\Delta t)$ at a reference time t_0 . In turn, the

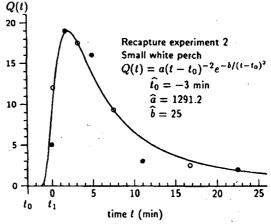


FIGURE 11.—Efflux Q(t) (=dR/dt) of white perch smaller than 8 cm in release-recapture experiment 2, R being cumulative recoveries over time t from release time t_0 . Reference time $t_1 = 0$ corresponds to the first appearance in the collection sluice of individuals from the released sample. Finite interval recoveries $\Delta R/\Delta t$ are denoted by solid bullets (\bullet). Mid-interval adjustments to dQ/dt are denoted by open bullets (O). Quantities \hat{a} , etc., are the regression values.

quantities L (screen length), ρ (concentration of fish at x_0 per unit length of L), and a fish activity coefficient D map to equation (4) in the ratios

$$\frac{L\rho\delta(\Delta x)}{D^{1/2}}\Rightarrow\frac{C_0\delta(\Delta t)}{\gamma},\tag{5}$$

 C_0 being the concentration of fish at the screen front at reference time t_0 , and γ the risk (or chance) per unit time that a randomly selected individual of C_0 will be impinged (and hence recovered). From mapping (5), the coefficients of equation (4) take on the proportionalities

$$a \propto \frac{C_0}{\gamma}$$
 and $b \propto \gamma^{-2}$,

with corresponding adjustments to the powers of t.

The equal probability of capture hypothesis—to the extent that the selected value of scaling parameter δ was more suited to the constant incremental recoveries ΔR of the striped bass samples—failed to hold for either the small white perch or the large ones (those greater in length than 8 cm). Despite the ill-suited progression of sampling intervals for white perch, the larger fish of the samples still seemed to be governed by the case-I Poisson process discussed by Fletcher (1985), whereby expected recoveries from S accumulate as

$$R(t) = S(1 - e^{-\gamma(t-t_0)}), \qquad (6)$$

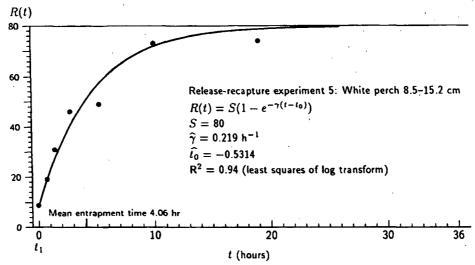


FIGURE 12.—Cumulative recoveries R of the 80 larger white perch released in recapture experiment 5. Reference time $t_1 = 0$ corresponds to the appearance in the collection sluice of the first individual(s) from the released sample. Symbol $\hat{\gamma}$ denotes the regression value of γ , the individual risk per unit time of capture by the screen. Symbol \hat{t}_0 denotes the regression value of t_0 , a parameter of convenience that does not in this case correspond to the release of the sample, because the domain of validity of R(t) does not extend to the left of t_1 .

the random variable (Y, say) being the time that an arbitrarily designated individual of S is captured. The recovery data from experiments 5 and 6 (the white perch experiments having the greater number of releases S) are plotted in Figures 12 and 13. The regressions shown in the figures were fitted to the log transform of equation (6), or

 γt_0 and γ being the parameters estimated. The mean entrapment times shown on the figures were extracted from the probability density function associated with regression (7). That is,

The regressions shown in the figures were the log transform of equation (6), or
$$\log_{\mathbf{r}} \left(1 - \frac{R}{S}\right) = \gamma t_0 - \gamma t, \qquad (7) \qquad \qquad = \frac{e^{\gamma t_0}}{\gamma}.$$

$$R(t)$$

$$R(t) = S(1 - e^{-\gamma(t - t_0)})$$

$$S = 70$$

$$\hat{\gamma} = 0.0994 \text{ h}^{-1}$$

$$\hat{t_0} = -0.82$$

$$R^2 = 0.99 \text{ (least squares of log transform)}$$
Mean entrapment time 9.2 hr

FIGURE 13.—Cumulative recoveries R of the 70 larger white perch released in recapture experiment 6. Reference time $t_1 = 0$ corresponds to the appearance in the collection sluice of the first individual(s) from the released sample. Symbol $\hat{\gamma}$ denotes the regression value of γ , the individual risk per unit time of capture by the screen. Symbol \hat{t}_0 denotes the regression value of t_0 , a parameter of convenience that does not in this case correspond to the release of the sample because the domain of validity of R(t) does not extend to the left of t_1 .

i (hours)

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Equation (8) yields a mean entrapment time of 4.06 h for the 80 larger fish of experiment 5, and 9.2 h for the 70 larger fish of experiment 6.

Opportunistic Collections

Following the release-recapture experiments, the fixed screen was removed from the forebay entrance, the circulating pump of the test bay was operated for extended periods at its full intake rate of river water (~529,000 L/min), and the reconfigured screen was allowed to function in its normal fashion. Over the period 16 September to 24 October 1986, 146 2-h collections were taken of captured river fish. The dead and injured were tallied on collection; fish not exhibiting visible trauma were held in aquariums for 8-h morbidity observations. In addition, 29 extended collections were made that ranged in duration from 6 to 28 h. Fish from these extended collections were examined at the end of each collection period for deaths and apparent trauma, but were not held for the additional 8 h of observation.

In the 175 collections, 8,882 fish were recovered from the fish and debris sluices and 34 species were identified (Table 3). Collection data on the 13 most numerous species are given by Table 4. The fish exhibiting the highest proportions of deaths and injuries in the opportunistic collections were bay anchovy, alewife, American shad, blueback herring, Atlantic menhaden, and American eel, all but American eel being tender species easily descaled. As the data show, fish of these species that were transferred to aquariums suffered higher proportions of latent mortality than those from the extended collections, which were held directly in the collection tanks. Nevertheless, no adjustments have been made here to the collection data for handling mortality.

Screen Versions 1 and 2 Compared

The experiments described in preceding sections of this paper were intended to provide enough empirical information for making a reliable assessment of the likely reductions in fish kills and injuries attributable to the reconfiguring of the prototype machine, as compared in particular to the first version. Comparisons between the opportunistic field collections from the two machines suffer somewhat from dissimilarities in experimental variables. The machines were tested during unlike seasons of the year; the low water temperature of the river during the testing of version I probably increased susceptibility of trauma of some of the sampled species, and because of

TABLE 3.—Fish collected in 175 samples from fish and debris sluices, 16 September to 24 October 1986, during field tests of screen version 2 at Indian Point nuclear unit 2.

| Development tucker misskilli | 1.000 |
|--|--------------|
| Bay anchovy Anchoa mitchilli American shad Alosa sapidissima | 1,060 169 |
| | 192 |
| Bluegill Lepomis macrochirus | 212 |
| Pumpkinseed Lepomis gibbosus | |
| Hogchoker Trinectes maculatus | 3,543 |
| Largemouth bass Micropterus salmoides | 1 |
| Blueback herring Alosa aestivalis | 277 |
| Rainbow smelt Osmerus mordax | 4 |
| Striped bass Morone saxatilis | 86 |
| White catfish Ictalurus catus | 25 |
| Yellow perch Perca flavenscens | 1 |
| Lookdown Selene vomer | • 7 |
| Atlantic needlefish Strongylura marina | 1 |
| Weakfish Cynoscion regalis | 467 |
| Butterfish Peprilus triacanthus | . 8 |
| Rough silverside Membras martinica | · 1 。 |
| Naked goby Gobiosoma bosci | .13 |
| Alewife Alosa pseudoharengus | 72 |
| Bluefish Pomatomus saltatrix | 16 |
| Brown bullhead Ictalarus nebulosus | 6 |
| American eel Anguilla rostrata | 65 |
| Banded killifish Fundulus diaphanus | 134 |
| Atlantic menhaden Brevoortig tyrannus | 24 |
| Atlantic silverside Menidia menidia | 3 |
| Spottail shiner Notropis hudsonius | 2 |
| Atlantic tomcod Microgadus tomcod | 603 |
| White perch Morone americana | 1.806 |
| Northern pipefish Syngnathus fuscus | 4 |
| Redbreast sunfish Lepomis auritus | 4 |
| Crevalle jack Caranx hippos | 6 |
| Clupeid sp. | i |
| Centrachid sp. | 39 |
| Summer flounder Paralichthys dentatus | 29 |
| Grey snapper Lutjanus griseus | í |
| | |

the difference in seasons the species compositions of the collections also differed considerably.

During Consolidated Edison's field testing of screen version 1, the experimenters collected 45,608 fish in their samplings of the fish and debris sluices. Of 36 identified species, 20 also appeared in the sampled recoveries from screen version 2. Discounting those species represented by only one fish reduces the shared species to 15 (Table 5).

From the 36 species collected during Consolidated Edison's testing of screen version 1, the experimenters selected the 10 most abundantly represented for their "latent survival" tests. Eight of those 10 are among the shared species appearing on Table 5 (those starred). Of the eight common species, two from the version-2 samplings (rainbow smelt and spottail shiner) were not collected in numbers sufficient for mortality comparisons. The deaths and injuries accrued to the remaining six species are given in Table 6.

The information on the version-1 survival testing appearing on Table 6 was taken from Consolidated Edison (1985), in which the numbers of fish "tested" were apparently subsamples of the version-1 collections; the actual totals collected are given in Table 5. The quantities listed in Table 6 for screen version 2 are the actual totals from the opportunistic collections (2-h and extended. collections combined; see Table 4 for clarification). The large recovery of fish from the debris sluice of the version-1 machine was attributed to the entanglement of fish in the filamentous alga mentioned earlier. Of the total numbers of fish collected during those winter tests, 31% were recovered from the debris sluice (as opposed to 4% during the testing of the version-2 machine). The actual proportion was probably greater than the reported 31%, owing to the difficulties in searching through the debris, which formed a nearly inseparable mass of fish and algae when recovered. (On two site visits during the testing of screen version 1, I observed quantities of uncounted fish in the discarded debris.)

The screen-fouling problem is also reflected in the high mortalities observed during the version-1 tests. Of the white perch collected, 32% were recovered from the debris; of the striped bass, 23% from the debris; of the rainbow smelt, 44%, and so on. Therefore, when the casualties of the fishsluice and debris-sluice collections are combined (Table 6), the importance of the alterations to the above-water portions of the version 2 machine becomes more obvious. Since the completion of our experimental work in 1986, the test screen at the Indian Point plant has been operated routinely, including operations during three winter-spring seasons of high debris loading. As reported to me by Kenneth Marcellus, supervising biologist for Consolidated Edison, the apparatus has continued to function as intended; apparently, the results reported here are valid representations of the improvements incorporated into the reconfigured machine, particularly in regards to the problem of fish and debris separation.

Comment on Sampling and Scoring Protocols

The procedures and scoring methods employed in the field samplings reported here differ from those of standard industry practice. Deaths and visible trauma accrued to recovered fish were tallied and classified on collection. Those fish exhibiting no apparent trauma were held in aquariums or collection tanks for 8 h (or longer) after collec-

tion (but see Table 4 for clarification). Deaths and revealed injuries from these latent morbidity observations were added to those tallied on collection for calculating total casualties. Damages to the dead and injured were classified by type and frequency of occurrence.

In testings of barrier screens and fish conservation apparatus by the power industry (most particularly for state and federal regulatory demonstrations), fish on collection are customarily scored as "live" (able to swim normally), "stunned" (all injuries, irrespective of kind), and "dead." All fish not dead (those classed as live and stunned) are held in aquariums for periods ranging from 48 to 96 h and the injured allowed to recover. At the end of the latent survival test (so named), the aquarium fish are then reclassified as either dead or alive, the "live" now being any fish exhibiting opercular movement or response to prodding. The ratio of these final live (injured and uninjured) to the total sample size (live plus dead) is reported as "percent survival" or "total system efficiency."

The differences in scorings between the two procedures are sometimes significant. In a comparative test, 10 fish were dead on collection and 40 injured (to one extent or another) out of a sample of 100. In accordance with the first procedure, the 50 apparently uninjured were held for the 8-h latent morbidity observation. Out of those 50, 3 died and 2 exhibited erratic swimming. In accordance with the second procedure, the 90 not dead were held for 96 h, during which time 20 died and 22 of the originally injured were still alive (exhibiting opercular movement or response to prodding). By the first method of scoring, there were 55% casualties (50 + 3 + 2 fish) or a 45% survival without injury. By the second method survival was scored as 70% (100 - 10 - 20).

The first method might be viewed as overly stringent, but the second is decidedly misleading if one presumes the objective common to all displacement schemes is that of rescuing fish from intake structures and returning them to the source waters unharmed. Partial corrections to reported survivals in industry studies can sometimes be made by noting from the raw data the numbers recorded as stunned on collection, with the understanding that the classification is a euphemism for all injuries, however severe. Such uses and scoring procedures are departures from the recognized protocols in other biological sciences where animal deaths and morbidities are the measures of interest. Not only are the data subverted by such practices, we are also denied the injury clasTABLE 4.—Collection data on the 12 most numerous species in the opportunistic fish collections, screen version 2, 16 September-24 October 1986, Indian Point nuclear unit 2. Fish drawn from the river and captured by the screen were sampled in 146 2-h collections and 29 extended collections of 6-28 h duration. Mean water speed in the forebay was approximately 30 cm/s (varying with the tide), river water temperature was 24-25°C, conductivity was 5,900-6,500 μS/cm, and the vertical speed of the test screen was 3 m/min. Key: Fish sluice¹ and debris sluice¹ signify fish from 2-h collections that were transferred to aquariums for 8-h morbidity observations. Fish sluice² and debris sluice² signify fish from 2-h collections that were shunted to collection tanks, with no handling, for 8-h observations. Fish sluice³ and debris sluice³ signify fish of the extended collections, all of which were shunted to tanks and examined at the end of a collection period.

| | | | On collection | | After 8 h | | Cumulative dead and | |
|---|---------------------------------|--------|---------------|----------------|----------------------|---------|---------------------|---------|
| | Recovery | Normal | Damaged | Dead | Normal | Damaged | Dead | injured |
| | | | Bay ancho | vy (1,060 col | lected*) | | , | , |
| | Fish sluice! | 60 | . 8 | 12 | 41 | 12 | 27 | |
| | Rear debris sluice ¹ | 0 | Ö | 3 | 0 | 0 | 3 | |
| | Fish sluice ² | | | | 42 | 13 | 12 | |
| | Fish sluice ³ | 723 | 24 | 147 | | ••• | | |
| | Rear debris sluice3 | 6 | 1 | 8 | | | | 23% |
| | | 73 · | American | shad (169 co | llected) | | • | |
| | Fish sluice ¹ | 10 | 9 | . 9 | 9 | 3 | 16 | |
| | Rear debris sluice ¹ | 0 | 0 | 2 | 0 | . 0 | 2 | |
| | Fish sluice ² | | | | 18 | 2 | . 9 | |
| | Fish sluice ³ | 83 | 2 | 25 | | - | • | |
| | Rear debris sluice ³ | 0 | ō | ō | | | | 35% |
| | | | Bluegil | i (192 collect | ted) | | | |
| | Fish sluice! | 119 | 0 | 0 | 119 | 0 | 0 | |
| | Rear debris sluice1 | 0 | 0 | 0 | | | | |
| | Fish sluice ² | | | | 15 | 0 | 1 | |
| | Fish sluice ³ | 56 | 0 | 1 | | _ | _ | |
| | Rear debris sluice ³ | 0 | ŏ | Ö | | | | 1% |
| | | | Pumpkins | eed (212 coli | ected ^a) | | | |
| | Fish sluice! | 40 | 2 | 0 | 39 | 3 | 0 | |
| | Rear debris sluice1 | ĩ | ō | Ō | · 1 | ő | ŏ | |
| | Fish sluice ² | • | • | • | 29 | ŏ | 2 | |
| | Fish sluice ³ | 127 | 3 | 6 | | v | • | |
| | Rear debris sluice ³ | , "i | ő | ŏ | • | | | 7% |
| | | / | America | eel (65 colle | ected) | | | |
| | Fish sluice! | 16 | 8 | 0 | 15 | . 7 | 2 | |
| | Rear debris sluice | Ŏ | ő | ŏ | ., | Ó | Õ | |
| | Fish sluice ² | • | J | • | 9 | i | 2 | |
| | Fish sluice ³ | 23 | 0 | 0 | • | • | 4 | |
| | Rear debris sluice ³ | ō | ŏ | ŏ | | | | 28% |
| | | | Hogchoke | r (3,543 colk | ected ^a) | | | |
| | Fish sluice! | 486 | Ī | 4 | 486 | 0 | 5 | |
| | Front debris sluice! | 46 | 0 | 1 | 45 | 3 | 2 | |
| | Fish sluice ² | | | | 561 | 2 | 13 | |
| | Rear debris sluice ² | | | | ./ 101 | 2 | 7 | |
| | Fish sluice ³ | 2,094 | 1 | 407 | , - | | | |
| | Rear debris sluice ³ | 176 | 0 | 4 | | 1 | | 13% |
| | | | Banded kil | lifish (134 co | llected) | , , | | |
| | Fish sluice! | 75 | 0 | 0 | 74 | 0 | 1 | |
| | Rear debris sluice ¹ | 0 | 0 | .0 | | | | |
| | Fish sluice ² | | | | 14 | 1 | 0 | |
| | Rear debris sluice ² | | | | 2 | 0 | 0 | |
| 1 | Fish sluice ³ | 42 | 0 | 0 | | | | |
| ′ | Rear debris sluice ³ | 0 | 0 | 0 | | | | 1% |
| | | | Blueback he | erring (277 c | ollected) | | | |
| | Fish sluice ¹ | 24 - | 7 | 3 | 16 | 5 | 13 | |
| | Rear debris sluice! | 0 | 0 | 0 | | • | | |
| | Fish sluice ² | | | | 72 | 0 | 25 | |
| | Fish sluice ³ | 118 | 3 | 25 | - - | _ | | |
| | Rear debris sluice3 | 0 | ō | 0 | | | | 26% |

TABLE 4.—Continued.

| | ., | On collection | | | After 8 h | | Cumulative dead and |
|---------------------------------|--------|---------------|----------------------|----------|-----------|------|------------------------|
| Recovery | Normal | Damaged | Dead | Normal | Damaged | Dead | injured |
| | | Striped | bass (86 colle | cted) | | | |
| Fish sluice! | 7 | 0 | 0 | 7 | 0 | 0 | |
| Rear debris sluice 1 | 0 | 0 | 0 | | | ; | |
| Fish sluice ² | | | | 11 | 1 | 0 | |
| Fish sluice ³ | 60 | 2 | 5 | | | • | |
| Rear debris sluice ³ | 0 | 0 | 0 | | | | 9% |
| | | Atlantic to | cacod (603 co | llected) | | | |
| Fish sluice ¹ | 52 | 21 - | 1 | 51 | 21 | 2 | |
| Rear debris sluice ¹ | 0 | Ō | 0 | | | | |
| Fish sluice ² | | | | 36 | · 3 | 5 | |
| Fish sluice ³ | 410 | 8 | 65 | | | | |
| Rear debris sluice ³ | ì | 0 | 1 | | | | 17% |
| | • | White per | ch (1,806 col | lected*) | | | |
| Fish sluice! | 486 | 18 | 15 | 476 | 7 | 36 | |
| Rear debris sluice! | 6 | 1 | 0 | 6 | 1 | 0 | |
| Fish sluice ² | | | | 276 | 11 | 24 | |
| Rear debris sluice ² | | | | 8 | 2 | 0 | |
| Fish sluice ³ | 787 | 35 | 132 | | • | | |
| Rear debris sluice ³ | 5 | 0 | . 0 | | | | 14% |
| | | Weakfi | sh (467 colle | cted) | | | |
| Fish sluice! | 19 | 2 | 0 | 14 | 3 . | 7 | |
| Rear debris sluice ¹ | 1 | 0 | 0 | 0 | 1 | 0 | |
| Fish sluice ² | | | | 21 | 0 | 7 | |
| Fish sluice ³ | 368 | 7 | 25 | | | | |
| Rear debris sluice ³ | . 11 | 3 | 3 | | | | 12% |

^a One bay anchovy, I pumpkinseed, 13 hogchokers, and 1 white perch were recovered from the front debris sluice.

sifications that give us clues to the sources of injury. I see no legitimate reason for suppressing such important information for the sake of inflating survival statistics; I urge the supervising biologists of such studies to adopt more accurate classification and scoring protocols. However the collection samples might be divided for extended observations, the numbers (or percentages) of fish dead and injured should be reported and the practice of scoring the injured as "live" abandoned.

Conclusions and Remarks

The tests of the reconfigured machine in the hydrodynamics flume were meant to verify the causal findings that led to the innovations now incorporated into the device, and the site experiments at Indian Point were meant to produce information on the likelihood that fish mortalities would be substantially reduced, as compared to the first version of the machine and other screening systems. The flume tests essentially substantiated the earlier findings that led to the re-ordering of the debris and fish removal procedures and to the redesigning of the fish-catching apparatus. The probabilities of capture on first encounter with

the screen were significantly increased, and all test species, once captured, suffered less buffeting in the redesigned fish troughs than they did in any of the standard troughs tested. The release-recapture experiments at Indian Point confirmed our

TABLE 5.—Numbers of fish collected of 15 species common to the field testings of screen versions 1 and 2. Asterisks denote species used in "latent survival" tests, screen version 1.

| | Screen version | | | |
|-------------------|----------------|-------|--|--|
| Species | 1 | 2 | | |
| Alewife* | 117 | 72 | | |
| Bluegill | 9 | 192 | | |
| Brown bullhead | 15 | 6 | | |
| Pumpkinseed* | 144 | 212 | | |
| American eel | 131 | 65 | | |
| Hogchoker | 198 | 3,543 | | |
| Banded killifish | 61 | 134 | | |
| Blueback herring | 29 | 277 | | |
| Rainbow smelt* | 373 | 4 | | |
| Spottail shiner* | 217 | 2 | | |
| Striped bass* | 5,546 | 86 | | |
| Atlantic tomcod® | 413 | 603 | | |
| White catfish* | 443 | . 25 | | |
| White perch* | 37,536 | 1,806 | | |
| Northern pipefish | 4 | . 4 | | |

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TABLE 6.—Casualty observations after opportunistic field collections from Indian Point test screens; versions 1 and 2 compared.

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| | Screen v | ersion I | Screen version 2 | |
|-------------------------------|----------|------------------------|------------------|------------------------|
| Species and collection sluice | Tested | Dead and injured | Tested | Dead and injured |
| Alewife | | | | |
| Fish sluice | 22 | 98% | 71 | 62% |
| Debris sluices | 3 | | 1 | |
| Atlantic tomcod | | | | |
| Fish sluice | 32 | 75% | 601 | 17% |
| Debris sluices | 8 | | 2 | |
| Combined | 40 | 80% | 603 | 17% |
| Pumpkinseed | | | | |
| Fish sluice | 17 | 46% | 210 | 7% |
| Debris sluices | 0 | | 2 | |
| Striped bass | | | | |
| Fish sluice | 860 | 48% | 86 | 9% |
| Debris sluices | 264 | | 0 | |
| Combined | 1,124 | 53% | 86 | 9% |
| White catfish | | | | |
| Fish sluice | 85 | 39% | 25 | 40% |
| Debris sluices | . 25 | | 0 | |
| Combined | 110 | 53% | 25 | 40% |
| White perch | | | | |
| Fish sluice | 4,227 | 58% | 1.783 | 13% |
| Debris sluices | 2,051 | | 23 | - |
| Combined | 6,278 | 64% | 1.806 | 14% |

findings from the flume experiments that juveniles of some species are rapidly impinged at flow speeds as low as 30 cm/s, but we also discovered that impingement as such is not the proximate agency of high mortality it was thought to be, provided the durations of impingement are short and the speed of the water approaching the screen is moderate. Given such conditions, we found that captured fish were harmed more by injuries imposed during the recovery process.

In the case of fish able to swim against the flow for extended periods, the release-recapture experiments tended to confirm the hypothesis of random encounter and active capture by the redesigned fish troughs. Mean entrapment times (9.73 h, 5.67 h, 4.06 h, 9.2 h) were an order of magnitude less than those documented from similar experiments with a competing device when reported water speeds were about 30 cm/s. In mark-recapture experiments at the Oswego generating station on Lake Ontario, during field tests on an angled screen and bypass system (Lawler, Matusky & Skelly 1982), estimated mean entrapment times were 73 h for white perch, 295 h for smallmouth bass Micropterus dolomieui, 20 h for yellow perch, 200 h for brown trout Salmo trutta, 76 h for white bass Morone chrysops, and 41 h for bluegill. In the opportunistic collections at Oswego, extended entrapment times were also reflected, at least partly, in the high percentages of observed deaths and injuries. From even the simple assumption of constant risk of death per unit time (μ) , extended entrapment times imply decreased probabilities of survival (whether the fish removal device is a Ristroph screen or an angled screen and bypass system), because the individual probability of death from exposure to constant mortality risk increases in time approximately as $1 - e^{-\mu t}$ (for more complex distributions of mortality risk, including analyses of the Oswego and other fish recovery experiments, see Fletcher 1985).

The reconfigured machine has been approved by the parties to the power plant settlement for installation in the 12 intake bays of the Indian Point plants, and the New York State Department of Environmental Conservation now employs the performance of the prototype as the state's best available technology standard for reducing fish impingements at water intake systems. If the machine continues to operate as well as the flume and field testings indicate, it probably can be regarded as the screening device most likely to impose the least mortalities in the rescue of entrapped fish by mechanical means. In view of the great numbers of fish typically exposed to mortality risk from large-scale water withdrawals, however, even the (comparatively) low percentages of kills and injuries observed during the prototype testings may still represent significant reductions in some stocks.

At locations where water speeds approaching screening devices are significantly greater than those examined here, impingement proper undoubtedly inflicts its share of casualties. In a later series of flume experiments on a special intake and screening geometry, water speeds at the screen were on the order of 120–150 cm/s. Fish were thrust against the screen mesh with such force that most were crushed or beheaded. Survival of test fish (again, golden shiners, striped bass, and white perch) was nil.

Further refinements to the Ristroph family of screening systems are possible, of course, but I do not believe that improvements beyond those reported here are apt to bring about greatly enhanced reductions in fish kills. Owing to the operating principles of these devices, captured fish would still be exposed to the hazards of direct mechanical encounter and removal. If some new device is to be better at conserving fish life, it must bring about a reduction in mean entrapment time through some active means of removal or diver-

sion of fish from intake systems, but some active means not dependent on forcible contact with the fish or their extraction from the source waters.

The reconfigured machine, as tested at the Indian Point plant and described here, is now manufactured by Envirex, Inc., of Waukesha, Wisconsin.

Acknowledgments

Special thanks rightly go to Trent Gathright and Richard Ewbank for their long and creative labors in the laboratory, to Kenneth Marcellus for good counsel and his part in coordinating the field work, to the field crews of Normandeau Associates for their competence and all around good cheer, and to James Reichle, supervisor of the field crews, for his skill at identifying juvenile fishes and his many 24-h watches.

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ON THE RECONFIGURATION AND EMPIRICAL EVALUATION OF A PROTOTYPE SCREENING DEVICE AT INDIAN POINT NUCLEAR UNIT 2

FINAL REPORT TO

HUDSON RIVER FISHERMEN'S ASSOCIATION

1 December 1986

R. Ian Fletcher
Great Salt Bay Experimental Station

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Brief history

At full pumping capacity, the two operating nuclear plants at Indian Point divert approximately 1,680,000 gallons per minute of Hudson River water for condenser cooling. This water is withdrawn by circulating pumps through intake bays, each 13 feet wide and (about) 27 feet deep, that open onto the river. Each plant is equipped with six such bays and circulating pumps. Hence, a single bay accounts for about 140,000 gallons per minute of water withdrawal and heated discharge at full operating capacity. In addition, each plant has a service water bay that withdraws an additional 30,000 gallons per minute (or 60,000 gpm combined).

Each intake bay is furnished with a barrier screen that prevents indrawn debris from passing into the circulating pumps. Because of the large volumetric intake of river water, quantities of fish are regularly drawn with the water flow into the barrier screens and killed. As one intended means of reducing these fish kills, the Settlement Agreement of 10 December 1980 called for the replacement of the existing screens with barrier devices known as "angled screens."

Owing, however, to a subsequent analysis that showed the proposed angled screen design as offering little promise for significantly reducing fish kills (Fletcher 1984a), the settlement parties ultimately rejected angled screens in favor of an option in the Settlement Agreement that allowed for "alternative mitigation measures." That provision was interpreted, in turn, as allowing for alternative barrier devices that provide for the conservation of entrapped fish. One such device, known somewhat erroneously as a Ristroph screen, is now being tested, and it is the principal subject of this report. As currently configured, this test device little resembles the standard Ristroph design.

On rejection of the angled screens, Consolidated Edison elected to install and test the Ristroph device as manufactured by the Royce Equipment Company of Houston, Texas. The first test version of the Royce screen was placed in intake bay number 6 of Indian Point unit 2 (the Consolidated Edison plant) the latter part of 1984, and Consolidated Edison commenced its initial fish collection studies in January 1985. These collections continued for three months, the results of which were reported in Con Ed (1985).

Figure 1 on page 8 shows the general mechanical arrangement of the prototype screen as it was configured during those initial tests. Site arrangements of the screen and the sampling apparatus are depicted in Con Ed (1985) by Figures 2-1, 2-2, and 2-3. Although similar in principal to the existing screening devices at both Indian Point plants, the Royce stan-

dard screen is equipped with fish-catching troughs (the so-called Ristroph modification) and it is designed for continuous operation (continuous travel and debris removal) as opposed to the intermittant mode of rotation of the existing screens.

As reported in Con Ed (1985), the initial version of the prototype screen (called "Royce version 1" here) imposed high mortalities on several collected species, not unlike the levels of mortality measured at other intake systems (other power plants) employing similar screening devices (reviewed in Fletcher 1984b). During the initial testing program at Indian Point, conditions adverse to fish conservation were noted, namely, (1) fish adhered to the metal screen troughs, (2) fish entangled in unreleased algal matting, (3) inadequate width and shape of fish recovery sluice, and (4) ill-positioned flap seal (items reported in Fletcher 1985 and reviewed here in Section 1). Owing to the unexceptional performance of the test screen in its fish recovery portions, the device, as then configured, was judged by HRFA to be no more desirable than the rejected angled screen system.

As reported to you in Fletcher (1985), I examined the operation of the test machine in detail, then conferred with Dr. Marcellus of Consolidated Edison and devised a number of possible fixes for improving the debris removal and fish recovery performance of the device (of Royce version 1). That information was transmitted to the manufacturer, who in turn constructed a working replicate of the test screen in the Royce hydrodynamics flume (in Houston) and proceeded thereafter with the mechanical design and testing of the recommended alterations. I participated in that work, the results of which were reported to you in Fletcher (1986a and 1986b).

The problems connected with fish recovery and debris separation (the adverse conditions noted above) seemed to have been resolved, at least in principle, by the several modifications tested in Houston, but those modifications were limited to the observed portions of the machine above the water. Whether or not the fish-catching rails (those affixed to each screen panel) actively captured freely swimming fish (as opposed to merely lifting impinged fish from the water), or to what extent the screen and rail system below water might be contributing to death and injury of empounded fish, were questions still unresolved.

In response to those questions, the manufacturer installed an underwater filming port in the side of the hydrodynamics flume, and carried out a series of flow and fish experiments, which I designed and supervised. Those experiments revealed flow patterns in the vicinity of the fish-catching rails not altogether compatable with fish behavior and injury-free recovery. The rails were then redesigned and certain apparatus added that brought about increased rates of fish capture, as well as reduced incidence of imposed injury. Results of the fluid dynamical experiments were reported to you in Fletcher (1986b and 1986c); some of that experimental information is given in more detail in Section 2 of this report. The modifications and improvements developed in the Houston test flume were then incorporated into the prototype screen at Indian Point. The manufacturer removed the

machine (Royce version 1), reconfigured it as indicated on Figure 2, then reinstalled it in the test bay (as Royce version 2).

Although we had conducted an extensive series of mechanical and fluid dynamical experiments on Royce version 2 in the Houston flume, the accompanying flume experiments with fish were circumstantial in nature and could not be considered sufficiently rigorous for probabilistic examination, nor could flume experiments alone be thought adequate for assessing the overall risks associated with field conditions. Therefore, I drew up a proposed, two-part testing program (Fletcher 1986c) that consisted of site tests at Indian Point and further tests in the Royce hydrodynamics flume. I circulated the proposal to HRFA, DEC, EPA, PASNY, and Con Ed for comments, and then composed an improved experimental design for the flume tests. At the request of Consolidated Edison, I also assisted Dr. Marcellus in drawing up a detailed working plan for the site tests at Indian Point (Con Ed 1986).

The tests proposed for the Royce flume were meant to test the causal findings that led to some of the innovations now incorporated into the reconfigured device, while the proposed in situ tests at Indian Point were meant to produce information on the likelihood of decrease in fish mortalities, as compared to the mortalities associated with the device as originally configured and tested. Both parts of the testing program were structured in a sequence of discrete steps that allowed for a detailed examination of each station or operation of the machine in turn, with the view to identifying and further improving any particular apparatus or functioning of the machine that might be imposing undue damage on captive fish.

The tests in the Houston hydrodynamics flume (some of which were conducted with striped bass and white perch from the Hudson) essentially substantiated the earlier findings that led to the redesigned fish-catching apparatus. The probabilities of capture (the chance that a fish would be caught on its first encounter with the barrier screen) were significantly increased for some species, and all test fish, once caught, suffered less buffeting in the redesigned fish rails than they did in the standard rails of Royce version 1. See Section 3 for the testing results, and Appendix A for the corresponding data register.

The field tests at Indian Point with known samples of released fish (the mark and recapture tests reported in Section 4) confirmed our findings from the flume experiments that juveniles of some species are rapidly impinged at a fluid speed of 30 cm/sec, the speed of the intake flow at the Indian Point plants, but we also determined that impingement is not the proximate agency of high mortality it is thought to be. Captured fish were harmed more by injuries imposed on them during the recovery process. In the case of fishes able to swim against the flow for extended periods, the mark and recapture experiments confirmed a hypothesis of random encounter and active capture by the redesigned fish rails.

Over the period 16 September to 24 October, the reconfigured machine and the circulating pump of the test bay were allowed to operate in

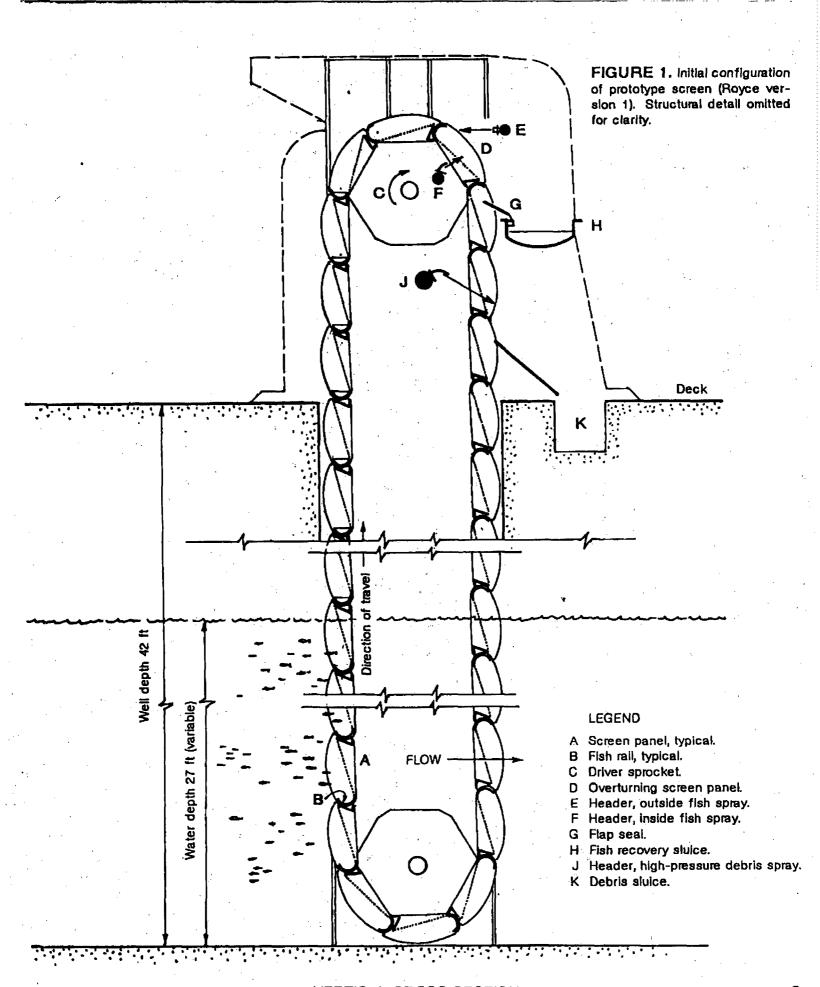
the manner required for maximum intake of cooling water. During this period, 146 two-hour collections of captured fish were taken and held for 8-hour morbidity tests, Also, 29 collections were taken that ranged from six to 29 hours duration. The results of these fish collection experiments are given in Section 4. A comparison between these data and the tests by Consolidated Edison on the machine as originally configured showed significant reductions in imposed deaths and injuries to captured fish (see Section 5). Because the two testing programs were conducted during unlike seasons (version I in winter, version 2 in summer), the problem of algal matting was not tested, however. The indrawn debris during the summer testing of the version 2 machine was mostly eel grass, which was not stapled firmly into screen mesh like the winter alga encountered during the tests on the version 1 machine. Nor was there evidence to suppose that fish mortalities were increased by the presence of the eel grass.

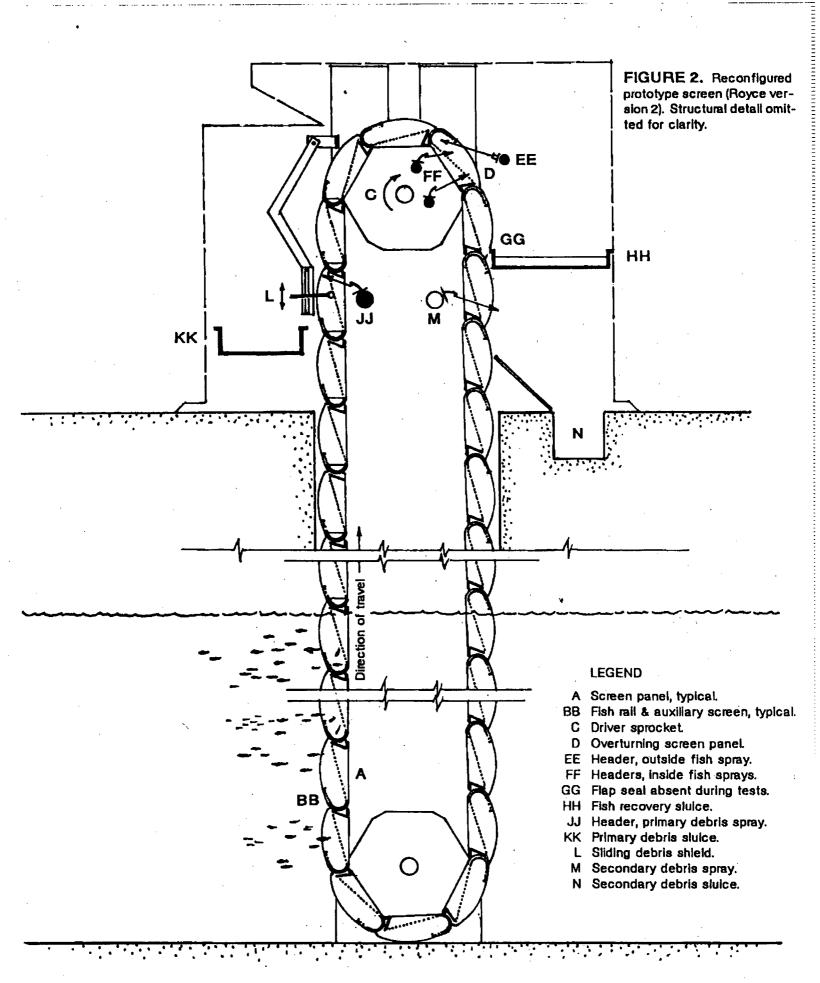
None of the testing or experimental work was directed to an examination of any fish conservation apparatus beyond the confines of the single barrier device. No investigative work has yet been done on the mechanism for returning recovered fish to the source waters. For further commentary on testing not yet completed or undertaken, see pages 11, 32, 38-39, 50, and 53.

EXPANDED CAPTIONS

Figure 1 (page 8). Mechanical arrangement of the prototype screening device as originally configured and tested in January-April 1985 (Con Ed 1985); called Royce version 1 here. The screening apparatus proper, whose principal function is the protection of the intake sump from water-borne debris, consists of rectangular screen panels, linked together as an endless chain, that travel vertically and so accomodate the removal of captive debris from the meshes and auxiliary structure of the panels. To that extent, the prototype device is similar to the existing debris screens at both Indian Point plants, but unlike the existing screens it is constructed of stainless steel (as opposed to plain carbon steel), it is designed for continuous rotation and cleaning (as opposed to intermittant rotation), and it is equipped with fish recovery apparatus. The bottom rail (B) of each screen panel (A) has a concave shape that retains water and captive fish as the panels ascend to the driver sprocket (C). As a panel (D) rotates over the sprocket, the fish rail affixed to the panel spills out its captive water and fish. Released fish are meant to fall or slide along the incline of the descending panel into a fish sluice (H) and thence to a conduit for their return to the source waters. The release of fish from the rail and screen surface is aided by two rows of low-pressure sprays (E) and (F). A wide strip of flexible material (G), called a flap seal, is meant to prevent released fish and debris from falling behind the fish sluice and into the intake flow. Debris and fish remaining on the screen panels are blown into a debris sluice (K) by a row of high-pressure water jets (J).

Figure 2 (page 9). Mechanical arrangement of the reconfigured prototype as currently installed at Indian Point and tested in August-October 1986; called Royce version 2 here. Each screen panel (A) now has an auxiliary screen attached to the leading edge of its (reshaped) fish rail (BB). Debris embedded in the meshes of a screen panel (and its auxiliary screen) is blown free as the panel ascends through a row of high-pressure jets (JJ). The spray is interrupted by deflectors, mounted on the fish rails, that prevent disturbance to the water and fish contained in the rails. Released debris that would otherwise fall into the fish rails is deflected by an articulated shield (L) to a debris sluice (KK). As a screen panel (D), now free of debris, rotates over the driver sprocket (C), captive fish slide or fall into a fish sluice (HH). The release of fish from the metal fish rails is aided by a low-pressure spray (EE), and the release of fish from the surfaces of the descending screen panels is aided by two rows of fish sprays (FF). During the field tests on the reconfigured machine, the seal (at GG) was removed.





On the reconfiguration and empirical evaluation of a prototype screening device at Indian Point unit 2.

SECTION 1.

Notes on the field and flume tests of Royce version 1

During the Con Ed tests of January-April 1985 on the device as it was originally configured (as Royce version 1) or during my flume experiments on its replica, the following deficiencies were observed. Each has been addressed by the manufacturer, and the various fixes noted below have been incorporated into the reconfigured prototype, Royce version 2. The effectiveness of each such alteration in performing its intended function was observed and measured during the course of the two-part testing program documented in this report. Those testing procedures are described more fully in Section 3 (flume tests) and Section 4 (field tests); the corresponding data registers are contained in Appendices A and B. Section 2 contains a description of the Royce hydrodynamics flume, together with some information on the flow and fish experiments that led to the redesigning of the fish rails. In the following narrative, references to components and locations of the test machines are keyed to the letter codings (A,B,C,...) that appear on Figures 1 and 2.

- 1. Fish adhered to the metal fish rails. As a screen panel (D, Figure 1) rotates over the top of the upper driving sprockets of the machine, the fish rail (or trough) affixed to that panel spills out its captive water. In turn, captive fish are also meant to spill from the rail and slide along the incline of the moving panel to the fish return sluice (H). During the initial field tests of Royce version 1, some fish remained in the overturned screen rails, apparently stuck fast to the metal surfaces, and were carried past the fish collection sluice and into the debris sluice below (at K) or into the intake flow behind the screen. As recommended by Dr. Marcellus of Con Ed, the manufacturer repositioned the outside low-pressure spray header (from E of version 1 to EE of version 2), which cured the problem of unreleased fish, at least while the spraywash was functioning at its intended rate of flow. But during the field tests on version 2, I observed inadequate spray patterns from all three low-pressure headers (EE and FF) owing to clogged spray nozzles, an apparent fault of poor debris straining at the service pump.
- 2. Obstruction of the inside fish spray by algal matting. If captive fish spill as intended from an overturning fish rail and onto the inclined surface of the descending screen panel, then the freeing of fish from the panel surface is aided by a row of directed low-pressure jets (F on Figure 1) that spray water through the descending panels from a location between the ascending and descending halves of the travelling screen. But during the months (January to April) of the initial tests on Royce version 1, that fish

spray was ineffective owing to a covering, over the extent of every screen panel, of an embedded filamentous alga, which prevented much of the spray from penetrating the screen mesh. As a consequence, many fish were not freed from the surface of the algal matrix, but were carried past the fish collection sluice (H) into the high-pressure debris spray (at J on version 1), and thus were blown into the debris sluice (K) with the algae and other debris. Although the river loading of filamentous algae is highest during winter months, I observed this problem, although to a lesser extent, as late as June. The magnitude of fish loss attributable to this process is not known with any precision owing to the difficulties of inspecting large quantities of debris.

As recommended in Fletcher (1985), a fundamental reordering of the fish and debris removal systems was incorporated into the design of the reconfigured device (Royce version 2; Figure 2). The related alterations were essentially five in number:

- i. a repositioning of the primary high-pressure debris header (from J of version 1 to JJ of version 2) so that its jets now blow through the ascending screen panels;
- ii. a relocating of the primary debris sluice (KK) to the ascending side of the screen;
- iii. the adding of an inside low-pressure fish spray and a repositioning of the existing inside fish spray (location FF);
- iv. the adding of longitudinal spray deflectors to the backs of the panel rails, as a means of preventing disturbance to captured fish as the ascending fish rails pass in turn through the relocated high-pressure debris spray;
- v. the adding of an articulated metal shield (L) for protecting the ascending fish rails against the debris that would otherwise fall into the rails as the screen panels pass through the (relocated) high-pressure debris spray.

This reordering of the debris removal and fish recovery systems was meant to resolve the problem of poor fish recovery associated with the obstruction of the inside fish spray by the algal matting, the intention being that if the algal mat were blown loose from the ascending side of the screen—and if that removal should leave the ascending fish rails (and the fish within) undisturbed in the process—then the low pressure fish sprays (at FF on the descending side of the screen) might do their work as intended. In experiments with debris loading of the replicate device in the Houston flume, the relocated high-pressure jets removed embedded (or "stapled") filamentous algae as intended. In both the flume tests and the site tests, captive fish passed undisturbed through the high-pressure spray, but debris tests at Indian Point (on Royce version 2) were inconclusive, as no filamentous algae were present in the river during the testing period (August-October 1986). Although the articulated shielding device (L) fulfilled its function in the flume tests, its mechanical reliability, as currently designed, remains uncertain.

- 3. Inadequate width and shape of the fish collection sluice. Should the fish recovery system operate as intended, the fish spilled from the overturning screen rails are meant to slide or fall into a fish sluice at the rear of the device, and from there be carried by a common conduit back to the source waters. The fish sluice is supplied, at its farthermost end from the return conduit, with a stream of running water. Owing to the semicircular shape of the original sluice (H), the effective width of the stream was too narrow, irrespective of the speed of the stream flow. As observed during the initial field tests (of Royce version 1), the livlier fish would often spring loose from an overturning screen panel (at D) and sail over the fish sluice altogether or strike the far side of it, instead of falling directly into the sluice water as intended. As recommended, the manufacturer increased the width of the sluice and changed its shape from semicircular to rectangular (HH), thus increasing the effective width of the stream). The desired width was determined from filmed trajectories of falling fish.
- 4. Ill-positioned flap seal. As a part of the manufacturer's standard design, a panel of flexible material (G), called a flap seal, is affixed to the inward edge of the fish collection sluice and extends across the width of the screen. In its relaxed position, the flap seal is inclined upwards and it projects slightly into the path of travel of the downward moving panel rails (hence the "flap"). When correctly positioned, the flap seal is meant to prevent fish from dropping between the screen and the fish sluice. During the initial field tests (of Royce version 1), the flap seal had been relocated in a position that left a sizeable gap between the seal and the travelling panels, a positioning that allowed debris (and entangled fish) to pile atop it in heaps. Because debris is now removed from the screen panels at the front side of the machine (at JJ), little debris should reach the back side, so a standard flap seal (at GG) would probably perform as intended. Although the flap seal was effective in the flume tests, it was not tested in the field trials of the reconfigured machine. An alternate device, designed by Dr. Marcellus, had been installed in its place, but this alternate device interfered with the fall of fish to the collection sluice, so it was removed during the field tests. Even in the absence of any shielding device whatever, few fish fell into the gap between the screen and fish sluice, but the flap seal (or alternative device) should be installed and observed especially during winter months when the intake of filamentous algae is highest.
- 5. Shear-driven vortices in the fish rails. Underwater dye studies of the flow path lines around the manufacturer's standard fish rails (B, Figure 1) revealed longitudinal vortices along the lateral axes of the rails that were strong enough to impose orbital motions and consequential buffeting on the fish captured by the rails. The dye studies showed these vortices to be shear driven by the acceleration imparted to the main flow by the leading edges of the fish rails (see Figure 7, page 22). The redesigned fish rail (installed on Royce version 2) now has an elevated leading edge that creates a flow stall immediately behind the elevated portion, which provides a somewhat

sheltered region for captive fish. With this rail design (and the auxiliary rail screen discussed in the next item), swimming fish are now more actively caught by the ascending fish rails, and once caught the fish suffer less buffeting and damage.

6. Avoidance and escape of actively swimming fish. Fish and flow experiments on the standard fish rail revealed small proclivity on the part of actively swimming fish to remain sufficiently within the bounds of the ascending fish rails to be captured and raised from the water. The redesigned rail now has an auxiliary screen, 3 inches in height, attached to its leading edge. Swimming fish enter this new profile preferentially, and once within it they tend to remain (as opposed to repeated escape from the standard rails of Royce version 1). The increase in the removal rate of impounded fish is an important improvement, since the frequencies of imposed death and injury increase in proportion to entrapment time and repeated contact with the barrier screen.

On the reconfiguration and empirical evaluation of a prototype screening device at Indian Point unit 2.

SECTION 2.

Fish and flow experiments in the hydrodynamics flume

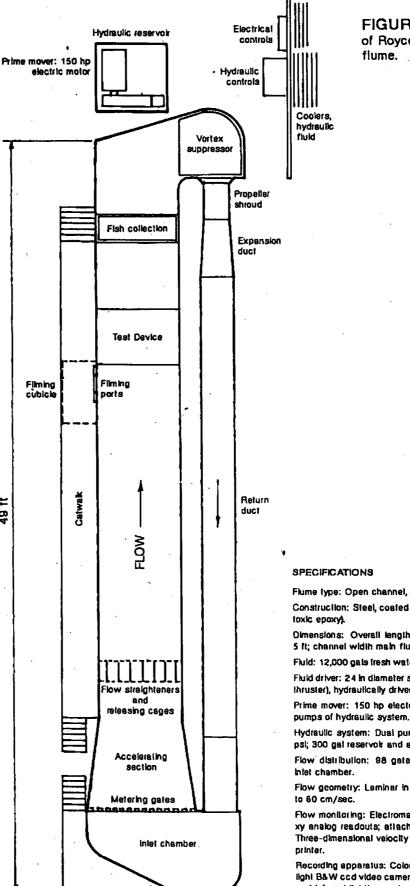
This section contains a description of the Royce hydrodynamics flume, together with some of the experimental findings that led to the redesigning of the fish catching rails.

Following HRFA's disapproval of the prototype screen as originally configured, the manufacturer constructed a replica of the machine in the hydrodynamics flume in Houston and reconfigured it after the recommendations reported in Fletcher (1985) (and reviewed in Section 1). As later reported to you in Fletcher (1986a and 1986b), I conducted flume experiments on those revisions, including underwater filming of debris loading and recovery of fish. The flow marking experiments on the fish rails and screen panels, however, are described more fully here than in previous reports.

With the exception of the design of the articulated debris shield (L on Figure 2) and a trial apparatus, favored by Dr. Marcellus, for replacing the flap seal (G), I believed the various modifications to have been sufficiently proven by this experimental work to merit a formal retesting of the screening system. A two-part testing program (on Royce version 2) was eventually carried out, the results of which are documented in other sections of this report.

A diagram of the Royce hydrodynamics flume is shown by Figure 3 (page 15), and the installation of the replicate screen is shown by the photographs on page 17. The overall length of the flume and inlet chamber is about 49 feet, and in its test section the flume is 7 feet wide with sides 5 feet high. For the experimental work on the replica, water depth was 4 feet. The system contains about 12,000 gallons of water, which is circulated by a 24 inch propeller (a bow thruster) located in the return ducting. The propeller will drive the flow at speeds to 60 cm/sec in the test section of the flume. More complete specifications of the flume and its apparatus are given in the caption to Figure 3. The flume is operated and maintained by Trent Gathright of the Royce Equipment Company. Although I designed the flume, Mr. Gathright directed its engineering and construction. He was also an active participant in the experimental work, more often as collaborator than assistant.

Continued on page 18



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FIGURE 3. Diagram of Royce hydrodynamics

Flume type: Open channel, recirculating.

Construction: Steel, coated with Carboline (a non-

Dimensions: Overall length 49 ft; channel depth 5 ft; channel width main flume 7 ft.

Fluid: 12,000 gals fresh water; continuous filtration.

Fluid driver: 24 in diameter shrouded propeller (bow thruster), hydrautically driven and controlled.

Prime mover: 150 hp electric motor connected to

Hydraulic system: Dual pumps, 100 gpm at 2000 psi; 300 gal reservoir and auxiliary coolers.

Flow distribution: 98 gated metering tubes from

Flow geometry: Laminar in test section at speeds

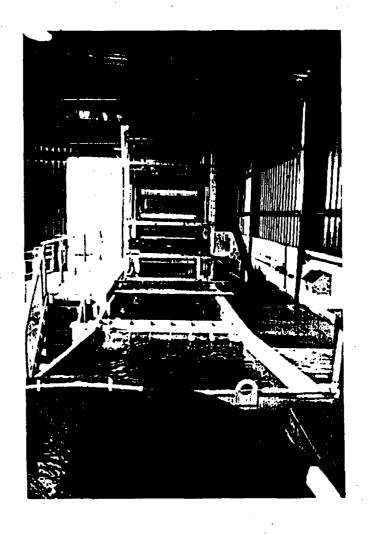
Flow monitoring: Electromagnetic flow meter with xy analog readouts; attached to digital converter. Three-dimensional velocity display on monitor and

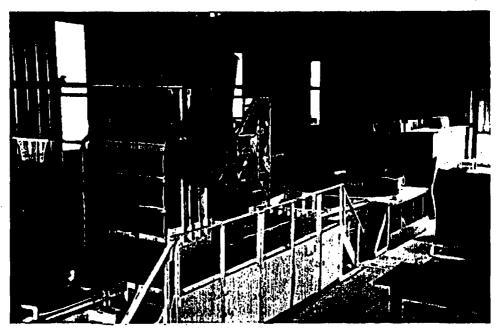
Recording apparatus: Color ccd video camera; low light B&W ccd video camera; 35mm camera. White and infrared lighting; underwater filming ports.

Figure 4 (facing).

Top: View of hydrodynamics flume looking downstream from inlet end. Circular structure in immediate foreground is one of two fish holding tanks on a platform above the flume. Flow straighteners can be seen in middle foreground. The surface disturbance visible in the photograph is owed to the discharge from an outlet pipe of the filtration system (at the left end of the flow straighteners). The filtration flow is usually turned off during experiments.

Bottom: Installation of the Indian Point replica. Except for the depth below the water surface and the width of the screen panelling, the replicate machine is identical to the prototype machine at Indian Point. The technician in the photograph (Mr. Gathright) is standing on the catwalk directly over the underwater filming cubicle.





Flow marking experiments.

The initial experimental work in the Houston flume, on the modifications eventually incorporated into the reconfigured machine, was undertaken, for the most part, over the period 2 December 1985 to 24 February 1986 (as reported in Fletcher 1986a and 1986b). The six major alterations addressed in that work are itemized in Section 1 (pages 10-13) of this report. Many of the underwater experiments were recorded on video tape or 35mm film (referenced in the data register, Appendix A). In this section, the topics of interest from that experimental work are the findings that led to the redesigning of the fish catching rails.

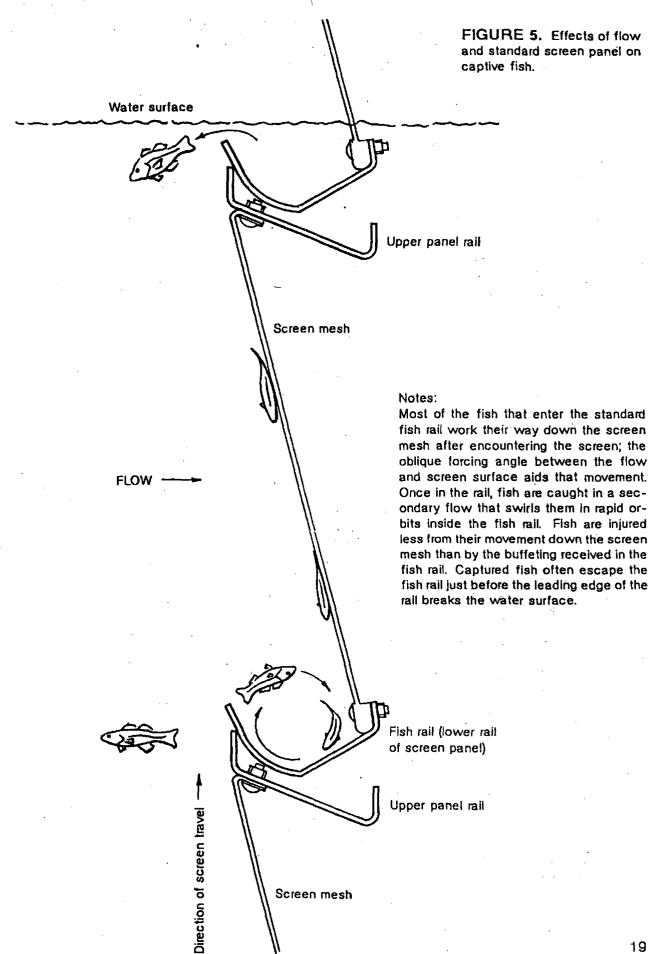
We commenced our underwater experiments by releasing fish upstream in the flume and observing their behavior as they were carried downstream to the screen. Most of the fish employed in these early experiments were juvenile shiners, Notemigonus crysoleucas, obtained locally. At the two water speeds employed in the experiments (30 and 45 cm/sec), fish behavior was similar, although the juvenile shiners, in not being strong swimmers, were less able to stem the flow at the higher flow speed. At both flow speeds, we discovered that actively swimming fish (those able to maintain station) were not readily caught by the (upward moving) fish rails.

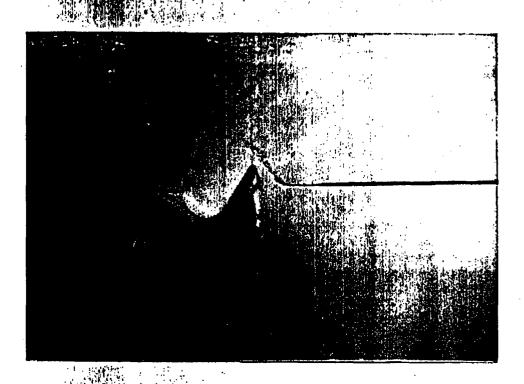
Virtually all of the test fish that entered the fish rails had worked their way down the inclined screen mesh (or were carried down the mesh by the oblique force of the water flow) after being flattened ("impinged") against the screen. Once in the vicinity of a fish rail, they were caught in a secondary flow, interior to the rail, that swirled them about in the manner depicted on Figure 5 (page 19). Fish captured in this fashion were injured less by their motions along the screen mesh (which, in the Royce device, has a smooth surface) than by the buffeting they received in the fish rails.

We also discovered that captured fish would often escape an ascending fish rail just before the leading edge of the rail broke the surface, as indicated on Figure 5. Apparently, the fish were able to sense their nearness to the water surface and reacted to it by darting out from the rail confines into deeper water.

As a means for examining the flow geometry at the screen panels and rails, we constructed dye releasing apparatus and established flow profiles of the Royce standard screen panel, the Ristroph panel of another manufacturer, and several trial shapes of our own devising. For each profile, we released the dye (potassium permanganate) on 1 cm vertical intervals, just upstream of the subject, and photographed each dye release (40 to 50 per profile). Figure 6 on page 20 shows two such dye tracings. From these photographic records, we assembled complete flow profiles of the panel sections (as in Figure 7 on page 22).

Continued on page 21





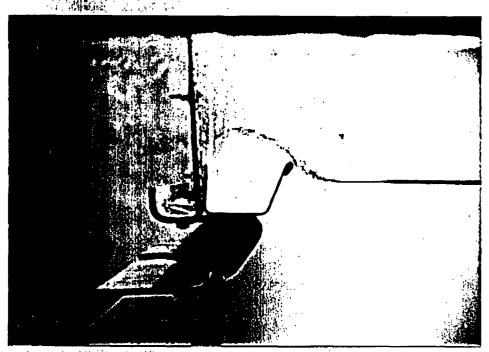


Figure 6. Top: Typical dye marking of a flow pathline, screen panel of Royce version 1. Bottom: Typical dye marking of a flow pathline, standard Ristroph panel, as manufactured by the Rexnord Company. A complete profile of flow pathlines consisted of similar dye releases at vertical intervals spaced 1 cm apart.

As illustrated by Figure 7 (page 22), the dye studies of the Royce standard screen panel revealed the cause of the rapid orbiting of the fish caught in a fish rail. The water interior to the rail was being shear driven, by the main flow through the screening, in the form of an independent, longitudinal vortex of such strength that test fish were not able to maintain a stable position within the rail. In consequence of these imposed swirling motions, captive fish were often injured by repeated contact with the screen structure at the rear interior of the fish rail.

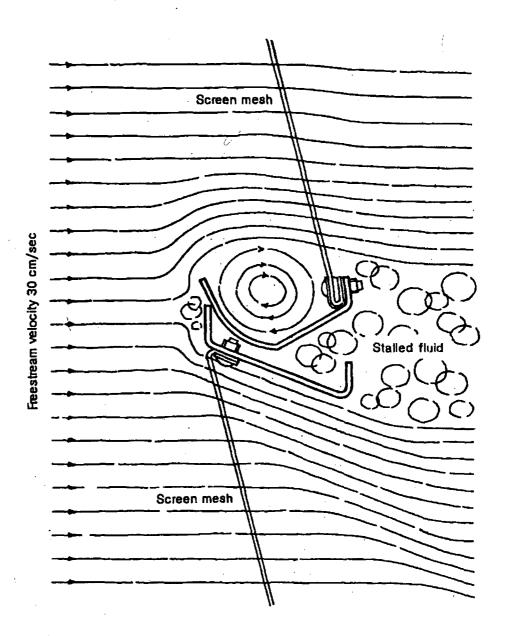
The independence of the rail vortex was evident from the long (and visible) duration of dyed fluid spinning within the rail following shut off of the dye supply. The fading in color of the dyed vortex was also an indication of the rate of turbulent exchange between the main flow and the captive rail water.

Because the fish rail is also a structural member of the screen panel, the latitude allowed us in reshaping the rail was somewhat restricted, but I believed the vortex could be eliminated by replacing it with a flow stall immediately ahead of the rail (or, more precisely, ahead of its back wall). I hoped to bring about that alteration in flow geometry by recurving the rail profile, by lowering its leading edge, and, to prevent the escape of captured fish, by affixing a low auxiliary screen to the leading edge. We did some initial studies on rail shaping, but that developmental work was not completed in the time alloted to us. Instead, Mr. Gathright employed the alternate strategem of merely elevating the leading edge of the standard rail, which is now the rail shape of the reconfigured machine (Figure 2).

As shown on Figure 8 (page 23), the elevated leading edge of the modified rail trips the main flow, and the resulting turbulence immediately behind the front wall of the rail provides a somewhat sheltered region for captured fish. The diminished vortex at the rear of the rail imposes less disturbance to the fish than the vortex of the unmodified rail. The auxiliary screen proposed for the leading edge of the modified rail was retained, but the screening is made from expanded metal (with diamond shaped perforations) instead of wire mesh, apparently for ease of construction. The perforations are large in comparison to the mesh size of the screen panels, but in tests with fish small enough to fit through the perforations of the auxiliary screen, the numbers of fish escaping the rails in that manner were insignificant.

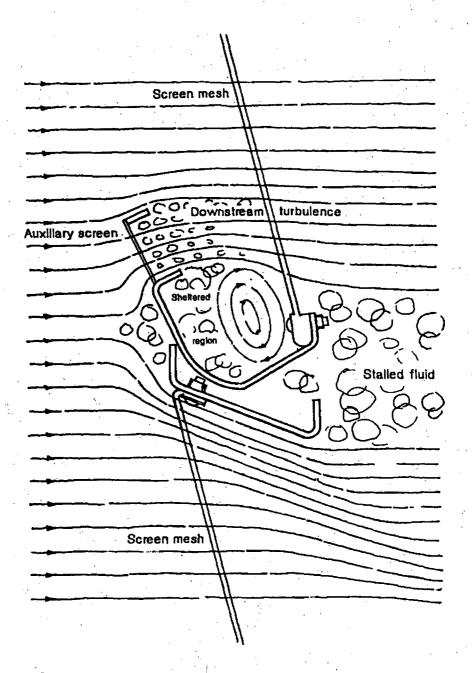
The auxiliary screen creates a downstream turbulence apparently favorable to fish capture. In experiments with shiners, and later, in the flume tests with white perch from the Hudson, many of the fish that moved into the vicinity of the rails were observed to dive, preferentially, behind the auxiliary screen and into the rail (and remaining there), as opposed to the active avoidance reactions of fish swimming freely in the accelerated flow above the unmodified rails of Royce version 1.

FIGURE 7. Flow profile of Royce standard screen panel and rails.



Notes:

Composite pattern of flow pathlines reconstructed from photographed dye releases spaced at 1 cm vertical intervals. The flow geometry surrounding the adjoining panel rails was similar at the (upstream) test speeds of 30 and 45 cm/sec, although the angular velocity of the captive vortex in the fish rail was greater at the higher fluid speed. The rail vortex is independent of the flow through the screen mesh, except for turbulent exchange across the (shearing) boundary between the two.



Notes:

Composite geometry of flow pathlines reconstructed from photographed dye releases spaced at 1 cm vertical intervals. Elevated leading edge of the fish rail alters the flow geometry by moving the rail vortex rearwards, thus creating a region of stalled, captive fluid where fish are able to maintain swimming equilibrium. Once captured, fish are prevented from escaping the (upward moving) rail by the auxiliary screen. Freely swimming fish do not avoid the turbulent entry behind the auxiliary screen and its supporting bar as consistently as they avoid the accelerated flow over the standard fish rail (Figure 7).

On the reconfiguration and empirical evaluation of a prototype screening device at Indian Point unit 2.

SECTION 3.

Flume tests, final testing program, Royce version 2.

Sections 3 and 4 of this report contain the results of the final, two-part program of tests on the fish conserving properties of Royce version 2, the reconfigured prototype screen. These results are evaluated in Section 5 by comparing them to the field and flume observations of Royce version 1 and to the results from the testing by Consolidated Edison of version 1 (Con Ed 1985). The requirements of the testing program for Royce version 2 were given in Fletcher (1986c); for convenience of reference the test flume portion is outlined below. The flume tests were carried out over the periods 15–18 July and 12–15 August 1986 by myself, Mr. Gathright, and assistants from the Royce Equipment Company.

Outline of required tests, Royce hydrodynamics flume.

A. Underwater system

- 1. Documentation, by underwater filming and quantitative measures, of events associated with capture and avoidance:
 - a. Water speeds: 30 cm/sec and 45 cm/sec.
 - b. Species: local shiners; juvenile white perch and striped bass from Hudson River.
 - c. Sample sizes: Upstream release of 20 to 50 fish, each sample, for underwater filming at moving screen; 3 or more replicates, each set of experimental variables.
 - d. Environmental records: Temperatures and chemical properties of water in holding tanks and flume.
 - e. Temporal records: Holding times; re-use of samples. Camera clock for flume experiments.
- 2. Report of results.
 - a. Register of experiments and experimental variables.
 - b. Sythesis of experimenters' descriptive observations.
 - c. Calculations of capture probabilities.
- B. Above-water system
 - 1. Contemporary observations and quantitative measures of events:
 - a. Examinations of [items 1-4, pages 10-12 of this report].
 - 2. Report of results.
 - a. Register of experiments and experimental variables.
 - b. Compilation of data and synthesis of experimenters' descriptive observations.

Instrumentation employed in flume tests:

Cole Parmer model 5983 pH meter.

Fisher Scientific model 152 conductivity meter.

Marsh McBirney model 511M electromagnetic current meter.

Aquarist #35100 ammonia test kit.

Stem thermometers.

Panasonic model WV-3230 ccd color video camera.

Chugai model BS-704R high resolution B&W video camera.

Canon model AE-1 35mm camera.

Flume underwater tests

The measurement of importance from the flume underwater tests is the empirical probability that a fish, released upstream, will be captured and removed from the water on its first contact with the screening device.

16-17 July 1986

Species: Notemigonus crysoleucas, 11.0 cm mean fork length.

Water of origin (fish farm): pH 6.95, temperature 24°C.

Holding tank: pH 8.3, temperature 24°C.

Flume water: 3 days residence before tests, continuously filtered and circulated; pH 8.1, temperature 26°C, conductivity $1.5 \times 10^{3} \mu \text{mho/cm}$ (distilled water 64 $\mu \text{mho/cm}$).

Experimenters: I. Fletcher, T. Gathright, R. Ewbank, C. Sunley. Fish samples released 15 feet upstream of travelling water screen; low light levels (covered flume); fish behavior at screen front recorded on video tape with the Chugai BS-704R ccd through underwater filming port; dark camera cubicle. The following results were extracted from the tapes.

| Trial No. | Sample sise | Water speed cm/s | Total fish observed | Lost from view | Escaped screen | Caught on contact |
|--------------|----------------|------------------------|---------------------------|----------------------|-------------------|-------------------------|
| 1 | 20 | 30 | 10 | 1 | 1 | 8 |
| 2 | 20 | 30 | 16 | 7 | 5 | 4 |
| 3 | 20 | 30 - | 8 | 2 | 1 | 5 |
| .4 | 50 | 30 | 18 | 6 | 1 | 11 |
| 5 | 50 | 30 | 19 | 5 | 8 | 6 |
| 6 | 40 | 30 | 19 | 5 | 8 | 6 |
| | | | 80 | 26 | 24 | 40 |

18 July 1986

Species: Notemigonus crysoleucas, 6.5 cm mean fork length.

Water of origin (fish farm): pH 6.95, temperature 24°C.

Holding tank: pH 8.1, temperature 31°C.

Flume water: 5 days residence time before tests, continuously filtered;

pH 8.1, temperature 31°C, conductivity $1.5 \times 10^3 \,\mu \text{mho/cm}$.

Experimenters: T. Gathright, R. Ewbank, C. Sunley.

Fish samples released 15 feet upstream of travelling screen; low light levels (covered flume); fish behavior at screen front recorded on video tape with the Chugai BS-704R ccd through underwater filming port; dark camera cubicle. The following results (overleaf) were extracted from the tapes.

| Trial No. | Sample size | Water speed cm/s | Total fish observed | Lost from view | Escaped screen | Caught on contact |
|--------------|----------------|------------------------|---------------------------|----------------------|----------------|-------------------------|
| 1 | 20 | 30 | 11 | 0 | ¹ 1 | 10 |
| 2 | 20 | 45 | 15 | 0 | 0 | 15 |
| 3 | 20 | 45 | 18 | 3 | 2 | 13 |
| 4 | 20 | 45 | 19 | 3_ | 2_ | 14 |
| | | | 63 | <u>-6</u> | 5 | 52 |

12 August 1986

White perch juveniles from the Hudson River and striped bass juveniles from the Verplankt hatchery shipped by air to Houston. Of 750 fish in six containers, approximately one-third survived in a condition suitable for use in the flume tests. The pH of the water in the shipping containers measured 7.0; ammonia levels were off scale. Conductivity of the water of origin reported to be $500 \,\mu\text{mho/cm}$, but since 5 per mille salt had been added to the container water, we did not test its conductivity. As the fish were red in the gills and sluggish, we transferred them as quickly as possible to the (two) holding tanks (which were fitted with O_2 bubblers), but we first lowered the pH of the tank water from 8.2 to 7.5 in one tank with sodium bisulfate, and to 7.8 in the other with hydrochloric acid. The temperatures of both the container water and the tank water were 28°C .

13 August 1986

Species: Morone americana, 5.0 cm mean fork length.

Holding tank: pH 7.5, temperature 28°C.

Flume water: 3 weeks residence time, continuously filtered and aerated; pH 8.2, temperature 28°C, conductivity 1500 μ mho/cm.

Experimenters: I. Fletcher, T. Gathright, R. Ewbank.

Fish samples released 15 feet upstream of travelling screen; low light levels (covered flume); fish behavior recorded on video tape with the Chugai BS-704R ccd through underwater filming port; dark camera cubicle. The following results were extracted from the tapes.

| Trial No. | Sample sise | Water speed cm/s | Total fish observed | Lost from view | Escaped screen | Caught on contact |
|--------------|----------------|------------------------|---------------------------|----------------------|-------------------|-------------------------|
| 1 ' | 25 | 30 | • | | | |
| 2 | 25 | 30 | 10 | 5 | 1 | 4 |
| 3 | 25 | 30 | 14 | 6 | 3 | 5 |
| 4 | 25 | 30 | 11 | 2 | 1 | 8 |
| 5 | 25 | 45 | 6** | 1 | 1 | 4 |
| 6 | 25 | 45 | 5** | 3 | 0 | 2 |
| 7 | 25 | 45 | 7 | 2 | 1 | 4 |
| 8 | 25 | 45 | 7_ | 4 | _1_ | 2 |
| | | . ' | 60 | 23 | 8 | 29 |

^{*}Trial terminated after release of fish; screen not operating. Fish in this sample drifted with the flow in a tight group to the screen face, then scattered. Two of about 15 at the screen front were impinged; 3 or 4 darted downwards into a fish rail and remained there; 4 darted forward after contacting the screen; the remainder were lost from view.

** 10 to 15 fish of the sample were drawn to the screen along the bottom of the flume and could not be accounted for with any accuracy.

14 August 1986

Species: Morone sazatilis, 7.1 cm mean fork length.

Holding tank: pH 7.8, temperature 28°C.

Flume water: three weeks residence time prior to tests, continuously filtered and aerated; pH 8.2, temperature 28°C, conductivity 1500 µmho/cm.

Experimenters: I. Fletcher, T. Gathright, R. Ewbank.

Fish samples released 15 feet upstream of travelling screen, except as noted; covered flume, low light levels except as noted; fish behavior at screen front recorded on video tape with the Chugai BS-704R ccd through underwater filming port; dark camera cubicle.

| Trial No. | Sample size | Water speed cm/s | Total fish observed | Lost from view | Escaped screen | Caught on contact |
|--------------|----------------|------------------------|---------------------------|----------------------|----------------|-------------------------|
| 1 | 25 | 30 | • | | | |
| 2 | 25 | 30 | , 3 | 0 | 2 | 1 |
| 3 | 25 | 45 | 10 | 2 | _1_ | <u>7</u> . |
| | | | 13 | 2 | 3 | 8 |

* Trial terminated. Experimenter reported (orally, on tape) that all the fish went immediately to the bottom upstream and remained there, apparently because a light had been left on in the flume.

In none of the tests with striped bass did fish of a released sample reach the screen in quantity. In experiment 2, no fish appeared at the screen within 3 minutes of release; the flume was then made totally dark for 30 seconds, but the fish remained upstream. After an hour of observation, only three fish had come into view at the screenfront. In experiment 3, fish were released in a dark flume; the low-level lighting was turned on 1 minute after release. Although the fish had moved farther along the flume bottom than usual, they still tended to keep station upstream of the screen. During an hour of observation, ten fish came into view at the screenfront.

15 August 1986

Species: Morone sazatilis, 7.1 cm mean fork length.

Holding tank: pH 7.8, temperature 29°C.

Flume water: three weeks residence time prior to tests, continuously filtered and aerated; pH 8.2, temperature 29°C, conductivity 1500 μ mho/cm.

Experimenters: T. Gathright, R. Ewbank.

Fish samples released 15 feet upstream of travelling screen, except as noted; covered flume, low light levels; fish behavior at screen front recorded on video tape with the Chugai BS-704R ccd through underwater filming port; dark camera cubicle. The following results were extracted from the tapes.

| Trial No. | Sample sise | Water speed cm/s | Total fish observed | Lost from view | Escaped screen | Caught on contact |
|--------------|----------------|------------------------|---------------------------|----------------------|-------------------|-------------------------|
| 1 | 25 | 45 | 1 | 0 | 1 | 0 |
| 2 | 25 | 45 | . 2 | 0 | 1 | 1 |
| 3 | 25 | 45 | 2 | 0 | 0 | 2 |
| 4 | 25 | 45 | 6 | 0 | 0 | 6 |
| 5 | 25 | 45 | 8_ | 0 | 2 | 6_ |
| | | | 19 | 0 | 4 | 15 |
| | | | | | | |

(Footnote overleaf)

In trials 1, 2, 3, and 4, released fish went immediately to the bottom of the flume and kept station 6 to 8 feet upstream of the travelling screen. In trial 3, after 10 minutes into the experiment, the flume was darkened for 2 minutes, but the fish did not move any closer to the screen. After 30 minutes, two fish had come into view. In trial 4, of the six fish recovered, four were dead. In trial 5, the fish were released 4 feet upstream of the screen. The fish came suddenly into view at the screen front; six entered fish rails. Two of the six escaped before the rails ascended to the water surface. The remainder of the sample darted upstream and again kept station at the bottom of the flume.

Summary, flume underwater tests and experiments. On the question of conserving fishlife with a barrier device that operates on the principle of direct contact with the entrapped fish, impingement is inevitable, and what matters is the effectiveness of the fish-catching apparatus in removing the entrapped (and impinged) fish quickly and with little added harm. As revealed by the flume experiments of December 1985-February 1986, freely swimming fish were not readily captured (or retained) by the fish rails of screen version 1. We also determined from those experiments that test fish were injured less from impingement (from being flattened against the screen mesh) than from the buffeting imposed on the captured fish by the vortex action in the fish rails (Figure 5). The low rate of impingement injury is apparently owed to the smooth surface of the (Smooth-Tex) brand of screening mesh employed by Royce, as opposed to the more abrasive surface of standard wire mesh. Also, the oblique forcing angle between the inflow and the inclined surface of the Royce screen panel tends to move a struggling, impinged fish down the panel towards the fish rail, whereas in the more standard Ristroph design (Figure 6, bottom), the flow is normal to the surface of the screen panel and tends to hold the impinged fish in place.

Two alterations to the Royce fish rail were incorporated into the design of the reconfigured machine: the elevation of the fish rail's leading edge and the addition of the auxiliary screen (Figure 8). As determined from the flow and fish experiments discussed in Section 2, the modified rail profile reduced the vortex buffeting of captured fish. As determined from the tests reported in this section, the modified rails increased the likelihood of capture and retention of a fish on its first encounter with the device.

In the experiments on the standard (version 1) rails with juvenile shiners, virtually all the fish captured by the rails had first been impinged. Fish able to swim against the flow actively avoided the rail openings, and impinged fish that entered an ascending rail often escaped the rail before it cleared the water surface. In the testing of the reconfigured rails (reported in this section), 62% of the larger shiners were captured and retained on first encounter (of those fish that encountered the screen). In the tests with the smaller shiners, which were less able to stem the flow, 91% were captured and retained on first encounter, but most of these smaller fish, being weaker swimmers, were impinged before capture. These proportions were identical at both the water speeds employed (30 and 45 cm/s).

In the tests with Hudson River white perch, 77% were caught and

retained on first encounter at the 30 cm/s water speed, while 80% were caught and retained on first encounter at the 45 cm/s water speed. The two proportions are statistically indistiguishable, as the 3% difference between them is well within the bounds of uncertainty. At both water speeds, many of the white perch were impinged before capture. The high impingement rates of both the white perch and the shiners is a consequence of the inability of the fish to keep station ahead of the screen, and not inconsistent with the recovery rates of weak swimmers in the field tests.

In the tests with the hatchery striped bass, 76% were caught and retained on first encounter (test speeds combined), most of which were freely swimming fish. Although few were impinged before capture, few of the released fish encountered the screen during the observations. The striped bass results should be viewed as inconclusive, owing to behavior probably not representative of striped bass behavior in the plant intake bays. The recovery rates of striped bass in the test flume were not consistent with the recovery rates of striped bass samples introduced into the test bay at Indian Point (a topic of Section 4).

Above water tests

Of the several modifications enumerated in Section 1 (pages 10-13) and incorporated into the modified machine, the above water flume tests were meant to produce information, under controllable conditions, on those items that influence the transport of captured fish from the upstream side of the machine to the fish sluice at the downstream side.

17 July 1986

Test: effectiveness of relocated, outside fish spray (EE of Figure 2) in freeing fish from overturning rail; see item 1, page 10.

Test species: Notemigonus crysoleucas, 6.5 and 11.0 cm mean fork lengths.

Experimenters: I. Fletcher, T. Gathright, R. Ewbank.

Each sample loaded into water-filled fish rail on upstream side of machine. Screen then activated until loaded rail had passed over the driver sprocket and through the outside spray wash.

| Trial No. | Sample sise | Fish state | Not freed |
|--------------|----------------|---------------|--------------|
| . 1 | 10 | live . | ` o |
| 2 | 10 | live | 0. |
| 3 | 10 | / live | 0 |
| 4 | 10 | moribund | 0 |
| 5 | 10 | moribund | 0 |

During these trials we noted the interference of a debris shield (location GG of Figure 2) with the trajectories of fish as they fell from the overturning screen panel to the collection sluice (events recorded on video tape). The manufacturer had substituted this shield (a suspended, swinging device made of a rigid plastic material) for the standard, flexible flap seal of screen version 1 (G of Figure 1). Because a large proportion of the fish in these tests struck the blade of the shield when falling from the overturning screen panels, we removed the shield altogether for the remainder of the above water tests.

Test: trajectories of falling fish, and reception of fish by collection sluice (HH of Figure 2); see item 3, page 12. No flap seal.

Species: Notemigonus crysoleucas, 6.5 and 11.0 cm mean fork lengths. Experimenters: I. Fletcher, T. Gathright, R. Ewbank.

Each sample loaded into water-filled fish rail on upstream side of machine. Screen then activated until loaded rail had passed over the driver sprocket and past the fish collection sluice. In this test, numbers "misdirected" are fish that struck the inner sluice edge or fell between the sluice and the travelling screen—fish that failed to fall directly into the sluice as intended.

| Ttial No. | Fish sprays | Sample sise | Mis- directed | Trial No. | Fish sprays | Sample size | Mis- directed |
|--------------|----------------|----------------|------------------|--------------|----------------|-------------|------------------|
| 1 | off | 10 | . 4 | 11 | on . | 10 | 1 |
| 2 | off | . 10 | 1 | 12 | on | . 10 | 0 |
| 3 | off | 10 | 2 | 13 | on | 10 | 2 |
| 4 | off | - 10 | 1 | 14 | on | 10 | . 0 |
| 5 | off | 10 | 2 | 15 | on | 10 | 3 |
| 8 | off | 10 | 4 | 16 | оп | 10 | 2 |
| 7. | off | 10 | 1 6 | 17 | on | 10 | 1 |
| 8 - | off | 10 | 3 | | | 70 | 9 |
| 9 | off | 10 | 3 | | | | • |
| 10 | off | 10 | 2 | , | | | |
| | | 100 | 23 | | | | |

17-18 July 1986

Test: passage of fish rail through high-pressure debris spray (JJ of Figure 2). No debris shield (L).

Species: Notemigonus crysoleucas, 6.5 and 11.0 cm mean fork lengths. Spraywash pressure: 105 psi.

Experimenters: T. Gathright, R. Ewbank, C. Sunley.

Samples of ten fish loaded into each of two water-filled fish rails just above water surface on upstream side of machine. Travelling screen activated until loaded rails had passed through debris spray. Screen halted, spray shut off, rails examined for missing fish and for fish exhibiting apparent trauma (such as erratic swimming). Missing fish replaced, travelling screen then reversed and rails lowered to initial position above water surface. Spray turned on, described routine repeated ten times (20 rail replicates).

| Trial No. | Sample size | Escaped or missing | Apparent trauma |
|--------------|----------------|--------------------|-----------------|
| 1 - | 20 | 0 | none |
| 2 | 20 | 0 | none . |
| 3 | 20 | · ` 0 | none |
| 4* | 20 | 0 | none |
| 5 | 20 | 0 | none |
| 6 | 20 | 0 | none |
| 7 | 20 | 1 | none |
| 8 | 20 | 0. | none |
| 9 | 20 | 0 | none |
| 10 | 20 | <u>o</u> | |
| | 200 | 1 | |

^{*}Last trial on 17 July; test fish left in fish rails overnight; trials resumed 18 July, fish upright and swimming vigorously in rails; none replaced.
**See following tabulation (overleaf).

Individual examination of the 20 test fish at conclusion:

1. 1-2 scales missing. 2. 8-12 scales missing. 3. 6-8 scales missing. 4. 10-15 scales missing. 5. 6-8 scales missing. 6. 1-2 scales missing. 7. 3-4 scales missing. 8. No visible injury. 9. No visible injury. 10. 3-4 scales missing. 11. 1 scale missing. 12. 2-3 scales missing. 13, 2-3 scales missing. 20-25 scales missing one side. 15. 6-8 scales missing. 16. No visible injury. 17. 4-5 scales missing. 18. No visible injury. 19. 1-2 scales missing. 20. 10-12 scales missing.

Summary, above-water tests and experiments. The above-water modifications incorporated into the prototype machine at Indian Point were brought about, for the most part, by a fundamental reordering of its debris removal and fish recovery systems (as discussed in Section 1). Screen version 1 had been designed with the intent of removing the captive fish before removing the captive debris (Figure 1); those removals are reversed in version 2 (Figure 2).

As a screen panel rises from the water on the upstream side of the reconfigured machine, it passes first through a high-pressure debris spray (JJ on Figure 2). The spray is prevented from blowing into the bottom rail (the fish rail) of the panel by a deflector now affixed to the spray side of each rail. If the deflector functions as intended, the spray jets blow water through the mesh of the screen panel but leave the rail water and captured fish undisturbed. From the testing evidence (page 30), the deflectors function as intended. Fish damage was limited to descaling, most of it minor, and at least some believed to be a consequence of handling.

We did not load the screen panels with debris during these tests, so the sliding debris shield (L of Figure 2) was not tested. This shielding function will be critical during winter and spring months in the Hudson, owing to the expected burdens of filamentous algae like those that prevented the fish-conserving apparatus of screen version 1 from functioning as intended. As reported in Section 4, the debris shield has not yet been tested on site, since the field testing of screen version 2 was completed during months when the winter algae were nearly absent from the river.

We discovered the need for rail shielding during the design and experimental phase of the flume work (December 1985-February 1986). We loaded the screen panels of the replicate machine with a filamentous pond alga by merely dumping it into the upstream end of the flume and running the machine until the alga had travelled downstream and covered several

panels. The pond alga, which was similar to the winter algae of the Hudson, at least in its physical nature, was stapled firmly into the screen mesh by the force of the water flow and formed a cohesive matrix over each screen panel like the matting observed during the winter testing of prototype version 1 at Indian Point (Con Ed 1985). As we learned from our flume experiments, the high-pressure debris spray does not blow the stapled algal matrix clear of the screen mesh, but peels it downward instead, as the panel ascends through the spray. The lower panel rail (the fish rail), if unprotected, receives the whole of the algal mat, which displaces the rail water. The captured fish, if not otherwise washed out of the rail, become entangled in the algal mat, and the resulting mixture of fish and debris is carried over the driver sprocket and dumped into the fish sluice at the downstream side of the machine.

Both Mr. Gathright and I designed articulated debris shields, Gathright's a sliding device and mine a four-pin pivoting device. As Gathright's device, although unrefined, seemed to fulfill its intended function, mine was not constructed. The manufacturer adopted the Gathright design for screen version 2; the device has since been revised owing to some mechanical failings. Irrespective of the ultimate form of the front debris shield, it must be reliable enough to withstand continuous operation during the months of high algae intake at Indian Point.

Once through the high pressure spray, the screen panel travels over the driver sprocket of the machine and overturns. The captured fish are then meant to slide or fall from the inverted rail to a fish sluice. During the Con Ed field tests of screen version 1, some fish remained in the overturned rails, apparently stuck fast to the metal surfaces of the rails. In our flume tests of the repositioned fish spray (page 29), all test fish were freed from the overturning rails. But during these tests we noted the interference of a rear shielding device with the trajectories of fish as they fell from the overturning screen panels. The manufacturer had substituted this shield (a suspended, swinging device made of rigid PVC material) for the standard flap seal of screen version 1 (G of Figure 1). We removed the shield for the remainder of the above-water tests.

The fish released from the overturning rails are meant to fall directly into the flowing water of the fish sluice. During the field tests of screen version 1, lively fish were observed to spring away from the overturning panels and sail completely over the fish sluice or strike its far side. For screen version 2, the sluice was reshaped and widened. Our flume tests of fish trajectories (page 30) showed the reconfigured sluice to be adequate in width, at least for the species tested. None of the test fish trajectories reached the far side of the sluice. Some fish fell between the screen and the inner edge of the sluice, however, owing to the absence of the flap seal (location GG of Figure 2). For the sake of clear filming of fish trajectories, we ran 10 trials with the fish sprays off. With the sprays operating, fewer fish fell between the screen and sluice, but a flap seal that does not project into the paths of falling fish should be devised and tested.

On the reconfiguration and empirical evaluation of a prototype screening device at Indian Point unit 2.

SECTION 4.

Site tests, final testing program, Royce version 2.

The requirements of the testing program for Royce version 2 were given in Fletcher (1986c); for convenience of reference the site testing portion is outlined below. The Con Ed work scope for the testing program is reproduced in Appendix C. The site tests were carried out over the period August-October 1986 by Normandeau Associates, and Kenneth Marcellus was senior project biologist for Consolidated Edison. I observed the site testing routines at Indian Point on 26-27 August, 5 September, and 9-10 September. Some of those routines were recorded on video tape.

Outline of required tests, Indian Point test site

A. Above-water system

- 1. Contemporary observations, descriptive records and quantitative measures of events.
 - a. Transport of fish samples through high-pressure spraywash, with and without debris loading of screen; samples introduced into fish rails between water surface and debris wash; fractions lost and fractions injured.
 - b. Recovery of samples at fish sluice, with and without debris loading of screen; samples introduced (or tallied) at station between debris wash and upper driver sprockets of machine; fractions lost and fractions injured.
 - c. Examination and monitoring of items 1-4 under "Components of special interest" [see pages 10-12, this report].
- 2. Report of results.
 - a. Register of experiments and experimental variables.
 - b. Sythesis of experimenters' descriptive observations.
 - c. Compilation of data from experiments, and calculations of expectations of success, items A.1.a and A.1.b.
- B. Recovery of impounded fish, known samples
 - 1. Documentation of capture probabilities and expectations of trauma.
 - a. Species: juvenile white perch and striped bass; other species of convenience.
 - b. Sample sizes: release of marked (or entrapped) samples in fore-bay, in sets of 100 or more; 2 or more replicates each species; collection of recoveries at fish sluice on logarithmic time intervals (see attachment); recovered fish examined immediately for injuries (death, damaged integuments, bleeding, avulsions, and abnormal swimming); fish not exhibiting observable trauma on collection to be held 8 hours and examined for latent mortality.

- c. Environmental records: Intake water speeds; water temperatures; time of day and tide on release of sample; cycling speed of machine.
- 2. Report of results
 - a. Register of experiments and experimental variables.
 - b. Synthesis of experimenter's descriptive observations.
 - c. Compilation of data; calculations of capture expectations and empirical probabilities of injury, each test species.
- C. Opportunistic collections of impounded fish
 - 1. Contemporary observations; descriptive records and quantitative measures of events.
 - a. Collection of impounded, indigenous species; counts and identifications on collection (same observational protocols as item B.1.b).
 - 2. Report of results.
 - a. Register of collections and experimental variables.
 - b. Compilation of data and observational results (rates of capture, fractions injured).
- D. Sampling intervals, recovery of marked (impounded) fish:

Because of the nonexistence of field data on capture expectations for the prototype machine (or any similar device), sampling intervals corresponding to items B.1.b will have to be adjusted in the field on the basis of trial results. The initial trial recommended here [36 hours, 12 samples] is a best guess from test flume experiments. In any case, calculate all sampling schedules for recovery of marked (or impounded) releases by the following formulae (which, on the expectation of random encounter by freely swimming fish and active capture by the fish rails, will reduce uncertainty in the estimates of capture probabilities):

Duration of experiment: TNumber of observations: nSampling index: $j=1,2,\ldots,n$ Sampling times: $t_j=t_1,t_2,\ldots,t_n$ $(t_1=0,\,t_n=T)$ Intervals: $\Delta t_j=t_{j+1}-t_j$ Scaling factor δ (resolved by iteration)

In general:

$$j = \frac{\ln(t+\delta)}{\ln \delta},$$

$$T = \delta^n - \delta,$$

$$t_j = e^{j \ln \delta} - \delta.$$

The first collection $(j = 1 \text{ at } t_1 = 0)$ after release of the sample should be taken on the first appearance of any individuals from the sample, which will depend on the (unknown) fishing success of the machine and its cycling rate. Sampling intervals will depend on the rate of fishing.

Above-water site tests.

Of the several modifications incorporated into the reconfigured machine, the above-water site tests were meant to produce information, under operating conditions, on the adequacies of the modifications that influence the transport of captured fish from the upstream side of the machine to the fish sluice at the downstream side. The purposes of the modifications are described in items 1-4, pages 10-12 of Section 1, and the tests are similar in their intents to the corresponding above-water flume tests reported in Section 3. The site tests were supervised by James Reichle of Normandeau Associates.

Passage of fish rail through high-pressure debris spray.

These tests were conducted three times in August 1986 (two of which I observed). The striped bass juveniles employed on one day were hatchery fish; the remaining test species had been captured from the intake bay by the machine itself. At the start of a trial, the fish sample was loaded into a fish rail above the water surface on the upstream side of the machine. The travelling screen was then activated until the loaded rail had passed through the debris spray (JJ of Figure 2). The screen was halted, the spray shut off, andthe rail examined for missing and injured fish.

Test date: 5 August 1986. Spraywash pressure: 80 psi. Screen travelling speed: 10 fpm. River water temperature: 27°C.

Conductivity of river water; 3200 μ mho/cm.

| Trial No. | Test species | Mean length | Sample sise | Escaped or missing | Damaged |
|--------------|-----------------|----------------|----------------|--------------------|---------|
| 1 | Tomcod | 9 cm | 20 | Ο, | 0 |
| 2 | Tomcod | | 17 | 0 | 0 |
| 3 | Tomcod | | - 14 | 0 | 0 |
| 4 | Tomcod | | 12 | 0 | 0 |
| 5 | Tomcod | | 11 | 0 | 0 |
| 6 | Bay anchovy | 8 cm | 10 | 0 | 0 |
| 7 | Bay anchovy | | 9 | 0 | 1 a |
| 8 | Bay anchovy | | 9 | 0 | 3 љ |
| 9 | White perch | 7 cm | 20 | 1 | 0 |
| 10 | White perch | | 20 | 0 | 0 |
| 11 | White perch | | 20 | 0 | 0 |
| 12 | White perch | | 20 | 0 | 0 |
| 13 | White perch | | 20 | 0 | 0 |
| 14 | White perch | | 20 | 0 | 3 а |
| 15 | White perch | | 20 | 0 | 0 |
| 16 | White perch | | 20 | .0 | 0 |
| 17 | White perch | | 20 | 0 | 0 |
| 18 | White perch | | 20 · | 0 | 0 |
| 19 | Amer. shad | 11 cm | 20 | 0 | 2 a |
| 20 | Amer, shad | | 20 | 0 | 2 a |
| 21 | Amer. shad | | 20 | 0 | 6 a, b |
| 22 | Amer. shad | | 20 | 0 | 9 a,b |
| - - | | | 382 | 1 | 26 |

a Stunned; b Missing scales.

Test date: 26 August 1986. Spraywash pressure: 90 psi. Screen travelling speed: 11 fpm. River water temperature: 27°C.

Conductivity of river water: 315 μ mho/cm.

| Triai No. | Test species | Mean length | Sample size | Escaped or missing | Damaged |
|--------------|-----------------|----------------|----------------|--------------------|----------|
| 1 | Striped bass | 7.5 cm | 20 | 0 | 0 |
| 2 | Striped bass | | 20 | 0 | 0 |
| 3 | Striped bass | | 20 | . 0 | · 0 |
| 4 | Striped bass | | 20 | 0 | 0 |
| 5 | Striped bass | | 20 | 0 | 0 |
| 6 | Striped bass | | 20 | 0 | 0 |
| 7 | Striped bass | | 20 | 0 | <u> </u> |
| | . • | | 140 | <u> </u> | <u> </u> |

Test date: 27 August 1986. Spraywash pressure: 85 psi. Screen travelling speed: 11 fpm. River water temperature: 25.5°C.

Conductivity of river water: 349 μ mho/cm.

| Trial No. | Test species | Mean length | Sample size | Escaped or missing | Damaged |
|--------------|-----------------|----------------|----------------|-----------------------|------------|
| 1 . | White perch | 7 cm | 20 | 0 | 4 a |
| 2 | White perch | | 20 | 0 | · 0 |
| 3 | White perch | | 20 | 2 | 1 a |
| 4 | White perch | | 20 | 0 | 1 a |
| 5 | White perch | | 20 | 0 | 0 |
| 6 | White perch | | 18 | 1 | 2 a |
| 7 | White perch | | 20 | 2 | 1 a |
| 8 | White perch | | 20 | 1 | Ö |
| 9 | White perch | | 20 | 0 ' | <u>l</u> a |
| | • | | 178 | 6 | 10 |

a Stunned.

Recovery at fish sluice.

The following tests apply to the fish conserving apparatus at the back (the downstream side) of the reconfigured machine, and they correspond to the flume tests on the fish sprays, the flap seal, and the fish sluice reported in Section 3. They were conducted concurrently with the three sets of tests tabulated above. Following the transit of a loaded fish rail through the high-pressure spray in many of those tests, the damaged fish would be removed, the fish sprays turned on, and the screen activated. The remainder of the fish then became the test sample for the apparatus tests at the back side of the machine.

As we also observed in the Houston tests, the swinging shield (at location GG) interfered with the trajectories of fish falling from the overturning screen panels, so it was removed at the end of trial 13 on 5 August. In the following tabulations, the numbers of test fish recovered from the fish sluice and the numbers recovered from the auxiliary debris sluice are

entered in the columns "Fish sluice" and "Debris sluice." The observed injured among the fish sluice recoveries are recorded in the last column.

Test date: 5 August 1986.

Pressure, outside fish spray: 5 psi. Pressure, inside fish sprays: 8 psi. Screen travelling speed: 10 fpm. River water temperature: 27°C.

Conductivity of river water: 3200 μ mho/cm.

| Trial No. | Test species | Mean length | Sample sise | Fish sluice | Debris sluice | Damaged, fish sluice |
|----------------|-----------------|----------------|----------------|----------------|------------------|-------------------------|
| 1 | Tomcod | 9 cm | 20 | 17 | 0 | 0 |
| 2 | Tomcod | | . 17 | 11 | ` 3 | 0 |
| 3 | Tomcod | | 14 | 14 | 0 | 2 в |
| 4 | Tomcod | | 12 | 12 | 0 | 1 a |
| 5 | Tomcod | | 11 | 10 | 0 | 0 |
| [:] 6 | Tomcod | | 10 | 10 | 0 | 0 |
| 7 | Bay anchovy | 8 cm | 10 | 9 | 0 | 0 |
| 8 | Bay anchovy | | 9 | 9 | 0 | 3 а |
| 9 | Bay anchovy | | 9 | 8 - | 1 | 2 a |
| 10 | White perch | 7 cm | 19 ' | 13 | 0 | 0 |
| 11 | White perch | | 20 | 11 | 0 | 0 |
| 12 | White perch | • | 20 | 13 | 4 | 0 |
| 13 | White perch | | 21 | 14 | 2 | 0 |
| 14* | White perch | | 20 | 12 | 3 | 0 |
| 15 | White perch | | 20 | 16 | 2 | 0 |
| 16 | White perch | | 21 | 19 | 2 | 0 |
| 17 | White perch | | 20 | 20 | 0 | 0 - |
| 18 | White perch | | 20 | 20 | 0 | 1 c |
| 19 | White perch | | 20 | 18 | 2 | 1 c |
| 20 | Amer. shad | 11 cm | 20 | 20 | 0 | 4 a,b |
| 21 | Amer, shad | | 20 | 19 | 0 | 4 a,b. |
| 22 | Amer. shad | | 20 | 20 | 0 | 6 a,b |
| 23 | Amer. shad | | 20 | 17 | ., 1 | 9 a,b |
| 24 | Amer. shad | | 20 | 16 | 3_ | 0 |
| | | | 413 | 348 | 23 | 33 |

^{*}Rear shield removed. a Stunned; b Missing scales; c Dead.

Test date: 26 August 1986.

Pressure, outside fish spray: 4 psi. Pressure, inside fish sprays: 4 psi. Screen travelling speed: 11 fpm. River water temperature: 26°C.

Conductivity of river water: 315 μ mho/cm.

| Trial No. | Test species | Mean length | Sample sise | Fish sluice | Debris sluice | Damaged, fish sluice |
|--------------|-----------------|----------------|----------------|----------------|------------------|-------------------------|
| 1 | Striped bass | 7.5 cm | 20 | 20 | 0 | 0 |
| 2 | Striped bass | | 20 | 20 | 0 | 0 |
| 3 | Striped bass | | 21 . | 21 | 0 . | 0 |
| 4 | Striped bass | | 20 | 20 | 0 | 0 |
| 5 | Striped base | | 20 | 20 | : 0 | 0 |
| 6 | Striped bass | | 19 | 19 | 0 | 0 |
| 7 | Striped bass | | 20 | 20 | 0 | <u>o</u> |
| . • | • | | 140 | 140 | Ò | 0 |

Test date: 27 August 1986.

Pressure, outside fish spray: 4 psi. Pressure, inside fish sprays: 4 psi. Screen travelling speed: 11 fpm. River water temperature: 25.5°C.

Conductivity of river water: 349 µmho/cm.

| Trial No. | Test species | Mean length | Sample size | Fish sluice | Debris sluice | Damaged, fish sluice |
|--------------|-----------------|----------------|----------------|----------------|------------------|----------------------|
| 1 | White perch | 7 cm | 17 | 17 | 0 | . 0 |
| 2 | White perch | | 20 | 20 | 0 | 2 a |
| 3 | White perch | | 18 | 12 | 0 | 0 |
| 4 | White perch | | 21 | 19 | 0 | 0 |
| 5 | White perch | | 20 | 20 | 0 | 0 . |
| 6 | White perch | | 15 | 14 | _0_ | 0 |
| | | | 111 | 102 | 0 | 2 |

a Stunned.

Summary, above-water tests. The results of the above-water site tests on the reconfigured machine (Royce version 2) were similar to the results from the above-water flume tests in Houston. As in the Houston tests, the rail deflectors protected the fish rails from disturbance by the high-pressure debris spray, and few fish escaped the rails during their transit through the spraywash. Of 700 fish in 38 trial passages through the debris spray, 7 were lost (1% of the sample total). The seven lost fish apparently escaped through the openings of the auxiliary screens, which are made of perforated metal, but such losses are not so significant as to require a material or fabricating change of inconvenience to the manufacturer. Other apparatus, however, needs refining, some of which will require further study and experimentation.

The sliding debris shield (L of Figure 2) could not be tested with the troublesome alga species that created the debris problem during the winter testing of Royce version 1, as that plant was absent from the indrawn river water during the summer testing of version 2. Owing to some mechanical failings, the shield, which the manufacturer views as a trial apparatus, is being redesigned. When replaced, the shield should be tested for sustained operation during times of heavy debris loading.

The relocated outside fish spray (EE of Figure 2) functioned as intended; fish were consistently freed from the overturning fish rails, at least while the spray jets were open and functioning. Clogging of all three fish sprays (EE and FF of Figure 2) was a consistent problem during the site tests—a problem that was attributed to the passage of river silt through the spraywash pump.

Although the test machine is equipped with a clear Plexiglas housing, accurate visual observations at the rear of the machine are not easily made when the spray washes are operating. To the extent that observations were possible, the trajectories of fish falling from the overturning screen panels did not exceed the far edge of the widened fish trough, but as in the Houston tests, falling fish struck the blade of the swinging sluice shield

(location GG), so it was removed early in the testing. But with or without the shield, some fish fell into the gap between the fish sluice and screen. Although the reconfigured fish sluice is closer to the descending screen panels than the version 1 sluice, enough of a clearance gap remains to warrant the installation of a flap seal (or other device of similar function). Of the 664 fish employed in the tests on the recovery apparatus at the rear of the machine, 590 (89%) were recovered from the fish sluice. Of the 11% missing from the fish sluice, 23 fish (3.5% of the sample total) were found in the auxiliary debris sluice (N of Figure 2). The 28 fish not accounted for (7.5%) of the sample total) might have fallen through the clearance gap as well, but into the intake flow behind the screen. Of the 590 fish recovered from the fish sluice, 35 (6%) sustained obvious trauma (descaling, impaired swimming). Thus the combined loss (morbidity plus the missing) was 16.4% of the sample total, a reduction significant enough to call for remedial study of the recovery process at the back side of the machine.

7.62

Mark and recapture tests

These tests were meant to provide information on the recovery rates and the risks of death or injury to fish captured and removed from the Indian Point test bay by the reconfigured barrier screen. For each of the tests, a fine-mesh fixed screen was emplaced at the entrance of the intake bay and allowed to remain throughout the duration of a test. A diver on site kept the screen free of debris the while. A known sample of fish was introduced to the forebay, between the fixed screen and the operating test screen, and captured fish of the sample were tallied at the fish sluice on the following time scale, which was calculated from the formulations given on page 34. The zero reference time t_1 corresponds to the appearance in the fish sluice of the first recapture. The sample was released into the forebay at time t_0 .

| $t_1: 0$ | t_7 : | 1.43 hr |
|-------------------------|-----------|---------|
| $t_2: 1.7 \min$ | t_8 : | 2.75 hr |
| $t_3: 4.9 \min$ | t_{9} | 5.25 hr |
| t_4 : 11 min | $t_{10}:$ | 10 hr |
| $t_5: 22.5 \text{ min}$ | $t_{11}:$ | 19 hr |
| ta: 44.6 min | t12: | 36 hr |

Recovered fish were examined on collection for deaths and injuries, then held in aquariums eight hours and monitored for apparent morbidity. The t_1 to t_6 collections were combined; the collections from t_7 to t_{12} were held in separate aquariums.

Six of these recapture tests were completed, two with striped bass and four with white perch. I assisted in the first test on the 5th of September, and I observed the tests of the 9th and 10th of September. Portions of the testing routines were recorded on video tape.

Recapture test 1.

Date at start: 5 September 1986.

Test species: Morone saxatilis (hatchery striped bass), 7.6 cm mean length.

Sample size: 250 fish.

Recoveries: 228 in 36 hours.

Water speed in forebay: 30 cm/sec.

Water temperature: 24-25°C.

Conductivity: 5900-6500 μ mho/cm. Screen travelling speed: 11 fpm. Pressure, debris spray: 90 psi.

Pressure, outside fish spray: 4 psi. Pressure, inside fish spray: 4 psi.

 $t_1 - t_0 = 3$ minutes.

| | t_1 | t_2 | ta | t4 | t ₅ | t ₆ | t ₇ | t ₈ | tg | t_{10} | t_{11} | t ₁₂ |
|------------|-------|-------|----|-----|----------------|----------------|----------------|----------------|-----|----------|----------|-----------------|
| Recoveries | 10 | | | 12, | | | 25 | 25* | 3 | 38 | 15 | 13 |
| Cumulative | 10 | 36 | 62 | 74 | 88 | 109 | 134 | 159 | 162 | 200 | 215 | 228 |
| Dead | | | | | | | 1 | 8 | Α, | 1 | | |
| Damaged | | | | 1 | | | | 1 | , | | / | |
| Dead, 8 hr | | | | | | . ' | | 1 | | | | |

*Spraywashes shut down 15 minutes during recovery.

See Figure 9 for graph of recoveries. During the 8-hour morbidity tests, one additional fish died, for a total of 11 deaths and one observable injury among the 228 recoveries.

Recapture test 2.

Date at start: 6 September 1986.

Test species: Morone americana (Hudson River white perch), 5.0-15.2 cm

Sample size: 67 fish.

Recoveries: 54 in 36 hours.

Water speed in forebay: 30 cm/sec.

Water temperature: 24-25°C.

Conductivity: 5900-6500 µmho/cm. Screen travelling speed: 11 fpm. Pressure, debris spray: 90 psi. Pressure, outside fish spray: 4 psi. Pressure, inside fish spray: 4 psi.

 $t_1 - t_0 = 6$ minutes.

See Figure 10 for graph of recoveries. During the 8-hour morbidity tests, one fish died for a total of 4 deaths among the 54 recoveries. No observable injuries reported.

Recapture test 5.

Date at start: 9 September 1986.

Test species: Morone americana (Hudson River white perch), 5.0-15.2 cm

length range.

Sample size: 250 fish.

Recoveries: 225 in 36 hours.

Water speed in forebay: 30 cm/sec.

Water temperature: 24-25°C.

Conductivity: 5900-6500 μ mho/cm. Screen travelling speed: 11 fpm. Pressure, debris spray: 90 psi. Pressure, outside fish spray: 4 psi.

Pressure, outside fish spray: 4 psi.

 $t_1 - t_0 = 3$ minutes.

 t_{11} tz tg t4 ts te t7 tg t_{10} 100 29 10 8 19 12 16 1 25 0 Recoveries Cumulative 105 134 144 152 171 183 199 200 225 225 Dead Damaged Dead, 8 hr 1

During the 8-hour morbidity tests, one of the injured died for a total of two deaths and three injuries among the 225 recoveries.

Recapture test 6.

Date at start: 10 September 1986.

Test species: Morone americana (Hudson River white perch), 5.0-15.2 cm

length range.

Sample size: 250 fish.

Recoveries: 222 in 36 hours.

Water speed in forebay: 30 cm/sec.

Water temperature: 24-25°C.

Conductivity: 5900-6500 μ mho/cm.

Screen travelling speed: 11 fpm. Pressure, debris spray: 90 psi. Pressure, outside fish spray: 4 psi.

Pressure, inside fish spray: 4 psi.

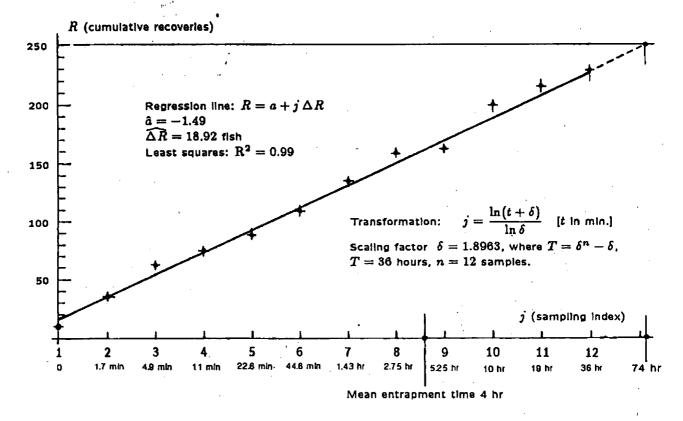
 $t_1 - t_0 = 5$ minutes.

During the 8-hour morbidity tests, no fish died and none exhibited trauma symptoms, for a total of zero deaths and zero observable injuries

The recovery data of experiment 1 are plotted on the graphs of Figure 9 (page 44). The hypothesis of random encounter is supported by the regression of cumulative recoveries R against the sampling indices j (on the log transformed time scale). Apparently then, the test fish were actively captured by the reconfigured screen rails, few being impinged beforehand. As previously shown by the Houston flume tests, the juvenile striped bass, of the size employed in the recapture experiments, were capable of sustained swimming at the 30 cm/sec water speed in the forebay. Of the 250 released fish, 228 (or 91%) were recaptured during the 36-hour experiment. The debris sluice was not examined for recoveries, but on the strength of the above-water tests with striped bass (pp 36-37), I discounted any loss to the debris sluice in the calculations of mean residence time and projected sample recovery. The observed deaths and injuries (together with the anomaly at t_8) were too few for constructing a reliable distribution, but the empirical probability of death or injury to a sample member captured by the machine and recovered from the fish sluice was .052. In experiment 3, with similar experimental variables, the empirical probability of death or injury to a recovered sample member was .027.

The results from experiment 3 also support the hypothesis of random encounter and active capture of freely swimming fish (see Figure 11, page 45). But unlike the two experiments with striped bass, the recapture results from the white perch experiments signify instead a high impingement rate and rapid recovery (at least in the case of the smaller fish of the sample), similar to the results from the Houston flume tests. Figure 10 illustrates the recovery rate over the first 45 minutes of experiment 2, a pattern exhibited by the recovery data from all the white perch experiments. The released sample of experiment 2 contained a mixture of fish lengths ranging from 5 to 15.2 cm (as did all four releases of white perch). Of the 45 fish recaptured in 36 hours, 83% (or 67% of the total sample) were recovered in 22.5 minutes (by j = 5), including 100% of the recaptures less than 8 cm length.

The high rates of return during the first few minutes of the white perch experiments were a consequence of impingement—of fish unable to swim (or swim very long) at speeds equal to the water speeds at the face of the barrier screen (which are somewhat greater than the mean upstream water speed owing to the accelerated flow geometry at the screen panels). The longer residence times of the larger white perch signify either impingement from progressive exhaustion or random encounter by actively swimming fish (as in the case of the striped bass). The data are not sufficiently detailed for making the distinction. In all four experiments with white perch, however, mean residence times were less than 30 minutes for those portions of the released samples recovered in 36 hours (80% in experiment 2, 83% in experiment 4, 90% in experiment 5, and 89% in experiment 6). Numbers lost to the debris sluice were not reported, but of the fish recovered from the fish sluice, the empirical probability of death or injury to a sample member in the white perch experiments was .019.



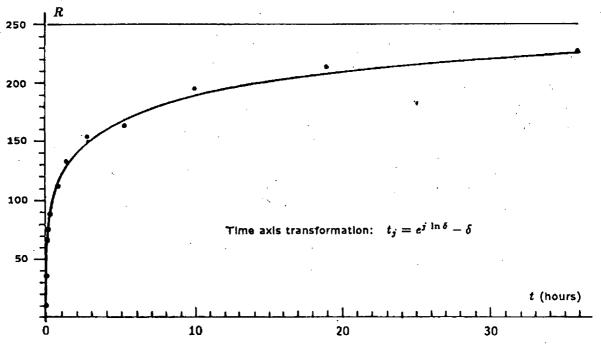


Figure 9. Top: Recapture experiment 1 (5 September 1986), hatchery striped bass. Numbers recovered from fish sluice over sampling intervals j (on logarithmic time scale). Sample size 250 fish in forebay; intake flow speed 30 cm/s; duration of experiment 36 hours. Estimated time of total sample recapture 74 hours (projected from regression). Bottom: Regression line of top graph transformed from logarithmic to linear time scale. Mean entrapment time 4 hours (calculated from regression with 74 hours as time of total sample recapture).

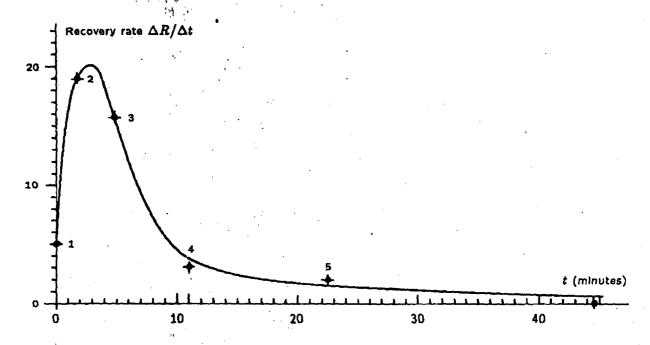


Figure 10. Recapture experiment 2 (6 September 1986), Hudson River white perch. Recoveries 1-6, first 45 minutes of experiment. Sample size 67 fish in forebay; intake flow speed 30 cm/sec. At j = 6 (22.6 minutes), 67% of original sample had been recovered.

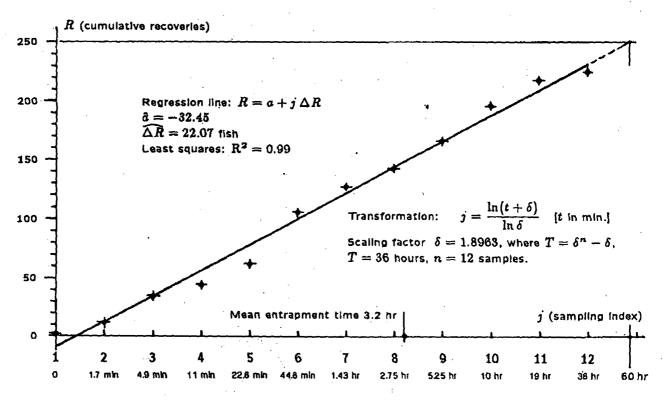


Figure 11. Recapture experiment 3 (7 September 1986), hatchery striped bass. Cumulative recoveries from fish sluice on sampling intervals j (logarithmic time scale). Sample size 250 fish in forebay; intake flow speed 30 cm/sec; duration of experiment 36 hours. Estimated time of total sample recapture 60 hours. Mean entrapment time of 3.2 hours calculated from regression with 60 hours as time of total sample recapture.

Opportunistic fish and debris collections

Following the mark and recapture experiments, the fixed screen was removed; the reconfigured machine and the circulating pump of the test bay were allowed to operate for extended periods in the manner required for maximum intake of cooling water. As specified in item C of the outline of required site tests (page 34), periodic collections of captured indigenous fish were taken from the sluices and tallied. The collected fish were examined for deaths and observable injuries, then held in aquariums (or the collection tanks) 8 hours and monitored for apparent morbidity. Captured debris was also collected, classified, and separately measured (by volume) at the fish sluice and the two debris sluices.

Fish collections

Over the period 16 September to 24 October 1986, 146 two-hour collections were taken and the surviving fish held for the 8-hour morbidity tests. In some cases, when all the available aquariums were occupied, a two-hour collection would be held in the collection tank for the eight-hour morbidity test. Fish collected and held in this manner were examined for deaths and injuries after eight hours, but not on initial recovery. Also, 29 collections were taken that ranged from six to 29 hours duration. Fish from these extended collections were examined for deaths and apparent trauma, but were not held for the additional eight hours of observation. In the 175 collections, a total of 8882 fish were recovered and 34 species identified (as tabulated below). For the more numerous of these, I have summarized the collection data on the tables that follow.

| Bay anchovy | 1060 | Alewife | 72 |
|---------------------|------|---------------------|------|
| American shad | 169 | Bluefish | 16 |
| Bluegill | 192 | Brown bullhead | 6 |
| Pumpkinseed | 212 | American eel | 65 |
| Hogchoker | 3543 | Banded killifish | 134 |
| Largemouth bass | 1 | Atlantic menhaden | 24 |
| Blueback herring | 277 | Atlantic silverside | 3 |
| Rainbow smelt | 4 | Spottail shiner | 2 |
| Striped bass | 86 | Atlantic tomcod | 603 |
| White catfish | 25 | White perch | 1806 |
| Yellow perch | 1 | Northern pipefish | 4 |
| Lookdown | 7 | Redbreast sunfish | 4 |
| Atlantic needlefish | 1 | Crevalle jack | 6 |
| Weakfish | 467 | Clupeid sp | 1 |
| Butterfish | 8 | Centrachid sp | 39 |
| Rough silverside | 1 | Summer flounder | 29 |
| Naked goby | 13 | Grey snapper | 1 |

Bay anchovy (1060* collected)

| • | | ollecti | | After 8 hours | | | | |
|---|----------|---------|--------|---------------|--------|--------|-------------|--|
| Two-hour collections | Normal D | amage | d Dead | Normal | Damage | d Dead | Dead & Inj. | |
| Fish sluice ¹ | 60 | 8 | 12 | 41 | 12 | 27 | 49% | |
| Fish sluice ² | | | | 42 | 13 | 12 | 37% | |
| Rear debris sluice | | | 3 | | | 3 | | |
| Extended collections | | | | | | | | |
| Fish sluice ⁸ | 723 | 24 | 147 | | | | 19% | |
| Rear debris sluice ^a | 6 | 1 | 8 | | | | 60% | |
| | | _ | | | | | | |

^{*}One bay anchovy recovered from front debris sluice.

¹Held in aquariums. ²Held in collection tanks. ⁵Recovered from collection tanks.

| Alewife (72* collecte | On | collection | | | r 8 hour | - | • |
|---|----------------------|---|---------------|------------|---------------------|-------------|---------------------|
| Two-hour collections Fish sluice ¹ | Normal 1 | Damaged 3 | Dead 10 | Normal I | amaged 1 | Dead 13 | Dead & Inj. 82% |
| Extended collections Fish sluice ² | 24 | 3 | 27 | | | | 55% |
| *One alewife recovere | | - | | 3. | | | 22,0 |
| 'Held in aquariums. | | | | | | | |
| American shad (16 | | d) collection | n | Afte | r 8 hour | A. | |
| Two-hour collections | | | | | | - | Dead & Inj. |
| Fish sluice ¹ | 10 | 9. | 9 | 9 | 3 | 16 | 68% |
| Fish sluice ² | | - | | 18 | 2 | 9 | 38% |
| Rear debris sluice | * | | 2 | | | .` 2 | |
| Extended collections | 83 | • | OE | | | | 25% |
| Fish sluice ³ Held in aquariums. | | 2 | 25 | 3 D | 6 | anllast | · · · · |
| neid in aduariums. | - Ueld III (| OHECTION | tanks. | . Iracove | ed itom | Conect | on talks. |
| Bluegill (192 collect | ed) | | | | | | |
| | | collection | n | Afte | r 8 hour | 6 | |
| Two-hour collections | Normal | Damaged | Dead | Normal I | Damaged | Dead | |
| Fish sluice1 | 119 | 0 | 0 | 119 | 0 | 0 | 0% |
| Fish sluice ² Extended collections | | | | 15 | 0 | 1 | 6% |
| Fish sluice ³ | 56 | 0 | 1 | | | | 2% |
| ¹ Held in aquariums. | | - | _ | . BRecover | red from | collect | • • |
| | | | | | | | |
| Pumpkinseed (212) | | l) collectio | ر n | Afte | er 8 hou | rs | |
| Two-hour collections | Normal | | l Dead | Normal 1 | Damaged | l Dead | Dead & Inj. |
| Fish sluice ¹ | 40 | 2 . | 0 | 39 | 3 | 0 | 7% |
| Fish sluice ² Rear debris sluice ¹ | • | | | 29 | 0 | 2 | 6% |
| Extended collections | 1 | • | i, | . 1 | | | |
| Fish sluice ⁵ | 127 | 3 | 6 | | | | 7% |
| Rear debris sluice | | _ | _ | | | | - • • |
| *One pumpkinseed r | ecovered i | rom fron | t debri | is sluice. | 7 | | |
| Held in aquariums. | ² Held in | collection | tanks | . SRecove | red from | collect | ion tanks. |
| | | • | | | | | |
| American eel (65 c | | 11 | _ | A 64 | 9 1 | | • |
| Two-hour collections | | collectio | | | er 8 hou: Damage | | Dond & Ini |
| Fish sluice ¹ | 16 | B S S S S S S S S S S S S S S S S S S S | 0 | 15 | 7 | 2 | 38% |
| Fish sluice ² | | _ | | 9 | 1 | 2 | 25% |
| Extended collections | | | | | | | - |
| Fish sluice ^s | 23 | . 0 | 6 | | | | 21% |
| ¹ Held in aquariums. | ² Held in | collection | tanke | . Recove | red from | collect | ion tanks. |
| Hogchoker (3543* | | | | , | _ • | : | |
| 9 19 .4 | | collection | | | et 8 yon | | D 1 1 . 7 . |
| Two-hour collections Fish sluice ¹ | Normal | Damage | o Dead ₄ | Normal | Damage 0 | d Dead 5 | Dead & Inj. |
| Fish sluice ² | 400 | • | • | 561 | 2 | 13 | 2% |
| Rear debris sluice | 46 | 0 | 1 | 45 | ī | 2 | 2% |
| Rear debris sluice | _ | | _ | 101 | 2 | 7 | 8% |
| Extended collections | | | | | | | • - |
| Fish sluice ³ | 2094 | 1 | 407 | | | | 2% 2% |
| Rear debris sluice | | . 0 | 4 . | | | | 2% |
| *13 hogchokers reco | vered from | a front de | Dris s | uice. | and from | ممالمم | tian tambi |
| Held in aquariums. | rield in | COHECTION | ı tankı | , recove | HEG ILOM | r collec. | vion sanks. |

| * | | | | | | | , , |
|---------------------------------|-------------------------|------------|--------|------------------------|----------|------------|-------------|
| Banded killifish (13 | 34 collected | 1) | | | | | |
| | | ollection | | | r 8 hou | | |
| Two-hour collections | | | | | | _ | |
| Fish sluice | 75 | 0 | 0 | 74 | 0 | 1 | 1% |
| Fish sluice ² | • | | | 14 | 1 | 0 | 7% |
| Rear debris sluice2 | | | | 2 | | | |
| Extended collections | 42 | | ^ | | | | 0% |
| Fish sluice | | 0 | 0 | 30 | | 11 . | |
| ¹ Held in aquariums. | rheid in co | Discrion | tanks. | Recover | ed from | collecti | on tanks. |
| Blueback herring (| '277 collect | (he | | | | | |
| | | collection | מ | Afte | r 8 hou | rs · | |
| Two-hour collections | | | | | | | Dead & Ini. |
| Fish sluice ¹ | 24 | 7 | 3 | 16 | 5 | 13 | 53% |
| Fish sluice2 | | | | 72 | 0 | 25 | 19% |
| Extended collections | | | | | | | |
| Fish sluice ^s | 118 | 3 | 25 | | | | 19% |
| Held in aquariums. | ² Held in co | ilection | tanks. | 5Recover | ed from | collect | ion tanks. |
| | | | | | | | |
| Striped bass (86 co | | | | | | | |
| | | collectio | | | r 8 hou | | |
| Two-hour collections | | | - | _ | . • | _ | |
| Fish sluice ¹ | 7 | 0 | 0 | 7 | 0 | 0 | 0% |
| Fish sluice ² | | | | 11 | 1 | , O | 1% |
| Extended collections | 40 | • | r | | | | 100/ |
| Fish sluices | 60 | . 2 | . 5 | 350 | | | 10% |
| Held in aquariums. | -Held In C | ollection | tanks. | Hecover | ed irom | collect | ion tanks. |
| Atlantic tomcod (6 | 802 aallaat. | .41 | | | | - | |
| Muantic tomeod (| | collectio | - | A ft. | r 8 hou | PO . | |
| Two-hour collections | | | | | | | Doed & Ini |
| Fish sluice ¹ | 52 | 21 | 1 | 51 | 21 | 2 | 31% |
| Fish sluice ² | | | - | 36 | 3 | 5 | 18% |
| Extended collections | | • | | | _ | | -5/0 |
| Fish sluices | 410 | 8 | 65 | | | | 15% |
| Rear debris sluice ³ | 1 | 0 | 1 | | | , | |
| ¹ Held in aquariums. | ² Held in c | ollection | tanks | . ³ Recover | red from | collect | ion tanks. |
| | , | | | | • | | |
| White perch (1806 | * collected |) | | . • | | * | |
| | | collectio | | | er 8 hou | | |
| Two-hour collections | | | | | | | Dead & Inj. |
| Fish sluice1 | 486 | 18 | 15 | 476 | 7 | 36 | 8% |
| Fish sluice ² | | | _ | 276 | 11 | 24 | 11% |
| Rear debris sluice | | 1 | , 0 | 6 . | 1 | . 0 | 14% |
| Rear debris sluice ² | | | | 8 | 2 | 0 | 20% |
| Extended collections | | | | | | | ~ |
| Fish sluice ³ | 787 | 35 | 132 | | | | 18% |
| Rear debris sluice | | | | | | | |
| *One white perch rec | | | | | | | |
| ¹ Held in aquariums. | Held in c | ollection | tanks | . 'Recover | red from | collect | ion tanks. |
| Weakfish (467 colle | ctadl | | | | | | |
| AAGENTEE (401 COHE | | collectio | | A ft. | er 8 hou | * 4 | - |
| Two-hour collections | | | | | | | Dezd & Inj. |
| Fish sluice ¹ | 19 | 2 | 0 | 14 | 3 | 7 | 33% |
| Fish sluice2 | | - | _ | . 21 | ŏ | 7 | 25% |
| Rear debris sluice | 1 | | | , - - | 1 | - | |
| Extended collections | - | | • | | _ | | • |
| Fish sluice ⁵ | 368 | 7 | 25 | | | | 8% |
| Rear debris sluice | 11 | 3 | 3 | | | | 35% |
| ¹ Held in aquariums. | ² Held in c | oliection | tanks | . Recover | red from | collect | ion tanks. |
| = | | | | | | | |

Debris collections

During the 146 two-hour collections and the 29 extended collections, 1594 gallons of debris were recovered, of which 27% was collected from the fish sluice, 26% from the front debris sluice, and 47% from the rear debris sluice. The debris consisted of eel grass, accompanied from time to time by a small quantity of tree leaves. Unlike the fine alga species collected during the winter tests on Royce version 1, the eel grass does not staple firmly into the screen mesh, and much of it falls into the fish rails as the screen panels ascend through the water surface.

As indicated by the distribution of collected debris, the eel grass blown from the screen mesh and into the front debris sluice(KK) by the primary debris spray amounted to only 26% of the quantity captured by the ascending screen; the remainder was carried over the driver sprockets by the fish rails and dumped onto the overturning screen panels, about one-third of it sliding into the fish sluice and the rest falling into the rear debris sluice (N) as the panels descended through the auxiliary debris spray (M). Despite the large proportion that reached the back side of the machine, the eel grass did not entangle the fish into an inseparable matrix of debris, as did the filamentous winter algae. The numbers of fish collected from the rear debris sluice, when compared with the above-water tests in the absense of debris, do not indicate that fish were carried past the fish sluice with greater likelihood in the presence of the eel grass, nor is there evidence to suppose that the accumulation of eel grass in the fish rails increased mortality to any significance.

Summary of the fish recovery tests. As in the the Houston flume experiments with golden shiners and white perch, the mark and recapture experiments with white perch show that juveniles of some species are impinged (flattened against the screen mesh) at a high rate when the water velocity is (about) 30 cm/sec, the speed of the intake flow at the higher of the two pumping rates at Indian Point. The recapture experiments with white perch also support our findings from the flume experiments that impingement itself, unless of extended duration, is not the proximate agency of high mortality it was thought to be, even in the case of fishes easily descaled. The captured fish are harmed more by the knocking about imposed on them after their entry into the fish rails. Those risks have been reduced by some of the innovations now incorporated into the reconfigured machine.

The mark and recapture experiments with striped bass are representative of fish capable of swimming against the flow for extended periods. In the flume experiments with striped bass of the size employed in the site experiments, the fish persistently maintained station upstream of the screen (see page 27). and were not readily impinged at flow velocities exceeding 45 cm/sec. Therefore, the hypothesis of random encounter and active capture by the reconfigured fish rails (principally by the auxiliary rail screens) is supported by the results from the recapture experiments.

The fish exhibiting the highest proportions of deaths and injuries in the opportunistic collections were bay anchovy, alewife, American shad, blueback herring, Atlantic menhaden, and American eel, all of which, excepting the eels, are tender species easily descaled. At least some of the observed trauma can be attributed to handling. As the data show, fish of these species that were transferred to aquariums suffered higher proportions of death and injury during the 8-hour morbidity tests than those held in the collection tanks. Striped bass mortalities were low (but only 86 were collected), and white perch mortalities were lower than expected.

Recoveries of fish from the front debris sluice were rare, but the recoveries from the rear debris sluice were sufficiently great, for some species, to substantiate the finding from the above-water testing that certain remedial work is needed on the recovery apparatus at the back side of the machine. The capturing of eel grass by the fish rails did not appear to hinder the separation and recovery of captured fish, but the reconfigured debris removal system was not really tested, since the filamentous winter algae that brought about the need for reconfiguration in the first place were not present in the river during any of the tests on the version 2 screen.

In conclusion, you are reminded that none of the experimentation or testing was directed to an examination of any fish conservation apparatus beyond the confines of the single barrier device. No investigative work has yet been done by me or by Consolidated Edison on the mechanism for returning fish to the source waters. As currently intended by both Consolidated Edison and the Power Authority, a common fish sluice, extending the entire width of the combined intake bays, will serve all six screens (plus the screens of the service water bay, apparently). The sluice, pitched at a slight angle from the horizontal, will feed its accumulated water, fish, and debris into a single pipe for the return of those contents to the river.

At least two sources of potential malfunctioning come immediately to mind—one the eel grass loading in summer and the other the icing of the sluice and flash freezing of fish in the winter. The combined amounts of eel grass dumped into the fish sluice by each of the screens might easily exceed the flushing capabilities of the sluice, and, during winter, ice will probably form in the sluice, at least at the channel boundaries. Several solutions also come to mind, should those problems be serious enough to impair the return of fish, but I suggest that a demonstration sluice be constructed and the problems evaluated first, before the permanent sluices and their accompanying apparatus are installed.

On the reconfiguration and empirical evaluation of a prototype screening device at Indian Point unit 2.

SECTION 5.

Fish conservation, Royce versions 1 and 2 compared.

From the results of Consolidated Edison's testing of Royce version 1, from casual observations during that testing, and from the experimental work in the Houston flume, several sources of fish mortality were identified, which led ultimately to the alterations now part of the reconfigured machine. The experiments described in Sections 3 and 4 of this report were intended to provide enough empirical information for making a reliable assessment of the likely reductions in fish kills attributable to the reconfiguring of the machine, as compared to the first version.

Reliability suffers somewhat here from dissimilarity in experimental variables. The two machines were tested during unlike seasons of the year; the low temperature of the river during the winter testing of version 1 probably increased trauma to some of the sampled species. Because of the difference in seasons, the species compositions of the collections differed considerably, and the captured algae were altogether dissimilar (most particularly in those physical characteristics important to the workings of the fish conserving apparatus). Given the extent of the field sampling and the flume experiments, however, I believe a reasonable assessment of the improvements in fish recovery can be extracted from the data, although a similar assessment of the reconfigured debris removal system, to the extent that it influences fish conservation, must be deferred to a time when testing with the winter alga species is undertaken.

During the winter testing by Consolidated Edison on Royce version 1, the experimenters collected 45,608 fish in their samplings of the fish and debris sluices. Of 36 identified species, 20 also appeared in the sampled recoveries from Royce version 2. Discounting those species where only one of a kind appeared in the collections reduces the shared species to 15, which are identified by the following table. The numbers of each species collected from the version 1 machine appear in column v1 and the numbers from version 2 in column v2. The percentages signify the proportions out of total fish collected (45,608 in the sampling of version 1, and 8,882 in the sampling of version 2); an omission signifies a proportion less than 1%.

| | _ v1 | v2 | | v1 | v2 |
|------------------|-------------|------------|------------------|--------------|-------------|
| Alewife | 117 | 72 | Bluegill | 9 | 192 (2%) |
| Brown bullhead | 15 | 6 | Pumpkinseed | 144 | 121 (1.4%) |
| American eel | 131 | 65 | Hogchoker | 198 | 3,543 (40%) |
| Banded killifish | 61 . | 134 (1.5%) | Blueback herring | 29 | 277 (3%) |
| Rainbow smelt | 373 | 4 | Spottail shiner | 217 | 2 ` ´ |
| Striped bass | 5,546 (12%) | 86 (1%) | Atlantic tomcod | 413 (1%) | 603 (7%) |
| | 443 (1%) | 25 | White perch | 37,536 (82%) | 1,806 (20%) |
| Northern pipefis | | 4 | • | | |

From the 36 species collected during the winter testing of Royce version 1, the experimenters selected the ten most abundantly represented for their "latent survival" tests. Eight of those ten are among the species appearing on the preceding table (no red hake or tesselated darter were found during the summer sampling of version 2). Of those eight shared species, two species from the version 2 testing were collected in numbers insufficient for mortality comparisons (rainbow smelt and spottail shiner). The deaths and injuries accrued to the remaining six species are given by the following table. The information on the version 1 survival testing is taken from Con Ed (1985). Apparently, the numbers of fish tested were subsamples of the version 1 collections; totals collected are given by the table on page 51. The quantities listed for version 2 on the following table are taken from the data of the opportunistic collections, two-hour and extended collections combined (see page 46 for clarification).

| • | | version 1 Dead&Inj. | Royce version 2 Tested Dead&Inj. | | |
|-----------------|------|------------------------|-------------------------------------|------|--|
| Alewife | | • | | | |
| Fish sluice | 22 | 98% | 71 | 62% | |
| Debris sluices | 3 | 100% | 0 | | |
| Atlantic tomcod | | | | | |
| Fish sluice | 32 | 75% | 601 | 32% | |
| Debris sluices | 8 | 76% | 2 | 50% | |
| Pumpkinseed | = | | - | | |
| Fish sluice | 17 | 46% | 192 | 1% | |
| Debris sluices | a | 10,0 | 0 | -/- | |
| Striped bass | | | - | | |
| Fish sluice | 860 | 48% | 86 | 9% | |
| Debris sluices | 264 | 70% | 0 | 0,0 | |
| White catfish | | | _ | | |
| Fish sluice | 85 | 39% | 25 | 40% | |
| Debris sluices | 25 | 44% | ō | 10,0 | |
| White perch | | | | | |
| Fish sluice | 4227 | 58% | 1784 | 14% | |
| Debris sluices | 2051 | 77% | 23 | 1% | |

The large numbers of fish recovered from the debris sluice during the testing of the version 1 machine are attributable to the entanglement of fish in the filamentous alga that was captured in such large quantities during the winter. Of the total numbers of fish collected during the winter tests, 31% were recovered from the debris sluice (as opposed to 4% during the testing of the version 2 machine). The actual proportion was probably greater than 31%, owing to the difficulties in searching through the winter debris, which formed a nearly inseparable mass of fish and algae when recovered.

The winter alga problem is also reflected in the high mortalities observed during the version 1 tests. Of the white perch collected, for example, 32% were recovered from the debris; of the striped bass, 23% from the debris; of the rainbow smelt, 44%, and so on. Therefore, when the mortalities of the fish sluice and debris sluice collections are combined, the importance of the alterations to the above-water portions of the machine becomes more obvious. The combined recoveries and observed mortalities for three species are given on the following table.

| • | | version 1 Dead&Inj. | Royce version 2 Tested Dead&Inj. | | |
|--------------------------------------|------|------------------------|-------------------------------------|-----|--|
| Atlantic tomcod Collections combined | 40 | 75% | 603 | 32% | |
| Striped bass Collections combined | 1124 | 53% | 86 | 9% | |
| White perch Collections combined | 6278 | 64% | 1807 | 14% | |

Whether or not the fish conserving apparatus of the reconfigured machine will continue to operate as successfully during times of heavy loading with winter algae remains to be proven.

While the reordering of the fish and debris removal system was brought about by addressing the major problem identified during the winter testing of Royce version 1, other innovations now incorporated into Royce version 2 contributed to the observed reductions in fish mortalities. The flume work, the mark and recapture experiments, and the above-water tests all give evidence of improvements in fish capture and in lessened battering of fish after capture. I also believe that further reductions in fish kills are possible.

Although the altered profile of the fish rails has reduced the (underwater) buffeting of captured fish, a profile can probably be developed that would eliminate the trough vortices altogether. The sliding shield (L) at the location of the debris spray might perform as intended when tested with the winter alga, but the shielding problem at the fish trough (at location GG) has yet to be resolved. As observed during both the flume tests and the site tests on the reconfigured machine, fish still occasionally fall between the screen and the inner edge of the fish trough. The swinging apparatus provided by the manufacturer, in its current configuration, interferes with the free fall of fish to the fish sluice. The original flap seal design of Royce version 1 might yet prove adequate, should the reconfigured debris removal system operate as intended. In any case, these shielding problems cannot be resolved without further experimentation during times when the intake of filamentous algae is similar to the loadings observed during the testing of Royce version 1.

APPENDIX A

Data register, flume experiments and tests.

The documents of the following inventory are stored at the Great Salt Bay Experimental Station, Damariscotta, Maine.

Film documents

Title: Flume experiments, Indian Point replicate machine, Feb-March 1986. Medium: VHS video tape.

Contents: Fluid dynamics of rail and screen sections. Dye releases, orbiting of captive fish in standard rails. Auxiliary rail screens. Flow profiles of Royce panel, Envirex panel, channel, and streamlined rails. Flow trajectories with fish, Gathright's elevated rail section. Fish response, with and without auxiliary rail screen. Underwater debris loading of panels and rails.

Title: Flow profiles 1, Royce standard panel section, Feb 1986.

Medium: 35mm B&W film.

Contents: Dye marked streamlines of flow, 30 cm/sec, 20 frames.

Title: Flow profiles 2, Royce standard panel section, Feb 1986.

Medium: 35mm B&W film.

Contents: Dye marked streamlines of flow, 45 cm/s, 21 frames.

Title: Flow profiles 1, Ristroph panel (Rexnord), Feb 1986.

Medium: 35mm B&W film.

Contents: Dye marked streamlines of flow, 30 cm/s, 20 frames.

Title: Flow profiles 2, Ristroph panel (Rexnord), Feb 1986.

Medium: 35mm B&W film.

Contents: Dye marked streamlines of flow, 45 cm/s, 22 frames.

Title: Testing program, flume tests, 16-18 July 1986.

Medium: VHS video tape.

Contents: Underwater portion of flume testing program with golden shiners. Fish capture and behavior at 30 cm/sec and 45 cm/sec. Above-water portion of testing program with golden shiners. Trajectories of falling fish.

Title: Testing program, flume tests, 12-15 August 1986

Medium: VHS video tape.

Contents: Underwater portion of testing program with white perch and striped bass. Fish capture and behavior at 30 cm/sec and 45 cm/sec.

Paper documents

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Title: Flume tests, 16-18 July, 25 July, 12-15 August 1986.

Contents: Laboratory notes and records, fish capture tests and above-water tests, 17 pages.

Title: Flume tests, data, 17-18 July, 13-15 August 1986.

Contents: Extraction of data from video tapes; fish capture and behavior, 10 experiments with shiners, 8 experiments with white perch, 8 experiments with striped bass, 5 pages.

APPENDIX B

Data register, site tests of Royce version 2

The documents of the following inventory are stored at the Great Salt Bay Experimental Station, Damariscotta, Maine.

Film documents

Title: Indian Point field tests, Royce version 2

Medium: VHS video tape.

Contents: Views of working machine and fish sampling gear; experimental

routines.

Paper documents

Title: Site tests, 5 August, 26-27 August 1986.

Contents: Copies of field data records, above-water tests; 75 experiments,

21 pages.

Title: Mark and recapture tests, 5-10 September 1986.

Contents: Copies of field data records, six experiments, 48 pages.

Title: Opportunistic collections 16 Sept-24 Oct 1986.

Contents: Copies of field data records, fish collections and mortalities; 175

experiments, 244 pages.

Title: Debris collections, 16 Sept-24 Oct 1986.

Contents: Compilation of data records, 175 collections, 5 pages.

APPENDIX C

Consolidated Edison work scope for site tests of Royce version 2.

The contents of this appendix were furnished by Consolidated Edison as the scope of work issued to Normandeau Associates, Inc., contractor for the field testing of Royce version 2.

Representative Scope of Work for Evaluation of Modified Ristroph-Type Traveling Water Screen at Indian Point Unit 2 Intake Bay 26 1986

Background

In May, 1986 Royce Equipment company installed five modifications to the Ristroph screen at Indian Point Unit 2. These included a reordering of low pressure and high pressure wash systems to remove debris before fish are removed to alleviate their potential for entanglement with debris during the transfer to the fish sluice; 2.) an improved low pressure spray wash system to more efficiently wash screen basket troughs to enhance the transfer of fish to the fish sluice: 3.) 3-foot wide a flat-bottomed fish sluice with a diffused supplemental wash system so that fish being transferred from the screen would fall into the return water (As originally designed, the test screen was outfitted with an 18" wide round-bottomed fish sluice, and fish often struck the sides of this sluice.); 4) a modified flap seal to close the gap between the descending screen baskets and (Note: With the installation of a wider fish the return sluice. sluice, placed closer to the descending screen baskets than was the original sluice, the need for the modified seal is less certain.); and 5.) a modification consisting of an extension to front edge of the fish trough on each screen basket to alleviate water flow conditions within the trough potentially adverse to fish and to enhance the ability of the screen to collect fish before they become exhausted.

Tests of these new components, individually and together, are to be conducted to determine the rates of loss, damage, and mortality they impose on fish collected by the machine. Four species of fish including striped bass, white perch, bay anchovy and Atlantic tomcod are to be evaluated under various operating conditions including with and without debris loads on the Ristroph screen mesh. Test fish inserted into the screen basket troughs, entrapped in the intake forebay, and collected opportunistically are to be examined for initial and latent (8 hour) damage and mortality. Testing will be conducted in part under the supervision of Dr. Ian Fletcher, technical consultant to the Hudson River Fishermen's Association. Data will be provided to Dr. Fletcher for analysis and interpretation in concert with tests he will conduct on a test screen at Royce's facilities in Houston.

- Objective I: Provide the comprehensive management required to ensure that all tests are carried out as directed.
 - Task 1: Provide all personnel, equipment, materials and supplies required to carry out the work described herein.

- Task 2: Design, fabricate, and utilize as necessary the following devices.
 - a. A collection device by which fish can be quickly (within a few seconds) removed from the fish sluice for examination and placement into latent mortality evaluation tanks.
 - b. A device by which fish washed from the screen by the front mounted high pressure wash system can be collected from the associated debris sluice.
 - c. A device by which fish washed from the screen by the rear high pressure wash system can be collected.
 - d. Latent mortality evaluation tanks and associated water systems for use near the Ristroph screen or in the Fish Laboratory at the Unit 1 intake.
 - e. A device by which fish may be introduced into intake forebay 26 while the fixed screen at the entrance to the bay remains down. (The fish should be placed as close as possible to the fixed screen.)
 - f. A device by which fish can be placed in the fish troughs on screen baskets at a point below the front mounted high pressure spray wash system.
- Objective II: Collect, maintain and provide test fish for Ristroph screen studies at Indian Point and Houston, Texas.
 - Task 1: Collect and maintain in a healthy condition at the Indian Point Station bay anchovy, juvenile striped bass, white perch and Atlantic tomcod in sufficient numbers to conduct the specified tests. Approximately 2000 individuals of each species may be required. These fish may be collected from the Ristroph screen, or as necessary, by haul seining.
 - Task 2: At the request of Con Edison, ship live juvenile striped bass and white perch with appropriate governmental approvals to Houston, Texas for use by Dr. Ian Fletcher. (Note: multiple shipments may be required depending upon the capacity of holding tanks at Royce's facilities in Houston, to be provided by Dr. Fletcher.)

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Objective III: Determine the extent of damage and mortality that occurs to fish encountering the the Ristroph screen.

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- Task 1: Coordinate as necessary to ensure that a screen operator will be available on test days.
- Task 2: Determine the extent of damage and immediate mortality of bay anchovy, juvenile striped bass, white perch, and Atlantic tomcod following passage through the front mounted high pressure spray wash system.
 - Subtask 2.1: Place 20 live fish of a given species within a screen trough on the front (river) side of the machine below the high pressure spray wash, and have the screen basket rotated through the high pressure wash.
 - Subtask 2.2: Observe the fish in the screen trough following passage through the high pressure wash to determine a) the number of individuals that are missing, b) the number that are dead, and c) the number that display signs of damage including, but not limited to, erratic swimming, cuts, bruises, or substantial descaling. (Record the frequency with which each type of damage is noted).
 - Subtask 2.3: Record qualitatively the amount of debris removed from the screen mesh and transferred to: a) the front debris sluice, and b) the fish trough.
 - Subtask 2.4: Record the screen rotation speed, the pressure at which the high pressure wash is being operated, the water temperature and salinity.
 - Subtask 2.5: Repeat subtasks 2.1, to 2.4 five times for each species.
- Task 3: Determine the extent of damage and immediate mortality of bay anchovy, juvenile striped bass, white perch and Atlantic tomcod following passage through the low pressure wash and the fish return sluice with the flap seal in operation and with it out of service.
 - Subtask 3.1: Place 20 fish of a given species within a screen trough on the front side of the machine above the high pressure wash.

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 Flush all fish from the fish and debris sluices on the rear side of the screen, and then have the screen basket rotated through the low and high pressure washes on the rear side of the machine.

- Subtask 3.2: Collect fish from the fish sluice and the debris sluice on the rear side of the screen and determine for each sluice: a) the number recaptured, b) the number dead and, c), the number displaying signs of damage. (Record the frequency at which each type of damage is noted.
- Subtask 3.3: Record qualitatively the amount of debris transferred to: a) the fish sluice, and b) rear debris sluice.
- Subtask 3.4: Record the screen rotation speed, the pressure at which the low and high pressure washes are being operated, the water temperature and the salinity.
- Subtask 3.5: Repeat subtasks 3.1 to 3.4 five times for each species for each test condition.
- Task 4: Determine the collection rate of dead fish placed in the fish trough of screen baskets with the rear flap seal in operation and out of service.
 - Subtask 4.1: Place 20 each of dead bay anchovy, striped bass and white perch in a screen trough following its passage through the front mounted high pressure wash, and record the number of each species collected in the fish return sluice and the debris sluice, and the pressures at which the low pressure wash and the high pressure wash are being operated. Repeat this test 5 times for each species for each test condition.
- Ovjective IV: Determine the collection rate, damage and mortality experienced by striped bass, white perch and Atlantic tomcod placed in the intake forebay and subsequently collected in the fish and debris return sluices of the Ristroph screen system.
 - Task 1: Coordinate to assure that the fixed fine mesh screen to be installed at Intake Bay 26 will be left in the down position for up to 36 hours and that a diver will be available to keep the screen free of debris during a test period.

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- Task 2: Introduce 250 fish of each given species (striped bass, white perch) into the intake bay 26 between the Ristroph screen and the fixed fine mesh screen.
- Task 3: Collect fish recovered by the Ristroph screen and transferred to the fish sluice at the end of the intervals over a 36 hour period as specified by the following schedule:

Time

Action

- $t_0 =$ Fish introduced into bay
- t1 = the observation of the first
 released fish in the return
 sluices; sampling interval
 initiated
- t₂ = 1 minute 42 seconds since t₁:
 collect first sample
- t₃ = 4 minutes 55 seconds since start: collect second sample
- t₄ = 11 minutes since start: collect third sample
- t₅ = 22 minutes 37 seconds since start: collect fourth sample
- t₆ = 44 minutes 34 seconds since start: collect fifth sample
- t₇ = 1 hour 26 minutes since start: collect sixth sample
- t₈ = 2 hours 45 minutes since start: collect seventh sample
- t₉ = 5 hours 15 minutes since start: collect eighth sample
- t₁₀ = 9 hours 58 minutes since start: collect ninth sample
- t₁₁ = 18 hours 57 minutes since start: collect tenth sample
- t₁₂ = 35 hours 57 minutes since start: collect eleventh sample

Immediately following the collection of a sample,

examine the fish and record the number of fish that are a) alive and undamaged, b) alive but damaged, and c) dead. For those fish that are damaged record the frequencies of each type of damage. Species other than test fish that are collected should also be examined and their condition recorded.

- Task 4: Retain undamaged fish collected in task 3 in ambient temperature Hudson River water for 8 hours and record latent effects, including damage as well as mortality, at 1, 3.5 and 8 hours following collection. (Note: sample Nos. T-1, through T-6 shall be placed in one holding tank for latent effects studies. All succeeding samples are to be placed in separate holding tanks). If sufficient numbers (> 10) of species other than test fish are collected, these should also be held for examination.
 - Subtask 4.1: Record qualitatively the amount of debris transferred to: a) each of the debris sluices, and b) the fish sluice.
 - Subtask 4.2: Record the screen rotation speed and the pressure at which the high pressure and low pressure washes are being operated, the water temperature, and salinity.
- Objective V: Determine the abundance, morbidity and mortality of fish recovered opportunistically from the test Ristroph screen.
 - Task 1: Collect and record by species and length class all of the fish discharged each day (approximately 24 hour period) from the:
 - a) front debris sluice
 - b) rear debris sluice
 - c) fish sluice

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- Task 2: Determine the percentage of fish "alive and undamaged", "alive but damaged", "freshly dead", and "old dead" in collections from the fish sluice and from each of the debris sluices.
- Subtask 2.1: Three 2-hour long collections are to be made from the fish sluice and each of the debris sluices each day beginning at approximately 7:00 p.m. Collections should be made from the fish sluice by diverting water from that sluice into one of the three adjacent holding tanks for a period of 2 hours. At the end of 2 hours, sweep the fish sluice to remove all

fish, and then redirect the flow to another holding tank. Record the time that each test began and ended.

Immediately upon completion of each 2 hour collection interval, remove the fish from the first holding tank and each of the two debris sluice collection basins. Record the numbers of each species that are alive and undamaged, alive but damaged, freshly dead, and old dead in each of the standard impingement length classes. (Note: Fish that have begun to decompose or developed substantial fungus growth, demonstrating beyond any doubt that they were dead for a period of time much longer than the duration of the sample, should be classified as "old dead"; all other dead fish should be considered "freshly dead".)

Place the fish that are "alive and undamaged" and those that are "alive but damaged" from each sluice in separate aquaria. Non-predatory species may be mixed in a single aquarium. Predatory species should be held separately from other species upon which they might prey. The density of fish held in each aquarium should not exceed the capacity of the aquarium. Monitor the collection rate of fish and terminate a sample if the numbers of fish collected are near the holding capacity for the available aquaria. Repeat the above until three 2-hour collections have been transferred to the laboratory.

At the end of 8 hours following the termination of each sample collection interval, tabulate the numbers of each species "alive and undamaged", "alive but damaged", "freshly dead", and "old dead" by length class and sluice.

Subtask 2.2:

Following completion of the third 2-hour collections made from the fish sluice and each of the debris sluices, water from the fish sluice should be diverted into one of the three holding tanks for a period of two hours. At the end of 2 hours, sweep the fish sluice on the Ristroph screen to remove all fish, and then redirect the flow to a second holding tank. Do not remove the fish from the holding tank into which the sample was collected.

Remove and classify the fish collected in the debris basins as in Subtask 2.1 at the end of each 2 hour collection interval. Transfer fish collected in the debris basins to the fish laboratory and place in aquaria as described in Subtask 2.1.

At the end of 8 hours following the termination of each 2 hour sample collection, drain the holding tanks in which fish from the fish sluice are being held, and the aquaria in which fish from the debris basins are being held and tabulate the numbers of each species as in Subtask 2.1.

- Subtask 2.3: Following completion of the sample collections for Subtask 2.2, redirect the water flow from the fish sluice to the mobile fish collection tank to continuously accumulate fish discharged during the next 12 hours. Separately collect all fish discharged from the front and rear debris sluices over the same 12 hour interval. At the end of approximately 12 hours, tabulate by collection basin, the numbers of each species as in Subtask 2.1.
- Subtask 2.4: For each of the fish collections determine the amount and type of debris collected from the associated sluice. Characterize the type of debris of filamentous algae, eel grass, spartina, leaf litter or other.

Task 3: Record operational and environmental data

- a) Wash Pressure; debris spray; inside fish spray; outside fish spray
- b) Screen travel speed
- c) Water temperature
- d) Water salinity
- e) Circulating water pump flow rate

Objective VI: Schedule and Data Records

April 1964

- Task 1: Complete Objective III by July 15, 1986, Objective IV by August 15, 1986 and Objective V by October 24, 1986.
- Task 2: Provide within 72 hours of completion of each of the Objectives III, IV, and V verified results, including compiled data sheets and all written notes of observations made during the study.



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Consolidated Edison Company of New York, Inc. 4 Irving Place, New York, N.Y. 10003

December 16, 1993

Dr. Mark Mattson Normandeau Associates, Inc. 25 Nashua Road Bedford, New Hampshire 0

Dear Dr. Mattson:

Enclosed is a scope (fish-saving features insta Kill Generating Station.

of pages ▶ Post-It™ brand fax transmittal memo 7671 Phone # Dept. Fax

--milar to that performed by NAI with theupn-modified through-flow screen at Indian Point Unit No. 2, requires collection efficiency tests as well as monthly latent effects assessments from two modified and one unmodified dual flow screen for a period of one year, beginning as soon as screen modifications are completed in February 1994. Results are to be compared with those from Indian Point.

Please provide a technical proposal to perform this work under the terms and conditions of the impingement and entrainment study contract for Arthur Kill, Purchase Order No. 220385, by January 14, 1994. If you have any questions, please call me at 212-460-6059.

Ken now works

this by 31 Dec. 1993

Sincerely,

Kenneth L. Marcellus, Ph.D.

Senior Scientist

Attachment

cc: Wm. L. Kirk



Scope of Work

To Determine the Post-Impingement Viability of Fish and Bluecrabs Impinged on Dual Flow Screens Installed at Arthur Kill Generating Station

Background:

Arthur Kill Station dual flow screens nos. 24 and 31 are being outfitted with Ristroph-type fish-saving features to determine whether post-impingement survival of fish will be similar to that observed following collection from Ristroph-modified through-flow screens at Indian Point Unit No. 2. Dual flow screen modifications are expected to be completed during February 1994. Biological evaluations will start immediately thereafter, and continue monthly for one year. Evaluations will include determination of collection efficiencies for fish released into the intake, transfer efficiencies of fish from screen baskets to return sluices, and initial and latent mortality of recovered fish. Results will be compared with similar evaluations of fish collected from an unmodified dual flow screen as well as from the Ristrophmodified through-flow test screen at Indian Point Unit No. 2 (Attachment 1). Computation of species-specific mortality will be based on total numbers of damaged and dead fish at the end of the latent effects assessment periods relative to the total numbers collected. Fish condition will be classified as follows:

Alive: No visible signs of physical damage; active

swimming and orientation behavior.

Damaged: Fish with visible external damage (missing

scales, mutilations, or hemorrhages) or showing abnormal or weak swimming and

orientation behavior.

Dead: No obvious external signs of life or severe

physical mutilation with only slight opercular motion and no other body

movement.

Data are to be tabulated in the format established by Fletcher (1986; Attachment 1). Results of the first five months of evaluations will be presented to the NYSDEC in an oral briefing. Based upon the information available at that time, study objectives may be modified.

Work Scope

- Objective I. Provide the comprehensive management required to ensure that all evaluations of this Sub-study are carried out in compliance with the terms and conditions of the contract.
 - Task 1. Provide necessary controls to ensure contract compliance.
 - Task 2. Provide materials and equipment needed to fulfill the requirements of this scope of work. Major equipment includes, but is not limited to:
 - a. Three 8 ft x 3 ft x 2 ft 200 gallon tanks, each outfitted with a screened overflow/valved drain pipe and flexible discharge hose, and mounted on wheels, for collection of fish from low pressure wash fish sluices.
 - b. Three collection baskets for recovery of fish alive and undamaged from the high pressure wash debris sluice for determination of survival and latent effects.
 - c. Latent effects assessment tanks
 (Aquaria) for evaluations of up to 50
 fish of each of 5 species of fish,
 including blue crabs, at one time from
 each of three test screens. The tanks
 shall be supported on prefabricated
 metal shelving, which must be
 appropriately coated to minimize
 rusting from salt water. Provide all
 plumbing and drain lines for these
 tanks.
 - d. Submersible pump(s) for provision of water to the latent effects assessment tanks.
 - Task 3. Provide information necessary for Con Edison to evaluate work in progress.
 - a. Provide oral reports, as requested, on status of evaluations.

- b. Document invoices by providing receipts for all expenses exceeding \$100, employee time sheets, travel and expense vouchers, and equipment expense charges.
- Task 4. Provide standard operating procedures for the performance of fish collection efficiency and latent effects assessments.
 - a. Provide 5 copies of a draft Standard Operating Procedure (SOP) for performance of tests 10 working days before commencement of tests.
 - b. Provide updates to the SOP 10 working days after modification of procedures, as necessary.
 - c. Provide the final SOP as an appendix to the comprehensive study report.
- Task 5. Provide personnel for performance of the work plan.
- Task 6. Analyze all biological samples fresh.

 Samples removed from the Arthur Kill
 premises are the responsibility of the
 contractor, and disposal must be in
 accordance with all applicable federal,
 state and local laws. Samples remaining on
 the premises may be disposed of with dualflow screen washings.
- Task 7. Check all collected striped bass for magnetic cheek tags. Unless otherwise available, provide magnetic field detector for detection of striped bass tags. Retain frozen all suspected cheek-tagged striped bass for verification under separate contract.
- Task 8. Provide special handling for all shortnose sturgeon that might be encountered. Record date, time, location, weight (nearest gm), and length (nearest mm). If fish is alive, release it as soon as possible to the water source. If the fish is dead, record all pertinent data, tag it and store it frozen for up to one year for inspection by the DEC.

- Task 9. Modify work scope to improve study procedures at the direction of Con Edison.
- Objective II. Determine Effectiveness of Fish-Saving Components of Modified Dual Flow Screens Relative to that of an Unmodified Screen (Controlled Tests).
 - Task 1. Evaluate fish transfer efficiency from screen baskets to the collection sluices of two Ristroph-modified dual flow screens and to the debris sluice of one unmodified dual flow screen.
 - Subtask 1. Coordinate with Con Edison to ensure that a screen operator will be available on the test day(s).
 - Subtask 2. Have Con Edison install the temporary fish sluices into the screen housing of the two dual flow screens outfitted with fish saving features.
 - Subtask 3. Install fish collection nets within the fish and debris sluice of the modified dual flow screens.
 - Subtask 4. Turn on the low pressure sprays wash and supplemental sluice water supply to the screens.
 - Subtask 5. Open the inspection hatch on the ascending side of the modified dual flow screens, and distribute 150 marked, dead specimens of each of two seasonally abundance species among 15 screen baskets as they rotate by the hatch. Record separately, the number of each species recovered from the fish sluice and from the debris sluice of each screen. Identify the number not recovered. To the extent practical, identify the cause for non-recovery of fish in the fish sluice. Repeat this test on an unmodified screen.

Subtask 6.

Perform subtask 5 with two species of live, marked seasonally abundant fish, and determine 8 hour latent effects for those recovered from the fish sluice and the debris sluice of each modified screen. Hold a similar number of marked "control" fish of the two species used in the test to evaluate handling effects. Examine fish at the end of the test and record the nature and extent of observable damage. Record total lengths of test and control fish. Repeat this test on one unmodified screen.

Note:

Test fish should represent each of two relative hardiness groups (i.e. hardy = striped bass, white perch; delicate = bay anchovy, alewife), and may be collected from the dual flow screen. However, live fish must be held for at least 24 hours before testing. Only healthy, undamaged fish are to be used in latent effects assessment tests. Fish density per latent effects assessment tank should not exceed approximately one gram of fish per liter.

- Subtask 7.
- Record screen rotation speed, and high and low spray wash pressures
- Subtask 8.

Record water temperature, salinity and dissolved oxygen within the latent effects assessment tanks at the beginning and the end of each test.

Schedule:

Perform Task 1 during the second month of each quarter, using species of fish that differ from those tested before.

- Task 2. Evaluate bluecrab transfer efficiency from screen baskets to the collection sluice.
 - Subtask 1. Repeat Task 1 with live bluecrabs and perform 8 hour latent effects assessments for recoveries from both the fish sluice and the debris one time during the summer season for Task 1.
 - Subtask 2. Repeat Subtask 1 on an unmodified screen.
- Unless otherwise performed in other Arthur Task 3. Kill Station monitoring programs, evaluate fish collection efficiency from the intake forebay by releasing 150 marked, dead fish (seasonally abundant species) through the bar screen at each intake bay outfitted with a modified dual flow screen and at one unmodified screen. The fish are to be released at approximately 5 feet below the surface of the water at the center line of each intake bay. A 2" pvc pipe may be used to convey the fish to the release point. Monitor sluices for recoveries for one Record the number of fish recovered hour. from the fish and the debris sluices of the respective screens for the intake bays at which the releases were made during the next 24 hours. Perform this test on each of four tidal current stages: low slack, maximum flood, high slack, and maximum ebb tide.

Schedule: Perform Task 3 quarterly on the same schedule that Task 1 is performed.

- Objective III. Determine Post-impingement Viability of Fish and Bluecrabs Collected Opportunistically From Modified Dual Flow Screens and From an Unmodified Screen.
 - Task 1. Coordinate with Con Edison to ensure that a screen operator will be available on the test day(s).
 - Task 2. Have Con Edison install the temporary fish sluices into the screen housings of each of the two dual flow screens outfitted with fish saving features.

Task 3. Prepare latent assessment holding tanks to receive fish collected from the fish and the debris sluices of the two dual flow screens and one unmodified screen.

Note: Fish density per latent effects assessment tank should not exceed approximately one gram of fish per liter.

- Task 4. Install fish collection tanks to receive flow from the fish sluices; place collection nets within the debris sluices.
- Have Screen Operator turn on the low Task 5. pressure spray washes (10 psig) and the supplemental collection sluice water supplies, and collect fish for up to one hour from each modified dual flow screen and from the unmodified screen. (Since some fish may have accumulated in the screen sluices before the start of the test, flush these fish from the systems prior to the start of the sampling interval. (Sample collection duration may be shortened/lengthened depending on debris loading and relative abundance of fish and bluecrabs.)
- Task 6. At the end of the sample collection period, turn off the low pressure spray washes and the supplemental sluice water supplies.
 - Subtask 1. Flush out all fish and bluecrabs remaining in the sluices, and carefully remove fish and bluecrabs from the debris collection nets. Examine fish and bluecrabs and record the nature os damage, including mortality, if present. Place only live, undamaged fish and bluecrabs into separate aquaria for 8 hour latent effects assessments. Attempts should be made to hold all alive (normal) fish collected from all collection gear. (Shorten sampling interval if excessive quantities of fish are collected; however, once the requisite number of 50 of a target species

has been collected within the monthly sampling interval, further collections of that species may be disregarded. Compatible species of fish may be held within the same aquarium.)

Subtask 2. Drain the fish sluice collection tanks; carefully remove fish and record the nature of damage, including mortality, if any is observed. Place alive (normal) fish into aquaria for 8 hour latent effects assessments.

Subtask 3. Record by sluice, the number of fish collected and determine by species number recovered alive, damaged and dead initially and at the end of 8 hours. Record the total lengths of fish evaluated.

Note: Test fish are to be classified as Alive (Normal), Damaged, or Dead, as follows:

Alive: No visible signs of physical damage; active swimming and orientation behavior.

Damaged: Fish with visible external damage (missing scales, mutilations, or hemorrhages) or showing abnormal or weak swimming and orientation behavior.

Dead: No obvious external signs of life or several physical mutilation with only slight opercular motion and no other body movement.

Task 7. Repeat Task 6 up to three times (at least two hours) per test day per screen (two modified and one unmodified dual flow screen) to attempt to obtain 50 fish of each of 5 target species that are seasonally abundant. Up to 50 fish (or more if space allows) of other seasonally abundant opportunistically collected

species are to be held per sampling day as well.

- Task 8. At end of the final collection on each of the three test screens each month, drain down the collection tank and remove bluecrabs and debris. Leave the fish in the tank, refill it, and determine latent effects at the end of 8 hours. Record the total lengths of fish evaluated.
- Task 9. Have the screen operator remove the fish collection sluice and return the dual flow screens to normal operation.
- Notes: Tasks 1 through 9 are to be performed monthly from February 1994 through January 1995.

Sample collection may need to be performed at night in order to increase the likelihood of collecting adequate quantities of target species.

- Objective IV. Provide Summary and Comprehensive Study Reports.
 - Task 1. Following completion of five months of sampling, prepare summary tables of results of fish and bluecrab transfer efficiency and latent effects assessments, intake bay recovery assessments, and post-impingement viability assessments of fish collected opportunistically.

Note: Mortality is to be calculated based on the combined numbers of damaged and dead fish relative to the total number collected and evaluated.

- Task 2. Attend and discuss results of studies at meetings (two attendees at two possible meetings) as requested.
- Task 3. Following completion of field studies prepare a draft Comprehensive Report on Results.
 - Subtask 1. Compare and contrast results obtained from the modified dual

flow screens with those from the unmodified dual flow screens.

Subtask 2. Compare and contrast results obtained from the modified dual flow screens with those obtained from the modified Ristroph screens installed at Indian Point as reported by Fletcher (1986).

Task 4. Provide Con Edison with the following preliminary data for each sampling date: Species and numbers collected; total length of all test fish, including control fish, evaluated for transfer and collection efficiency, and post-impingement viability. Data must be provided as SAS or ASC-II files three working days following the end of each monthly test period.

Task 5. Provide all final data in standard SAS files having file structure similar to the impingement master data base for the Arthur Kill Station, and provide microfilm records of all corrected data sheets and detailed standard operating procedures within 45 working days after completion of field studies.

Schedule: Obj

Objective IV. Task 1.

Submit 5 copies of draft tables of study results 15 days after completion of the fifth month of field studies.

Objective IV. Task 3.

Submit 5 copies of a draft comprehensive report 30 days after completion of field studies. Submit final report within 30 days of resolution of comments.

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- Objective II. Provide Velocity Profile Measurements of Water Passage Through The Dual Flow Screens
- Task 1. Conduct velocity profile measurements on both the ascending and descending sides of the dual flow screen on four tidal current stages low slack, maximum flood, high slack, and maximum ebb tide. Profiles are to be measured at five uniformly spaced locations across the face of the screen basket and at five uniformly-spaced depths within the intake bay. Profiles are to be recorded for x and y coordinates, at a distance of approximately 6 inches from the screen mesh along the horizontal centerline of the basket.

Note:

It is anticipated that flow measurement equipment will have to be mounted on screen baskets, which will then be rotated to the required location for recording velocities. An installation plan should be developed and worked out with Con Edison in advance of the test day(s).

- Task 2. Coordinate with Con Edison to ensure that a screen operator will be available on the test day(s).
- Task 3. Record water temperature and conductivity during each velocity profile assessment.
- Schedule: Perform Objective II within the first 3 months of field studies.

TO: Jim Reichle FROM: Paul G. DATE: 12/20/93

RE: Survival work at Arthur Kill

cc: M. Ricci

Ken just sent this sole source scope of work to us for the survival work at Arthur Kill Station. He may talk to you about this at Ravenswood on Tuesday. I want you to read the entire RFP and cost out completely, labor (hours by labor grade) and non-labor (include sales tax), the following sections:

Obj I Task 2 (all)
Task 7 (need detector in working condition)
Task 8 (prob. no cost)

Obj II Task 1 (all) Task 2 (all) Task 3 (all)

Obj. III All tasks

For each objective and task state all assumptions. For example on Obj. III state how long do we assume collections will be made to make quotas. Do we use two crews? One to make collections and start holding periods, and the other to terminate? Note that in Objective II we will need a lot of fish for transfer and collection efficiency and there will not be any ongoing impingement programs. Also note in Obj. IV Task 4 that lengths will be needed for transfer and collection efficiency and survival work. Ken wants this ASAP. Can you complete costing by 28 December and FAX to me? This is not competitive bid and it is likely that the Scope of Work will change once we start.

AK will be demobilized this week at the end of sampling. Tell Ricci where the AK flow diverters are. You will have 27 December available for this costing. Call me if you have questions.

Risk Analysis for Fish Diversion Experiments: Pumped Intake Systems¹

R. IAN FLETCHER

Great Salt Bay Experimental Station Damariscotta, Maine 04543

Abstract

Such facilities as power-generating stations, public water systems, and ore-processing plants draw off large quantities of water from estuaries, coastal seawaters, lakes, and rivers. In turn, large numbers of fishes are often drawn into these pumped intake systems and killed if not otherwise removed or diverted. The large mortalities associated with many intake systems threaten the perpetuation of indigenous stocks. The diversion and removal devices most commonly used for protecting fish life from such risks are presumed to operate on principles shown here to be erroneously conceived. In consequence of these faulty theories, the estimators and experimental designs of standard industry practice seldom reveal the true correlations necessary for improvements in fish conservation systems, nor do the assessments of small-scale experiments extend with reliability to full-scale system designs. Such passive devices as angled barrier screens are thought to guide fish in some way into pumped bypassing ducts, but an analysis of existing data supports instead a hypothesis of random encounter whereby the activities of entrapped fish are governed by the probabilistic mechanics associated with random walks and unlike boundary conditions. Experimental designs for separating and assessing time-dependent risks are developed for the case of competing devices in a given test system. From time-dependent comparisons between large and small systems (in particular, between a model system and its full-scale prototype), the net decrease in the probability of fish survival associated with increased system size is shown to be the consequence of increased exposure to the risk of death (increased residence time) rather than the consequence of increases in the unit risk of death itself. Where extensions of small-scale empirical results to full-scale system designs are wanted, arithmetic extrapolations yield erroneous results, Because displacement dependence (fish movement and system size) enters the risk analysis, the scaling problem must be resolved instead from a corresponding system of partial differential equations.

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Industrial and public-service facilities of many and dissimilar functions share a common demand for large volumes of water in their operations. As a rule, such users as power-generating stations, ore-processing plants, public water systems, pumped irrigation canals, and pulp mills draw their supplies, more or less continuously, from such natural sources as rivers, lakes, estuaries, and coastal seawaters. At the two Indian Point nuclear power stations in New York State, for example, upwards of 7.5 million litres perminute of Hudson River water are pumped through the condensers of the generating units (Stone and Webster 1976). Similar quantities are diverted from the San Joaquin and Sacramento rivers at Tracy, California, and pumped into the Delta-Mendota Canal, accounting at times for the entire flow of the San Joaquin River and half the Sacramento flow (Bates and Vinsonhaler 1956).

As with most such diversions of natural waters, quantities of fishes large and small are regularly drawn into the intake structures of the pumping facilities. Once drawn in, the fish tend to move with the water flow until they are blocked in their transit by barrier or "intake" screens. These screens, in one form or another, are universally employed as the means for preventing the passage of debris into the circulating pumps of the facility. Some barrier screens are stationary, but many, as part of a system for removing debris and fish caught in the screen meshes, are moved (are caused to "travel") in a vertical direction around driving sprockets after the manner of an endless belt. Whether stationary or travelling, the barrier screens block the further entrainment of indrawn fish (except for larvae small enough to be extruded through the screen meshes). Up-

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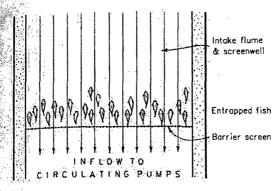


FiGURE 1.—Fish entrapped in a water intake flume swim headmost into the current.

wards of 100% of the fish so entrapped remain in the screenwells of the intake structure if not otherwise removed, eventually suffering injury or death from being pressed against the barrier screen or into its meshes by the force of the water flow. Because active fish tend to align themselves parallel with the oncoming flow and headmost into it, they are moved rearwards in their approach to the barrier screen (Schuler 1973; Stone and Webster 1976). As the fish come into tailfirst contact with the barrier screen they may dart out some ways but tend to stand against the flow in the region just ahead of the screenfront (Fig. 1). In so swimming at the net speed of the oncoming flow, the fish must increase their rates of energy expenditure owing to increased swimming effort. As the fish become exhausted over time, they are pressed onto the barrier screen by the force of the inflow (the time to exhaustion depending on such factors as species, size, physiological condition, water velocity, and water temperature).

The fish kills associated with large-volume water diversions are often very great, and the potential for long-term depletion of indigenous populations has been a worrisome problem over several decades for the regulatory agencies of the various states, the U.S. Environmental Protection Agency, and the power industry in particular. The conservation problem, although significant in terms of risks to fish populations, litigation costs, and costs to industry for expensive (but generally ineffective) fish conservation systems, has not been well attended to by the fishery science community at large. Although much industry-funded research has been produced over the years (in the form of test-flume studies, field sampling of full-scale systems, laboratory-scale experiments on fish diversion devices, and hydrological modelling), very little of it has appeared in the open, refereed literature. Because these industry-generated studies are seldom subjected to outside review, they vary in reliability and must be used with caution.

Very often, industry and consulting biologists are forced to deal with problems outside their own fields of specialization, and a hard-pressed investigator is apt to follow without examination the conventions and doctrines of his predecessors. In this way, apparently, several plausible but faulty hypotheses have persisted in the technical literature and, through repetition, become axiomatic. These errors in reasoning and practice, generally arising from misperceptions of critical topics in probability theory, vector mechanics, fluid dynamics, and relative motion, have misled investigators into designing experiments in which inconsequential events are often stressed and the more critical ignored, all to the cost of advancements in conservation designs and the requisite understanding of fish behavior in moving water.

Many of these faulty hypotheses and experimental designs are examined at length in Fletcher (1984), a study sponsored by the New York State Department of Environmental Conservation, and it is not my purpose here to repeat that criticism in detail. But because the analysis and experimental designs outlined here depart so radically from those of industry practice, and because the conclusions reported here are so opposed to the beliefs of many investigators and industry biologists, a certain amount of critical exposition is owed the reader. Some discussion of those difficulties has been incorporated into the narrative that follows; more explicit examples of the estimators and experimental designs associated with current practices can be found in Appendices C and D of this article.

Owing to the (usually) limited circulation of the technical literature on fish conservation, active entry into this important field of inquiry is hindered as much by the inaccessibility of information as it is by the cross-disciplinary demands of the phenomenological problems themselves. The citing of obscure literature in this article is regretted, but it is unavoidable; no other starting point exists at this time. For the benefit of the reader who might be motivated to pursue the problems addressed here, I have augmented the citations with as much source information as possible. For additional assistance in obtain-

ing obscure references, two good sources are the Electric Power Research Institute, 3412 Hillview Avenue, Palo Alto, California 94303, and the Empire State Electric Energy Research Corporation, 1217 Avenue of the Americas, New York, New York 10020.

The work of this article applies to systems of pumped (or pressure-driven) flows; it does not extend unaltered to intake systems that operate on gravity-driven flows (such as the turbine intakes of hydroelectric dams). The geometry and velocity distributions of a gravity-driven flow (as well as the disposition of the fish entrapped therein) will differ in some ways from those of a pumped flow. Because of those differences, the risk assessments that apply to systems of gravity-driven flows are deferred to a later paper.

Conservation Devices

Many schemes and appliances have been devised with the common aim of reducing the fish kills associated with large water-intake systems. Various nonmechanical means have been tried with the intended purpose of frightening off the fish prior to their entrapment or inducing their entry into bypassing conduits. No known stratagem of that kind (such as sound waves, bubble generators, strobe lights, shock waves, chemical repellents, or electricity) has yet proven effective in full-scale systems (Kerr 1953; Applegate et al. 1954; Moore and Newman 1956; Johnson et al. 1958; Burner and Moore 1962; Van Derwalker 1966; Bates and Van Derwalker 1969; Bechtel Associates 1970; Pugh et al. 1970; Bell 1973; Texas Instruments 1974; Schuler and Larsen 1974; Stahl 1975; Stone and Webster 1976; Pagano and Smith 1977; Lieberman and Muessig 1978; Patrick and Vascotto 1981; Hadderingh 1982; Haymes et al. 1984; Lawler, Matusky and Skelly 1984; Ontario Hydro 1984).

Various mechanical modifications to the barrier screens themselves have also been tried. In one demonstration, a travelling barrier screen, ordinarily moved in a vertical direction, was redesigned and moved in a lateral direction, crosswise to the flow, with its frontmost side driven in the direction of a bypassing slot located at one end of the moving screen (Bates 1970; Farr and Prentice 1973; Prentice and Ossiander 1973). During experiments in a testing flume (and at least one full-scale installation), the horizontal screen effectively conveyed young salmonids to the bypassing slot with little apparent trauma to

the test fish. Although promising in that regard, the device was mechanically unsound. Among other problems, the engineers were unable to devise a suspension system adequate to the scale and to the pressure heads of large intake systems.

Vertical travelling screens of conventional design have also been equipped with troughs affixed at regular intervals and extending across the screenface (the so-called Ristroph modification). The troughs are meant to scoop the fish up from the front of the screen and then raise them through a system of water jets, which, in turn, are meant to wash the fish from the troughs and into a sluice for their return to the source waters. An application of the Ristroph design at the Surrey power station in Virginia is reported by White and Brehmer (1977) as being effective in reducing fish mortalities (although the authors cite no data in their report). Tests with a similar modification at the Danskammer Point power station in New York showed no mortality reductions over conventional travelling screens when the conventional screens themselves were moved through a wash-down system like that of the Ristroph modification (Clock and Huggins 1981; Ecological Analysts 1982). In a series of comparative tests at the Salem nuclear power station on Delaware Bay, a variation on the fish-trough screen by Royce Equipment Company was shown to impose mortalities somewhat lower than those of a more standard Ristroph design (Public Service Electric and Gas Company 1984).

In recent years, many large pumping facilities have been equipped with passive guiding barriers, usually in the form of vertical metal louvres or conventional barrier screens, placed diagonally across the intake flume (or in some way at an angle to the oncoming flow), with a narrow bypassing slot located at the apex of the acute angle between the barrier and the wall of the flume. The thought behind any of these angled barriers is that indrawn fish might somehow be guided or swept along it and into the bypass.

In many tests with angled louvre arrays, the majority of the fish were drawn directly through the louvres and into the pumps of the intake system or into an auxiliary barrier screen (Ducharme 1972; Schuler 1973; Skinner 1974; Texas Instruments 1974; Stone and Webster 1976; Taft and Mussalli 1978). The only louvre arrays that seem to be effective in guiding fish in any way are those whose louvre vanes are designed to create a strong local turbulence within the vane

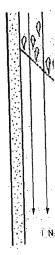


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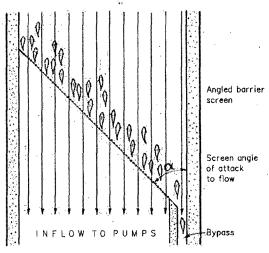


FIGURE 2.—Typical configuration of angled barrier screen and pumped bypassing slot. Fish swim headmost into the current.

openings (Bates and Vinsonhaler 1956; Hallock et al. 1968; Stone and Webster 1976; Odenweller and Brown 1982). As a fish comes into tailfirst contact with the zone of turbulence at the louvre face, it tends to move away from the turbulence somewhat more in a direction normal to the angled array than directly into the free-stream current, the net effect being a small lateral displacement that eventually puts the fish, after repeated excursions, into the bypassing current along the flume wall. But the innovation that imparts the gain in fish survival also imparts a loss in efficiency to the plant. Because the turbulence between the louvre vanes impedes the free flow of water into the intake system, the power expended in overcoming the accompanying head losses becomes so great that turbulent barrier systems are judged to be impractical for most facilities.

With conventional barrier screens set at an angle of attack to the flow, no effective turbulence is created (beyond the small-scale disturbance immediately behind each screen wire). As with the barrier screens set normal to the flow, the indrawn fish tend to stand against the oncoming flow in the region just ahead of the screenface (Fig. 2), and their lateral excursions seem to be randomly executed (in contrast to their responses to the turbulent louvre array). Some advocates of angled-screen designs advance the curious hypothesis that while the inflowing water is obviously drawn through the barrier screens by the pumps of the facility, some portion of the water

will also flow along the face of the screen, towards the bypassing slot, carrying the fish along with it. Other writers envision the fish as being guided across the oncoming flow and towards the bypass by a velocity vector component. Although the first notion (the criss-crossing flow) is an appeal to a physical impossibility, and the second (the Cartesian vector component) an appeal to a mere mathematical convention, the notions persist and are given wide credence among industry experimenters. At least one of the two arguments appears explicitly in each of the following studies: Schuler (1973); Texas Instruments (1974); Schuler and Larsen (1974); McGroddy et al. (1981); Copeland et al. (1981); Lawler, Matusky and Skelly (1982b).

Although the presumed objective common to all displacement schemes is that of removing fish from intake structures unharmed, the practice in virtually all fish diversion demonstrations is that of emphasizing the "efficiency" (the effectiveness) of a system in diverting fish from the screenwell into a removal device (such as a screen trough or a bypassing duct), whether the fish are alive when diverted or not. This efficiency measure is calculated, over any arbitrary time period, from the ratio

$$\frac{D}{D+I},\tag{1}$$

D being the numbers of fish diverted (the numbers collected, dead or alive, after their exit from the screenwell) and I the numbers impinged (the numbers actually embedded in the screen meshes or held fast in some way by the screen structure). So whether all the fish might be alive when collected or all dead, the associated diversion efficiencies (1) would be the same. Although the percentage surviving of the fish passed through the removal system is sometimes accounted for and reported, angled-screen demonstrations in particular are invariably conceived and designed around formula (1), and often with either or both of the mistaken notions about fish guidance as the given assumptions. No distinctions are ever made between actively swimming fish that might enter the bypass without forcible contact with the barrier screen and those that are pressed against the screen and forced along it to the bypass by the oncoming flow. Owing at least partly to this indistinction, misconceptions about the physical properties of the system and the actions of the entrapped fish are perpetuated.

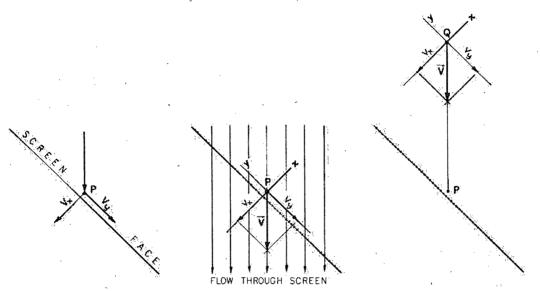


FIGURE 3.—Left, erroneous interpretation of water flow in the vicinity of an angled screen. Center, correct Cartesian representation of water velocity V (as a vector point function) in the vicinity of a barrier screen, pumped intake flow. Right, reference point (Q) moved a distance directly upstream of P.

It is common to read of angled-screen installations being 90 to 100% effective in guiding or successfully diverting entrapped fish from a screenwell into a bypassing system. But all that such figures really tell us are the percentages of fish that remain affixed to the barrier screen itself. An angled screen device 99% effective in diverting captive fish and debris into a pumped bypass may leave only 1% of the fish behind, but it may also be ineffective altogether in preserving the lives of the 99% diverted. In a typical study of a full-scale installation of angled barrier screens at a power-generating plant on Lake Ontario (Lawler, Matusky and Skelly 1982b), the "total diversion efficiencies" for one particular month were reported as being 91% for alewives Alosa pseudoharengus (9% remaining on the screen meshes, or "impinged"), 92% for rainbow smelt Osmerus mordax (8% impinged), and, for another month, 93% for white perch Morone americana (7% impinged). But from the data on the bypassed fish it can also be determined that of the bypassed alewives, 86% were dead or injured on arrival in the collection basin, and of the 14% remainder 89% died soon after collection, for an overall mortality of 99%. The corresponding immediate and cumulative mortalities for the rainbow smelt were 59 and 95%, and for the white perch 80 and 84%. Apparently, few of the suc-

cessfully diverted fish escaped a direct and unhappy encounter with the barrier screen.

In experiments with angled-screen and bypass devices in small test flumes (Stone and Webster 1976; Alden Research Laboratory 1981; Lawler, Matusky and Skelly 1981, 1982a), the imposed deaths and injuries occur in percentages significantly lower than those of large-scale systems, owing principally to the shorter mean times that fish spend in the screenwell prior to encountering the escape route. As shown in films of test flumes, fish swimming in the region just ahead of the barrier screen exhibit small lateral displacements, apparently from cueing on other members of the school, that tend to distribute the fish along the screenfront. Thus, the narrower the intake flume the greater the probability that an actively swimming fish will encounter the narrow band of bypassing current at the flume wall before exhaustion (or chance) overtakes it and the oncoming flow presses it against the barrier screen.

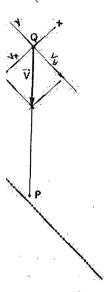
The Guiding-Component Hypothesis

The relationships between fish and barrier screen and the forces of the water flow on the fish are not the same for a fish impressed against the screen as they are for a fish stemming the current just ahead of it. Let us clearly understand

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at the outset that with a flow and screen configuration like that of Fig. 2, there can be no such thing as a bifurcating flow at the screenface or a guiding water velocity parallel to the screen. Yet in reports of angled barrier studies, the investigator will often illustrate the theory of guiding velocities by showing (or describing) a diagram like the left panel of Fig. 3, where the component \mathbf{v}_{ν} is said to represent the velocity of the flow parallel to the screen and v_x the velocity of the water flowing through the screen. Neither interpretation is correct. The quantities v_x and v_y (often given as v_1 and v_2) are nothing more than the mathematical components (the directed Cartesian components) of the water velocity V at some arbitrary point ahead of the screen (Fig. 3, center). Nothing in this corporeal universe was ever guided or caused to move by a Cartesian component of velocity. The directions of components v_r and v_v merely reflect the author's choice of reference axes (whatever his motivation might have been for choosing them), not independent velocities or directions of flow. Any other orientation of the reference axes would be just as valid for describing velocity V as the component sum $\mathbf{v}_x + \mathbf{v}_y$; the choice is arbitrary and wholly independent of the phenomenology of the flow.

It is never made clear just how far in front of the screenface the guiding velocity or guiding flow is thought to extend. Presumably it is not more than several centimeters. In the full-scale study of the Oswego plant by Lawler, Matusky and Skelly (1982b), for example, components v₁ and v₂ were resolved from velocity measurements approximately 15 cm forward of the screenface and so labelled as flows and velocities parallel and perpendicular to the screen. Let us examine that hypothesis by moving the reference point well ahead of the presumed guiding zone, say a distance ten feet directly upstream of P to a new location point Q (Fig. 3, right) without a change in orientation of the reference axes. The velocity V at point O will have exactly the same vector components as V at point P: $V = v_x + v_y$. If we now put a fish (or any other neutrally buoyant object) at Q, it will no more be guided in the direction of \mathbf{v}_{ν} (or \mathbf{v}_{x} for that matter) than it would be at point P. It is gratifying to find the following substantiation in at least one report on angled-screen experiments (Alden Research Laboratory 1981):

"Velocity data indicated that the flow in the approach section [of the test flume] was distributed

uniformly at a cross-section 10 feet upstream of the angled screen. A traverse of velocity measurements 4 inches upstream of the screenface [revealed] velocities of the same magnitude and same direction as those of the upstream crosssection."

In swimming directly into a freestream flow of water (whether 4 inches or 10 feet upstream of a barrier screen), a fish needs only to resist the straight-on force of the flow in maintaining its position ahead of the screen; the screen imposes no lateral forces on the fish upstream of the screenface. Should the fish fall back against the screen, whether through exhaustion or the inability to swim at a speed equal to the speed of the oncoming flow, then the forces of the screen, through frictional roughness (or impediments) and its angle to the flow, will directly influence the disposition of the fish and may then guide it, so to speak, to the bypass. But if our representative fish arrives at the entry to the bypass without forcible contact with the barrier screen, it does so through its own actions and reactions, either through random lateral excursions while swimming, through cueing on or reacting to the excursions of other fish, or through some stimulus that biases its own lateral movements more towards the bypass than away from it. If angled screen devices provide any such bias, it must be a weak one.

Entrapped fish spend surprisingly long periods of time in screenwells merely standing against the flow, just ahead of the barrier screening. In a series of experiments with angled barrier screens in a laboratory test flume, Alden Research Laboratory (1981) evidently found the residence times of test fish in a typical experiment to be greater (sometimes much greater) than the planned duration of the experiment. Although the test flume was less than 2 m wide, the fish were not readily guided to the bypass by screens set at either of two test angles. The Alden experimenters conducted 58 experiments with various combinations of species (striped bass Morone saxatilis, white perch, alewife, Atlantic menhaden Brevoortia tyrannus), screen angles (25°, 45°), water velocities (30 cm/s, 60 cm/s), and water temperatures (0-22°C). In all but three cases, quantities of fishes (sometimes the majority of the experimental sample) were still swimming in the test flume at the termination times of the experiments. (The Alden data are tabulated on Table C-1, Appendix C of this article.)

Residence times of entrapped fish are even greater in full-scale systems. In the study by Lawler, Matusky and Skelly (1982b) on the angled barrier and bypass system of the Oswego power station, the investigators introduced marked fish of various species into the intake screenwells and found residence times of at least 681 h for brown trout Salmo trutta, 1,269 h for smallmouth bass Micropterus dolomieui, 48 h for yellow perch Perca flavescens, and 546 h for white perch. (Sclections from the Oswego data are given in Appendix D.)

The greater the mean residence times of fish entrapped in a screenwell, the greater the chances are that the fish will suffer exhaustion and be thrust against the barrier screen before encountering the bypassing system. That eventuality is reflected in the higher percentages of deaths and injuries for full-scale screen and bypass systems in comparison to small experimental systems. With the thought to overcoming these size-related mortalities, the more recent barrier-bypass installations have been designed around screen angles of attack α as steep as 20 or 25°, and hence longer screen arrays, which in turn require greatly extended forebays for their accommodation (Fig. 4). But lengthening the barrier and steepening its angle (reducing its angle of attack² to the flow) does nothing to decrease the cross-flume excursion distance and only increases the distance available for the distribution of fish along the screenface, a factor that seems to work against the rapid exit of actively swimming fish.

Although steeply pitched screens are favored for their high diversion efficiencies (their propensities for lowering impingements), the overall survivals of entrapped fish apparently fail to increase accordingly. In the Alden flume study, for example, the survivals of bypassed fish—although better than in full-scale systems—were not improved by steepened screen pitches, at least in the view of the investigators themselves (Alden Research Laboratory 1981), who concluded that

"Within the range of variables examined, it appears that... the angle of the device... did not significantly affect total efficiency"

("total efficiency" being the overall survival of the test fish, as opposed to "total diversion efficiency," impingement index [1]). In some earlier studies, Schuler (1973) and Schuler and Larsen (1974) found no significant differences in overall survival of test fish for screen angles of 30°, 45°, and 90°. They say further that

"Results with [angled] screens were generally poor ... fishes were guided to the bypass with only marginal success Fishes were impinged against rather than guided along the screen panels."

From another series of experiments on angled screens and bypasses, Stone and Webster (1976) report that their

"... analysis of the data did not show a significant difference in [fish survival] between 25- and 45-degree orientations.... Within the range of variables studied, screen angle... had no effect on total efficiency."

The investigators add this revealing observation:

"It was subjectively observed, however, that fish suffered more physical damage in tests conducted with the angled screen at 45 degrees than they did with the screen at 25 degrees."

The advocating of steeper and steeper screen pitches (lessened angles of attack α), despite their reported failures in improving overall survival. is apparently motivated by the importance given to the diversion efficiency index (1) and to the universal acceptance of the guiding actions of angled barrier devices. Although the notions of guiding velocity components can be dismissed out of hand for the reasons already set forth, it is true that the diversion efficiencies (the indices of impingement [1]) of angled barrier screens do seem to increase with steepness of pitch. In the case of a fish pressed against a shallow pitched screen, the starting and developed resistances to sliding and tumbling motions would be greater, for a given inflow velocity, than those of a more steeply pitched screen, owing to the angle between the screen surface and the direction of flow. In consequence of those differing resistances (differing in both direction and magnitude), the resultant force on the fish is more nearly tangent to the screen surface in the case of the steeper screen. With the shallower pitched screen, the resultant is directed more towards the normal; hence the fish is pressed with greater force against the screen the shallower its pitch (the greater the Figure 4.screen sy

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² By convention, a meridional plane normal to a flow is said to have a 90° angle of attack; one parallel to the flow has an angle of attack of 0°. Hence, the less its angle of attack, the "steeper" its pitch.

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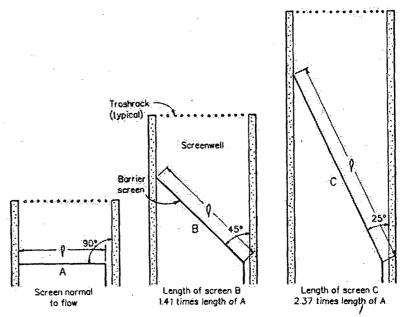


FIGURE 4.—Comparative screen lengths and forebay extensions for commonly employed attack angles of angledscreen systems.

angle of attack α) and more nearly into its mesh openings, the result being a greater probability of abrasion or impingement. The subjective observations noted by Stone and Webster (1976) are probably correct.

The actions of flow and screen on a fish thrust against a screen surface are further complicated by the size of the fish and its species, and most importantly by its struggles to remove itself from the screen. In any case, although fewer fish remain immobilized on the fronts of steeply pitched screens, overall survivals do not seem to be improved by lessened angles of attack. Apparently, the rates of exit of live, uninjured fish are related more to the sizes of intake wells (their cross-flume excursion distances) than to the angles of their barrier screens.

Estimators and Conventions of Reported Diversion Experiments

From among the various industry reports on fish diversion experiments, I have selected two for exposition, one of which is representative of empirical modelling in small test flumes (Alden Research Laboratory 1981) and the other of field tests on full-scale operating systems (Lawler, Matusky and Skelly 1982b). Although neither is suited in its experimental design to a separation of competing risks, more useful data were re-

covered from these two experiments than from other reported projects.

Small-Scale Test System

The Alden Laboratory test flume is wider than most model flumes (1.83 m, as compared to test flumes as narrow as 0.76 m), but the estimators and experimental conventions employed in the Alden work are identical in most respects to those of its relatives. The purpose of the 1981 Alden study is stated on page 13 of the cited report:

"... past angled screen studies had yielded diversion efficiencies of nearly 100 percent at an approach velocity of 1 fps [foot per second] and a screen angle of 25 degrees to the flow.... These results indicated that higher velocities and greater angles, both of which would reduce the cost of an angled screen system in a power plant, might also yield acceptable diversion efficiencies. Accordingly, velocity and angle were the primary variables of interest in the ESEERCO study."

Again, the diversion efficiencies stressed in the report are the indices of impingement (1), not the overall survivals of the test fish.

The Alden test facility (Fig. 5) is a water-recirculating flume with an approach section 1.83 m wide, 1.83 m deep, and approximately 10.7 m long. The water velocity is adjustable. The

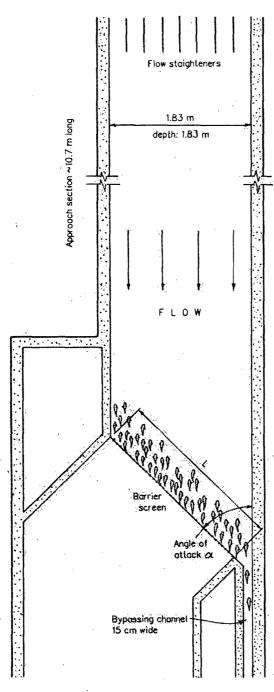


FIGURE 5.—Alden test flume configuration (Alden Research Laboratory 1981). When screen angle $\alpha=45^{\circ}$, screen length L=2.36 m. When $\alpha=25^{\circ}$, L=3.96 m.

flume was equipped with a fish bypass slot 15 cm wide and leading to a collection basin. Fixed barrier screens of 9.5-mm standard wire mesh were employed in the experiments, at test angles of 25° and 45°. In all tests the ratios of water velocities at screen and bypass were said to be 1:1 (reached some time after the release of a fish sample). Structural details and hydraulic tests of the Alden flume are given in Stone and Webster (1976).

As with most such fish-diversion studies, the experimental information from the Alden work was reported in summarized form. The experimental observations do not appear in the report itself, but the investigator's laboratory notes were recovered and transmitted to me by Kenneth Marcellus of the Consolidated Edison Company of New York. Because that information has not been promulgated in any form accessible to the general reader (and because it is especially important in the time-dependent analysis given in another section of this paper), I have included it in Appendix C, Table C-1. Other information discussed here was extracted from the Alden report proper.

Of 58 recorded experiments, 50 were conducted with the 45° barrier screen and eight with the 25° screen. The water velocity for all eight of the experiments with the 25° screen was 30 cm/s; it was 30 cm/s for 34 of the 45° experiments and 60 cm/s for the remaining 16. Juvenile fish were used in all experiments. Length ranges by species were:

Atlantic menhaden, 3.9 to 7.0 cm (August to October):

white perch, 5.1 to 9.0 cm (October to February);

striped bass, 6.6 to 12.0 cm (December to March).

One of the Atlantic menhaden tests (experiment 6; Appendix C) was disqualified because of chlorine contamination of the flume water. Four experiments were also run with alewives (a species especially vulnerable to intake systems), but the results of the alewife tests were not included in the reported analysis, and the observations from the alewife tests were not forwarded to me. With the elimination of the five disallowed experiments, results from the remaining 53 were analyzed statistically by the authors. In 39 of these, sample sizes were 200 or more fish released si-

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multaneously; in the remaining 14, sample sizes were 100 fish each. Owing to the estimating procedures employed in the experiments, the linear regressions and analysis of covariance produced spurious correlations considered "significant but unimportant" by the authors.

In each of the experiments the fish were placed in the flume upstream of the barrier screen and behind a "crowder." The fish were released simultaneously on removal of the crowder, but the flume pump was not started until release of the sample. The starting conditions may have introduced several complications into the experiments not easily accounted for in the experimental results.

- (1) Because the tests were run in a darkened flume, the distribution and behavior of the fish in their approach to the barrier screen could not be observed and remains unknown.
- (2) Owing to the transient flow geometry in the flume during the start-up period, the possibility cannot be discounted that during that initial period the velocity and pattern of water flow into the bypassing slot may have been altogether different from the flow through the screen. Irregular flow patterns during start-up (probably the first 15 min or so of each experiment) might have been related to the initial washout of fish that was characteristic of all experiments except the first.
- (3) Because of the small size of the flume, the simultaneous release of 200 or more fish (in 36 of the experiments) implies a dense packing of fish along the screenfront. Data from the recovered laboratory notes clearly reveal the bypassing rates to be nonlinear (or density-dependent: the greater the number of fish in the flume the greater the bypassing rate). For this reason alone (but also because most of the experiments were terminated before all the fish of a test sample had exited the flume), the 14 experiments with sample sizes of 100 fish are not statistically comparable (without time-dependent corrections) to the experiments where sample sizes were 200 or more.

The durations of individual experiments ranged from 15 min to 12.8 h (Appendix C, Table C-1). Seventeen of the experiments were terminated at 15 min, or during the apparent transient flow period noted above. In 50 of the 53 experiments analyzed by the authors, fish were still swimming in the flume at termination. In 10 of

the 24 experiments with striped bass, for example, over 50% of the test fish were swimming in the flume at termination, yet in each case the "diversion efficiency" (the presumed effectiveness of the angled barrier screen in diverting fish into the bypass) was scored as 100%. In five cases, as few as one-fourth of the test fish had been bypassed when the experiments were cut off, but the corresponding diversion efficiencies were still scored as 100%. With regard to the fish remaining in the flume, the investigators say on page 16 of the report:

"Non-bypassed fish (those still swimming in the flume) were removed from the flume at the end of a test, but they were not held for mortality studies; however, they were included in the calculations of efficiency."

This is a curious instruction. In every case the numbers of fish remaining in the flume were subtracted from the calculations as though they had never entered the experiment. Efficiency E is defined (page 17) as

"
$$E = \frac{\text{Number Bypassed}}{\text{(No. Tested)} - \text{(No. Non-Bypassed)}}$$
"

But the quantity of fish still swimming in the flume (the "No. Non-Bypassed") subtracted from the original sample size (the "No. Tested") equals the numbers bypassed. The denominator of E is identically equal to its numerator, irrespective of the quantities bypassed or left swimming in the flume. The ingenious practice of discounting the undetermined portion of a test sample allows the investigators to make the following claim (page 17):

"... the efficiency E of the device in diverting fish into the bypass ... was typically 100%."

The ultimate effectiveness of a diversion system in conserving fish life is presumably measured by an index of survival E_T , a quantity called the "total efficiency" or the "system efficiency" (as opposed to "total diversion efficiency" [1]) and customarily defined (as it is in the Alden report) by the formula

$$E_T = E(1 - m). \tag{2}$$

This is the equation employed in the calculations of the quantities listed on Table 3.1 of the Alden report under the heading "96-hour total efficien-

cy." Quantity E of (2) is the diversion efficiency estimator discussed above; m is defined as "the mortality attributable to the system" (although m does not include the impingement mortalities), or

$$m = M_T - M_C$$

 M_C being the fraction dying of a control subset held apart (usually for 96 h) from the test fish, and M_T the fraction dead (or dying within 96 h) of the fish that pass through the bypass. Quantities E, m, and E_T are employed as probability estimators, and each therefore should satisfy the general inequality $0 \le X \le 1$, which they do not (see Appendix C).

Quantity E_T is regarded as the measure of the system's success in conserving entrapped fish (or, the chance that a fish entering the intake system will bypass the system alive), but the estimating procedures adopted for the Alden (and similar) flume experiments cannot possibly reveal the true correlations that link those chances with the experimental variables. The practice of scoring incomplete experiments as perfect or nearly so in diversion efficiency only confounds the correlation testing and frustrates the very purpose of the project.

But even if these kinds of experiments were run to conclusion, little could be gained with the customary estimators, owing to their inability to reflect even time dependence. The events of injury, death, and escape are governed by time-dependent, density-dependent, and displacement-dependent distributions, and no linear statistical analysis or invariant estimators like those of the Alden report should be thought appropriate to such experiments. From plots of the recovered laboratory data, it is obvious that the bypassing rates were nonlinear and dependent over time t on the (changing) size of the test sample, or that

$$\frac{dN}{dt} = f(N),$$

N(t) being the test population swimming in the flume. The nature of that relationship (and its extension to displacement dependence) is explored in other sections of this paper.

Full-Scale Operating System

In tests of full-scale systems, the estimators (1) and (2) are also employed as the indices of effi-

ciency, but the experimental samples are collected, at various intervals, from the fish drawn (in unknown numbers) into the intake system from the source waters. On occasion, marked fish are placed directly in the intake flume or screenwell. Typical of full-scale studies is the 9-month sampling program on Unit 6 of the Oswego power station by Lawler, Matusky and Skelly (1982b). As stated on page 1.0-1 of the Lawler, Matusky and Skelly (LMS) report, the purpose of the study was an evaluation of

"... the effectiveness of the fish diversion system.
... The effectiveness of the system is defined
by the ability of the system to divert, alive, the
fish entrapped in the circulating cooling water
from the primary screenwell back to the source
water body These initial studies concentrated on survival subsequent to passage through
the diversion system but prior to transport back
to the source water body."

At the Oswego station, cooling water from Lake Ontario is drawn into a submerged, cylindrical intake (a "velocity cap") and thence through 366 m of tunnel to the primary screenwell. The water velocity through the tunnel is about 182 cm/s. The primary screenwell is 11.3 m wide and divided into two intake bays (Fig. 6). Water depth in the screenwell varies between 7.3 and 10.1 m. Each bay is equipped with three angled intake ports, each 3.05 m wide. One port of each bay is closed off; the open ports are equipped with vertical travelling screens angled 25° to the inflow. Each intake bay is equipped with a pumped bypassing slot, 15 cm wide and located at the apex of the acute angle between the dividing wall and each downstream barrier screen. The bypasses enter a common conduit that leads to a small secondary well from which the bypassed fish are drawn for their passage back to the lake. The return flow from the secondary well may also be diverted into a collection basin for fish sampling purposes. The flow through the barrier screens is somewhat irregular in distribution and varies over the extent of the screen arrays from about 30 to 65 cm/s. The entry velocities at the bypasses were said to be on the order of 60 cm/s.

Samples of the fish drawn into the intake system were collected intermittently over 9 months, April-December 1981. Fish diverted into the collection basin were classified as live, stunned (injured), and dead (those exhibiting no oper-

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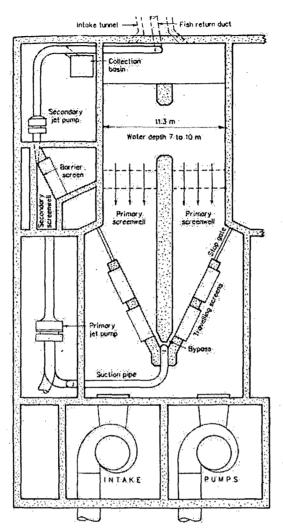


FIGURE 6.—Intake structure, Unit 6 of the Oswego generating station, Lake Ontario (Lawler, Matusky and Skelly 1982b).

cular movement). During the sampling periods, the impinged fish (the fish caught and held by the barrier screens) were also collected and counted. The diversion efficiencies of the system were quantified by index (1), the ratio of bypassed fish (dead and alive) to the sum total of collected fish (impinged plus bypassed). This ratio, or nonimpingement index, is the basis for all quantities bearing the designations diversion efficiency, total diversion efficiency, successfully diverted, overall diversion efficiency, and mean monthly diversion efficiency—not to be confused with the "efficiency" of the system in conserving

the lives of the entrapped fish. It is the custom in reports on fish-diversion experiments to emphasize these indices, and very often the total mortalities imposed by the system are not reported.

The display of results in the LMS report is not easily interpreted. For the reader's convenience I have reproduced their Table 3.0-8 "Monthly total plant efficiencies," with an appended mortality column, as Table D-1 in Appendix D. The entries on the LMS table are values apparently extrapolated from small samples; the actual quantities of fish collected are not reported. Because the information from the Oswego study is useful in the context of the probabilistic models outlined in the next two sections of this paper, I have recalculated the survival, mortality, and morbidity measures of the various tables from the LMS report so as to accommodate those requirements (Table D-2, Appendix D).

The tagging experiments carried out by LMS at the Oswego plant are also important because they give us some idea of the residence times of fish entrapped in full-scale systems. Varying numbers of marked (fin-clipped) brown trout, white perch, smallmouth bass, yellow perch, white bass Morone chrysops, rock bass Ambloplites rupestris, and bluegills Lepomis macrochirus were released directly into the primary and secondary screenwells of the intake system. The bypassing flow was monitored continuously for a 48-h test period after release, but marked fish were recovered over much longer periods. Table 3.0-9 of the LMS report gives the recovery totals of marked fish. Although Table 3.0-10 purports to give the overall survivals of recovered fish, the impingement mortalities are excluded from those calculations, and the survival statements on page 3.0-24 are incorrect. The tagging data from the LMS study, including the correct mortality figures, are summarized in Appendix D, Table D-3, of this article. In four of six cases, over 50% of the marked fish remained in the screenwell beyond the 48-h test period.

From the tagging information we gain some idea of the mean residence times of fish drawn into full-scale diversion systems. Owing to the obvious nonlinearities of the (cumulative) recoveries of marked fish, a geometric distribution gives us less erroneous results than a linear regression on recoveries. Therefore, I have estimated mean residence times of the marked fish from the quantity $1/\lambda$ where

$$e^{-\lambda t} = 1 : -\frac{B(t)}{S}$$

is the fraction of marked sample S unrecovered at time t (=48 h for the test period) and B(t) is cumulative recoveries. Thus, for the white perch, S=23, B(48)=11 (0 live, 11 dead), and the estimated mean residence time for the marked white perch becomes

$$-48/\log_e \left[1 - \frac{11}{23}\right] = 73 \text{ h.}$$

In a similar fashion, the estimated mean residence time is 295 h for the smallmouth bass, 20 h for the yellow perch, 200 h for the brown trout, 76 h for the white bass, and 41 h for the rock bass-bluegill group.

Time-Dependent Risk Analysis

The failures of full-scale diversion systems to bear out the extrapolations drawn from smallscale test flumes are attributable, at least in part, to the misconceptions addressed in preceding sections of this article and to ill-framed estimators of the probabilistic events that should apply with commonality to diversion systems large and small. A search of the conservation literature turned up no probabilistic analysis capable of taking into account the time-varying risks that might apply to fish passing through an intake and diversion system, and none in which competing risks could be separated sufficiently well for distinguishing between the risk of death and the chances of escaping that risk. Although no experiments seemed to have been designed with those purposes in mind, some empirical information does exist to guide us along here in the construction of a time-dependent risk analysis.

The analysis of this section applies to the general case when sample size is known (as in the Alden test flume studies or the marking experiments of the Oswego study), but the analysis is system-specific. That is, it will apply to comparisons between devices (tests on angled barriers of various angles, say) in a given system, but because it contains no displacement (or space) variable, it does not extend to predictions of outcomes between systems of unlike sizes. Extension of the analysis to both time and space dependence is treated in the next section.

As our means for distinguishing between the competing risks that govern the passage of fish

through a given intake and removal system, we can devise two thought experiments from which (it is hoped) we can construct a valid set of probabilistic statements. As our first step, we consider the time-dependent accruals of deaths (mortal injuries) of entrapped fish. We specify our experimental variables (species and sizes of fish to be tested, inflow velocity, water temperature, and so on); we then put into the intake flume a sample of S-many fish (or, as desired, n-many samples S_1, S_2, \ldots, S_n of differing species or sizes). In this first experiment the intake flume is blocked by a barrier device (of any configuration we care to test), but the fish have no means of escape, the effects of the escape route being a part of the next experiment.

pr

In our first experiment we leave the fish in the screenwell until all are injured (or dead). We now want a time-dependent description of the accruals of those deaths and injuries, and although no experiments of the kind we require have been reported, some evidence of the process can be inferred from marking experiments and test flume experiments (Stone and Webster 1977; Alden Research Laboratory 1981; Lawler, Matusky and Skelly 1982b, and the information in Appendices C and D). As a note of clarification, the designation "live" (as in "live and uninjured") shall mean here a fish uninjured and swimming in a manner natural to its species, whereas "injured" (as in "dead or injured") shall mean a fish incipiently dead, bearing visible trauma, or swimming erratically. The observation of importance in this experiment is the occurrence of injury, not the survival duration following it.

For the sample S of our first experiment, we let ϕ_t signify the time-dependent probability that an individual of S survives without injury, with the condition that $\phi_0 = 1$, and that $\phi_t \to 0$ as t becomes large. We impose the latter condition on ϕ_t because we expect all members of S to eventually suffer death or injury. At any time t during the experiment we expect $S \cdot \phi_t$ individuals to be alive and uninjured. Thus, the cumulative expected deaths or injuries M at time t becomes

$$M(t) = S - S \cdot \phi_t \tag{3}$$

and the corresponding distribution function for deaths and injuries is

$$P_M(t) = 1 - \phi_t. \tag{4}$$

Should the death and injury "rate"

removal system, we eriments from which ct a valid set of probfirst step, we consider ils of deaths (mortal

We specify our exas and sizes of fish to ater temperature, and ntake flume a sample ed, n-many samples species or sizes). In ake flume is blocked configuration we care no means of escape, te being a part of the

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over successive time increments be a simple Poisson process with parameter μ (constant risk per unit time of mortal injury), then survival probability ϕ_l reduces to the simple exponential distribution

$$\phi_t = e^{-\mu t} \tag{5a}$$

(see, for example, Feller 1957), and the observed deaths and injuries should accumulate approximately as

$$M(t) = S(1 - e^{-\mu t})$$
 (6a)

where

$$P_M = 1 - e^{-\mu t}. (7a)$$

In practice, the parameter μ of (5a) and (7a) would be determined empirically from a regression of (6a) on the experimental data (the observed accumulations of deaths and injuries).

Deaths and injuries might accrue in accord with some distribution that differs markedly from the specified Poisson process, but the nature of the events in question (the chance of death or injury), together with the existing data (as sparse as they are), tends to support the choice, at least for the systems examined. In some cases, however, especially for low intake velocities and hardy species, deaths and injuries accumulate very slowly at first (survival probability remaining high) but then increase more rapidly (apparently owing to the onset of exhaustion) after the manner of a Poisson process. For such cases I have postulated a delayed process having the form

$$\phi_t = \frac{c+1}{c+e^{\mu t}} \tag{5b}$$

with parameter c providing the delay in the decline of survival probability over time. Parameter c may take on any suitable positive value; the greater the value of c the greater the delay in the accumulation of deaths and injuries. The properties of a distribution function like that of (5b) are examined in Appendix D. With (5b) in place of (5a), the probability distribution for death and injury becomes

$$P_M(t) = 1 - \frac{c+1}{c+e^{\mu t}}$$
 (7b)

The parameters μ and c of (5b) and (7b) are empirically derived by substituting (5b) into (3) and taking a regression on the experimental observations. The random variable (T, say) of either of the distribution functions (7a) or (7b) is the time after introduction of sample S that a randomly designated individual of S suffers injury or death, where

$$P_M(t) = \text{Prob}[T \le t]$$

for any time t we care to name.

At the conclusion of the first experiment all of the original fish are removed and excluded from further experiments. For the second experiment we restore or introduce the desired means of egress (the pumped bypass or other means of escape). We again put into the intake flume a sample of S-many fish (or the n-many combinations of species or sizes) as identical as possible to the first sample S. As the system is operated, fish will be impinged, bypassed, or otherwise removed (alive, injured, and dead) at some time-dependent frequency. It is that frequency (and its summation) we now wish to determine.

Although our second experiment is similar in some respects to the usual demonstrations of diversion efficiencies, we are not interested here in quantifying the physical absence of fish from the meshes of a barrier screen. A diversion efficiency. as customarily measured by (1), may be a good index of the self-cleansing properties of a barrier screen, but whether a killed fish passes into the removal system for disposal or becomes impinged (affixed to the screen) and removed by other means for disposal is a distinction of little importance in the context of our risk analysis. Let us remember that our population of interest, N(t) say, consists of the live, uninjured fish swimming in the screenwell. It is their fate that depends on the probabilities of staying alive and getting out of the screenwell unhurt, so let us consider how their numbers are reduced.

In our second experiment, fish depart population N(t) by two processes, one by death or injury (whether removed from the screenwell or not) and the other by escaping uninjured by means of the removal device. Experiment 1 was designed to give us the probability of entrapped fish surviving death or injury in the absence of any other agency of reduction. That is, probability ϕ_t applies explicitly to the individuals N(t) that remain in the screenwell uninjured and swimming. But N(t) is also being reduced now

by the exits of uninjured fish, those events having, say, a probability distribution $1 - \theta_t$. Thus, θ_t is the probability of remaining in N(t), and in that regard θ_t is similar to a survival probability [at least as it influences the size of N(t)]. Therefore, in experiment 2 at time t we expect

$$N(t) = S \cdot \phi_t \theta_t \tag{8}$$

individuals to be uninjured and swimming in the screenwell. The expected cumulative "exits" from S (live, dead, or injured, bypassed, impinged, or traumatized) is

$$B(t) = S - N(t), \tag{9}$$

which has the associated probability distribution

$$P_B(t) = 1 - \phi_t \theta_t. \tag{10}$$

We want to extract two probability statements from (10), one describing the likelihood of fish escaping uninjured from the intake system and one describing the probable distribution of deaths or injuries. We accomplish the separation by differentiating (10) and then re-integrating, which gives us the probability density function for the frequency of live exits

$$f(t) = -\phi_t \frac{d}{dt} \theta_t, \tag{11}$$

and the density function for death and injury

$$g(t) = -\theta_t \frac{d}{dt} \phi_t \tag{12}$$

(whether the affected fish remain impinged on the barrier screen or pass through the same removal system as the uninjured). The probability distribution $P_B(t)$ for fish departing population N(t) can now be expressed as the sum of the probability $P_L(t)$ of live (uninjured) escape and the probability $P_D(t)$ of death or injury:

$$P_B(t) = P_L(t) + P_D(t),$$
 (13)

where

$$P_L(t) = \int_0^t f(t) dt,$$

and

$$P_D(t) = \int_0^t g(t) dt.$$

Therefore, at time t we can expect a total of $S \cdot P_L(t)$ individuals to have escaped uninjured

from sample S and $S \cdot P_D(t)$ to have suffered death or injury.

We now seek an appropriate functional form for probability distribution θ_t . But unlike the procedures of experiment 1, where we were able to deduce the form of survival probability ϕ_t directly from experiments, independent of the influence of probability θ_t , we cannot accomplish the converse. We cannot directly determine the form of escape probability $1-\theta_t$ independent of deaths and injuries. Experiment 2 gives us instead the combined results of these probabilistic events, so it is from the results of both experiments that we must extract the form of θ_t .

Let us suppose we have run experiment 2 to our (statistical) satisfaction; we have recorded the live exits and those of S dead or injured on some regular sequence of time intervals i. Thus, we have a sequence B_i of numerical estimates of B(t), as well as those of $S \cdot P_L(t)$ and $S \cdot P_D(t)$. Accordingly, our experimental measures of distribution $P_B(t)$ over intervals i become

$$\hat{P}_B(i) = \frac{B_i}{S} \,, \quad .$$

and since distribution $P_B(t)$ has the general form of (10), our experimental estimates of product $\phi_l\theta_l$ are given by

$$\widehat{\phi_i\theta_i}=1-\frac{B_i}{S}.$$

But function ϕ_t is known from experiment 1. Therefore, the data on B(i) from experiment 2 are converted to empirical measures of probability distribution θ_t as

$$\hat{\theta}_i = \frac{1 - \hat{P}_B(i)}{\phi_i} \,. \tag{14}$$

From regressions on this time sequence of estimates we extract the most likely form of distribution function θ_t . The measured proportions $S \cdot P_L(i)$ of uninjured escapes and $S \cdot P_D(i)$ of deaths and injuries then provide the means for verification not of the validity of determined function θ_t but of the similarity of conditions (the constancy or inconstancy of the experimental variables) between the two experiments.

Because the kinds of information we need here do not yet exist, we cannot extract applicable forms of θ_l by the methods described above. But from such evidence as incidental films of fish swimming before a screen barrier, from recorded

bypassing frequen test systems where C), and from the next section, the c

seems well suited of escape, at least fish stand against and by random ex of encountering the

where $d\theta_t/dt = -$ parameter λ reflethe screenwell undicate that λ is given a larger one of probability that (15) is simply

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nation we need here extract applicable escribed above. But lental films of fish rier, from recorded bypassing frequencies of live fish in small-scale test systems where mortalities are low (Appendix C), and from the random-walk analysis of the next section, the density pattern

$$\lambda e^{-\lambda t}$$
 (15)

seems well suited for describing the frequencies of escape, at least for some tested species, where fish stand against the flow before a barrier screen and by random excursions increase their chances of encountering the escape route. By (11) we can now write

$$f(t) = \lambda e^{-\lambda t} \phi_t,$$

where $d\theta_t/dt = -\lambda e^{-\lambda t}$, and it is obvious that parameter λ reflects the rate at which fish escape the screenwell uninjured. All reported data indicate that λ is greater in a small system than in a larger one of similar geometry. The escape probability that corresponds to density pattern (15) is simply

$$\theta_t = e^{-\lambda t}. (16a)$$

A formal reduction of (15) from a general Poisson distribution is given in Appendix A.

As occurred during the Alden Laboratory experiments, fish of some species tend to stand before the barrier screen for long periods of time, and Bates and Vinsonhaler (1956) describe some species as tending to avoid a bypass current on initial encounter. Because of such behavior, exits from the screenwell accumulate slowly at first but then increase in frequency after the manner of (15). With the simplest analytical provision for such delays incorporated into (16a), escape probability θ_t takes on the altered form

$$\theta_l = \frac{k+1}{k+e^{\lambda l}}.$$
 (16b)

The properties of (16b) are examined in Appendix B. The influence of delay parameter k can be seen from the regressions of Figs. 7, 8, and 9.

Because of the possibilities of delays in either the probability of live escape, the probability of injury, or both, the probability $P_N(t)$ that governs a fish's chance of remaining in the screenwell, uninjured, could take on any one of four possible combinations.

Case 1, no delays:

$$P_N(t) = e^{-(\mu + \lambda)t}. (17a)$$

Case 2, delay in mortality, no delay in escape:

$$P_N(t) = \frac{(c+1)e^{-\lambda t}}{c+e^{\mu t}}$$
. (17b)

Case 3, delay in escape, no delay in mortality:

$$P_N(t) = \frac{(k+1)e^{-\mu t}}{k+e^{\lambda t}}$$
 (17c)

Case 4, delay in mortality, delay in escape:

$$P_N(t) = \frac{(c+1)(k+1)}{[c+e^{\mu t}][k+e^{\lambda t}]}.$$
 (17d)

Case 1: No Delays

For case 1, probabilities ϕ_t and θ_t have the nondelay forms (5a) and (16a); then, by (17a), the expected size of the (uninjured) screenwell population at time t becomes

$$N(t) = Se^{-(\mu + \lambda)t}. \tag{18a}$$

The expected cumulative departures from N(t) now become

$$B(t) = S(1 - e^{-\gamma t}),$$
 (19a)

where $\gamma = \mu + \lambda$. Should the removal system be a total failure at conserving entrapped fish, then $\lambda = 0$ and $\gamma = \mu$. Should it be a total success, then $\mu = 0$ and $\gamma = \lambda$.

The random variable (Y, say) of our second experiment is the time that a randomly designated individual of S departs N(t). Thus, with $P_B(t)$ as the distribution function that describes the probability of departures (live, dead, or injured) in the following way,

$$P_B(t) = \operatorname{Prob}[Y \le t]$$

$$= 1 - \operatorname{Prob}[Y > t]$$

$$= 1 - P_N(t)$$

$$= 1 - e^{-\gamma t},$$

then Y has the probability density function

$$\frac{dP_B}{dt} = \gamma e^{-\gamma t},$$

and the expected mean residence time of fish in the screenwell is

$$E[Y] = \gamma \int_0^\infty t e^{-\gamma t} dt$$

$$= \frac{1}{\gamma}$$
 (20)

(which is also the assumption behind the mean residence estimates, shown in the previous section, for the marking data from the Oswego study). By (11) the density function for the frequency of live exits becomes

$$f(t) = \lambda e^{-\lambda t} e^{-\mu t},$$

and by (12) the density function for death and injury is

$$g(t) = \mu e^{-\mu t} e^{-\lambda t}.$$

Thus by (13),

$$P_B(t) = \lambda \int_0^t e^{-\gamma t} dt + \mu \int_0^t e^{-\gamma t} dt,$$

and the probabilities of interest become

$$P_L(t) = \frac{\lambda}{\gamma} (1 - e^{-\gamma t}), \qquad (21a)$$

(which is the probability distribution for live exits) and

$$P_D(t) = \frac{\mu}{\gamma} (1 - e^{-\gamma t}) \tag{22a}$$

(which is the probability distribution for death and injury). Population N(t) is reduced accordingly in the proportions

$$B(t) = S \cdot P_L(t) + S \cdot P_D(t).$$

Case 2: Delay in Mortality, No Delay in Escape

Should the experiments reveal a delay in the accumulation of deaths and injuries (experiment 1), but no delay in live escapes (experiment 2), then ϕ_t and θ_t take the forms (5b) and (16a), and $P_N(t)$ is given by (17b). Therefore,

$$N(t) = \frac{(c+1)Se^{-\lambda t}}{c+e^{\mu t}},$$
 (18b)

and the expected cumulative departures (impinged and bypassed, live, dead, and injured) become

$$B(t) = S \left[1 - \frac{(c+1)e^{-\lambda t}}{c + e^{\mu t}} \right]$$
 (19b)

with μ and c known from experiment 1. Parameter γ is determined from a regression of (19b) on the observed B_i of experiment 2. The value of λ is then estimated from the relationship $\lambda = \gamma - \mu$. The shapes of the regression curves are influenced by extended probability (7b), but (7b)

has its greatest influence on the proportionings between the live escapes and the dead and injured, $S P_L$ and $S P_D$. Those distributions are resolved after the manner of (11), (12), and (13) as before, or

$$P_L(t) = \lambda(c+1) \int_0^t \frac{e^{-\lambda t} dt}{c + e^{\mu t}};$$
 (21b)

$$P_D(t) = \mu(c+1) \int_0^t \frac{e^{(\mu-\lambda)t} dt}{(c+e^{\mu t})^2}.$$
 (22b)

Case 3: Delay in Escape, No Delay in Mortality

Should death and injury (experiment 1) follow a simple exponential distribution, but live fish exhibit a delay in escaping the screenwell (experiment 2), then ϕ_t and θ_t take on the forms (5a) and (16b), and $P_N(t)$ has the form (17c) shown above. Therefore,

$$N(t) = \frac{(k+1).Se^{-\mu t}}{k+e^{\lambda t}},$$
 (18c)

and, as before, B(t) = S - N(t). The distributions P_L and P_D in turn become

$$P_L(t) = \lambda(k+1) \int_0^t \frac{e^{(\lambda-\mu)t} dt}{(k+e^{\lambda t})^2};$$
 (21c)

$$P_D(t) = \mu(k+1) \int_0^t \frac{e^{-\mu t} dt}{k + e^{\lambda t}}.$$
 (22c)

Case 4: Delay in Mortality, Delay in Escape

Should experiments 1 and 2 reveal a delay in the accumulation of deaths and injuries as well as a delay in live escapes from the screenwell, then ϕ_t and θ_t take on the forms (5b) and (16b), and $P_N(t)$ becomes (17d). Therefore,

$$N(t) = \frac{(c+1)(k+1)S}{(c+e^{\mu t})(k+e^{\lambda t})},$$
 (18d)

$$P_L(t) = \lambda(c+1)(k+1) \int_0^t \frac{e^{\lambda t} dt}{(c+e^{\mu t})(k+e^{\lambda t})},$$
(21d)

and

$$P_D(t) = \mu(c+1)(k+1) \int_0^t \frac{e^{\mu t} dt}{(k+e^{\mu t})(c+e^{\lambda t})}.$$
(22d)

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$$\int_0^t \frac{e^{-\lambda t} dt}{c + e^{\mu t}}; \qquad (21b)$$

$$\int_0^t \frac{e^{(\mu-\lambda)t} dt}{(c+e^{\mu t})^2} \,. \tag{22b}$$

in Escape, Mortality

'(experiment 1) follow ribution, but live fish ig the screenwell (extake on the forms (5a) the form (17c) shown

$$\frac{1)Se^{-\mu t}}{e^{\lambda t}},$$
 (18c)

- N(t). The distribution

$$\int_{0}^{t} \frac{e^{(\lambda-\mu)t} dt}{(k+e^{\lambda t})^2}; \quad (21c)$$

$$\int_{0}^{t} \frac{e^{-\mu t} dt}{k + e^{\lambda t}}.$$
 (22c)

Mortality, scape

d 2 reveal a delay in and injuries as well from the screenwell, orms (5b) and (16b), herefore,

$$\frac{1)S}{e^{\lambda t}}$$
, (18d)

$$\frac{e^{\lambda t} dt}{(c + e^{\mu t})(k + e^{\lambda t})},$$
(21d)

$$\frac{e^{\mu t} dt}{(k + e^{\mu t})(c + e^{\lambda t})}.$$
(22d)

I have not sought closed forms for equations (21b, c, d) and (22b, c, d) because their basic forms cannot be resolved in terms of elementary functions (Tchebycheff 1853). They can, of course, be approximated with asymptotic series or evaluated numerically, depending on the desired application. In each case, their sum $(1 - P_N)$ is known exactly, so once P_L or P_D is resolved the other is known immediately.

Douglas Robson of Cornell University has suggested a refinement for the distribution functions of case 1. Robson's refinement permits a separation of the probabilities of injured escape and uninjured escape, which could be useful in accommodating the information from survival tests. Robson adds a third parameter η to μ and λ , and gives these definitions:

η: constant risk (chance per unit time) of injured escape;

λ: constant risk of uninjured escape (as before);
 μ: constant risk of death or mortal injury (as before);

 $\gamma = \mu + \lambda$ (as before).

Thus, if the distributions (5a) and (16a) of case 1 apply then random variable Y has the probability density function

$$dP_B(t) = \lambda e^{-\gamma t} dt + \left[\int_0^t \mu e^{-\gamma x} dx \cdot e^{-\eta(t-x)} \right] dt.$$
(23)

Integration of (23) from zero reference time (the start of the experiment) yields the distribution function

$$P_B(t) = \frac{\lambda}{\gamma} (1 - e^{-\gamma t}) + \left[\frac{\mu}{\gamma} (1 - e^{-\gamma t}) - \frac{\mu}{\gamma - \eta} (e^{-\eta t} - e^{-\gamma t}) \right].$$
(24)

the first term of which is distribution $P_L(t)$ and the second $P_D(t)$. Robson's form of $P_D(t)$ allows a backtracking of mortal injuries, so to speak, and would be especially useful when the actual occurrences of injuries were not known, or, equivalently, when survival tests for all bypassed fish were commenced simultaneously (at termination of the experiment, in particular), irrespective of the actual times the fish were bypassed.

Applications of the Time-Dependent Analysis

Although the Alden experiments (Alden Research Laboratory 1981) were not designed to accommodate the separation of time-dependent risks, a few of the experiments, when supplemented with the recovered laboratory data (Appendix C), can be adapted to the time-dependent analysis of this section. The data from most of the experiments with non-zero differential mortalities are confounded by inseparable delays in either deaths or live escapes, so I have selected three sets of data for regression analysis in which differential mortalities were zero (at least to the termination of the experiment) and relatively few fish were left swimming in the flume (Figs. 7-9). These regressions show three magnitudes of delay in live escape (extended, moderate, and short). A fourth set of data from the Alden series (experiment 13) is especially instructive because the data (apparently) permit a separation of the distributions $P_L(t)$ and $P_D(t)$ (Figs. 10, 11).

As remarked previously, virtually all the data sets of the Alden study reflect an "initial washout" of test fish, which is apparently an artifact of the experimental methods or the effect of an overcrowded flume. The washout effect is reproduced analytically in another section of this article. For the data of Figs. 7–9, the regression formula is

$$N(t) = \frac{(k+1)(S-W)}{(k+e^{\lambda(t-t_0)})},$$
 (25)

which is merely an adaptation of (16b). Quantities W and t_0 are regression values that accommodate the initial washout. In general, the cumulative delay period t_d from (16b) (adjusted here for t_0) is given by

$$t_d = \frac{1}{\lambda} \log_e \left(\frac{k}{2} + 1 \right) + t_0.$$
 (26)

Figure 10 shows a regression of (18a) on the decline of test population N(t), Alden experiment 13, again with the regression adjustments t_0 and W, or

$$N(t) = (S - W)e^{-(\mu + \lambda)(t - t_0)}, \tag{27}$$

Figure 11 shows the associated trajectories of B(t), $P_L(t)$, and $P_D(t)$. As described in the calculations that follow, the projected probability for total live escapes is 68.7% of the sample, or

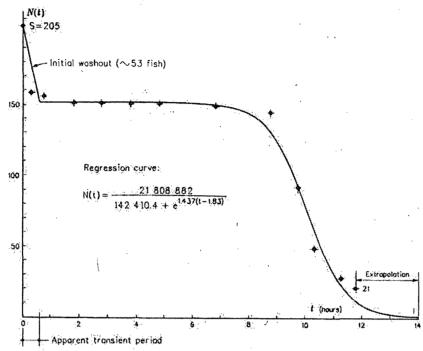


FIGURE 7.—Regression of equation (25) on data of Alden experiment 2 (Appendix C), illustrating extended delay in escape of fish from the test flume. Test species Atlantic menhaden; screen angle 45°; water velocity 30 cm/s; water temperature 20.5°C. Regression values: k = 142,410.4, $\lambda = 1.437/h$, S - W = 153.14, $t_0 = 1.83$.

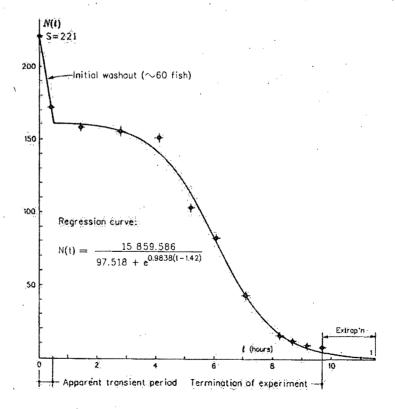


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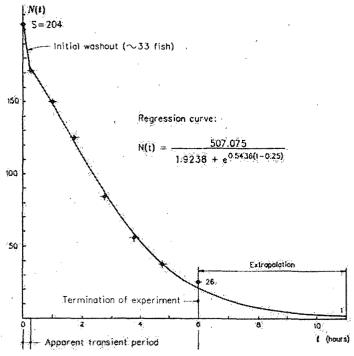


FIGURE 9.—Regression of equation (25) on data of Alden experiment 15 (Appendix C), illustrating brief delay in escape of fish from the test flume. Test species white perch; screen angle 45°; water velocity 30 cm/s; water temperature 12.9°C. Regression values: k = 1.9238, $\lambda = 0.5436/h$, S - W = 173.43, $t_0 = 0.25$.

Extrapolation

llustrating extended delay 15°; water velocity 30 cm/ 1 = 153.14, 10 = 1.83.

20 percentage points lower than the reported Alden value of 89% for total efficiency E_T . From the Alden report and the laboratory data the following calculations can be made.

(a) Differential mortality m = 0.11 and sample size S = 207 implies that 0.11(207) = 23 fish suffered lethal injuries. One fish was impinged. Therefore, at termination time 5.25 h, 23 + 1 = 24 fish were dead or injured.

(b) At reference time $t_0 = 0.25$ h, washout W = 110; at termination time 5.25 h, N(observed) = 18 fish.

(c) With S - W = 207 - 110 = 97, there were 97 - 18 = 79 cumulative exits from S - W at 5.25 h, of which 79 - 24 = 55 were live escapes.

Accordingly, the direct estimates of the probabilities of live escape and of death or injury at the termination of the experiment are

$$\hat{P}_D(5.25) = \frac{24}{97} = 0.247$$
, and

$$\hat{P}_L(5.25) = \frac{55}{97} = 0.567$$

(see Fig. 11). From (22a), parameter μ can be resolved as

$$\mu = \frac{\gamma P_D(t)}{1 - e^{-\gamma(t - t_0)}}.$$
 (28)

Therefore, with $P_D(5.25) = 0.247$ from the data, with $t_0 = 0.25$, and with $\hat{\gamma} = 0.3114$ from the regression of (27) on the observed data (Fig. 10), the estimate of μ from (28) becomes

$$\hat{\mu} = 0.0975/h_{\odot}$$

and we have

$$\hat{\lambda} = \hat{\gamma} - \hat{\mu} = 0.2139/h.$$

FIGURE 8.—Regression of equation (25) on data of Alden experiment 3 (Appendix C), illustrating moderate delay in escape of fish from the test flume. Test species Atlantic menhaden; screen angle 45°; water velocity 30 cm/s; water temperature 23°C. Regression values: k = 97.518, $\lambda = 0.9838/h$, S - W = 160.85, $t_0 = 1.42$.

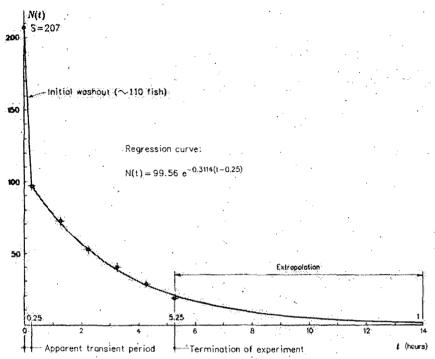


FIGURE 10.—Regression of equation (27) on data of Alden experiment 13 (Appendix C) showing decline of the screenwell population N(t), no delays. Test species Atlantic menhaden; screen angle 45°; water velocity 30 cm/s; water temperature 15°C. Regression values: $\mu + \lambda = 0.3114/h$, S – W = 99.56, $t_0 = 0.25$.

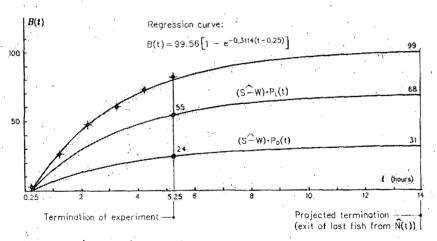


FIGURE 11.—Regressions on data of Alden experiment 13 (Appendix C) showing cumulative departures B(t). probable live escapes $(S-W)P_L(t)$, and probable cumulative mortalities $(S-W)P_D(t)$. Regression values: $\mu=0.0975/h$, $\lambda=0.2139/h$. (See also Fig. 10.)

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Thus, the trajectories of the time-dependent distributions of Fig. 11 are given by

$$P_L(t) = \frac{0.2139}{0.3114} [1 - e^{-0.3114(t - 0.25)}];$$

$$P_D(t) = \frac{0.0975}{0.3114} [1 - e^{-0.3114(t - 0.25)}].$$

At the time of the projected departure of the last fish from sample S-W, the expected proportionings between live escapes and deaths (or mortal injuries) become

$$P_L(14^*) = \frac{\lambda}{\mu + \lambda} = 0.687$$

= 68.7% live escapes;
 $P_D(14^*) = \frac{\mu}{\mu + \lambda} = 0.313$
= 31.3% dead, injured.

Large versus Small Diversion Systems

The reported results of diversion experiments in small-scale flumes extend with little reliability to full-scale designs, an apparent consequence of the differing risks of exposure to the risk of death or injury. Those size-related dissimilarities are examined next. Because it is the more vulnerable species that concern us the most, the simpler case-1 equations seem to be suitable distributions from which to draw our lessons here, which are not too greatly altered by the more complex distributions. In practice, of course, simplicity should not be imposed on the experimental data if complexity is warranted. Depending on the mix of species involved, all four sets of distributions might be needed for making sense of some systems.

With the case-1 probabilities (5a) and (16a), parameter μ is our index for assessing the risk of death or injury and λ is our index for assessing the exposure to that risk. The greater the value of μ the greater the risk of death or injury; the greater the value of λ the lesser the exposure. Their combined effects for the case-1 equations are given in the ratios μ/γ and λ/γ .

Suppose we are comparing two systems, similar in design but unlike in size, one a small-scale test facility and the other its full-scale prototype, each equipped, let us say, with a pumped bypass and angled barrier screen. Their (unlike) volumetric intakes are adjusted for equal flow velocities, sample sizes are adjusted for equal spatial densities, and all other experimental variables are alike. In the absence of some of the empirical

data we need, we assign values to our distribution parameters that appear to be representative of typical ranges of risk and exposure conditions.

First consider thought experiment 2. From the cited reports on residence times of marked or captive fish in large and small systems, the data show that fish of all species exhibit residence times of some duration in the screenwells of diversion systems both large and small, but that residence times of like species are considerably greater in the larger systems. On the basis of the marking experiments from the Oswego study (Appendix D) and the recovered data from the Alden experiments (Appendix C), let us choose 3 h as a representative mean residence time for our small system, and 45 h for the full-scale system.

Consider thought experiment 1. Our statistical individual, when introduced to either system, swims ahead of the barrier screen, against the inflow; as time passes its chances of suffering death or injury continue to increase. Because the fish has no means of escape, its eventual demise is certain in either system, but would its death or injury occur any sooner in one system than in the other? Probably not.

For want of contrary evidence or rationale, we must suppose that risk parameter μ (chance of death or injury per unit time of exposure) has equal values for the two systems. Rough estimates from the mortality data from several studies (Stone and Webster 1976, 1977; Alden Research Laboratory 1981) suggest that a half-life on the order 60 h (the time when half the fish of a test sample have suffered death or injury) would be a representative figure for many species (and, in turn, for the fish of our experiment 1, both systems). A half-life of 60 h implies a mean life expectancy (or a mean residence time without death or injury) of 86.6 h. These "findings" give us the value 0.012/h for μ . In summary, we have chosen our parameter values for the two systems in the following way:

| Parameter | Small system | Large system |
|---------------------------------------|--|---|
| $\gamma = \frac{1}{\bar{Y}}$ | $\frac{1}{3 \text{ h}} = 0.333/\text{h}$ | $\frac{1}{45 \text{ h}} = 0.022/\text{h}$ |
| $\mu = \frac{\log_e 2}{60 \text{ h}}$ | 0.012/h | 0.012/h |
| $\tilde{T} = \frac{1}{\mu}$ | 86.6 h | 86.6 h |
| $\lambda = \gamma - \mu$ | 0.321/h | 0.010/h |

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showing decline of the water velocity 30 cm/s; 25.

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Although the hazards of the two systems are equal for equal exposures, the differences in probable exposure times have a great influence on the proportionings of fish into live escapes and mortalities. The probability distributions for those proportionings over time are given for case 1 by (21a) and (22a). Thus, for our smaller system,

$$P_L(t) = 0.964(1 - e^{-0.333t}),$$

 $P_D(t) = 0.036(1 - e^{-0.333t});$

while for the larger,

$$P_L(t) = 0.455(1 - e^{-0.022t}),$$

 $P_D(t) = 0.545(1 - e^{-0.022t}).$

At the mean residence times \bar{Y} of the fish (when 63.2% of sample S has passed through either system), and at the end of the tests (when all fish have passed through the systems or been impinged), the expected proportionings are

| Fate | Small | Large |
|-------------------------------------|--------|--------|
| At \tilde{Y} | system | system |
| Live escapes: $0.632\lambda/\gamma$ | 61% | 28.8% |
| Dead, injured: $0.632\mu/\gamma$ | 2.3% | 34.4% |
| Final Live escapes: | | |
| $\mathcal{N}_{oldsymbol{\gamma}}$ | 96.4% | 45.5% |
| Dead, injured: μ/γ | 3.6% | 54.5% |

The differences between these proportionings are attributable to the difference in expected residence times between the two systems, because the only probabilistic dissimilarity between the two is the duration (or chance) of exposure to mortality risk; the risk of death per unit time of exposure we presumed to be the same for either system. In the absence of comparative experiments (like experiment 1) for showing otherwise, we cannot entirely dismiss the possibility that a full-scale system might pose a greater risk of death per unit time than a smaller for some species, but the reported evidence (of greater residence times in larger systems for all species tested) is clearly against the possibility. Increase in risk of death (increase in μ) brings about a reduction in residence time, not an increase. Although a decrease in μ would increase the mean residence time, there is little reason to suppose that increased system size might lessen the unit risk of death to an entrapped fish (think about experiment 1). Although a decreasing risk of death (decreasing μ) with increasing system size would account for the longer observed residence times in large systems than in small ones, the reduction in unit risk would also reduce the accumulated deaths and injuries to proportions less than those of smaller systems, a consequence contradicted by all reported evidence.

Thus, we are forced to conclude that the extended residence times of full-scale systems are owed not to reduced risk of death and injury but to decreased opportunity for escaping that risk, a consequence of the conservation system whose purpose is to bring about the opposite effect. As the experimental evidence confirms, the successes of small-scale models in conserving test fish are not preserved in geometric similarity. The move to steeper barrier screens and extended forebays seems to be a futile way of pursuing efficiency, because the exposure of fish to risk of injury (the chance of forcible contact with the barrier screen) is apparently increased by such measures, not reduced.

The foregoing risk analysis is applicable to comparative tests, device against device, screen angle against screen angle, in a given setting. And while the analysis also clarifies the qualitative dissimilarities between large and small systems, it is limited to time-dependent problems and time-dependent experiments. The scaling problem (the problem of projecting the probable outcome of a full-scale design from small-scale experiments) cannot be resolved unless a displacement variable (a variable of spatial dimension) is introduced into the probability analysis and the experimental designs. But a problem having two independent variables (time and displacement in our case) implies a treatment with partial differential equations.

Extension of Risk Analysis to Two (and Three) Independent Variables

Except when fish are pressed against a barrier screen and forced along it by the water flow, screen angle seems to have no more influence in directing swimming fish to a bypassing slot than any other stimulus that might provoke random excursions in the screenwell. The mere fact that uninjured fish do escape over time through a bypass could easily give one the impression that something must be compelling fish to move in a preferred direction. But the same result can be extracted from a one-dimensional random-walk hypothesis and appropriate boundary conditions.

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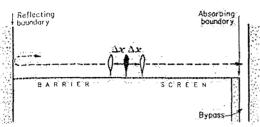


FIGURE 12.—Fish free to move left or right (with probability ½) along a barrier screen in discrete steps Δx with mean period τ. At either boundary the probability of a left move is zero. At the left boundary the probability of a right move is 1.

Figure 12 depicts a fish free to move in one dimension (horizontally, left or right) along a barrier screen. Vertical motions do not compete with horizontal motions in the probability analysis, because only those motions that put the fish towards one boundary or the other enter the observations. For the sake of the argument, the barrier screen is shown normal to the intake flow, with slight alterations for geometry the argument will also apply to an angled screen.

The problem has two boundaries, one perfectly absorbing (the bypass) and one perfectly reflecting (the opposite flume wall). The fish is free to move at random along the screenfront with lateral excursions Δx in either direction, the period between excursions being some finite time τ . If, in some random combination of excursions N, the fish encounters the absorbing boundary on its Nth move (to the right in the figure), then its probability of next moving (left) in the opposite direction and remaining in the flume is zero, because it will have been absorbed (removed) by the boundary (by the bypass). If the fish, instead, encounters the reflecting boundary in the same number N (but different combination) of random excursions Δx , its probability of next moving (left) away from the absorbing boundary is also zero, as it was at the absorbing boundary. Its probability of moving (right) in the opposite direction on its next move, however, is 1. The net effect on a fish (hence, on a sample of fish) is a greater overall probability of moving towards the absorbing boundary and being removed than moving away from it and remaining in the flume. Thus, it is the boundary conditions that provide the bias in guiding actively swimming fish to the bypass, not the path over which they move. To the observer counting the live fish emerging from

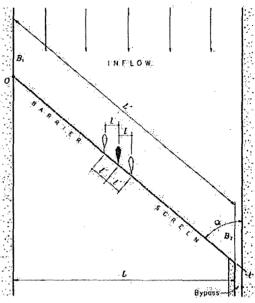


FIGURE 13.—Typical angled barrier screen and bypass in a flume with pumped inflow. The reflecting boundary is at B_1 and the absorbing boundary at B_2 . Screen length is L'; screen angle of attack is α ; flume width is $L = L'\sin\alpha$. Reference axis x is coincident with the screen face; its origin is at B_1 . Fish excursions of mean displacement 1 (=1'sin α) are measured along the x axis.

the bypass, it would seem that something were guiding fish along the (nonangled) screen.

In the foregoing process, the rate at which fish escape from the screenwell depends for the most part on the lateral activity of the fish themselves; the more active the fish the more likely their encounter with the bypass. Screen angle might or might not increase the rate of that encounter. Investigators seem to be unanimous in reporting no (apparent) differences between competing screen angles in the diversion rates of uninjured fish, or even in "total efficiencies" (the overall survivals of test fish). Nevertheless, the question is still open and ardently debated, and we can make provisions for the possible effects of screen angle in the analysis that follows.

We are especially concerned here with the initial distribution of fish at the barrier, with the flux rates of fish into a bypass, with the separation of mortalities and live escapes, and with the relationships of those variables to sample size, fish behavior, and flume size. Our system of interest consists of the usual assemblage (Fig. 13):

(1) an intake flume with parallel sidewalls but

of selectable widths, and a steady, pumped intake of water, flowing parallel to the sidewalls;

- (2) a barrier screen sufficient in height to span the depth of the indrawn water, its length L' determined by flume width L and selectable angles of attack α , where $0^{\circ} < \alpha \le 90^{\circ}$ and $L' = L/\sin \alpha$;
- (3) a pumped bypassing slot against one flume wall, admitting water at an entry velocity equal to that of the flow through the barrier screen.

The limits of displacement x are specified by boundaries B_1 and B_2 , a distance L' apart. The flume wall at B_1 is a reflecting boundary, and the bypass at B_2 is an absorbing boundary. The origin O of the displacement axis coincides with B_1 , and x is positive in the direction of B_2 .

We presume that our probabilistic fish swims headmost into the flow just ahead of the barrier screen and makes small but discrete excursions of mean displacement length l (=l'sin α), at random in either direction along displacement axis x. The mean excursion period is τ . In the most general case, time-dependent variations in the mean values of l, and τ are allowed. The fish of sample S may be released all at once (the customary case in test-flume and marking experiments) or the release may be distributed over time.

For experiments where the fish of S are released all at once (where the residence times of individuals commence simultaneously), the dependent variable of our governing equations is a concentration function U(x,t), which describes the time-dependent density of fish along the displacement axis between boundaries B_1 and B_2 . At any time t the relationship between screenwell population N(t) (the live and uninjured) and concentration function U is

$$N(t) = \int_0^{L'} U(x,t) \ dx.$$

The behavior of fish along the screenfront may also be density-dependent, excursions increasing or decreasing in length or frequency owing to schooling, avoidance reactions, or even sample size because of the effects of dense or sparse packing. With all of the foregoing constraints and provisions, concentration function U will be governed by the nonlinear relationship

$$\frac{\partial U}{\partial t} = \frac{\partial}{\partial x} \left[D(U, \alpha, t) \frac{\partial U}{\partial x} \right] - \beta(t) \cdot U(x, t). \tag{29}$$

Quantity $\beta(t)$ is a mortality rate. Except for the mortality term and the density-dependent provision of coefficient D, equation (29) is the limiting case of a one-dimensional random-walk process (see, for example, Barber and Ninham 1970 or Zauderer 1983). We already have some notion of the likely forms of β from our previous analysis of risk function ϕ_t . Mortality β has the definition

$$\beta(t) = -\frac{1}{\phi_t} \frac{d\phi_t}{dt} \,. \tag{30}$$

Coefficient D is our dispersion or fish-activity parameter, defined in the limit as

$$D \equiv \lim_{l,\tau \to 0} [l^2/\sin^2(\alpha/2\tau)]. \tag{31}$$

As an empirical coefficient, D is determined from measurements of the stochastic variables $l^* = E[l]$ and $\tau^* = E[\tau]$ in the relationship

$$\hat{D} = l^{*2}/\sin^2(\alpha/2\tau^*).$$

The values of l^* and τ^* may change over residence time, owing to exhaustion or acclimation of the fish (hence the dependence of D on t in [29]). The possible density-dependent effects of fish behavior are represented in (29) by the dependence of D on U itself (to whatever extent l and τ depend on the density of fish along the screenfront). The value or variation of D, for any combination of screen angle, intake velocity, species, and so on, is an empirical relationship and can be determined only from observed excursion patterns. It is worth noting that D does not depend directly on flume size L (or screen length L'), but the influence of flume size may enter indirectly into D if the mean values of land τ are density-dependent. Flume size enters the problem explicitly by way of the boundary conditions.

For experiments where the release of fish is distributed in some way over time, each fish or subset of fish in S will have its own time scale of residence (ζ , say) which has a zero value corresponding to arbitrary time t. Although we shall not pursue the analysis for this case here, the analysis (and experimental design) is aided by the introduction of a distribution function $F(x,t,\zeta)$, which describes the probability that a randomly designated fish will be found, at general time t and its own residence time ζ after introduction to the screenwell, at a location be-

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tween x and x+dx along the displacement axis. The relationship of F to concentration function U and live population N is

$$U(x,t,\zeta) = F(x,t,\zeta) \cdot N(t,\zeta), \tag{32}$$

and F has the governing equation

$$\frac{\partial F}{\partial t} + \frac{\partial F}{\partial \zeta} = \frac{\partial}{\partial x} \left[D(U, \alpha, \zeta) \frac{\partial F}{\partial x} \right] - \beta(\zeta) \cdot F(x, t, \zeta).$$
(33)

In general, the diversion rate (the time-dependent flux) Q(t) of fish departing the screenwell (live, dead, and injured) is given by

$$Q(t) = -D \left[\frac{\partial \dot{U}}{\partial x} \right]_{x=L^{-1}}$$
 (34)

In the interests of clarity and the insight we might gain into the dependence of residence time on flume size, we commence our exploratory analysis from the simplest assumptions. Let us discount mortality and density dependence for the moment and presume that over time all fish of a sample S enter the bypass alive. Governing equation (29) now reduces to

$$\frac{\partial U}{\partial t} = D \frac{\partial^2 U}{\partial x^2}, \tag{35}$$

with coefficient D still defined by (31) but with l and τ constant. The initial and boundary conditions for this special case and all other cases considered are given by (36, 37, 38):

at
$$t = 0$$
, $U(x,0) = S_0(x)$, (36)

where $S_0(x)$ describes the initial distribution of fish along the screenfront.

At
$$x = 0$$
, $\frac{\partial U}{\partial x} = 0$, (37)

which is the condition at B_1 that specifies a reflecting boundary (no flux of fish through B_1).

At
$$x = L'$$
, $U(L',t) = 0$, (38)

which is the condition at B_2 that specifies an absorbing boundary (the fish that encounter the bypass are presumed to enter it).

Equation (35) has the form of a simple linear diffusion equation with special boundary conditions. We show here the solution procedures for the problem specified by (35, 36, 37, 38).

Except for some additional complexities arising from the time dependencies of coefficient D and mortality β , all of the linear problems treated here are resolved in a similar manner. For the large-time solution of the problem we employ the Fourier method, or

$$U(x,t) = \sum A_n U_n(x,t), \qquad (39)$$

where each of the U_n must satisfy the boundary conditions (37, 38) and where the coefficients A_n are determined by (36), the initial distribution of fish along the screenfront. Therefore, by (39) and the usual procedures of separation,

$$A_n U_n(x,t) = A_n (a_n \cos \lambda_n x + b_n \sin \lambda_n x) e^{-\lambda_n^2 Dt}.$$

Because the A_n cannot be zero identically, we must have $b_n \equiv 0$ in order to satisfy boundary condition (37). With no loss of generality, we can now set the $a_n = 1$ and apply boundary condition (38). The eigenvalues of the solution become, for $n = 0, 1, 2, \ldots$,

$$\lambda_n = \frac{(2n+1)\pi}{2L} \,, \tag{40}$$

and the solution itself now becomes

$$U(x,t) = \sum_{n=0}^{\infty} A_n e^{-\lambda_n^2 Dt} \cos \lambda_n x.$$
 (41)

The values of coefficients A_n are determined by the initial concentration pattern of fish along the barrier screen. Thus, at time t = 0 we assume that (41) converges uniformly to $S_0(x)$, or

$$S_0(x) = U(0,x) = \sum_{n=0}^{\infty} A_n \cos \lambda_n x.$$

Therefore, the Fourier coefficients of function $S_0(x)$ become, for n = 0, 1, 2, ...,

$$A_n = \frac{1}{L} \int_{-L'}^{L'} S_0(x) \cos \lambda_n x \, dx.$$
 (42)

With (42) as the *n*-many coefficients corresponding to the eigenfunctions of (41), we can now write solution (41) in the form

$$U(x,t) = \frac{1}{L} \sum_{n=0}^{\infty} e^{-\lambda_n^2 Dt} \cos \lambda_n x$$

$$\int_{-L'}^{L'} S_0(x) \cos \lambda_n x \, dx \qquad (43)$$

with the λ_n given by (40). Solution (43) is now useful for examining the likely form of uninjured escapes at large time. As t increases, the minor sums of (43) decay and the asymptotic behavior of the solution becomes

$$U(x,t) \to \frac{1}{L} e^{-\pi^2 Dt/4L^2} \cos\left(\frac{\pi x}{2L}\right)$$
$$\int_{-L'}^{L'} S_0(x) \cos\left(\frac{\pi x}{2L}\right) dx \qquad (44)$$

(with the reminder that the definite integral $\int [-L',L']$ is a constant). Thus, at large time, the probability of live escape from the screenwell reduces the sample population as

$$N(t) = \int_0^{L^2} U(x,t) dx$$

$$\rightarrow \frac{2}{\pi} A_0 \exp\left(-\frac{\pi^2 Dt}{4L^2}\right)$$
 (45)

where A_0 is the definite integral of (44). Thus the escape of live fish (a condition of the problem) is governed by the rate parameter

$$\lambda^* = \frac{\pi^2 D}{4L^2} \,. \tag{46}$$

Relationship (46) reveals the factors that influence parameter λ of the probability functions θ_t and the data analysis illustrated by Figs. 7-11. The L^2 term in the denominator of (46) is especially ominous. It suggests that the chance per unit time of uninjured escape is inversely proportional to the square of flume width. That is, the characteristic time t^* for movement of live fish out of the screenwell is proportional to $1/\lambda^*$, or

$$t^* \propto \frac{L^2}{D} \tag{47}$$

We should not be surprised, therefore, to discover from experiments that for a given screen angle and species, the mean residence time of entrapped live fish increases with the square of flume size (and with it the exposure to the risk of death or injury).

For purposes of examination, the small-time behavior of U(x,t) is more conveniently expressed by the method of images. For some time immediately after the start of an experiment, the

flux of fish into the bypass and the (changing) distribution of fish along the screenfront will be strongly influenced by the initial distribution of fish as they come down the flume. We continue here for the moment with the assumption of zero mortality risk ($\beta = 0$), with governing equation (35), and with boundary conditions (37, 38). For initial condition (36), however, let us presume in the first instance that the fish are uniformly distributed at t = 0, or

$$S_0(x) = \frac{S}{L'} \,. \tag{48}$$

With these conditions the small-time solution becomes

$$U(x,t) = \frac{S}{L'} \left\{ 1 - \sum_{n=0}^{\infty} (-1)^n [\operatorname{erfc}(-\chi_n) + \operatorname{erfc}(\chi_n)] \right\}, (49)$$

where

$$-\chi_n = \frac{(2n+1)L' - x}{2(Dt)^{1/2}},$$

and

$$x_n = \frac{(2n+1)L^n + x}{2(Dt)^n};$$

SO.

$$Q(t) = \frac{D^{1/2}S}{(\pi t)^{1/2}L'} \left[1 + 2 \sum_{n=1}^{\infty} (-1)^n e^{-n^2 L'^2/Dt} \right].$$
 (50)

This result suggests that with a uniform initial concentration of fish along the barrier screen, the flux (the bypassing rate) of live fish from the screenwell would be inversely proportional to screen length (which is not surprising), but also proportional to $t^{-1/2}$ (which is).

Let us examine one more case of the small-time solutions above, but with a special initial condition that seems to apply to experiments 35 through 51 of the Alden study. Suppose sample S has been released in the flume in such a way as to result in a cluster of fish around some location x_0 of the barrier screen (Fig. 14). The distance of x_0 from the bypass is $L' - x_0$. We can represent this initial condition with a Dirac delta distribution $\delta(x - x_0)$ at location x_0 , or

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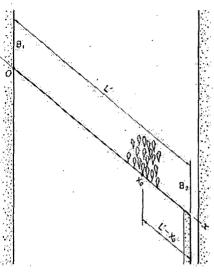
$$\frac{+1)L'-x}{2(Dt)^{1/2}},$$

$$\frac{1)L'+x}{Dt)^{1/2}};$$

$$\sum_{n=1}^{\infty} (-1)^n e^{-n^2 L^{\prime 2}/Dt} \bigg].$$
 (50)

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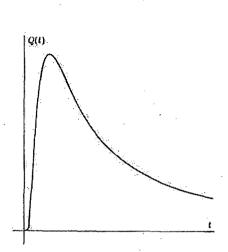


FIGURE 14.—Left, special case of initial fish distribution in a flume, $S_0(x)$, where sample S is concentrated on release around location x_0 (equation [51]). Right, graph of diversion rate Q(t) (equation [52]) for this initial condition.

$$S_0(x) = \rho \delta(x - x_0), \tag{51}$$

where ρ is the concentration of fish per unit length of screen around x_0 . Thus, the small-time approximation of departure rate Q(t) becomes

$$Q(t) \approx \frac{(L' - x_0)\rho}{2(\pi D)^{1/2}t^{3/2}} e^{-(L' - x_0)/4Dt}.$$
 (52)

As indicated by the right panel of Fig. 14, the flux of fish entering the bypass exhibits a sharp increase a short time after release. The surge occurs at a time governed by distance $(L' - x_0)$ and by the activity of the fish (as reflected by the presence of activity coefficient D in [52]).

Let us now introduce the risk of death and injury into the analysis, as well as possible time-dependent variations of activity coefficient D. The governing equation for U becomes

$$\frac{\partial U}{\partial t} = D(t) \frac{\partial^2 U}{\partial x^2} - \beta(t) U(x, t), \qquad (53)$$

with $\beta(t)$ defined by (30). Thus, in the case where ϕ_t is defined by (5a),

$$\beta(t) = \mu, \tag{54}$$

and in the case where ϕ_t is defined by (5b),

$$\beta(t) = \frac{\mu}{1 + ce^{-\mu t}}.$$
 (55)

Over time, a fish might reduce its mean excursion steps l or its frequency of making them, owing to such effects as exhaustion or acclimation. Should mortality be related to exhaustion, say, we can expect the form of D(t) to be functionally similar to probability ϕ_l . In the absence of further knowledge, we can only suppose that D is likely to decay in either of the following ways:

$$D(t) = D_0 e^{-\nu t}, (56)$$

which accommodates a decline in fish activity immediately following introduction of the fish into the screenwell; or

$$D(t) = \frac{(b+1)D_0}{b+e^{\nu t}},$$
 (57)

which accommodates a delay in the reduction of fish activity. In either case, ν governs the rate of decay in activity, and D_0 still depends on screen angle (and so might decay parameter ν and delay parameter b).

The solutions we seek all require integrations of β and D. For convenience of notation, the integrations are given the following symbols:

$$\Lambda(t) = \int_0^t \beta(t) dt$$

$$= \begin{cases} \mu t & \text{if } \beta(t) \text{ is (54).} \\ \log_e \left(\frac{c + e^{\mu t}}{c + 1} \right) & \text{if } \beta(t) \text{ is (55).} \end{cases}$$

$$\kappa(t) = \int_0^t D(t) dt$$

$$= \begin{cases} \frac{D_0(1 - e^{-\nu t})}{\nu} & \text{if } D(t) \text{ is (56).} \\ \frac{(b+1)D_0}{b} \left(\nu t - \log_e \frac{b + e^{\nu t}}{b + 1}\right) \\ & \text{if } D(t) \text{ is (57).} \end{cases}$$

For the analysis and examples that follow, (53) is our governing equation of interest, (37, 38) are the boundary conditions, and (36) is the initial condition, but initial distribution $S_0(x)$ will be specified for each examined application. The Fourier solution of the general problem specified is now

$$U(x,t) = e^{-\Lambda(t)} \sum_{n=0}^{\infty} A_n e^{-\lambda_n^2 \kappa(t)} \cos \lambda_n x, \quad (58)$$

where the λ_n take the values specified by (40) and where the A_n are defined by (42). First suppose the initial distribution of fish along the screenfront to be uniform at t = 0. Thus, the initial condition becomes

$$S_0 = \frac{S}{L},\tag{59}$$

where S is again the number of fish in the test sample. The Fourier coefficients in turn become

$$A_n = (-1)^n \frac{4S}{(2n+1)\pi L'} \,. \tag{60}$$

Let us now examine a few cases of (58) that seem to apply to the marking experiments of the Oswego study and to the Alden study. For the first application, presume that mortality $\beta(t) = \mu$, or $\Lambda(t) = \mu t$ (which corresponds to cases 1 and 3 of the time-dependent risk analysis). But let us also suppose that exhaustion plays a role in the behavior of the test species, such that activity parameter D decays in time after the manner of (56). With these conditions on $\Lambda(t)$ and $\kappa(t)$, the

asymptotic (or large-time) behavior of concentration function U becomes

$$U(x,t) \to \frac{4S}{\pi L'} \exp \left[-\frac{\pi^2 D_0 (1 - e^{-\nu t})}{4L^2 \nu} - \mu t \right] \cdot \cos \frac{\pi x}{2L'}, \tag{61}$$

and the associated diversion rate of fish (live, dead, and injured) is

$$Q(t) \to \frac{2SD_0}{L'^2} \cdot \exp\left[-\frac{\pi^2 D_0 (1 - e^{-\nu t})}{4L'^2 \nu} - (\mu + \nu)t\right]. (62)$$

But $\exp(e^{-\nu t}) \approx 1$ at large t, so that

$$\nabla U(x,t) \sim e^{-\mu t}$$

and

$$Q(t) \sim e^{-(\nu+\mu)t}.$$

The flux (the departure rate) Q(t) of fish is retarded by the decrease in fish activity (as governed by parameter ν of D), but the decline in overall density of fish in the screenwell is governed by the injury and mortality process. In turn, population N diminishes at large time as

$$N(t) = \int_0^{L'} U(x,t) \ dx \to \frac{8}{\pi^2} \exp\left[-\frac{\pi^2 D_0}{4L'^2 \nu}\right] Se^{-\mu t}$$
(63)

and the cumulative departures from N go as

$$B(t) = S - N(t),$$

a process dominated in this case by mortality. The results of this example reflect the influence of the decline in fish activity at the barrier screen and hence the associated increase in exposure to the risk of death or injury. The process seems to apply to the marking experiments on the white perch of the Oswego study (Table D-3, Appendix D) where recoveries were dominated by mortality but only 57% of the marked fish had exited the screenwell at the end of the 48-h test period (all of which were dead). The foregoing example is much the counterpart of result (45) where exits were dominated by live fish on the order of $\exp(-\lambda^*t)$.

In the case of more hardy and active fish, parameter D may decay very little over time. If we

ime) behavior of concen-

$$\frac{D_0(1 - e^{-\nu t})}{4L^2\nu} - \mu t \bigg]$$
 (61)

rersion rate of fish (live,

$$\frac{-e^{-\nu t}}{^{2}\nu}-(\mu+\nu)t\bigg]. (62)$$

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$$+\frac{8}{\pi^2} \exp \left[-\frac{\pi^2 D_0}{4L'^2 \nu} \right] S e^{-\mu t}$$
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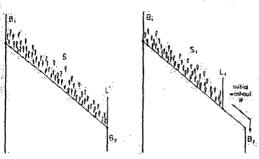


FIGURE 15.—Left, uniform initial distribution S/L' of fish before a barrier screen. Right, nonuniform distribution S_1/L_1 where $S_1 = S - W$ in equation (68).

allow D to be constant in (58), and with $\beta(t) = \mu$ as before, the general solution for U becomes

$$U(x,t) = \frac{4S}{\pi L'} e^{-\mu t} \sum_{n=0}^{\infty} \frac{(-1)^n}{2n+1} e^{-\lambda_n^2 D t} \cos \lambda_n x.$$
 (64)

At large time the asymptotic term of (64) is now

$$U(x,t) \to \frac{4S}{\pi L'} e^{-(\mu + \lambda^*)t} \cos \frac{\pi x}{2L'},$$
 (65)

and the departure rate of fish from N(t) is now approximately

$$Q(t) \to \frac{2DS}{L'^2} e^{-(\mu + \lambda^*)t},$$
 (66)

which is like the bypassing rate of live and injured (or dead) fish illustrated by Figs. 10 and 11 (Alden experiment 13). From integration of the asymptotic term of (64), the large-time approximation of the decline in the live, uninjured screenwell population becomes

$$N(t) \to \frac{8}{\pi^2} S e^{-(\mu + \lambda^*)t}, \tag{67}$$

which predicts a large-time decline in N similar to the single-variabled regression function of Fig. 10.

For purposes of examination at small time, the method of images gives us more convenient solutions. Thus, with conditions like those above for (64), the fish concentration function for small t is

$$U(x, t) = \frac{S}{L'} e^{-\mu t} \left\{ 1 - \sum_{n=0}^{\infty} (-1)^n \left[\operatorname{erfc}(-\chi_n) + \operatorname{erfc}(\chi_n) \right] \right\},$$
(68)

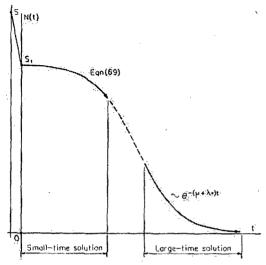


FIGURE 16.— Delay in departure of fish from flume population N(t) owing to an initial nonuniform distribution and its effect on small-time solution (69); see Fig. 15.

where the functions $-\chi_n(x)$ and $\chi_n(x)$ are identical to those of (49). With regard now to a peculiarity of the Alden data, let us impose a special initial condition on (68). In the previous example we presumed the distribution of fish on their arrival at the screenfront to be more or less uniform (Fig. 15, left). For the conclusion of the example, suppose that in a short period of time after arrival, the initial distribution of fish quickly becomes nonuniform (Fig. 15, right) as a result of an initial washout W, where $S - W = S_1$ (as reflected in the Alden data, Appendix C, and Figs. 7-9). Our initial condition changes accordingly:

at
$$t = 0$$
, $S_0(x) = \begin{cases} \frac{S_1}{L_1} & \text{where } 0 \le x \le L_1 \\ 0 & \text{where } L_1 < x \le L'. \end{cases}$

With this initial condition in (68), the small-time solution for N(t) becomes

$$N(t) = \int_0^{L'} U(x,t) dx$$

$$\approx S_1 \left[1 - \left(\frac{D}{\pi L_1^2 t} \right)^{1/2} e^{-(L' - L_1)^2 / 4Dt} \right], \quad (69)$$

which has a trajectory (Fig. 16) similar to those of Figs. 7-9. As this result suggests, the delay

following the initial washout in many of the Alden experiments might have been the result of high initial densities of test fish in a small test flume (the effect being most pronounced in experiments where S was 200 or more fish), or even the consequence of the nonuniform flow conditions at the starts of experiments.

As consistently shown by the analysis of this section, the characteristic diffusion time of live and swimming fish in escaping the screenwell depends on flume size L (=L'sin α) and activity coefficient D in the relationship

$$t^* = \frac{4L^2}{\pi^2 D} \,.$$

Over time, the screenwell population is reduced by death and injuries, as well as by live escapes. Those risks and reductions, and how they combine, may be influenced by any of the several factors discussed here (and perhaps by some that have not been discussed). We have seen how a few of those factors, for such important quantities as mortality β and activity D, may influence escape and survival, as inferred from sparse evidence. But that evidence does not extend to such fundamental questions as the effects of sample density on fish activity [whether or not D = D(U)]. or even to the nature of initial fish distributions along a screenface [the possible forms of $S_0(x)$]. As the solutions of U(x,t) depend on those unresolved complexities, so does the dependence on flume size L of expected entrapment time, and, most importantly, so do the projections to full-scale designs of the mortality probabilities resolved from small-scale experiments.

The Scaling Problem

Although the governing equations, boundary conditions, initial conditions, and parametric formulations can be written for many conceivable relationships between the quantities of interest, we have pressed the analysis about as far as inference and rational speculation can safely take us. What empirical information we do have at hand does not seem adequate for asking more from the analysis than simple instructions from simple assumptions. With these cautions in mind, and the simplifying assumptions of constant risk of death or injury $[\beta(t) = \mu]$, time-invariant fish activity (D constant for a given screen angle), a uniform initial distribution $[S_0(x) = S/L']$, and the disallowance of experimental artifacts, then

the dependence on flume size L of the expected entrapment time of a fish at risk in screenwell population N(t) is given by

$$E[Y(L)] = \frac{1}{\mu + \lambda^*}$$

$$= \frac{L'^2 \sin^2 \alpha}{\mu L'^2 \sin^2 \alpha + \frac{\pi^2 D}{4}}$$
(70)

(see Fig. 17). From the analysis of the Alden test data and the Oswego marking experiments, we have some idea of mean entrapment times and likely value ranges of risk parameters μ and λ for large and small systems. We can also so extract some likely values of coefficient D from that information and the analysis associated with Figs. 10 and 11.

From the regressions of Figs. 10 and 11 on the data of Alden experiment 13, the experimental mean residence time and estimated values of the risk parameters are

$$\bar{Y} = 3.21 \text{ h};$$

 $\hat{\mu} = 0.0975/\text{h};$
 $\hat{\lambda} = 0.2139/\text{h}.$

The Alden flume width is L=1.83 m, where screen length $L'=L/\sin\alpha$. For experiment 13, α was 45°, but, in the absence of information on the effects of differing screen angles on D (on mean excursion dimension l'), we calculate D in terms of cross-flume dimension l. The numerical relationship between l and L, for a given screen angle will be the same as that between l' and L'. By (46) then, the estimated value of activity coefficient D for the Atlantic menhaden of Alden experiment 13 is

$$\hat{D} = \frac{4L^2\hat{\lambda}}{\pi^2} = 0.29 \text{ m}^2/\text{h}.$$

Another (representative) estimate of D can be extracted from the comparison between the large and small diversion systems given previously. In those calculations the (implied) activity coefficient was the same for both systems. The calculations for the small system were based on the various Alden flume experiments, where flume size and the representative values for mean residence time and the risk parameters were

$$L = 1.83 \text{ m};$$

 $\bar{Y} = 3 \text{ h};$

e size L of the expected sh at risk in screenwell by

$$\frac{\lambda^*}{L'^2 \sin^2 \alpha} \frac{L'^2 \sin^2 \alpha}{\sin^2 \alpha + \frac{\pi^2 D}{2}}$$
 (70)

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h; 75/h; 39/h.

L=1.83 m, where . For experiment 13, ice of information on sen angles on D (on l'), we calculate D in sion l. The numerical L, for a given screen at between l' and L'. Talue of activity coefmenhaden of Alden

 $^{19} \text{ m}^{2}/\text{h}$

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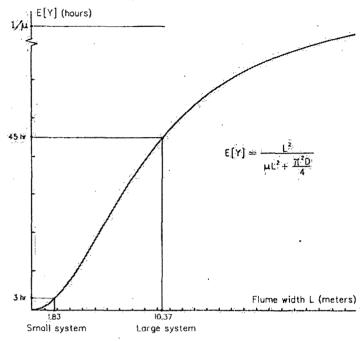


FIGURE 17.—Expected entrapment time versus flume size from equation (70) with $\mu = 0.012/h$ and D = 0.436 m^2/h .

$$\mu = 0.012/h;$$

 $\lambda = 0.321/h.$

Therefore, the representative value of activity coefficient D for the small system is

$$D = 0.436 \text{ m}^2/\text{h},$$

and it has the identical value for the large system, where

$$L = 10.37 \text{ m};$$

 $\ddot{Y} = 45 \text{ h};$
 $\mu = 0.012/\text{h};$
 $\lambda = 0.010/\text{h}.$

Figure 17 depicts relationship (70) with the values of μ and D above (the values of the largeand small-system comparison). The inflection point of (70) occurs at a flume width

$$L = \frac{\pi}{2} \left(\frac{D}{3\mu} \right)^{1/2} \tag{71}$$

(5.47 m on the example graph). At flume widths greater than (71), the unit risk μ , or death and injury distribution ϕ_t , has a greater influence on mean live entrapment [residence time in N(t)] than the live escape distribution $1 - \theta_t$. In fact,

the upper (asymptotic) bound on mean residence time is $1/\mu$.

With the same general assumptions as those

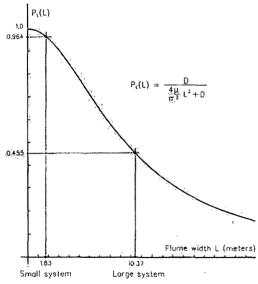


FIGURE 18.—Probability of live escape $P_L(L)$ versus flume size from equation (72) with $\mu = 0.012/h$ and $D = 0.436 \ m^2/h$.

given for (70), the probability of escape drops off rapidly with flume size in the relationship

$$P_L(L) = 1 - \mu \cdot E[Y(L)]$$

$$= \frac{\pi^2 D}{4\mu L^2 + \pi^2 D}$$
 (72)

which has the appearance of Fig. 18 (for the same values as those of Fig. 17). Thus for the small (representative) system, the probability that a fish drawn into the screenwall will escape uninjured is

$$P_L(1.83 \text{ m}) = 0.964,$$

where, as before, $\mu = 0.012/h$ and D = 0.0436 m²/h. The probability that it will die or be injured is

$$P_D(1.83 \text{ m}) = 1 - 0.964$$

= 0.036,

or, of a sample S, 3.6% are expected to die or be injured and 96.4% are expected to escape uninjured. For the large (representative) system,

$$P_L(10.37 \text{ m}) = 0.455,$$

 $P_D(10.37 \text{ m}) = 0.545,$

or 45.5% expected live escapes and 54.5% deaths and injuries.

Relationships (70) and (72) will be further complicated to the extent that activity D and mortality rate β are time- and density-dependent in the solutions of governing equation (29). Whether or not screen angle may influence D cannot be resolved from the existing empirical information, but the possibility cannot be discounted. Nevertheless, from the simplest of assumptions, we can see by (70) and (73) that projections of small-scale experimental results to full-scale designs cannot be made on such simple arithmetic extrapolations as flume-size ratios. And because of the clearly nonlinear relationships between flume size and the competing risks of mortality and escape, the scaling problem cannot be resolved from the experimental designs, estimators, and linear statistical analysis of current practice.

Conclusion

So long as the water supplies demanded by large water-use facilities are drawn from natural sources, the continued entrapment of large num-

bers of fishes is probably inevitable. Except for such topographical arrangements as porous dikes and barrier nets at the entries of cooling ponds, little in the way of actually preventing entrapment seems possible of achieving. The devices now commonly employed for conserving fish life have all been designed instead with the (conscious or unconscious) intent of reducing exposure to risk once a fish has encountered them. All such devices are mechanical in nature; some are passive (or semi-passive) in their operating principles and some are active. As revealed by the accumulated evidence, no device, active or passive, has proven to be very successful at preventing injury and death to fish in full-scale systems. Such passive devices as angled-screen arrays suffer from decreased effectiveness as they increase in size, and angled-louvre arrays are impractical or ineffective altogether. The known active devices (such as continuously travelling screens with the Ristroph modification) are limited in effectiveness because those devices operate on the expectation of direct encounter with the fish.

As demonstrated by the probabilistic analysis (and as reason tells us once the question has been posed), the expectation of live entrapment (the mean residence time) of fish drawn into a screenwell is lessened both by increased opportunity for escape (decreased exposure to risk of death) and by increased mortality (by increases in the unit risk of death), but the two have opposite effects on survival. With such passive devices as angled barrier screens, survival declines with increase in system size owing to increased residence time (increased exposure) in the absence of any reduction in the unit risk of death itself. In the case of active devices that depend on direct contact with the fish, the durations of entrapment are apparently reduced, but the reductions are brought about by increased risk and the accompanying cost in death and injury. From the foregoing findings, it becomes obvious that if a new design is to be better at conserving fish than the old, it must bring about a reduction in mean entrapment time through some active means of removal, but some active means not dependent on forcible contact with the fish.

In the case of angled barrier screens, whether or not a steepened pitch (a lessened angle of attack) contributes anything to reducing the mortalities of entrapped fish has not been established with certainty. And despite the many reports on "diversice or not directing bypass is sible rat nation he such a testificien ever bee against the water more in stimulus in the second control of the seco

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rier screens, whether lessened angle of ato reducing the mornot been established the many reports on "diversion efficiencies" of angled screens, whether or not screen angle has any influence at all in directing or guiding actively swimming fish to a bypass is still an undecided proposition. No plausible rationale capable of withstanding examination has ever been posed that would justify such a thesis, and no systematic observations sufficient for testing the guiding hypothesis have ever been reported. Except when fish are pressed against an angled screen and forced along it by the water flow, screen angle seems to have no more influence on swimming fish than any other stimulus that might provoke random excursions in the screenwell.

The barrier screen is always put forth as a conserver of fish, when in fact it is the hazard. In designing experiments on devices whose principal function is that of halting the influx of debris into the plant, it should not be a question of how much efficiency the device bestows on fish, but how much death and injury. If an angled screen and bypass, say, are any less hazardous to fish life than a 90° screen and bypass might be (in terms of the ultimate fate of fish returned to the source waters), nobody knows it for certain.

The behavior of fish entrapped in a screenwell is poorly understood. Whether their movements are systematic in some fashion (as in the guiding hypothesis for angled screens), or essentially stochastic (as in the random-walk hypothesis of this paper), can only be resolved by time-series experiments (such as continuous cinemagraphic measurements) and competent statistical analyses.

On the question of predicting the likely effects of full-scale conservation systems from the results of small-scale experiments, the equations and conditions for making such predictions can be constructed, but the requisite empirical information for quantifying the analysis and resolving parametric relationships does not now exist. An appropriate analysis requires experimental information with respect to (at least) two independent variables, time and displacement. In reported studies, whether of experimental flumes or operating systems, neither variable is taken into account because the experimental designs (hence the statistical analysis) employed in such works are constructed around invariant estimators $(E, E_T, m, and so on)$. Because of that want of dimensional dependence, past experiments have been severely system-dependent and thus extend with little reliability from one system to another.

Because an accurate resolution of the questions addressed in this work attaches with such importance to the conservation of fish life and to the costs for constructing conservation devices that otherwise may prove ineffective, I recommend that much of the past and current research on fish diversion systems be viewed as inconclusive, and that new or revised experimentation be undertaken that will allow a separation of the competing risks identified here.

Acknowledgments

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Appendix A: Reduction of a Random Walk to Frequency of Escape (Formula 15)

Let escape be a random process with reflecting and absorbing boundaries in one dimension (see, for example, Barber and Ninham 1970). That is, let the entrapped population size n at time t be a Poisson random variable with mean λt (where, at time t = 0, $n = n_0$). Therefore, the probability that the population consists of $n (\leq n_0)$ entrapped members at time t is

$$P_n(t) = 1 - \frac{(\lambda t)^n}{n!} e^{-\lambda t}.$$

Thus the probability that the population consists of no entrapped members at time t becomes

$$P_{\Omega}(t) = 1 - e^{-\lambda t},$$

which can be viewed as the risk (the chance) that a randomly designated individual of n_0 will have

escaped by time t. That is, with T the time of escape, then

$$P_0(t) = \text{Prob}[T \le t]$$

for any time t. In turn, the probability of the individual's being entrapped at least until time t is

$$P_E(t) = \text{Prob}[T > t]$$

$$= 1 - P_0(t)$$

$$= e^{-\lambda t},$$

and $P_0(t)$ has the corresponding density function

$$\lambda e^{-\lambda t}$$
. (15)

Parameter λ is a rate (in particular, rate of escape) with corresponding dimensions numbers/time.

Appendix B: Delay in Escape Probability (Equation 16a)

Let escape have the probabilistic conditions described for formula (15) of Appendix A, but let there be a time delay in that process. With k' the delay parameter, $P_0(t)$ takes the form

$$P_0(t)=1-\frac{k+1}{k+e^{\lambda t}},$$

and the probability of continued entrapment in turn becomes

$$P_E(t) = \frac{k+1}{k+e^{\lambda t}}.$$
 (16b)

The (cumulative) delay is determined by parameters λt and k on the time domain where

$$\lambda t \leq \log_e \left(\frac{k}{2} + 1\right).$$

Behavior of (16b):

at
$$t = 0$$
, $P_E(0) = 1$;
as $t \to +\infty$, $P_E(t) \to 0$;
as $k \to 0$, $P_E(t) \to e^{-\lambda t}$ (no delay);
at large t (where $t > \log_e[(k/2) + 1]$),
 $P_E(t) \to e^{-\lambda t}$.

Let
$$f(t) = \frac{d}{dt} \dot{P}_E(t)$$
; thus

$$\int_0^\infty f(t) dt = -(k+1) \left[\frac{1}{k + e^{\lambda t}} \right]_0^\infty = 1$$

as required.

Appendix C: Alden Test Data

Contained in this appendix are the recovered laboratory data (Table C-1) from the Alden test-flume experiments (Alden Research Laboratory 1981), along with several examples that illustrate the invalidities of the estimating procedures common to such work.

As noted previously, the estimator E, presumed to be a measure of the "diversion efficiency" of a conservation device on a sample of fish, is defined in the Alden report as

$$E = \frac{\text{Number by passed}}{\text{Number tested} - \text{Number non-by passed}},$$

the "Number tested" being sample S. The ultimate likelihood E_T , or the "total system efficiency," of the tested diversion system in bypassing fish alive is defined in turn as

$$E_T = E(1-m),$$

quantity m being the differential mortality described heretofore.

Example 1: Termination of experiments at like running times. Suppose that two competing devices are being tested (25° and 45° screens and bypasses, say). All other experimental variables are identical. Let S be 100 fish. Both experiments are terminated, say, after 4 h from start. Suppose the observed results to be the following

Device A: 1 fish bypassed alive, 99 left swimming in the flume.

Device B: 99 fish bypassed alive, 1 left swimming in the flume.

According to the estimating conventions of the Alden (and similar) demonstrations, the diversion efficiencies E for both devices would be 100%, and the total efficiencies E_T would also be 100% for both. The inequities of such measures are obvious. The rate of bypassing in case B is far greater than that of A, and the unknown fate of the one remaining fish of B is insignificant in comparison to the 99 of A, but such differences would not be distinguished by the measures given to E and E_T . In the example, the possibility could not be discounted that all 99 remainders of A might be killed, in which case the true efficiency of the system would fall from 100% to 1%.

Example 2: Termination of experiments when a predetermined number of fish have been by-passed. Again let the sample size for each of two experiments be 100 fish, but let each be terminated at the bypassing of 10 fish, irrespective of time.

Device A: 10 fish bypassed alive in 10 h; 90 left swimming in the flume.

Device B: 10 fish bypassed alive in 1 h; 90 left swimming in the flume.

Device B is obviously more effective at diverting fish than A, but again E would be scored as 100%

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(no delay); [(k/2) + 1]),

$$\left[\frac{1}{k+e^{\lambda i}}\right]_0^\infty = 1$$

alive, 99 left swim-

1 alive, 1 left swim-

conventions of the rations, the diverdevices would be ies E_T would also ities of such meabypassing in case and the unknown f B is insignificant at such differences the measures givle, the possibility all 99 remainders case the true efull from 100% to

xperiments when h have been byfor each of two t each be termiirrespective of

live in 10 h; 90

live in 1 h; 90

ive at diverting scored as 100%

for both, and E_T would also be 100%. But device B is less hazardous to its remaining 90 fish than A to its remaining 90 owing to the higher rate of diversion of B (because decreased exposure to risk decreases the likelihood of death). The consequences could only be determined with certainty by running the experiments to conclusion.

Example 3: Arbitrary termination of experiments (typical of the Alden practice). Again let the sample size for each of the experiments be 100 fish, but with the following results.

Device A: One fish bypassed alive in 15 min; 99 left swimming in the flume.

Device B: 97 fish bypassed in 2 h, two dead; one fish left swimming in the flume.

Device B is obviously very effective at bypassing and conserving fish. Device A appears less so, but the test on A is not sufficient for statistical significance. Yet by the standard methods of scoring, the diversion efficiencies E for both would still be 100%, without distinction. The total efficiency E_T for device A is 100%, but E_T for B is 98%, and according to the statistical methods of the Alden report, device B would be deemed inferior to A when the opposite is more likely true.

The foregoing examples are not exaggerations. The portions of test samples S not accounted for in the experiments lead to conclusions like that expressed on page 19 of the report: "The striped bass was the most effectively diverted species (97.8 percent; s.d. = 5.7)." The striped bass, in fact, was the least effectively diverted species. The experiments with the *lowest* percentages of bypassed fish were those with the striped bass. See the tabulated data for experiments 22, 24, 29, 30, 34, 52, 53, 54, 57, and 58, Table C-1, where the portions of S not bypassed ranged from 51% of S to 78%.

The following examples are taken from the Alden report itself. The diversion efficiencies E are not given in the report and must be calculated from the tabulated quantities appearing on Table 3.1 of the report.

Example 4: Alden test 24. Tabulated values: number tested (sample size): 200; number bypassed: 51; number left swimming in flume (not bypassed): 149; number impinged: 0; differential mortality m: 0; E_T given as 100%.

Since m = 0, then $E = E_T$, which implies that E = 1 (or 100%). For this experiment, then, E was calculated as

$$E = \frac{\text{Number bypassed}}{\text{Number bypassed}} = 1.$$

The 149 non-diverted fish were excluded from the calculations as though they had never entered the experiments.

Example 5: Alden test 50. Tabulated values:

number tested: 100; number bypassed: 81; number left swimming in flume: 0; number impinged: 19; number held for 96 h: 81; number of bypassed dead in 96 h: 8; control mortality: 0; differential mortality: m = 0.10 (as tabulated); E_T given as 73%.

Although the quantity E is not given, we must now have

$$E = \frac{E_T}{1 - m} = \frac{0.73}{0.9} = 0.81,$$

but let us make a trial calculation of E according to the definition given in the report:

$$E = \frac{\text{Number bypassed}}{\text{Number tested} - \text{Number non-bypassed}}$$

$$= \frac{81}{100 - 19}$$

$$= \frac{81}{81}$$

$$= 1.$$

which is obviously not what it seems to be. The value of E for this experiment was evidently calculated in the following way:

$$E = \frac{\text{Number bypassed}}{\text{Number bypassed} + \text{Number impinged}}$$
$$= \frac{81}{81 + 19}$$
$$= 0.81.$$

But E as calculated for this experiment (and some others) is an invalid estimator if any likelihood of failure exists. Suppose, for example, that in a given experiment (sample size 100, say), no fish

were bypassed and no fish were impinged during the time allotted for the experiment. Then estimator E, which must accommodate failure as well as success, would have to be zero (whether E is viewed as a probability estimator or as the "efficiency" of the system in bypassing fish). But by the method of calculation employed by the authors in test 50, one would have instead:

$$E = \frac{\text{Number bypassed}}{\text{Number bypassed} + \text{Number impinged}}$$
$$= \frac{0}{0+0},$$

which is indeterminate, not zero as required. If, instead, we let E be a natural probability estimator, strictly reflecting the experimental results, then it should be defined instead as

$$E' = \frac{\text{Number bypassed}}{\text{Number tested}}$$

whence, for the illustration of failure,

$$E'=\frac{0}{100}=0$$

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tim

as required. And for the results of test 50,

$$E' = \frac{81}{100} = 0.81$$

as required.

The natural estimates merely emphasize the arbitrary nature of the estimating methods employed in the Alden report; they do not rehabilitate the experiments but only reflect the empirical results as those results exist. Because the events of bypassing, injury, and death are governed by time-dependent distributions, no time-invariant estimators or statistical analyses like those appearing in the Alden and similar reports should be considered appropriate to the results of such experiments.

Table C-1.—Recovered experimental data corresponding to summarized results in Alden Research Laboratory (1981).^a

Key: Number preceding species denotes experiment. α is screen angle of attack; V is water velocity; T is water temperature; m is differential mortality (test mortality minus control mortality, $M_T - M_C$). Elapsed time is measured from the start of each experiment; the last entry represents test termination. Number bypassed includes live, dead, and injured fish bypassed since the previous observation; a value in parentheses gives the number of impinged fish collected at termination of the experiment. N(t) is the flume population at each observation time; the first number for each experiment is the sample size S and the last is the number of fish left swimming in the flume at termination of the experiment.

| Elapsed time, h | Number bypassed | N(t) | Elapsed time, h | Number bypassed | N(t) | Elapsed time, h | Number bypassed | N(t) | Elapsed time, h | Number bypassed | N(t) |
|-----------------------|------------------------------------|--------|--------------------|------------------------------|--------|--------------------|--------------------|--------|--------------------|----------------------------|--------|
| 1: Atla | antic menha | den | 11.33 | 18. | 29 | 3.0 | . 2 | 179 | . 0 | . 0 | 200 |
| $\alpha = 45^{\circ}$ | V = 3 | 0 cm/s | 11.83 | 8 | 21 | 4.0 | 3 | 176 | 0.25 | 78 | 122 |
| T = 20 | $.5^{\circ}C \text{ m} = 0$ | % | 12.83 | 0 | 21 | 4.5 | 22 | 154 | 0.75 | 15 | 107 |
| 0 | 0 | 200 | 3. Atl | antic menho | idan | 5.0 | 76 | 78 | 1.75 | 10 | 97 |
| 0.5 | ŏ | 200 | $\alpha = 45$ | | 0 cm/s | 5.75 | 21 | 57 | 2.75 | 13 | 84 |
| 1.0 | Ō | 200 | T=23 | - | | 6.5 | 11 | 46 . | 3.75 | 7 . | 77 |
| 2.25 | 122 | 78 | 0 | 0 | - | 7.0 | 7 | 39 | 4.25 | 32 | 45 |
| 2.5 | 49 | 29 | | - | 221 | 7.5 | 11 | 28 | 4.75 | 6 | 39 |
| 2.75 | o | 29 | 0.42 | 49 | 172 | 5: Atl | antic menha | den | 5.75 | 7 | 32 |
| 3.0 | ŏ | 29 | 1.42 | 14 | 158 | $\alpha = 25$ | V = 3 | 0 cm/s | 6.25 | 2 | 30 |
| 5.0 | J | | 2.92 | 3 | 155 | T = 21 | $^{\circ}C$ $m=0$ | 96 | 7. 4. | antic menho | . da |
| 2: Atla | ıntic menha | den | 4.17 | 4 | 151 | 0 | 0 | 214 | | unisc menne V = j | |
| $\alpha = 45^{\circ}$ | V = 30 | 0 cm/s | 5.17 | 48 | 103 | 0.5 | 22 | 192 | | $3^{\circ}C \text{ m} = 4$ | |
| T = 20. | $5^{\circ}C \text{ m} = 0^{\circ}$ | % | 6.17 | 21 | 82 | 1.5 | | 186 | | | |
| 0 | 0 | 205 | 7.17 | 39 | 43 | 2.5 | | 186 | 0 | 0 | 204 |
| 0.34 | 46 | 159 | 8.17 | 27 | 16 | 3.5 | ĭ | 185 | 0.25 | . 83 | 121 |
| 0.83 | 2 | 157 | 8.67 | 4 2 | 12 | 4.0 | 73 | 112 | 1.25 | 30 | 91 |
| 1.83 | 5 | 152 | 9.17 | 1 | 10 | 4.5 | 30 | 82 | 2.25 | 27 | 64 |
| 2.83 | ŏ | 152 | 9.67 | 1 | 9 | 5.25 | 23 | 59 | 3.0 | 9 | 55 |
| 3.83 | í | 151 | 4: Atl | lantic menh | ıden | 6.0 | 24 | 35 | 3.75 | 30 | 25 |
| 4.83 | Ô | 151 | $\alpha = 4.$ | 5° V = 3 | 0 cm/s | 6.5 | 6 | 29 | 4.25 | 11 | -14 |
| 6.83 | 1 | 150 | T=22 | $2.5^{\circ}C \text{ m} = 0$ |)% | 7.2 | 6 | 23 | 4.75 | 5 | 9 |
| 8.83 | 5 | 145 | 0 | 0 | 205 | | antic menha | | R: At | antic menh | rden |
| 9.83 | 52 | 93 | 1.0 | 22 | 183 | $\alpha = 25$ | | 0 cm/s | $\alpha = 43$ | | 0 cm/s |
| 10.83 | 46 | 47 | 2.0 | 2 | 181 | | .5°C m = 4 | | T = 18 | | |

tion of failure,

$$\frac{0}{00} = 0$$

e results of test 50,

$$\frac{2}{0} = 0.81$$
.

s merely emphasize the estimating methods empirit; they do not rehabilitionly reflect the empiricults exist. Because the ary, and death are govit distributions, no timestatistical analyses like iden and similar reports propriate to the results

lden Research Laboratory

water velocity; T is water — M_C). Elapsed time is nation. Number bypassed in parentheses gives the flume population at each last is the number of fish

| **** | | |
|-----------------------|----------------|------|
| lapsed | Number | |
| ime, h | bypassed | N(t) |
| 0 | | |
| | 0 | 200 |
| 0.25 | 78 | 122 |
| 0.75 | 15 | 107 |
| 1.75 | 10 | 97 |
| 2.75 | 13 | 84 |
| 3.75 | 7 | 77 |
| 4.25 | 32 | 45 |
| 4.75 | 6 . | 39 |
| 5.75 | 7 | 32 |
| 6.25 | 2 | 30 |
| 7: Atlan | itic menhad | lon |
| $\alpha = 25^{\circ}$ | $V \approx 30$ | Cm/c |
| T = 17.3 | °C m = 4% | 5 |
| 0 | 0 | 204 |
| 0.25 | 83 | 121 |
| 1.25 | 30 | 91 |
| 2.25 | 27 | |
| 3.0 | 9 | 64 |
| 3.75 | 30 | 55 |
| 4.25 | 11 | 25 |
| 4.75 | | 14 |
| 7,73 | 5 . | 9 |
| 8: Atlanti | ic menhade | n |

V = 30 cm/s

m = 7%

 $x = 45^{\circ}$ $\Gamma = 18^{\circ}C$

TABLE C-1.—Continued.

| TABLE C | C-1.—Cont | inued. | | | | | | | | | |
|-----------------------------|-----------------------------|------------|-----------------------|-----------------------------|--|-----------------------|-------------------|--------------|-----------------------|---------------|---------------|
| Elapsed | Number | | Elapsed | Number | ······································ | Elapsed | Number | , <u>,</u> , | Elapsed | Number | |
| time, h | bypassed | N(t) | time, h | bypassed | N(t) | time, h | bypassed | N(t) | time, h | bypassed | N(t) |
| 0 | 0 | 200 | 4.25 | 17 | 25 | 1.0 | 2 | 151 | £ 2. | . Carina d La | |
| 0.42 | 54 | 146 | 5.25 | 6(1) | 18 | 1.5 | 0 | 151 | $\alpha = 45$ | : Striped bas | ss 10 cm/s |
| 1.17 | 18 | 128 | | White perci | | 2.0 | ő | 151 | $T = 7^\circ$ | | |
| 2.17 | 31 | 97 | α == 45 | - | 0 cm/s | 2.5 | 2 | 149 | 0 | 0 | 200 |
| 3.17 | 46 | 51 | | $2^{\circ}C m = 8$ | | 3.0 | 0 | 149 | 0.33 | 24 | 176 |
| 3.67 | 18 | - 33 | 0 | 0 | 200 | 3.5 | 0 | 149 | 0.83 | l | 175 |
| 4.17 | 10 | 23 | 0.25 | 45 | 155 | 25: | White perch | | 1.33 | î | 174 |
| 4.67 | 5 | 18 | 1.25 | 23 | 132 | $\alpha = 45^{\circ}$ | | | 1.83 | 0 | 174 |
| | antic menha | | 2.25 | 30 | 102 | $T = 2^{\circ}C$ | | | 2.33 | 2 | 172 |
| $\alpha = 25^\circ$ | | | 2.75 | 12 | 90 | 0 | 0 | 100 | 2.83 | 2 | 170 |
| | .5°C m == 79 | | 3.25 | 12 | 78 | 0.5 | 62 | 38 | 3.33 | 3 | 167 |
| 0 | 0 | 200 | 3.75 | 19 | 59 | 1.0 | 1 | 37 | 3.83 | 2 | . 167 |
| 0.25 1.25 | 32 16 | 168 | 4.25 | 10 | 49 | 1.5 | 4 | 33 | 4.33 4.83 | · 5 | 160 |
| 2.25 | 41 | 152 111 | 4.75 | 5 | 44 | 2.0 | 4 | 29 | 5.33 | 5 | 151 146 |
| 3.25 | 5 | 106 | | White perci | | 2.5 | 2 | 27 | 2.32 | • | 140 |
| 4.25 | 14 | 92 | $\alpha = 45$ | | | 3.0 | 1 | 26 | | Striped bas | |
| 5.25 | 28 | 64 | | $.9^{\circ}C \text{ m} = 0$ | | 3.5 | 0 | 26 | $\alpha = 45$ | | 0 cm/s |
| 6.25 | 34 | 30 | 0 | 0 | 204 | 29: 5 | Striped bass | | T = 7.2 | | |
| 6.75 | 14 | 16 | 0.25 | 33 21 | 171 | α == 45° | - | | 0 | 0 | 200 |
| 7.25 | 5 | 11 | 1,0 1,75 | 24 | 150 126 | $T = 2.5^{\circ}$ | | | 0.5 | 16 | 184 |
| 10: Atl | antic menha | den | 2.75 | 43 | 83 | 0 | 0 | 200 | 1.0 | 1 | 183 |
| $\alpha \approx 25^{\circ}$ | V = 36 | em/s | 3.75 | 28 | . 55 | 0.5 | 81 | 119 | 1.5 2.0 | 0 | 183 |
| $T \approx 17$. | $7^{\circ}C \text{ m} = 19$ | ю | 4.75 | 17 | 38 | 1.0 | 3 | 116 | 2.5 | 0 | 182 182 |
| 0 | 0 | 200 | 6.0 | 12 | 26 | 2.0 | . 2 | 114 | 3.0 | . 0 | 182 |
| 0.25 | 31 | 169 | 16. | : White perc | L | 2.5 | 2 | 112 | 3.5 | 4 | 178 |
| 1.25 | 29 | 140 | $\alpha = 45$ | | n 0 cm/s | 30: 5 | Striped bass | | 4.0 | 3 | 175 |
| 1.75 | 24 | 116 | | 2.8°C m = 9 | | $\alpha = 45^{\circ}$ | V = 30 | | 5.0 | 6 | 169 |
| 2.75 3.75 | 55 41 | 61 | 0 | 0 | 208 | $T = 3^{\circ}C$ | m = 29 | б | 6.0 | 13 | 156 |
| 4.25 | 7 | 20 13 | 0.75 | 82 . | 126 | 0 - | 0 | 224 | 6.5 | 5 | 151 |
| | antic menha | _ | 1.75 | 36 | 90 | 0.5 | 44 | 180 | | Striped bas | |
| $\alpha = 45^{\circ}$ | | | 2,75 | 19 | 71 | 1.0 | 2 | 178 | $\alpha = 45^{\circ}$ | | 0 cm/s - |
| $T = 12^{\circ}$ | | _ | 3.75 | 26 | 45 | 1.5 | 1 | 177 | T = 8°(| | |
| 0 | 0- | 200 | 4.75 | 20 | 25 | 2.0 | 4 | 173 | 0 | 0 | 200 |
| 0.5 | 110 | 90 | 5,75 | 5 | 20 | 2.5 | 4 | 169 | 0.5 1.0 | 79 -3 | 121 |
| 1.0 | 49 | 41 | | White perce | | 3.0 3.5 | 3 0 | 166 166 | 1.5 | 12 | 118 106 |
| 1.5 | 4 | 37 | $\alpha = 45$ | | 0 cm/s | 3.3 | U | 100 | 2.0 | 1. | 105 |
| 2.0 | 6 | 31 | . T = 4. | | | | Striped bass | | 2.5 | i | 104 |
| 2.5 | 5 | 26 | 0 | 0 | 100 | $\alpha = 45^{\circ}$ | - | | 3.0 | 3 | 101 |
| 3.0 | 8(4) | 14 | 0.08 | 66 | 34 | $T = 3.8^{\circ}$ | | | 3.5 | 2 | 99 |
| | ıntic menhad | | 0.5 1.0 | 8 16 | 26 10 | 0 | 0 | 200 | 4.0 | 1 | 98 |
| $\alpha = 45^{\circ}$ | | | 1.5 | 10 | 9 | 0.5 | 50 | 150 | 4.5 | 3 | 95 |
| | $\mathcal{P}C m = 0\%$ | 5 | 2.0 | o · | 9 | 1.5 2.5 | 1 0 | 149 | 5.0 | 16 | 79 |
| 0 | 0 | 209 | | | • | 3.0 | 0 | 149 149 | 5.5 | 18 | 61 |
| 0.5 | 79 | 130 | $\alpha = 45^{\circ}$ | Striped bass V = 30 | | 3.5 | 2 | 147 | 6.0 6.5 | 12 2 | 49 47 |
| 1.5 | 40 | 90 | | V = 30 $C m = 39$ | | 4.5 | | 146 | | | |
| 2.5 3.0 | 28 21 | 62 | 0 | 0 | 200 | | | | | Striped bass | |
| 3.5 | 10 | 41 31 | 0.25 | 70 | 130 | | Striped bass | | | V = 60 | |
| 4.0 | 4 | 27 | 0.23 | 4 | 126 | α.≈ 45° | V = 30 $C m = 0$ | cm/s | | C m = 09 | |
| 4.5 | 2 | 25 | 1.25 | 11 | 115 | | | | 0 | 0 | 200 |
| 5.0 | 3 | 22 | 1.75 | 5 | 110 | 0 | 0 | 200 | 0.5 | 50 | 150 |
| | ntic menhac | | 2.25 | 3 | 107 | 0.5 1.0 | 42 | 158 | 1.0 | 2 | 148 |
| $\alpha = 45^{\circ}$ | | | 2.75 | 4 | 103 | 1.5 | 0 | 158 158 | 1.5 | 2 | 146 |
| | C = II | | 3.25 | 1 | 102 | 2.0 | 0 | 158 | 2.0 2.5 | 0 3 | 146 |
| 0 | 0 | 207 | 24: | Striped bass | 1 | 2.5 | 11 | 157 | 3.0 | 0 | 143 143 |
| 0.25 | 110 | 97 | $\alpha = 25^{\circ}$ | | | 3.0 | 2 | 155 | 3.5 | 4 | 139 |
| 1.25 | 21 | 76 | T = 3.5 | $^{\circ}C$ m = 09 | 6 | 3.5 | 9 | 146 | 4.0 | 6 | 133 |
| 2.25 | 21 | 55 | 0 | 0 | 200 | 4.0 | 3 | 143 | 4.5 | 7 | 126 |
| 3.25 | 13. | 42 | 0.5 | 47 | 153 | 4.5 | 6 | 137 | 5.0 | 33 | 93 |
| - | , | | | | | | | | | | |

TABLE C-1. - Continued.

| Elapsed time, h | Number bypassed | N(t) | Elapsed time, h | Number bypassed | N(t) | Elapsed time, h | Number bypassed | N(t) | Elapsed time, h | Number bypassed | N(t) |
|-----------------------|--------------------|------|--------------------|--------------------|------|-----------------------|-------------------------------------|------------|--------------------|--------------------|------|
| 5.5 | 11 | 82 | 1.0 | . Ó | 155 | 5.5 | 4 | 118 | 1.5 | 3 | 179 |
| 6.0 | 6 | 76 | 1.5 | 1 | 154 | 6.0 | 8 | 110 | 2.0 | 3 | 176 |
| 6.5 | 4 | 72 | 2.0 | 2 | 152 | | | | 2.5 | 4 | 172 |
| | | | 2.5 | 0 | 152 | 58: | Striped bass | 3 . | 3.0 | 3 | 169 |
| 57: 5 | Striped bass | • | 3.0 | 2 | 150 | $\alpha = 45^{\circ}$ | V = 60 | cm/s | 3.5 | 4 | 165 |
| $\alpha = 45^{\circ}$ | V = 60 | cm/s | 3,5 | 4 | 146 | T = 12 | $.5^{\circ}C \text{ m} = 3^{\circ}$ | Ж | 4.0 | 4 | 161 |
| $T = 11^{\circ}$ | C m = 1% | | 4.0 | 8 | 138 | 0 | 0 | 200 | 4.5 | 26 | 135 |
| 0 | 0 | 200 | 4.5 | 6 | 132 | 0.5 | 17 | 183 | 5.0 | 7 | 128 |
| 0.5 | 45 | 155 | 5.0 | 10 | 122 | 1.0 | 1 | 182 | 5.5 | 1 | 127 |

^a Data from experiments 17, 18, 19, and 20 on alewives were not released. Experiments 23, 26, 28, 31, 32, and 33 had only two datum points each; experiment 27 had only one point. Experiments 35–51 had only one datum point each, and all were terminated at 15 min.

Appendix D: Oswego Test Data

Table D-1.—Monthly estimated results from the 1981 study at Oswego Steam Unit 6. Data are from Table 3.0-8 of Lawler, Matusky and Skelly (1982b) except the mortality values appended here. Totals are for 9 months.

| Month | Estimated entrapment | Total plant efficiency | Estimated live return | Estimated entrapment | Total plant efficiency | Estimated live return | Estimated entrapment | Total plant efficiency | Estimated live return |
|-----------|----------------------|------------------------------|-----------------------------|----------------------|------------------------------|-----------------------------|----------------------|------------------------------|-----------------------------|
| | | Alewife | | R | ainbow sme | lt | | Gizzard sha | d |
| Apr | 54,432 | 33.7 | 18,344 | 8,280 | 75.2 | 6,227 | 144 | 48.2 | 69 |
| May | 91,810 | 1.5 | 1,377 | 3,422 | 4.2 | 144 | 0 | ? | ? |
| Jun | 42,768 | 9.9 | 4,234 | 432 | 3.8 | 16 | 72. | 48.2 | 35 |
| Jul | 20,088 | 24.0 | 4,821 | . 74 | 3.8 | 3 | 0 | ? | ? |
| Aug | 670 | 8.3 | 56 | 0 ` | ? | ? | 0 | ? | ? |
| Sep | 20,952 | 2.5 | 524 | 7,704 | 10.3 | 794 | 1,440 | 57.0 | 821 |
| Oct | 81,989 | 17.3 | 14,184 | 78,194 | 20.4 | 15,952 | 14,136 | 60.9 | 8,609 |
| Nov | 7,704 | 43.5 | 3,351 | 80,280 | 12.7 | 10,196 | 4,896 | 38.9 | 1,905 |
| Dec | 1,042 | 33.1 | 345 | 126,554 | 5.1 | 6,424 | 818 | 36.1 | 295 |
| Totals | 321,455 | 14.7a | 47,236a | 304,940 | 13.1 | 39,786 | 21,506 | 54.6 | 11,734 |
| Mortality | | 85% | | | . 87% | | | 45% | |
| | S | pottail shine | er | Emerald shiner | | | White perch | | |
| Apr | 144 | 90.6 | 130 | 72 | 94.4 | 68 | . 432 | 39.8 | 172 |
| May | 74 | 90.6 | 67 | 7.4 | 94.4 | 70 | 149 | 39.8 | 59 |
| Jun | 72 | 84.0 | 60 | 72 | 94.4 | 68 | 72 | 39.8 | 29 |
| Jul | 298 | 84.0 | 250 | 0 | ? | ? | 74 | 39.8 | 29 |
| Aug | 372 | 84.0 | 312 | 0 | ? | ? | 0 | ? | ? |
| Sep | 216 | 76.8 | 166 | 4,824 | 91.9 | 4,433 | 0 | ? | ? |
| Oct | 3,125 | 85.7 | 2,678 | 5,952 | 91.4 | 5,440 | 3,497 | 49.2 | 1,721 |
| Nov | 360 | 84.4 | 304 | 2,736 | 85.3 | 2,334 | 1,800 | 26.4 | 475 |
| Dec | 74 | 86.7 | 64 | 818 | 79.3 | 649 | 74 | 26.4 | 20 |
| Totals | 4,735 | 85.1 | 4,031 | 14,548 | 89.8 | 13,062 | 6,098 | 41.1 | 2,505 |
| Mortality | | 15% | | | 10% | | | 59% | |

^a Correction (error on source table).

Elapsed Number time, h bypassed N(t)179 2.0 176 2.5 172 3.0 169 165 161 135 5.0 128

6, 28, 31, 32, and 33 had only atum point each, and all were

127

Data are from Table 3.0-Totals are for 9 months.

| ateu plant li | nated |
|----------------------|-------|
| | |
| nent efficiency reti | |
| Gizzard shad | |
| | |
| 70,2 | 69 |
| 0 ? | ? |
| '2 48.2 | 35 |
| 0 3 | ? |
| 0 2 | ? |
| 0 57.0 8 | 21 |
| 6 60.9 86 | |
| 6 38.9 | |
| | 5 |
| 5 54.6 11,73 | - |
| 45% | • |
| White perch | |
| · 39.8 17 | 7 |
| 39.8 | - |
| 39.8 | |
| 39.8 | |
| ^ 4: | |
| ? | |
| 40.0 | |
| 1,721 | |
| 36.4 | |
| 20 | |
| 41.1 2,505 | |
| 59% | |

TABLE D-2.—Monthly mortalities and injuries among entrapped fish during the 1981 study at Oswego Steam Unit 6. Values are calculated from Tables 3.0-3, 3.0-5, and 3.0-6 of Lawler, Matusky and Skelly (1982b); + indicates data were not given; empty cell indicates data were not collected.

| Month | Proportion diverted | Proportion live | 96-h survival | Dead and injured |
|---|---------------------|-----------------|------------------|------------------|
| *************************************** | ····· | Alewife | | |
| Apr | 0.983 | + | 0.343? | . ? |
| May | 0.913 | 0.144 | 0.112 | 98.5% |
| Jun | 0.762 | 0.332 | 0.324 | 91.8% |
| Jul | 0.845 | 0.558 | 0.490 | 76.9% |
| Aug | 0.421 | 0.558 | 0.414 | 92.6% |
| Sep | 0.471 | 0.118 | 0.143 | 99.2% |
| Oct | 0.804 | 0.631 | 0.332 | 83.2% |
| Nov | 0.861 | 0.594 | 0.795 | 59.3% |
| Dec | 0.955 | 0.446 | 0.600 | 74.4% |
| | | White per | rch | |
| Apr) | | + | 0.429? | 2. |
| May | 0.027 | • | | ₹? |
| Jun [| 0.927 | | | ? |
| Jul 🕽 | | | | .7: |
| Aug | | | 0.762? | ? |
| Sep | | | 0.762? | 7 |
| Oct | 0.889 | 0:661 | | 55.2% |
| Nov 1 | 0000 | 0.007 | 0.762 | 86.7% |
| Dec 5 | 0.859 | 0.203 | | 86.7% |
| | | Rainbow si | melt | |
| Apr | 0.963 | + . | 0.781? | .2 |
| May | 0.923 | | 0.108 | 95,9% |
| Jun] | } | 0.416 | 801.0 | 96.2% |
| Jul } | 0.851 | | | ? |
| Aug J | , . | | • | ?: |
| Sep | 0.760 | 0.316 | 0.430 | 89.7% |
| Oct | 0.731 | 0.610 | 0.430 | 80.8% |
| Nov | 0.647 | 0.405 | 0.377 | 90.1% |
| Dec | 0.753 | 0.312 | 0.136 | 96.8% |

TABLE D-3.—Marking study of fish released into the primary screenwell at Oswego Steam Unit 6. The data, from Lawler, Matusky and Skelly (1982b), are numbers of fish unless indicated otherwise.

| Measure | Yellow perch | White bass | White perch | Brown trout | Smallmouth bass | Rock bass + bluegill |
|-------------------------------|-----------------|------------|-------------|----------------|-----------------|-------------------------|
| Marked releases | 56 | 64 | 23 / | 47 | 60 | 29 |
| Impinged, dead | 7 | 7 | 4 | 0 - | 1 | 1 . |
| Bypassed | | | | | | |
| 0-8 h | | | | | | |
| Live | 24 | 0 | 0 | 5 | 4 | 5 |
| Dead | 13 | 2 | 6 | 1 | 3 | 4. |
| 8-24 h | | | | | | |
| Live | 1 . | 3 | 0 | 4 | 0 | 1 |
| Dead | 2 | 7 | 1 | 0 | 0 | 2 |
| 24-48 h | | | | $\overline{}$ | | |
| Live | 3 | 10 - | 0 | 0 | 1 | 7 |
| Dead | 1 | 1 | 0 | 0 | 0 | 0 |
| >48 h | | | | | | |
| Live - | 0 | 8 | 0 | 6 | 10 | 0 |
| Dead | 0 | 0 | 2 | 0 | 0 | 0 ' |
| Total recoveries | | | | | | |
| Live | 28 | 21 | 0 | 1.5 | 15 | 13 |
| Dead (% of recoveries) | 23 (45%) | 17 (45%) | 13 (100%) | 1 (6%) | 4 (21%) | 7 (35%) |
| Nonrecoveries (% of releases) | 5 (9%) | 26 (41%) | 10 (43%) | 31 (66%) | 41 (68%) | 9 (31%) |

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