ZION SOLUTIONS LLC
An EnergySolutions Company

# ZION STATION RESTORATION PROJECT
# FINAL STATUS SURVEY RELEASE RECORD

# AUXILIARY BUILDING PENETRATIONS
# SURVEY UNIT 05120

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## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ALARA | As Low As Reasonably Achievable |
| AMCG | Average Member of the Critical Group |
| BFM | Basement Fill Model |
| DQA | Data Quality Assessment |
| DQO | Data Quality Objective |
| DCGL | Derived Concentration Guideline Level |
| EMC | Elevated Measurement Comparison |
| FOV | Field-of-View |
| FSS | Final Status Survey |
| IC | Insignificant Contributor |
| ID | Internal Diameter |
| LTP | License Termination Plan |
| MARSSIM | Multi-Agency Radiation Survey and Site Investigation Manual |
| MDC | Minimum Detectable Concentration |
| NaI | Sodium Iodide |
| QAPP | Quality Assurance Project Plan |
| OpDCGL | Operational Derived Concentration Guideline Level |
| QC | Quality Control |
| RE | Radiological Engineer |
| ROC | Radionuclides of Concern |
| SOF | Sum-of-Fraction |
| TSD | Technical Support Document |
| ZNPS | Zion Nuclear Power Station |
| ZSRP | Zion Station Restoration Project |

# 1. EXECUTIVE SUMMARY

This Final Status Survey (FSS) Release Record for survey unit 05120, "Auxiliary Building Penetrations", has been generated for the Zion Station Restoration Project (ZSRP) in accordance with Zion*Solutions* procedure ZS-LT-300-001-005, *"Final Status Survey Data Reporting"* (Reference 1) and satisfies the requirements of Section 5.11 of the *"Zion Station Restoration Project License Termination Plan"* (LTP) (Reference 2).

Two (2) Final Status Survey (FSS) sample plans (S1-05120A-F #1 and S1-05120A-F #2) were developed to perform this work in accordance with Zion*Solutions* procedure ZS-LT-300-001-001, *"Final Status Survey Package Development"* (Reference 3), the ZSRP LTP, and with guidance from NUREG-1575, "*Multi-Agency Radiation Survey and Site Investigation Manual"* (MARSSIM) (Reference 4).

Final Status Survey was performed to demonstrate that the concentrations of residual radioactivity on the interior surfaces of the penetrations were equal to or below site-specific Derived Concentration Guideline Levels (DCGL) corresponding to the dose criterion in 10 CFR 20.1402. Initially, the penetrations were segregated and classified in accordance with the type of system and system use. However, in a conservative measure to ensure that all accessible surfaces within each end-state penetration would be subjected to FSS, the classification of all penetrations was changed to Class 1.

Two (2) different survey approaches were used for FSS depending on the diameter, length and access to the penetrations. FSS measurements acquired under FSS sample plan #1, which was applicable to penetrations with an internal diameter (ID) less than 12 inches, consisted of a static measurement taken at 1-foot intervals inside the penetration using a sodium iodide (NaI), conservatively assuming a Field-of-View (FOV) of 1-foot for each measurement and thus providing 100% areal coverage of the accessible internal surfaces of the penetration.

FSS measurements acquired under FSS sample plan #2, which was applicable to penetrations with an ID greater than 12 inches, consisted of a 100% scan with a hand-held beta-gamma detector of the interior surface area of the penetration and at least one (1) 1-minute static gross beta-gamma measurement at a systematic location based on a triangular grid and a 1-minute static measurement at the location of the highest observed scan result in each penetration.

For the FSS of the Auxiliary Building Penetrations, sixty-six (66) measurements were obtained. LTP Chapter 6, section 6.4.5 states, "The dose from penetrations is summed with the dose from the wall and floor surfaces of both basements that the penetration interface." Containment DCGLs are more limiting than the Auxiliary Building DCGLs. Consequently, the penetrations identified as interfacing between the Auxiliary Building

and the Unit 1 and Unit 2 Containments were addressed in the Release Records for Unit 1 and Unit 2 Containment Penetrations. In order to comply with the requirements of LTP Chapter 6, section 6.4.5, a dose of 1.468 mrem/yr will be added to the Auxiliary Building basement survey unit from penetrations that interfaced between the Auxiliary Building and Unit 1 Containment and a dose of 0.206 mrem/yr will be added to the Auxiliary Building basement survey unit from penetrations that interfaced between the Auxiliary Building and Unit 2 Containment. The Auxiliary Building penetrations addressed in this Release Record interfaced with the Turbine Building (via the "G" wall and Steam Tunnels). Consequently, the FSS design for penetrations that interfaced between the Auxiliary Building and the Turbine Building employed the DCGLs for the Auxiliary Building penetrations, which were the most limiting. However, the mean concentration for each Radionuclide-of-Concern (ROC) was also compared against the Base Case Penetration DCGLs ($BcDCGL_{PN}$) for the Turbine Building as well.

No single measurement taken in any penetration exceeded an Operational Sum of Fraction (OpSOF) of one (1) when compared against the Operational DCGLs ($OpDCGL_{PN}$) for Auxiliary Building Penetrations. When compared against the $BcDCGL_{PN}$ for the Auxiliary Building, the FSS results produced a mean Base Case SOF (BcSOF) for the survey unit of 0.002, which equates to a mean dose of 0.053 mrem/yr.

No penetration exceeded the Auxiliary Building $OpDCGL_{PN}$ or $BcDCGL_{PN}$. However, in accordance with LTP Chapter 5 section 5.5.5, two (2) of the penetrations required grouting as they had measurements with activity greater than the Turbine Building OpDCGL for surfaces. Grouting of the two (2) penetrations was performed prior to backfill and there was no dose reduction attributed to the survey unit because of grouting.

## 2. SURVEY UNIT DESCRIPTION

In accordance with the definition of penetrations specified in LTP Chapter 5, section 5.5.5, "The end state will include embedded piping and penetrations. An embedded pipe is defined as a pipe that runs vertically through a concrete wall or horizontally through a concrete floor and is contained within a given building. A penetration is defined as a pipe (or remaining pipe sleeve, if the pipe is removed, or concrete, if the pipe and pipe sleeve is removed) that runs through a concrete wall and/or floor, between two buildings, and is open at the wall or floor surface of each building. A penetration could also be a pipe that runs through a concrete wall and/or floor and opens to a building on one end and the outside ground on the other end."

A summary of the original End State lengths and surface areas for the Auxiliary Building Penetrations as depicted in Zion*Solutions* Technical Support Document (TSD) 14-016, *"Description of Embedded Piping, Penetrations, and Buried Pipe to Remain in Zion End State"* (Reference 5), Attachment F. Locations are shown in Attachment 1 of this Release Record.

The Auxiliary Building penetrations survey unit consists of one hundred five (105) penetrations that access the Auxiliary Building between the 542 foot, 560 foot and the 579 foot elevations. However, seventy-nine (79) of the 105 penetrations are identified as being both an Auxiliary Building and Containment Building penetration. Since the Containment DCGLs are more limiting than the Auxiliary Building DCGLs, the penetrations identified as being both Auxiliary and Containment were addressed in the Release Records for Unit 1 and Unit 2 Containment Penetrations.

The remaining twenty-six (26) penetrations that access the Auxiliary Building between the 542, 560 and the 579 foot elevations, but do not access the Containments, are A001-A025, and A034. These penetrations interface between the Auxiliary Building and the Turbine Building primarily through the "G" wall and through the north and south walls into the Unit 1 and Unit 2 Steam Tunnels.

In accordance with LTP Chapter 5, section 5.5.5, penetration survey units have total surface areas that are less than the area of the wall/floor surface survey unit that the penetrations interface. To eliminate the potential for activity levels in penetrations that could lead to releases greater than the adjacent basement walls and floors, the following remediation and grouting action levels were applied to measurements of surface activity in penetrations.

- If maximum activity exceeded the $BcDCGL_{PN}$ from LTP Chapter 5, Table 5-13 (BcSOF >1), then remediation was performed.
- If the maximum activity in a penetration exceeded the most limiting $OpDCGL_B$ from LTP Chapter 5, Table 5-4 of the two basements where a penetrations interface (OpSOF>1), but is below the $BcDCGL_{PN}$ from LTP Chapter 5, Table 5-13, then the penetration was remediated or grouted.
- If a penetration was remediated and the maximum activity continued to exceed the most limiting $OpDCGL_B$ from LTP Chapter 5, Table 5-4 of the two basements where a penetrations interface (OpSOF>1), but was less than the $OpDCGL_{PN}$ (LTP Chapter 5, Table 5-14), then the penetration was grouted.
- If the maximum activity was below the surface $OpDCGL_B$ from LTP Chapter 5, Table 5-4, then grouting of the penetration was not required.

# 3. CLASSIFICATION BASIS

Survey unit 05120 was classified in accordance with Zion*Solutions* procedure ZS-LT-300-001-002, "*Survey Unit Classification*" (Reference 6).

The Auxiliary Building Penetrations were initially classified as Class 1, Class 2, or Class 3 based on historical assessment, exposure to radioactive materials and system use. As a conservative measure, the classifications of all Auxiliary Building Penetrations were changed to Class 1. Consequently, sufficient measurements were taken in all Auxiliary Building Penetrations to ensure 100% areal coverage of all accessible internal surfaces within the penetrations.

The Auxiliary Building housed numerous systems containing radioactively contaminated support systems. System leakage and maintenance activities over the operating life of the reactor resulted in the radiological contamination of most of the interior surfaces of the structures. Based on the building design basis and the operating history, all internal survey units in Auxiliary Building were assigned an initial classification of Class 1 in accordance with the "*Zion Station Historical Site Assessment*" (HSA) (Reference 7).

The Auxiliary Building penetrations housed numerous systems including the following:

- Service and primary water,
- Feed and demineralizer water,
- Fire protection,
- Vent and drain,
- Secondary sample,
- Waste disposal,
- Chemical addition,
- Vacuum control, and
- Condensate.

The location of the penetrations, their function, and the operational history of the Auxiliary Building to support the initial classifications are described in TSD 14-016.

In accordance with Zion*Solutions* TSD 14-013, *"Zion Auxiliary Building End State Estimated Concrete Volumes, Surface Areas, and Source Terms"* (Reference 8), there were seventeen (17) concrete core samples from the floors and three (3) cores from the walls that were obtained for analysis. The on-site gamma spectroscopy results for the sectioned cores from the 542 foot elevation initial characterization may be found in TSD 14-013. All radioactive systems and components were still located inside the building, consequently ambient radiation dose rates inside the Auxiliary Building prohibited the

direct assessment of penetrations or system interior surfaces by scanning or direct measurement.

As part of the survey unit turnover process, a Radiological Engineer (RE) performed the visual inspection and walk-down of the survey unit on March 27, 2018. The purpose of the walk-down was to assess the physical condition of the survey unit, evaluate access points and travel paths and identify potentially hazardous conditions and determine if the survey unit was acceptable for performing FSS.

The Auxiliary Building Penetrations were initially classified as Class 1, Class 2, or Class 3, based on historical assessment, exposure to radioactive materials and system use. Based upon completion of the Survey Unit Classification Basis for final classification, which included a review of the historical information, the results of the Characterization Survey data and completion of a final Survey Unit Classification Worksheet, the correct final classification of penetrations within the Auxiliary Building were validated. As a conservative measure, the classifications of all Auxiliary Building Penetrations were changed to Class 1. Consequently, sufficient measurements were taken in all Auxiliary Building Penetrations to ensure 100% areal coverage of all accessible internal surfaces within the penetrations.

## 4. DATA QUALITY OBJECTIVES (DQO)

Final Status Survey planning and design hinges on coherence with the DQO process to ensure, through compliance with explicitly defined inputs and boundaries, that the primary objective of the survey is satisfied. The DQO process is described in the ZSRP LTP Chapter 5, section 5.6.2 in accordance with MARSSIM. The appropriate design for a given survey was developed using the DQO process as outlined in Appendix D of MARSSIM.

The DQO process incorporated hypothesis testing and probabilistic sampling distributions to control decision errors during data analysis. Hypothesis testing is a process based on the scientific method that compares a baseline condition to an alternate condition. The baseline condition is technically known as the null hypothesis. Hypothesis testing rests on the premise that the null hypothesis is true and that sufficient evidence must be provided for rejection. In designing the survey plan, the underlying assumption, or null hypothesis was that residual activity in the survey unit exceeded the release criteria. Rejection of the null hypothesis would indicate that residual activity within the survey unit does not exceed the release criteria. Therefore, the survey unit would satisfy the primary objective of the FSS sample plan.

The primary objective of the FSS sample plan is to demonstrate that the level of residual radioactivity in the penetrations that comprised survey unit 05120 did not exceed the

release criteria specified in the LTP and that the potential dose from residual radioactivity is As Low As Reasonably Achievable (ALARA).

Zion*Solutions* TSD 11-001, *"Technical Support Document for Potential Radionuclides of Concern During the Decommissioning of the Zion Station"* (Reference 10) established the basis for an initial suite of potential ROC for the decommissioning of the Zion Nuclear Power Station (ZNPS). LTP Chapter 6, section 6.5.2 discusses the process used to derive the ROC for the decommissioning of ZNPS, including the elimination of insignificant dose contributors (IC) from the initial suite. Table 1 presents the ROC for the Auxiliary Building basement structural surfaces and the normalized fractions based on the radionuclide mixture.

**Table 1 - Dose Significant Radionuclides and Mixture**

| Radionuclide | % of Total Activity (normalized)(1) |
|---|---|
| Co-60 | 0.92 |
| Ni-63 | 23.71 |
| Sr-90 | 0.05 |
| Cs-134 | 0.01 |
| Cs-137 | 75.32 |

(1) Based on maximum percent of total activity from Table 20 of TSD 14-019, normalized to one for the dose significant radionuclides.

A fundamental precursor to survey design is to establish a relationship between the release criteria and some measurable quantity. This is done through the development of DCGLs. The DCGLs represent average levels of radioactivity above background levels and are presented in terms of surface or mass activity concentrations. Chapter 6 of the LTP describes in detail the modeling used to develop the DCGLs for penetrations.

The End State Basements are comprised of steel and/or concrete structures which will be covered by at least three feet of clean soil and physically altered to a condition which would not realistically allow the remaining structures, if excavated, to be occupied. The exposure pathways in the Basement Fill Model (BFM) are associated with residual radioactivity in floors and walls that is released through leaching into water contained in the interstitial spaces of the fill material. The BFM assumes that the inventory of residual radioactivity in a given building is released either instantly or over time by diffusion, depending on whether the activity is surficial or volumetric, respectively. The activity released into the fill water will adsorb into the clean fill, as a function of the radionuclide-specific distribution coefficients, resulting in equilibrium concentrations between the fill and the water. Consequently, the only potential exposure pathways after backfill,

assuming the 'as-left' geometry, are associated with the residual radioactivity in the water contained in the fill.

The final outputs of the BFM are the Penetration DCGLs, in units of $pCi/m^2$, which are calculated using the BFM Groundwater and BFM Drilling Spoils Dose Factors (LTP Chapter 6, Tables 6-24 and 6-25), LTP Equation 6-10 and the ratios in LTP Table 6-51. The $BcDCGL_{PN}$ are radionuclide-specific concentrations that represent the 10 CFR 20.1402 dose criterion of 25 mrem/yr and are calculated for each ROC and each backfilled basement. The "unity rule" is applied when there is more than one ROC. The measurement results for each singular ROC present in the mixture are compared against their respective DCGL to derive a dose fraction.

The $BcDCGL_{PN}$ for the unrestricted release of the Auxiliary Building penetrations are provided in Table 2. The IC dose percentage of 5% was used to adjust the Auxiliary Building Basement $DCGL_{PN}$ to account for the dose from the eliminated IC radionuclides.

Each radionuclide-specific $BcDCGL_{PN}$ is equivalent to the level of residual radioactivity (above background levels) that could, when considered independently, result in a Total Effective Dose Equivalent (TEDE) of 25 mrem/yr to an Average Member of the Critical Group (AMCG). To ensure that the summation of dose from each source term is 25 mrem/yr or less after all FSS is completed, the $BcDCGL_{PN}$ are reduced based on an expected, or *a priori*, fraction of the 25 mrem/yr dose limit from each source term. The reduced $DCGL_{PN}$, or $OpDCGL_{PN}$ can be related to the $BcDCGL_{PN}$ as an expected fraction of dose based on an *a priori* assessment of what the expected dose should be based on the results of site characterization, process knowledge and the extent of planned remediation. The $OpDCGL_{PN}$ is then used as the DCGL for the FSS design of the survey unit (calculation of surrogate DCGLs, investigations levels, etc.). Details of the $OpDCGL_{PN}$ derived for each dose component and the basis for the applied *a priori* dose fractions are provided in Zion*Solutions* TSD 17-004, "*Operational Derived Concentration Guideline Levels for Final Status Survey*" (Reference 11).

**Table 2 - Base Case DCGLs for Penetrations ($BcDCGL_{PN}$) from LTP Chapter 5, Table 5-13**

| Radionuclide | Auxiliary Building $BcDCGL_{PN}$ ($pCi/m^2$) |
|---|---|
| Co-60 | 8.82E+07 |
| Ni-63 | 6.79E+10 |
| Sr-90 | 2.41E+07 |
| Cs-134 | 3.28E+08 |
| Cs-137 | 6.17E+08 |

The $OpDCGL_{PN}$ for the unrestricted release of the Auxiliary Basement penetrations are provided in Table 3.

**Table 3 - Auxiliary Building Operational DCGLs for Penetrations ($OpDCGL_{PN}$) from LTP Chapter 5, Table 5-14**

| Radionuclide | Operational DCGL ($pCi/m^2$) |
|---|---|
| Co-60 | 6.95E+06 |
| Ni-63 | 5.35E+09 |
| Sr-90 | 1.90E+06 |
| Cs-134 | 2.58E+07 |
| Cs-137 | 4.86E+07 |

Instrument DQOs included a verification of the ability of the survey instrument to detect the radiation(s) of interest relative to the $OpDCGL_{PN}$. Survey instrument response checks were required prior to issuance and after the instrument had been used. Control and accountability of survey instruments was required to assure the quality and prevent the loss of data. The minimum acceptable minimum detectable concentration (MDC) for measurements obtained using field instruments was 50 percent of the applicable $OpDCGL_{PN}$.

# 5. SURVEY DESIGN

The level of effort associated with planning a survey is based on the complexity of the survey and nature of the hazards. Guidance for preparing FSS plans is provided in procedure ZS-LT-300-001-001 "*Final Status Survey Package Development*." The FSS plans for the survey of penetrations employed sample designs that combined hand-held scanning with static measurements and pipe detector survey methodologies.

The two (2) FSS sample plans for survey unit 05120, "Auxiliary Building Penetrations" includes FSS design and FSS results for the Auxiliary Building penetrations on the 542 foot, 560 foot and the 572 foot elevations. The survey method for large diameter penetrations (>12") differs from smaller penetrations due to measurement sensitivity (i.e., MDCs) differences in the two size regimes. The larger penetrations were surveyed using a similar approach to traditional building surface surveys, whereas the smaller penetrations were surveyed with a single detector advanced through the length in 1-foot increments and centrally positioned. Sample plan #S1-05120A-F #1 addressed the survey of penetrations smaller than 12 inches in diameter (A002, A003, A005, A007-A013, A015, A017 and A019-A023) and sample plan #S1-05120A-F #2 addressed that survey of penetrations with a diameter greater than or equal to 12 inches in diameter (A001, A004, A014, A024 and A025).

Penetrations and buried pipe associated with the west wall of the Auxiliary Building (Unit 1 and Unit 2 Hot Pipe Chases at the 570 foot elevation and buried pipe associated with the SFP) have been physically removed and disposed of as radioactive waste. The penetrations that were removed in its entirety were A006, A016, A018, A029, A034, A037, A038, A039, A040, A041, A042, A043, A044, A046, A047, A048, A049, A050, A052, A053, A054, A055, A056, A057, A058, A059, A060, A061, A063, A064, A065, and A066.

There are twenty-two (22) penetrations that remain in Auxiliary Building that were not attributed to the Containments. The remaining penetrations are located primarily on the "G" Wall between the Auxiliary Building and the Turbine Building.

FSS of the remaining twenty-two (22) penetrations consisted of sixty-six (66) one-minute static measurements, either using a NaI detector or hand-held detector taken at 1-foot intervals throughout the length of the penetrations, providing 100% areal coverage of the pipe interior surface.

Section 5.1 of LTP Chapter 5 states that Co-60, Ni-63, Sr-90, Cs-134, and Cs-137 are the ROC. During FSS, concentrations for Hard-to-Detect (HTD) ROC Ni-63, and Sr-90 are inferred using a surrogate approach. Cs-137 is the principle surrogate radionuclide for Sr-90, and Co-60 is the principle surrogate radionuclide for Ni-63. The mean, maximum

and 95% Upper Confidence Level (UCL) of the surrogate ratios for concrete core samples taken in the Auxiliary Building basements were calculated in Zion*Solutions* TSD 14-019, *"Radionuclides of Concern for Soil and Basement Fill Model Source Terms"* (Reference 12) and are presented in Table 4 (reproduced from LTP Chapter 5, Table 5-12). The maximum ratios were used in the surrogate calculations during FSS.

**Table 4 - Auxiliary Building Surrogate Ratios**

| Ratios | Auxiliary Building | | |
|---|---|---|---|
| | Mean | Max | 95%UCL |
| Ni-63/Co-60 | 44.143 | 180.450 | 154.632 |
| Sr-90/Cs-137 | 0.001 | 0.002 | 0.002 |

For the FSS of survey unit 05120, the surrogate $OpDCGL_{PN}$ for Co-60 and Cs-137 were computed based on the maximum ratios from Table 4.

The equation for calculating a surrogate DCGL is as follows:

**Equation 1**

$$Surrogate_{DCGL} = \frac{1}{\left[\left(\frac{1}{DCGL_{Sur}}\right) + \left(\frac{R_2}{DCGL_2}\right) + \left(\frac{R_3}{DCGL_3}\right) + \cdots \left(\frac{R_n}{DCGL_n}\right)\right]}$$

Where: $DCGL_{Sur}$ = Surrogate radionuclide DCGL

$DCGL_{2,3\ldots n}$ = DCGL for radionuclides to be represented by the surrogate

$R_n$ = Ratio of concentration (or nuclide mixture fraction) of radionuclide "n" to surrogate radionuclide

Using the $OpDCGL_{PN}$ presented in Table 3 and the maximum ratios from Table 4, the following surrogate calculations were performed:

**Equation 2**

$$Surrogate_{DCGL\ (Cs-137)} = \frac{1}{\left[\left(\frac{1}{4.86E07_{(Cs-137)}}\right) + \left(\frac{0.002}{1.90E06_{(Sr-90)}}\right)\right]} = 4.62E07\ pCi/m^2$$

The surrogate $OpDCGL_{PN}$ that was used for Cs-137 in this survey unit for direct comparison of sample results to demonstrate compliance is 4.62E+07 pCi/$m^2$.

**Equation 3**

$$Surrogate_{DCGL\ (Co-60)} = \frac{1}{\left[\left(\frac{1}{6.95E06_{(Co-60)}}\right) + \left(\frac{180.45}{5.35E09_{(Ni-63)}}\right)\right]} = 5.63E06\ pCi/m^2$$

The surrogate $OpDCGL_{PN}$ that was used for Co-60 in this survey unit for direct comparison of sample results to demonstrate compliance is 5.63E+06 pCi/$m^2$.

The most limiting DCGL was determined to be Co-60 (5.63E+06 pCi/$m^2$) or 1.25E+05 dpm/100 $cm^2$. This value was used as the action level for hand-held scan and static measurements and pipe detector static measurements in this survey unit. Action levels in counts per minute (cpm) for pipe detector surveys were calculated using the limiting Co-60 surrogate $OpDCGL_{PN}$, the effective area of detection for the various diameter penetrations, and the associated efficiency for each size penetration. The action levels in cpm for hand-held surveys were calculated using the limiting Co-60 $OpDCGL_{PN}$ and the efficiency of the instrument/detector combination. Table 5 provides a summary of the instrumentation and action levels used for the FSS of the penetrations.

**Table 5 - Survey Unit 05120 FSS Instrumentation and Action Levels**

| Survey Type | Instrument | Detector | Penetration Diameter (in) | Efficiency | Action Level (cpm) |
|---|---|---|---|---|---|
| Hand-held | Ludlum 2360 | Ludlum 43-93 | 14-50 | 0.117(1) | 14,600 |
| Pipe Detector | Ludlum 2350-1 | Ludlum 44-157 | 6 | 0.012(2) | 32,695 |
| | | | 8 | 0.009(2) | 32,751 |
| | | Ludlum 44-162 | 10 | 0.018(2) | 81,625 |
| | | | 12 | 0.016(2) | 87,186 |
| | | | 23 | 0.0142(2) | 148,131 |

(1) Efficiency determined using Tc-99 source. Derived instrument efficiency of 0.144 x source efficiency of 0.81 (NUREG-1507, Table 5.4) = 0.117 (total efficiency)

(2) Efficiency empirically derived using conformable Cs-137 source in various ID pipe jigs

For this Class 1 penetration survey unit, the "Investigation Levels" for area scanning and static measurement results are those levels specified in LTP Chapter 5, Table 5-25 and are reproduced below in Table 6.

**Table 6 – Investigation Levels**

| Classification | Scan Investigation Levels | Direct Investigation Levels |
|---|---|---|
| Class 1 | >Operational DCGL or >$MDC_{scan}$ if $MDC_{scan}$ is greater than Operational DCGL | >Operational DCGL |

Two (2) survey methodologies were utilized for the FSS of the Auxiliary Building Penetrations, pipe detector survey or hand-held survey. This was due to the varying diameters and lengths of the penetrations. The survey designs for the FSS of Survey Unit 05120 using the different methodologies are detailed below.

The first sample plan required that measurements be collected with a pipe detector. Penetrations included in this plan were twelve (12) inches in diameter or smaller. Seventeen (17) of the twenty-two (22) total penetrations were included in the survey design for pipe detectors. Refer to Table 5 for the FSS instrumentation summary. The total length of the penetrations under the pipe detector methodology is 51 ft. (15.54 m) with a total interior surface area of 6.98 $m^2$. As a Class 1 survey unit, the survey design required a 100% areal coverage. For the survey of pipe or penetration internal surfaces that cannot be practically surveyed using a hand-held detector methodology, areal coverage is achieved by the "area of detection" for each static measurement taken. Scanning, in the traditional context, is not applicable to this type of survey. With a 1-foot area of detection, a 1-minute static measurement at 1-foot increments throughout the penetration length was sufficient to provide 100% areal coverage. For 51 feet of penetrations in the survey unit, at least fifty-one (51) measurements were required to satisfy the 100% coverage requirement.

Sample plan #2 required that measurements be collected with a hand-held detector. Penetrations included in sample plan #2 were larger than twelve (12) inches in diameter. Five (5) of the twenty-two (22) total penetrations were included in the survey design for hand-held detectors. Refer to Table 5 for the FSS instrumentation summary. The total length of the penetrations under the hand-held methodology is 15 ft. (4.572 m) with a total interior surface area of 8.90 $m^2$. For the survey of these larger diameter pipes, the survey design required 100% scan of the accessible interior surfaces of the penetration. In addition, a minimum of one 1-minute static measurement was acquired in each penetration at systematic locations based on a triangular grid, and at least one 1-minute static measurement was acquired in each penetration at the location of the highest scan result. Seventeen (17) static measurements (15 systematic and 2 QC) were acquired in the large diameter penetrations with the locations selected as denoted in Table 7 below.

Maps of the penetrations and measurement locations are provided in Attachment 1.

**Table 7 - Systematic Static Locations for Hand-Held Survey**

| Measurement No. | Penetration No. | Inches into Penetration (1) |
|---|---|---|
| 1 | A001 | 12 |
| 2 | A001 | 24 |
| 3 | A001 | 36 |
| 4 | A014 | 12 |
| 5 | A014 | 24 |
| 6 | A014 | 36 |
| 7 | A014 | 36 |
| 8 | A004 | 12 |
| 9 | A004 | 24 |
| 10 | A004 | 36 |
| 11 | A024 | 12 |
| 12 | A024 | 24 |
| 13 | A024 | 36 |
| 14 | A025 | 12 |
| 15 | A025 | 24 |
| 16 | A025 | 36 |
| 17 | A025 | 36 |

(1) Static measurements were acquired on the bottom of the penetration circumference.

The implementation of quality control measures as referenced by LTP Chapter 5, section 5.9 and Zion*Solutions* ZS-LT-01, "*Quality Assurance Project Plan (for Characterization and FSS)*" (QAPP) (Reference 13) includes the collection of a duplicate measurement on 5% of the measurements taken with the locations selected at random. One (1) measurement out of every twenty (20) was required for QC compliance.

## 6. SURVEY IMPLEMENTATION

Survey instructions for this FSS were incorporated into and performed in accordance with FSS sample plans #S1-05120AF #1 and #2, which were developed in accordance with Zion*Solutions* procedure ZS-LT-300-001-001, *"Final Status Survey Package Development."* The FSS unit was inspected and controlled in accordance with

Zion*Solutions* procedure ZS-LT-300-001-003, *"Isolation and Control for Final Status Survey"* (Reference 14).

Surveys of the Auxiliary Building Penetrations began on March 27, 2018 and concluded on March 28, 2018. The survey design estimated seven (7) working days to implement the FSS in parallel with any required decontamination and inspection activities. In reality, only two (2) working days were necessary to complete this work. Throughout these activities, briefings were conducted on a daily basis to discuss the expectations for job performance and to review the safety aspects of the job.

Visual inspections of the penetrations were performed prior to the start of the survey. Inspections were performed to ensure that the penetrations were relatively dry and free of debris.

For pipe detector surveys using a NaI detector, a background value was determined for the detector/instrument combination to be used prior to deployment. The background value was obtained at the location where the pre-use response check of the instrument was performed. The background value was primarily used to ensure that the detector had not become cross-contaminated by any previous use. Background was not subtracted from any measurement.

Daily, prior to and following use, each detector was subjected to an Operational Response Check in accordance with procedure ZS-LT-300-001-006, *"Radiation Surveys of Pipe Interiors Using Sodium/Cesium Iodide Detectors"* (Reference 15). The Daily Operational Response Check compared the background response to check source ranges established for normal background and detector source response. This check ensured that the detector was working properly.

Once the detector was determined to be fully functional, it was then deployed to the field for insertion into the targeted penetrations. A one-minute static measurement was acquired at each foot traversed into the penetrations. The detector output represented the gamma activity for each one-minute timed measurement in units of gross cpm. The gamma measurement value in units of cpm was then converted to units of dpm using the efficiency factor for the detector applicable to the diameter of the penetration surveyed.

Each measurement assumed a conservative "area of detection" for the NaI detector of one foot. This assumption is conservative because there is additional instrument response from contamination located in the pipe at distances outside of the "area of detection." Consequently, the total activity from the measurement, in units of dpm, is adjusted for the total effective surface area commensurate with the penetration diameter and the assumed "area of detection," resulting in measurement results in units of dpm/100 $cm^2$. Using the appropriate conversion factors, the result is then converted to units of $pCi/m^2$. This

measurement result represents a commensurate and conservative gamma surface activity for the one foot of pipe surface where the measurement was taken.

For the penetration surveys performed with hand-held detectors, a background value was determined for the detector/instrument combination as the average of five (5) ambient 1-minute static measurements. An Alarm Set Point was developed using the background value plus the Action Level dictated in Table 5.

The entire surface area (100%) of the interior surface area of the designated penetrations were scanned using either the Ludlum 2350-1 paired with a pipe detector or a Ludlum 2360 paired with a Ludlum 43-93 detector operated in the rate-meter mode and using audio response. The probe was positioned as close to the surface as possible and was moved at a scan speed of 2.0 inches per second.

Systematic 1-minute static measurements were acquired at the locations denoted in Table 6. Additionally, 1-minute static measurements were taken at the locations of highest scan result in each penetration. Using the established efficiencies (denoted in Table 5), the static measurement activities in cpm were converted to activities in dpm/100 $cm^2$ and then to $pCi/m^2$ using the appropriate conversion factor.

## 7. SURVEY RESULTS

After completion of the FSS measurements in the penetrations, the sample plan was reviewed to confirm the completeness of the survey and the survey data was validated in accordance with procedure ZS-LT-300-001-004, *"Final Status Survey Data Assessment"* (Reference 16). Data processing included converting measurement data into reporting units, validating instrument applicability and sensitivity, calculating relevant statistical quantities, and verification that all DQO have been met.

For measurements acquired with a NaI detector, the gross output of the measurement is converted to units of dpm by dividing by the efficiency. The effective FOV of the measurement is calculated based upon diameter of the pipe at a length of 1 foot. The result, following unit conversion, is a gross gamma measurement result in units of $pCi/m^2$.

For measurements acquired as a direct static measurement with a hand-held detector, the gross gamma output of the measurement is again converted to units of dpm by dividing by the efficiency. As the detector has an area of 100 $cm^2$, the units for the measurement are actually in units of $dpm/100cm^2$. Again, through unit conversion, units of $dpm/100cm^2$ are converted to units of $pCi/m^2$.

Using the mixture from Table 5-2 of LTP Chapter 5 (reproduced as Table 1 of this Release Record), the gross gamma result from each measurement is multiplied by the

normalized gamma mixture fractions for C-60, Cs-134 and Cs-137 to derive a radionuclide specific concentration for each gamma ROC. The HTD ROC concentrations for Ni-63 and Sr-90 were then inferred using the maximum surrogate ratios from LTP Chapter 5, Table 5-15 (reproduced as Table 4 of this Release Record). Each concentration for each measurement is then compared against the $OpDCGL_{PN}$ to produce an OpSOF for each ROC, which were when summed to derive an OpSOF for the measurement.

In accordance with LTP Chapter 5 section 5.5.5, penetration survey units also have total surface areas that are less than the area of the wall/floor surface survey unit that the penetrations interface. To eliminate the potential for activity levels in penetrations that could lead to releases greater than the adjacent basement walls and floors, the results are also compared against the OpDCGL for surfaces from LTP Chapter 5, Table 5-4 of the two building that the penetration interfaces. In the case of the Auxiliary Building penetrations, the $OpDCGL_B$ for the Turbine Building are the most limiting. Two (2) of the penetrations required grouting as they had measurements with activity greater than the $OpDCGL_B$ for the Turbine Building. Grouting of the two (2) penetrations was performed prior to backfill and there was no dose reduction attributed to the survey unit because of grouting.

Table 8 provides the summary of Auxiliary Building penetrations, a summary of the FSS results, and whether the penetration required grouting. The complete tables containing the measurement results of all Auxiliary Building measurements that were taken are presented in Attachment 2. The measurement data collected passed the Sign Test. The results of the Sign Test are provided in Attachment 3. The statistical summary of the measurement data taken, when compared against the $BcDCGL_{PN}$ for Auxiliary Building penetrations are presented in Table 9.

**Table 8 - Auxiliary Building Penetrations Summary**

| Pen # | Description | Diameter (in) | Length (ft) | Area ($m^2$) | Measurement # (2) | | | By Direct Scan | Max SOF | | | Requires Grouting |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | $OpDCGL_{PN}$ | $BcDCGL_{PN}$ | $OpDCGL_B$ (1) | |
| A001 | Service Water | 24 | 3 | 1.75 | 52 | thru | 54 | X | 0.001 | 0.001 | 0.305 | No |
| A002 | Feedwater | 4.5 | 3 | 0.33 | 10 | thru | 12 | | 0.012 | 0.003 | 0.848 | No |
| A003 | Secondary Sample | 2.5 | 3 | 0.18 | 13 | thru | 15 | | 0.033 | 0.000 | 0.021 | No |
| A004 | Service Water | 24 | 3 | 1.75 | 58 | thru | 60 | X | 0.001 | 0.001 | 0.250 | No |
| A005 | Feedwater | 4.5 | 3 | 0.33 | 31 | thru | 33 | | 0.010 | 0.001 | 0.254 | No |
| A007 | Aux Vents & Drains | 4.5 | 3 | 0.33 | 1 | thru | 3 | | 0.010 | 0.001 | 0.311 | No |
| A008 | Aux Vents & Drains | 4.5 | 3 | 0.33 | 4 | thru | 6 | | 0.012 | 0.001 | 0.262 | No |
| A009 | Waste Disposal | 3.5 | 3 | 0.26 | 7 | thru | 9 | | 0.010 | 0.002 | 0.497 | No |
| A010 | Service Water | 11 | 3 | 0.80 | 49 | thru | 51 | | 0.020 | 0.022 | 7.078 | No |
| A011 | Waste Disposal | 7 | 3 | 0.51 | 19 | thru | 21 | | 0.279 | 0.001 | 0.346 | Yes |
| A012 | Chemical Feed | 3.5 | 3 | 0.26 | 22 | thru | 24 | | 0.014 | 0.001 | 0.421 | No |
| A013 | Primary Water | 4.5 | 3 | 0.33 | 16 | thru | 18 | | 0.017 | 0.000 | 0.020 | No |
| A014 | Service Water | 20 | 3 | 1.46 | 55 | thru | 57 | X | 0.001 | 0.001 | 0.373 | No |
| A015 | Waste Disposal | 6.5 | 3 | 0.47 | 28 | thru | 30 | | 0.015 | 0.002 | 0.636 | No |
| A017 | Fire Protection | 11 | 3 | 0.80 | 46 | thru | 48 | | 0.025 | 0.001 | 0.256 | No |
| A019 | Primary Water | 3.5 | 3 | 0.26 | 25 | thru | 27 | | 0.010 | 0.001 | 0.296 | No |
| A020 | Vacuum Control | 3.5 | 3 | 0.26 | 34 | thru | 36 | | 0.012 | 0.001 | 0.330 | No |
| A021 | Demin Water | 3.5 | 3 | 0.26 | 37 | thru | 39 | | 0.013 | 0.001 | 0.298 | No |
| A022 | Line with Flange | 4.5 | 3 | 0.33 | 40 | thru | 42 | | 0.012 | 0.013 | 4.181 | No |
| A023 | Waste Disposal | 6.5 | 3 | 0.47 | 43 | thru | 45 | | 0.165 | 0.000 | 0.066 | Yes |
| A024 | Condensate | 18 | 3 | 1.31 | 61 | thru | 63 | X | 0.003 | 0.000 | 0.018 | No |
| A025 | Supply Header | 36 | 3 | 2.63 | 64 | thru | 66 | X | 0.001 | 0.001 | 0.305 | No |

(1) Compared against the $OpDCGL_B$ for the Turbine Building from LTP Chapter 5, Table 5-4

(2) Measurement numbers correlates to Attachment 2, "Penetration Survey Data Assessment" Tables

The SOF for all sixty-six (66) measurements, based on the $OpDCGL_{PN}$, were less than one (1). The mean OpSOF for Auxiliary Building penetrations was 0.027. The maximum OpSOF for a measurement using $OpDCGL_{PN}$ for penetrations was 0.279. The data collected passed the Sign Test.

**Table 9 - Auxiliary Building Penetrations FSS Statistics Summary using Auxiliary Building $BcDCGL_{PN}$**

| Individual Measurement Metrics | | |
|---|---|---|
| Total Number of Systematic Measurements | = | 66 |
| Number of Quality Control Measurements | = | 5 |
| Number of Judgmental/Investigational Measurements | = | 0 |
| Total Number of Measurements | = | 71 |
| Mean Systematic Measurement OpSOF | = | 0.027 |
| Max Individual Systematic Measurement OpSOF | = | 0.279 |
| Number of Systematic Measurements with OpSOF >1 | = | 0 |

| Nuclide | Mean ($pCi/m^2$) | Median ($pCi/m^2$) | Max ($pCi/m^2$) | Min ($pCi/m^2$) | St Dev ($pCi/m^2$) | $BcDCGL_{PN}$ ($pCi/m^2$) | Mean Nuclide BcSOF |
|---|---|---|---|---|---|---|---|
| Co-60 | 1.37E+04 | 5.47E+03 | 1.43E+05 | 2.71E+02 | 2.93E+04 | 8.82E+07 | 0.000 |
| Ni-63 | 2.48E+06 | 9.87E+05 | 2.59E+07 | 4.88E+04 | 5.28E+06 | 6.79E+10 | 0.000 |
| Sr-90 | 2.25E+03 | 8.95E+02 | 2.35E+04 | 4.43E+01 | 4.79E+03 | 2.41E+07 | 0.000 |
| Cs-134 | 1.49E+02 | 5.94E+01 | 1.56E+03 | 2.94E+00 | 3.18E+02 | 3.28E+08 | 0.000 |
| Cs-137 | 1.12E+06 | 4.48E+05 | 1.17E+07 | 2.22E+04 | 2.40E+06 | 6.17E+08 | 0.002 |

The mean BcSOF for Auxiliary Building penetrations (survey unit 05120), when compared against the $BcDCGL_{PN}$ for Auxiliary Building penetrations is 0.002, which equates to a dose of 0.053 mrem/yr.

The SOF for two (2) measurements, when compared against the $OpDCGL_B$ for the Turbine Building, were above one (1). In accordance with LTP Chapter 5 section 5.5.5, these two penetrations (A011 and A023) were grouted. No dose reduction was attributed to the survey unit because of grouting.

## 8. QUALITY CONTROL

In compliance with ZS-LT-01, replicate measurements were performed on 5% of the survey locations chosen at random. Five (5) replicate measurements were taken, which equates to 7.6% of the total number of measurements and satisfies the requirement. Using the acceptance criteria specified in section 4.1.2 of ZS-LT-01, there was acceptable agreement between the replicate readings and the original readings. Refer to Attachment 5 for quality control analysis results.

## 9. INVESTIGATIONS AND RESULTS

No investigations were performed during the performance or analyses of the FSS.

## 10. REMEDIATION AND RESULTS

No radiological remedial action as described by MARSSIM Section 5.4 was performed in this survey unit prior to or as a result of the FSS.

## 11. CHANGES FROM THE FINAL STATUS SURVEY PLAN

There were no addendums to the FSS plan.

## 12. DATA QUALITY ASSESSMENT (DQA)

The DQO sample design and data were reviewed in accordance with Zion*Solutions* procedure ZS-LT-300-001-004, *"Final Status Survey Data Assessment"* for completeness and consistency. Documentation was complete and legible. Surveys and sample collection were consistent with the DQOs and were sufficient to ensure that the survey unit was properly classified.

The analytical results of all samples were less than an OpSOF of one. Although MARSSIM states that the Sign Test need not be performed in the instance that no measurements surpass the DCGL, the test was conducted to demonstrate coherence to the statistical principles of the DQO process. The Sign Test was performed on the data and compared to the original assumptions of the DQOs. The evaluation of the Sign Test results clearly demonstrates that the survey unit passes the unrestricted release criteria, thus, the null hypothesis is rejected.

The preliminary data review consisted of calculating basic statistical quantities (e.g., mean, median, standard deviation). All data was considered valid including negative values, zeros, values reported below the MDC, and values with uncertainties greater than two standard deviations. The mean and median values for each ROC were well below

the respective $OpDCGL_{PN}$. Also, a retrospective power curve showed that a sufficient number of samples were collected to achieve the desired power. Therefore, the survey unit meets the unrestricted release criteria with adequate power as required by the DQOs.

The data for Co-60 and Cs-137 is represented graphically through a frequency plot and a quantile plot. All graphical representations are provided in Attachment 6.

## 13. ANOMALIES

No anomalies were observed during the performance or analyses of the survey.

## 14. CONCLUSION

Survey Unit 05120 has met the DQOs of the FSS plan. The ALARA criteria as specified in Chapter 4 of the LTP were achieved. The Elevated Measurement Comparison (EMC) is not applicable to structural surfaces.

All identified ROC were used for statistical testing to determine the adequacy of the survey unit for FSS. Evaluation of the data shows that none of the ROC concentration values exceed the $OpDCGL_{PN}$ for the Auxiliary Building or any investigational levels; therefore, in accordance with the LTP Section 5.10, the survey unit meets the release criterion.

The sample data passed the Sign Test. The null hypothesis was rejected. The Retrospective Power Curve showed that adequate power was achieved. The survey unit was properly classified as Class 1.

LTP Chapter 6, section 6.4.5 requires that the dose from a penetration be added to each basement that the penetration interfaces with. The penetrations in the Auxiliary Building interface with both Unit 1 and Unit 2 Containments and with the Turbine Building. the penetrations identified as interfacing between the Auxiliary Building and the Unit 1 and Unit 2 Containments were addressed in the Release Records for Unit 1 and Unit 2 Containment Penetrations. In order to comply with the requirements of LTP Chapter 6, section 6.4.5, a dose of 1.468 mrem/yr will be added to the Auxiliary Building basement survey unit from penetrations that interfaced between the Auxiliary Building and Unit 1 Containment and a dose of 0.206 mrem/yr will be added to the Auxiliary Building basement survey unit from penetrations that interfaced between the Auxiliary Building and Unit 2 Containment. The Auxiliary Building penetrations addressed in this Release Record interfaced with the Turbine Building (via the “G” wall and Steam Tunnels). Consequently, a dose value of 0.053 mrem/yr will also be added to the Auxiliary Building basement and the Turbine Building basement.

The null hypothesis was rejected. Therefore, in accordance with the LTP Section 5.10, survey unit 05120 meets the release criterion and is acceptable for unrestricted release.

## 15. REFERENCES

1. Zion*Solutions* procedure ZS-LT-300-001-005, Final Status Survey Data Reporting
2. Zion Station Restoration Project License Termination Plan
3. Zion*Solutions* procedure ZS-LT-300-001-001, Final Status Survey Package Development
4. NUREG-1575, Multi-Agency Radiation Survey and Site Investigation Manual
5. Zion*Solutions* TSD 14-016, Description of Embedded Piping, Penetrations, and Buried Pipe to Remain in Zion End State
6. ZionSolutions procedure ZS-LT-300-001-002, Survey Unit Classification
7. Zion Station Historical Site Assessment
8. Zion*Solutions* TSD 14-013, Zion Auxiliary Building End State Estimated Concrete Volumes, Surface Areas, and Source Terms
9. Zion*Solutions* procedure ZS-LT-300-001-002, Survey Unit Classification
10. Zion*Solutions* TSD 11-001, Technical Support Document for Potential Radionuclides of Concern During the Decommissioning of the Zion Station
11. Zion*Solutions* TSD 17-004, Operational Derived Concentration Guideline Levels for Final Status Survey
12. Zion*Solutions* TSD 14-019, Radionuclides of Concern for Soil and Basement Fill Model Source Terms
13. Zion*Solutions* ZS-LT-01, Quality Assurance Project Plan (for Characterization and FSS)
14. Zion*Solutions* procedure ZS-LT-300-001-003, Isolation and Control for Final Status Survey
15. Zion*Solutions* procedure ZS-LT-300-001-006, Radiation Surveys of Pipe Interiors Using Sodium/Cesium Iodide Detectors
16. Zion*Solutions* procedure ZS-LT-300-001-004, Final Status Survey Data Assessment

# 16. ATTACHMENTS

Attachment 1 – Figures and Maps

Attachment 2 – Measurement Data

Attachment 3 – Sign Test

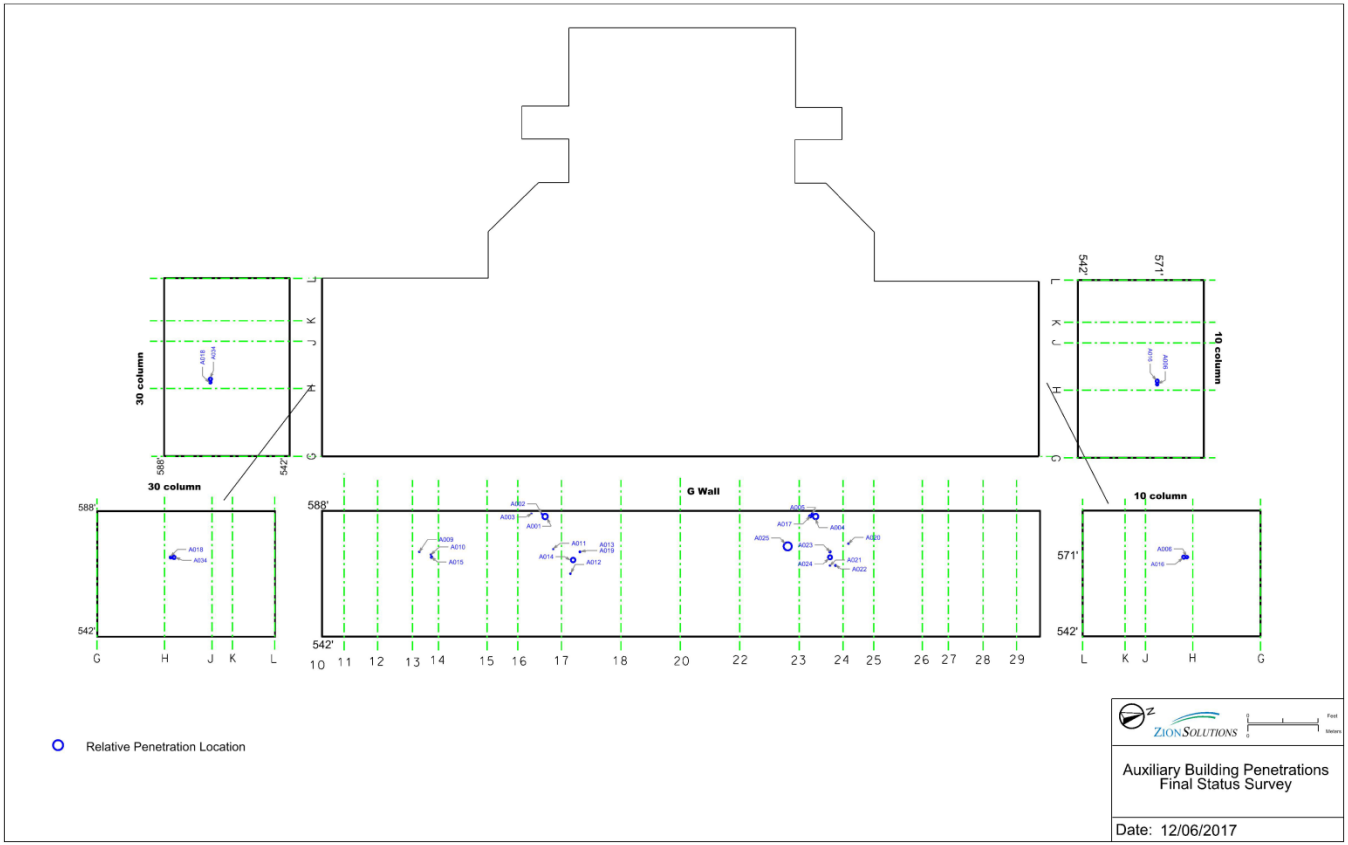
Attachment 4 – QC Data

Attachment 5 – QC Measurement Assessments

Attachment 6 – Graphical Presentations

# **ATTACHMENT 1**
# FIGURES AND MAPS

## Figure 1 – Overall Penetration Map



# **ATTACHMENT 2**
# MEASUREMENT DATA

**Auxiliary Building Penetration Summary**

| MEASUREMENT ID | | Co-60 ($pCi/m^2$) | Ni-63 ($pCi/m^2$) | Sr-90 ($pCi/m^2$) | Cs-134 ($pCi/m^2$) | Cs-137 ($pCi/m^2$) | OpSOF(1) |
|---|---|---|---|---|---|---|---|
| A007 | Position#1 | 4.84E+03 | 8.74E+05 | 7.93E+02 | 5.27E+01 | 3.97E+05 | 0.0094 |
| A007 | Position#2 | 4.96E+03 | 8.96E+05 | 8.13E+02 | 5.40E+01 | 4.06E+05 | 0.0097 |
| A007 | Position#3 | 5.15E+03 | 9.30E+05 | 8.44E+02 | 5.60E+01 | 4.22E+05 | 0.0100 |
| A008 | Position#1 | 6.29E+03 | 1.14E+06 | 1.03E+03 | 6.84E+01 | 5.15E+05 | 0.0123 |
| A008 | Position#2 | 5.76E+03 | 1.04E+06 | 9.43E+02 | 6.26E+01 | 4.72E+05 | 0.0112 |
| A008 | Position#3 | 5.70E+03 | 1.03E+06 | 9.33E+02 | 6.20E+01 | 4.67E+05 | 0.0111 |
| A009 | Position#1 | 5.30E+03 | 9.56E+05 | 8.67E+02 | 5.76E+01 | 4.34E+05 | 0.0103 |
| A009 | Position#2 | 5.17E+03 | 9.32E+05 | 8.46E+02 | 5.61E+01 | 4.23E+05 | 0.0101 |
| A009 | Position#3 | 5.28E+03 | 9.54E+05 | 8.65E+02 | 5.74E+01 | 4.33E+05 | 0.0103 |
| A002 | Position#1 | 5.21E+03 | 9.41E+05 | 8.54E+02 | 5.67E+01 | 4.27E+05 | 0.0102 |
| A002 | Position#2 | 4.92E+03 | 8.87E+05 | 8.05E+02 | 5.34E+01 | 4.02E+05 | 0.0096 |
| A002 | Position#3 | 6.19E+03 | 1.12E+06 | 1.01E+03 | 6.72E+01 | 5.06E+05 | 0.0121 |
| A003 | Position#1 | 6.82E+03 | 1.23E+06 | 1.12E+03 | 7.41E+01 | 5.58E+05 | 0.0133 |
| A003 | Position#2 | 7.39E+03 | 1.33E+06 | 1.21E+03 | 8.03E+01 | 6.05E+05 | 0.0144 |
| A003 | Position#3 | 1.72E+04 | 3.10E+06 | 2.81E+03 | 1.87E+02 | 1.41E+06 | 0.0335 |
| A013 | Position#1 | 7.93E+03 | 1.43E+06 | 1.30E+03 | 8.62E+01 | 6.49E+05 | 0.0155 |
| A013 | Position#2 | 8.30E+03 | 1.50E+06 | 1.36E+03 | 9.02E+01 | 6.80E+05 | 0.0162 |
| A013 | Position#3 | 8.53E+03 | 1.54E+06 | 1.40E+03 | 9.27E+01 | 6.98E+05 | 0.0166 |
| A011 | Position#1 | 1.25E+05 | 2.25E+07 | 2.04E+04 | 1.35E+03 | 1.02E+07 | 0.2427 |
| A011 | Position#2 | 1.43E+05 | 2.59E+07 | 2.35E+04 | 1.56E+03 | 1.17E+07 | 0.2794 |
| A011 | Position#3 | 1.21E+05 | 2.18E+07 | 1.98E+04 | 1.31E+03 | 9.88E+06 | 0.2352 |
| A012 | Position#1 | 5.44E+03 | 9.81E+05 | 8.91E+02 | 5.91E+01 | 4.45E+05 | 0.0106 |
| A012 | Position#2 | 5.50E+03 | 9.92E+05 | 9.00E+02 | 5.98E+01 | 4.50E+05 | 0.0107 |
| A012 | Position#3 | 7.01E+03 | 1.26E+06 | 1.15E+03 | 7.62E+01 | 5.74E+05 | 0.0137 |
| A019 | Position#1 | 4.75E+03 | 8.57E+05 | 7.78E+02 | 5.16E+01 | 3.89E+05 | 0.0093 |

(1) Compared against the $OpDCGL_{PN}$ for the Auxiliary Building from LTP Chapter 5, Table 5-14

**Auxiliary Building Penetration Summary (continued)**

| MEASUREMENT ID | | Co-60 ($pCi/m^2$) | Ni-63 ($pCi/m^2$) | Sr-90 ($pCi/m^2$) | Cs-134 ($pCi/m^2$) | Cs-137 ($pCi/m^2$) | OpSOF(1) |
|---|---|---|---|---|---|---|---|
| A019 | Position#2 | 4.73E+03 | 8.53E+05 | 7.74E+02 | 5.14E+01 | 3.87E+05 | 0.0092 |
| A019 | Position#3 | 5.18E+03 | 9.34E+05 | 8.48E+02 | 5.63E+01 | 4.24E+05 | 0.0101 |
| A015 | Position#1 | 6.64E+03 | 1.20E+06 | 1.09E+03 | 7.22E+01 | 5.44E+05 | 0.0129 |
| A015 | Position#2 | 6.59E+03 | 1.19E+06 | 1.08E+03 | 7.16E+01 | 5.40E+05 | 0.0128 |
| A015 | Position#3 | 7.55E+03 | 1.36E+06 | 1.24E+03 | 8.21E+01 | 6.18E+05 | 0.0147 |
| A005 | Position#1 | 4.51E+03 | 8.14E+05 | 7.39E+02 | 4.90E+01 | 3.69E+05 | 0.0088 |
| A005 | Position#2 | 4.50E+03 | 8.12E+05 | 7.37E+02 | 4.89E+01 | 3.68E+05 | 0.0088 |
| A005 | Position#3 | 5.07E+03 | 9.15E+05 | 8.30E+02 | 5.51E+01 | 4.15E+05 | 0.0099 |
| A020 | Position#1 | 5.13E+03 | 9.26E+05 | 8.40E+02 | 5.58E+01 | 4.20E+05 | 0.0100 |
| A020 | Position#2 | 5.98E+03 | 1.08E+06 | 9.80E+02 | 6.51E+01 | 4.90E+05 | 0.0117 |
| A020 | Position#3 | 5.95E+03 | 1.07E+06 | 9.74E+02 | 6.47E+01 | 4.87E+05 | 0.0116 |
| A021 | Position#1 | 6.67E+03 | 1.20E+06 | 1.09E+03 | 7.25E+01 | 5.46E+05 | 0.0130 |
| A021 | Position#2 | 5.59E+03 | 1.01E+06 | 9.16E+02 | 6.08E+01 | 4.58E+05 | 0.0109 |
| A021 | Position#3 | 5.63E+03 | 1.02E+06 | 9.22E+02 | 6.12E+01 | 4.61E+05 | 0.0110 |
| A022 | Position#1 | 4.44E+03 | 8.01E+05 | 7.27E+02 | 4.83E+01 | 3.64E+05 | 0.0087 |
| A022 | Position#2 | 4.46E+03 | 8.06E+05 | 7.31E+02 | 4.85E+01 | 3.66E+05 | 0.0087 |
| A022 | Position#3 | 6.03E+03 | 1.09E+06 | 9.88E+02 | 6.56E+01 | 4.94E+05 | 0.0118 |
| A023 | Position#1 | 6.23E+04 | 1.12E+07 | 1.02E+04 | 6.77E+02 | 5.10E+06 | 0.1214 |
| A023 | Position#2 | 8.47E+04 | 1.53E+07 | 1.39E+04 | 9.20E+02 | 6.93E+06 | 0.1650 |
| A023 | Position#3 | 6.52E+04 | 1.18E+07 | 1.07E+04 | 7.09E+02 | 5.34E+06 | 0.1270 |
| A017 | Position#1 | 9.91E+03 | 1.79E+06 | 1.62E+03 | 1.08E+02 | 8.11E+05 | 0.0193 |
| A017 | Position#2 | 1.07E+04 | 1.93E+06 | 1.75E+03 | 1.16E+02 | 8.74E+05 | 0.0208 |
| A017 | Position#3 | 1.29E+04 | 2.32E+06 | 2.11E+03 | 1.40E+02 | 1.05E+06 | 0.0251 |
| A010 | Position#1 | 8.41E+03 | 1.52E+06 | 1.38E+03 | 9.14E+01 | 6.89E+05 | 0.0164 |
| A010 | Position#2 | 8.59E+03 | 1.55E+06 | 1.41E+03 | 9.33E+01 | 7.03E+05 | 0.0167 |

(1) Compared against the $OpDCGL_{PN}$ for the Auxiliary Building from LTP Chapter 5, Table 5-14

## Auxiliary Building Penetration Summary (continued)

| MEASUREMENT ID | | Co-60 ($pCi/m^2$) | Ni-63 ($pCi/m^2$) | Sr-90 ($pCi/m^2$) | Cs-134 ($pCi/m^2$) | Cs-137 ($pCi/m^2$) | OpSOF(1) |
|---|---|---|---|---|---|---|---|
| A010 | Position#3 | 1.01E+04 | 1.82E+06 | 1.65E+03 | 1.10E+02 | 8.25E+05 | 0.0196 |
| A001 | Position #1 | 4.20E+02 | 7.59E+04 | 6.88E+01 | 4.57E+00 | 3.44E+04 | 0.0008 |
| A001 | Position #2 | 4.61E+02 | 8.33E+04 | 7.56E+01 | 5.02E+00 | 3.78E+04 | 0.0009 |
| A001 | Position #3 | 4.37E+02 | 7.89E+04 | 7.16E+01 | 4.75E+00 | 3.58E+04 | 0.0009 |
| A014 | Position #1 | 2.71E+02 | 4.88E+04 | 4.43E+01 | 2.94E+00 | 2.22E+04 | 0.0005 |
| A014 | Position #2 | 3.53E+02 | 6.36E+04 | 5.78E+01 | 3.83E+00 | 2.89E+04 | 0.0007 |
| A014 | Position #3 | 4.06E+02 | 7.32E+04 | 6.65E+01 | 4.41E+00 | 3.32E+04 | 0.0008 |
| A004 | Position #1 | 3.79E+02 | 6.84E+04 | 6.21E+01 | 4.12E+00 | 3.11E+04 | 0.0007 |
| A004 | Position #2 | 3.38E+02 | 6.10E+04 | 5.54E+01 | 3.68E+00 | 2.77E+04 | 0.0007 |
| A004 | Position #3 | 4.32E+02 | 7.80E+04 | 7.08E+01 | 4.70E+00 | 3.54E+04 | 0.0008 |
| A024 | Position #1 | 4.49E+02 | 8.11E+04 | 7.36E+01 | 4.88E+00 | 3.68E+04 | 0.0009 |
| A024 | Position #2 | 7.61E+02 | 1.37E+05 | 1.25E+02 | 8.27E+00 | 6.23E+04 | 0.0015 |
| A024 | Position #3 | 1.34E+03 | 2.42E+05 | 2.20E+02 | 1.46E+01 | 1.10E+05 | 0.0026 |
| A025 | Position #1 | 3.31E+02 | 5.97E+04 | 5.42E+01 | 3.60E+00 | 2.71E+04 | 0.0006 |
| A025 | Position #2 | 3.14E+02 | 5.67E+04 | 5.14E+01 | 3.41E+00 | 2.57E+04 | 0.0006 |
| A025 | Position #3 | 3.55E+02 | 6.41E+04 | 5.81E+01 | 3.86E+00 | 2.91E+04 | 0.0007 |

(1) Compared against the $OpDCGL_{PN}$ for the Auxiliary Building from LTP Chapter 5, Table 5-14

## Auxiliary Building Penetration Scan Measurements for Large Diameter Penetrations (>12 inches ID)

| Instrument/ID | Cal. Due | Detector/ID | Cal. Due | Efficiency | Survey Date | Penetration | Reading (cpm) | Reading ($dpm/100cm^2$) | Reading ($pCi/m^2$) |
|---|---|---|---|---|---|---|---|---|---|
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A001 | 174 | 870 | 3.48E+04 |
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A001 | 191 | 955 | 3.82E+04 |
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A001 | 181 | 905 | 3.62E+04 |
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A014 | 112 | 560 | 2.24E+04 |
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A014 | 146 | 730 | 2.92E+04 |
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A014 | 168 | 840 | 3.36E+04 |
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A014 QC | 145 | 725 | 2.90E+04 |
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A004 | 157 | 785 | 3.14E+04 |
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A004 | 140 | 700 | 2.80E+04 |
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A004 | 179 | 895 | 3.58E+04 |
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A024 | 186 | 930 | 3.72E+04 |
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A024 | 315 | 1575 | 6.31E+04 |
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A024 | 555 | 2775 | 1.11E+05 |
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A025 | 137 | 685 | 2.74E+04 |
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A025 | 130 | 650 | 2.60E+04 |
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A025 | 147 | 735 | 2.94E+04 |
| 2360/278576 | 1/27/2019 | 43-93/PR311187 | 1/27/2019 | 0.20 | 3/28/2018 | A025 QC | 120 | 600 | 2.40E+04 |

## Penetration Survey Data Assessment

| No. | Sample ID | Feet into Pipe | Gamma Result ($pCi/m^2$) | ROC | Gamma Mixture/ HTD Ratio | Activity per ROC ($pCi/m^2$) | Auxiliary $OpDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $OpSOF_{PN}$ | Auxiliary Total $OpSOF_{PN}$ | Auxiliary $BcDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $BcSOF_{PN}$ | Auxiliary Total $BcSOF_{PN}$ | Turbine $OpDCGL_B$ ($pCi/m^2$) | Turbine ROC $OpSOF_B$ | Turbine Total $OpSOF_B$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A007 Position#1 | 1 | 4.02E+05 | Co-60 | 0.0121 | 4.84E+03 | 6.95E+06 | 0.0007 | 0.0094 | 8.82E+07 | 0.0001 | 0.0007 | 5.98E+06 | 0.0008 | 0.2392 |
| | | | | Ni-63 | 180 | 8.74E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0047 | |
| | | | | Sr-90 | 0.002 | 7.93E+02 | 1.90E+06 | 0.0004 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0121 | |
| | | | | Cs-134 | 0.0001 | 5.27E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 3.97E+05 | 4.86E+07 | 0.0082 | | 6.17E+08 | 0.0006 | | 1.79E+06 | 0.2216 | |
| 2 | A007 Position#2 | 2 | 4.11E+05 | Co-60 | 0.0121 | 4.96E+03 | 6.95E+06 | 0.0007 | 0.0097 | 8.82E+07 | 0.0001 | 0.0008 | 5.98E+06 | 0.0008 | 0.2451 |
| | | | | Ni-63 | 180 | 8.96E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0048 | |
| | | | | Sr-90 | 0.002 | 8.13E+02 | 1.90E+06 | 0.0004 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0124 | |
| | | | | Cs-134 | 0.0001 | 5.40E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.06E+05 | 4.86E+07 | 0.0084 | | 6.17E+08 | 0.0007 | | 1.79E+06 | 0.2270 | |
| 3 | A007 Position#3 | 3 | 4.27E+05 | Co-60 | 0.0121 | 5.15E+03 | 6.95E+06 | 0.0007 | 0.0100 | 8.82E+07 | 0.0001 | 0.0008 | 5.98E+06 | 0.0009 | 0.2545 |
| | | | | Ni-63 | 180 | 9.30E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0050 | |
| | | | | Sr-90 | 0.002 | 8.44E+02 | 1.90E+06 | 0.0004 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0128 | |
| | | | | Cs-134 | 0.0001 | 5.60E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.22E+05 | 4.86E+07 | 0.0087 | | 6.17E+08 | 0.0007 | | 1.79E+06 | 0.2357 | |
| 4 | A008 Position#1 | 1 | 5.22E+05 | Co-60 | 0.0121 | 6.29E+03 | 6.95E+06 | 0.0009 | 0.0123 | 8.82E+07 | 0.0001 | 0.0010 | 5.98E+06 | 0.0011 | 0.3108 |
| | | | | Ni-63 | 180 | 1.14E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0061 | |
| | | | | Sr-90 | 0.002 | 1.03E+03 | 1.90E+06 | 0.0005 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0157 | |
| | | | | Cs-134 | 0.0001 | 6.84E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | Cs-137 | 0.9878 | 5.15E+05 | 4.86E+07 | 0.0106 | | 6.17E+08 | 0.0008 | | 1.79E+06 | 0.2878 | |
| 5 | A008 Position#2 | 2 | 4.77E+05 | Co-60 | 0.0121 | 5.76E+03 | 6.95E+06 | 0.0008 | 0.0112 | 8.82E+07 | 0.0001 | 0.0009 | 5.98E+06 | 0.0010 | 0.2844 |
| | | | | Ni-63 | 180 | 1.04E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0056 | |
| | | | | Sr-90 | 0.002 | 9.43E+02 | 1.90E+06 | 0.0005 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0143 | |
| | | | | Cs-134 | 0.0001 | 6.26E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.72E+05 | 4.86E+07 | 0.0097 | | 6.17E+08 | 0.0008 | | 1.79E+06 | 0.2634 | |
| 6 | A008 Position#3 | 3 | 4.72E+05 | Co-60 | 0.0121 | 5.70E+03 | 6.95E+06 | 0.0008 | 0.0111 | 8.82E+07 | 0.0001 | 0.0009 | 5.98E+06 | 0.0010 | 0.2814 |
| | | | | Ni-63 | 180 | 1.03E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0056 | |
| | | | | Sr-90 | 0.002 | 9.33E+02 | 1.90E+06 | 0.0005 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0142 | |
| | | | | Cs-134 | 0.0001 | 6.20E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.67E+05 | 4.86E+07 | 0.0096 | | 6.17E+08 | 0.0008 | | 1.79E+06 | 0.2607 | |
| 7 | A009 Position#1 | 1 | 4.39E+05 | Co-60 | 0.0121 | 5.30E+03 | 6.95E+06 | 0.0008 | 0.0103 | 8.82E+07 | 0.0001 | 0.0008 | 5.98E+06 | 0.0009 | 0.2615 |
| | | | | Ni-63 | 180 | 9.56E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0052 | |
| | | | | Sr-90 | 0.002 | 8.67E+02 | 1.90E+06 | 0.0005 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0132 | |
| | | | | Cs-134 | 0.0001 | 5.76E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.34E+05 | 4.86E+07 | 0.0089 | | 6.17E+08 | 0.0007 | | 1.79E+06 | 0.2422 | |
| 8 | A009 Position#2 | 2 | 4.28E+05 | Co-60 | 0.0121 | 5.17E+03 | 6.95E+06 | 0.0007 | 0.0101 | 8.82E+07 | 0.0001 | 0.0008 | 5.98E+06 | 0.0009 | 0.2551 |
| | | | | Ni-63 | 180 | 9.32E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0050 | |
| | | | | Sr-90 | 0.002 | 8.46E+02 | 1.90E+06 | 0.0004 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0129 | |
| | | | | Cs-134 | 0.0001 | 5.61E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.23E+05 | 4.86E+07 | 0.0087 | | 6.17E+08 | 0.0007 | | 1.79E+06 | 0.2363 | |

## Penetration Survey Data Assessment (continued)

| No. | Sample ID | Feet into Pipe | Gamma Result ($pCi/m^2$) | ROC | Gamma Mixture/ HTD Ratio | Activity per ROC ($pCi/m^2$) | Auxiliary $OpDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $OpSOF_{PN}$ | Auxiliary Total $OpSOF_{PN}$ | Auxiliary $BcDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $BcSOF_{PN}$ | Auxiliary Total $BcSOF_{PN}$ | Turbine $OpDCGL_B$ ($pCi/m^2$) | Turbine ROC $OpSOF_B$ | Turbine Total $OpSOF_B$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | A009 Position#3 | 3 | 4.38E+05 | Co-60 | 0.0121 | 5.28E+03 | 6.95E+06 | 0.0008 | 0.0103 | 8.82E+07 | 0.0001 | 0.0008 | 5.98E+06 | 0.0009 | 0.2609 |
| | | | | Ni-63 | 180 | 9.54E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0052 | |
| | | | | Sr-90 | 0.002 | 8.65E+02 | 1.90E+06 | 0.0005 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0131 | |
| | | | | Cs-134 | 0.0001 | 5.74E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.33E+05 | 4.86E+07 | 0.0089 | | 6.17E+08 | 0.0007 | | 1.79E+06 | 0.2417 | |
| 10 | A002 Position#1 | 1 | 4.32E+05 | Co-60 | 0.0121 | 5.21E+03 | 6.95E+06 | 0.0008 | 0.0102 | 8.82E+07 | 0.0001 | 0.0008 | 5.98E+06 | 0.0009 | 0.2574 |
| | | | | Ni-63 | 180 | 9.41E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0051 | |
| | | | | Sr-90 | 0.002 | 8.54E+02 | 1.90E+06 | 0.0004 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0130 | |
| | | | | Cs-134 | 0.0001 | 5.67E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.27E+05 | 4.86E+07 | 0.0088 | | 6.17E+08 | 0.0007 | | 1.79E+06 | 0.2384 | |
| 11 | A002 Position#2 | 2 | 4.07E+05 | Co-60 | 0.0121 | 4.92E+03 | 6.95E+06 | 0.0007 | 0.0096 | 8.82E+07 | 0.0001 | 0.0008 | 5.98E+06 | 0.0008 | 0.2427 |
| | | | | Ni-63 | 180 | 8.87E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0048 | |
| | | | | Sr-90 | 0.002 | 8.05E+02 | 1.90E+06 | 0.0004 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0122 | |
| | | | | Cs-134 | 0.0001 | 5.34E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.02E+05 | 4.86E+07 | 0.0083 | | 6.17E+08 | 0.0007 | | 1.79E+06 | 0.2248 | |
| 12 | A002 Position#3 | 3 | 5.13E+05 | Co-60 | 0.0121 | 6.19E+03 | 6.95E+06 | 0.0009 | 0.0121 | 8.82E+07 | 0.0001 | 0.0009 | 5.98E+06 | 0.0010 | 0.3055 |
| | | | | Ni-63 | 180 | 1.12E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0060 | |
| | | | | Sr-90 | 0.002 | 1.01E+03 | 1.90E+06 | 0.0005 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0154 | |
| | | | | Cs-134 | 0.0001 | 6.72E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 5.06E+05 | 4.86E+07 | 0.0104 | | 6.17E+08 | 0.0008 | | 1.79E+06 | 0.2830 | |
| 13 | A003 Position#1 | 1 | 5.65E+05 | Co-60 | 0.0121 | 6.82E+03 | 6.95E+06 | 0.0010 | 0.0133 | 8.82E+07 | 0.0001 | 0.0010 | 5.98E+06 | 0.0011 | 0.3365 |
| | | | | Ni-63 | 180 | 1.23E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0066 | |
| | | | | Sr-90 | 0.002 | 1.12E+03 | 1.90E+06 | 0.0006 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0170 | |
| | | | | Cs-134 | 0.0001 | 7.41E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | Cs-137 | 0.9878 | 5.58E+05 | 4.86E+07 | 0.0115 | | 6.17E+08 | 0.0009 | | 1.79E+06 | 0.3117 | |
| 14 | A003 Position#2 | 2 | 6.12E+05 | Co-60 | 0.0121 | 7.39E+03 | 6.95E+06 | 0.0011 | 0.0144 | 8.82E+07 | 0.0001 | 0.0011 | 5.98E+06 | 0.0012 | 0.3647 |
| | | | | Ni-63 | 180 | 1.33E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0072 | |
| | | | | Sr-90 | 0.002 | 1.21E+03 | 1.90E+06 | 0.0006 | | 2.41E+07 | 0.0001 | | 6.58E+04 | 0.0184 | |
| | | | | Cs-134 | 0.0001 | 8.03E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | Cs-137 | 0.9878 | 6.05E+05 | 4.86E+07 | 0.0124 | | 6.17E+08 | 0.0010 | | 1.79E+06 | 0.3378 | |
| 15 | A003 Position#3 | 3 | 1.42E+06 | Co-60 | 0.0121 | 1.72E+04 | 6.95E+06 | 0.0025 | 0.0335 | 8.82E+07 | 0.0002 | 0.0026 | 5.98E+06 | 0.0029 | 0.8484 |
| | | | | Ni-63 | 180 | 3.10E+06 | 5.35E+09 | 0.0006 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0168 | |
| | | | | Sr-90 | 0.002 | 2.81E+03 | 1.90E+06 | 0.0015 | | 2.41E+07 | 0.0001 | | 6.58E+04 | 0.0428 | |
| | | | | Cs-134 | 0.0001 | 1.87E+02 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | Cs-137 | 0.9878 | 1.41E+06 | 4.86E+07 | 0.0289 | | 6.17E+08 | 0.0023 | | 1.79E+06 | 0.7859 | |

## Penetration Survey Data Assessment (continued)

| No. | Sample ID | Feet into Pipe | Gamma Result ($pCi/m^2$) | ROC | Gamma Mixture/ HTD Ratio | Activity per ROC ($pCi/m^2$) | Auxiliary $OpDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $OpSOF_{PN}$ | Auxiliary Total $OpSOF_{PN}$ | Auxiliary $BcDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $BcSOF_{PN}$ | Auxiliary Total $BcSOF_{PN}$ | Turbine $OpDCGL_B$ ($pCi/m^2$) | Turbine ROC $OpSOF_B$ | Turbine Total $OpSOF_B$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | A013 Position#1 | 1 | 6.57E+05 | Co-60 | 0.0121 | 7.93E+03 | 6.95E+06 | 0.0011 | 0.0155 | 8.82E+07 | 0.0001 | 0.0012 | 5.98E+06 | 0.0013 | 0.3917 |
| | | | | Ni-63 | 180 | 1.43E+06 | 5.35E+09 | 0.0003 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0077 | |
| | | | | Sr-90 | 0.002 | 1.30E+03 | 1.90E+06 | 0.0007 | | 2.41E+07 | 0.0001 | | 6.58E+04 | 0.0197 | |
| | | | | Cs-134 | 0.0001 | 8.62E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | Cs-137 | 0.9878 | 6.49E+05 | 4.86E+07 | 0.0134 | | 6.17E+08 | 0.0011 | | 1.79E+06 | 0.3628 | |
| 17 | A013 Position#2 | 2 | 6.88E+05 | Co-60 | 0.0121 | 8.30E+03 | 6.95E+06 | 0.0012 | 0.0162 | 8.82E+07 | 0.0001 | 0.0013 | 5.98E+06 | 0.0014 | 0.4098 |
| | | | | Ni-63 | 180 | 1.50E+06 | 5.35E+09 | 0.0003 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0081 | |
| | | | | Sr-90 | 0.002 | 1.36E+03 | 1.90E+06 | 0.0007 | | 2.41E+07 | 0.0001 | | 6.58E+04 | 0.0207 | |
| | | | | Cs-134 | 0.0001 | 9.02E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | Cs-137 | 0.9878 | 6.80E+05 | 4.86E+07 | 0.0140 | | 6.17E+08 | 0.0011 | | 1.79E+06 | 0.3796 | |
| 18 | A013 Position#3 | 3 | 7.07E+05 | Co-60 | 0.0121 | 8.53E+03 | 6.95E+06 | 0.0012 | 0.0166 | 8.82E+07 | 0.0001 | 0.0013 | 5.98E+06 | 0.0014 | 0.4210 |
| | | | | Ni-63 | 180 | 1.54E+06 | 5.35E+09 | 0.0003 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0083 | |
| | | | | Sr-90 | 0.002 | 1.40E+03 | 1.90E+06 | 0.0007 | | 2.41E+07 | 0.0001 | | 6.58E+04 | 0.0212 | |
| | | | | Cs-134 | 0.0001 | 9.27E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | Cs-137 | 0.9878 | 6.98E+05 | 4.86E+07 | 0.0144 | | 6.17E+08 | 0.0011 | | 1.79E+06 | 0.3900 | |
| 19 | A011 Position#1 | 1 | 1.03E+07 | Co-60 | 0.0121 | 1.25E+05 | 6.95E+06 | 0.0179 | 0.2427 | 8.82E+07 | 0.0014 | 0.0191 | 5.98E+06 | 0.0208 | 6.1494 |
| | | | | Ni-63 | 180 | 2.25E+07 | 5.35E+09 | 0.0042 | | 6.79E+10 | 0.0003 | | 1.85E+08 | 0.1215 | |
| | | | | Sr-90 | 0.002 | 2.04E+04 | 1.90E+06 | 0.0107 | | 2.41E+07 | 0.0008 | | 6.58E+04 | 0.3099 | |
| | | | | Cs-134 | 0.0001 | 1.35E+03 | 2.58E+07 | 0.0001 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0010 | |
| | | | | Cs-137 | 0.9878 | 1.02E+07 | 4.86E+07 | 0.2098 | | 6.17E+08 | 0.0165 | | 1.79E+06 | 5.6961 | |
| 20 | A011 Position#2 | 2 | 1.19E+07 | Co-60 | 0.0121 | 1.43E+05 | 6.95E+06 | 0.0206 | 0.2794 | 8.82E+07 | 0.0016 | 0.0220 | 5.98E+06 | 0.0240 | 7.0781 |
| | | | | Ni-63 | 180 | 2.59E+07 | 5.35E+09 | 0.0048 | | 6.79E+10 | 0.0004 | | 1.85E+08 | 0.1398 | |
| | | | | Sr-90 | 0.002 | 2.35E+04 | 1.90E+06 | 0.0124 | | 2.41E+07 | 0.0010 | | 6.58E+04 | 0.3567 | |
| | | | | Cs-134 | 0.0001 | 1.56E+03 | 2.58E+07 | 0.0001 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0012 | |
| | | | | Cs-137 | 0.9878 | 1.17E+07 | 4.86E+07 | 0.2415 | | 6.17E+08 | 0.0190 | | 1.79E+06 | 6.5564 | |
| 21 | A011 Position#3 | 3 | 1.00E+07 | Co-60 | 0.0121 | 1.21E+05 | 6.95E+06 | 0.0174 | 0.2352 | 8.82E+07 | 0.0014 | 0.0185 | 5.98E+06 | 0.0202 | 5.9582 |
| | | | | Ni-63 | 180 | 2.18E+07 | 5.35E+09 | 0.0041 | | 6.79E+10 | 0.0003 | | 1.85E+08 | 0.1177 | |
| | | | | Sr-90 | 0.002 | 1.98E+04 | 1.90E+06 | 0.0104 | | 2.41E+07 | 0.0008 | | 6.58E+04 | 0.3003 | |
| | | | | Cs-134 | 0.0001 | 1.31E+03 | 2.58E+07 | 0.0001 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0010 | |
| | | | | Cs-137 | 0.9878 | 9.88E+06 | 4.86E+07 | 0.2033 | | 6.17E+08 | 0.0160 | | 1.79E+06 | 5.5191 | |
| 22 | A012 Position#1 | 1 | 4.51E+05 | Co-60 | 0.0121 | 5.44E+03 | 6.95E+06 | 0.0008 | 0.0106 | 8.82E+07 | 0.0001 | 0.0008 | 5.98E+06 | 0.0009 | 0.2685 |
| | | | | Ni-63 | 180 | 9.81E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0053 | |
| | | | | Sr-90 | 0.002 | 8.91E+02 | 1.90E+06 | 0.0005 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0135 | |
| | | | | Cs-134 | 0.0001 | 5.91E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.45E+05 | 4.86E+07 | 0.0092 | | 6.17E+08 | 0.0007 | | 1.79E+06 | 0.2487 | |

## Penetration Survey Data Assessment (continued)

| No. | Sample ID | Feet into Pipe | Gamma Result ($pCi/m^2$) | ROC | Gamma Mixture/ HTD Ratio | Activity per ROC ($pCi/m^2$) | Auxiliary $OpDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $OpSOF_{PN}$ | Auxiliary Total $OpSOF_{PN}$ | Auxiliary $BcDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $BcSOF_{PN}$ | Auxiliary Total $BcSOF_{PN}$ | Turbine $OpDCGL_B$ ($pCi/m^2$) | Turbine ROC $OpSOF_B$ | Turbine Total $OpSOF_B$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23 | A012 Position#2 | 2 | 4.56E+05 | Co-60 | 0.0121 | 5.50E+03 | 6.95E+06 | 0.0008 | 0.0107 | 8.82E+07 | 0.0001 | 0.0008 | 5.98E+06 | 0.0009 | 0.2715 |
| | | | | Ni-63 | 180 | 9.92E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0054 | |
| | | | | Sr-90 | 0.002 | 9.00E+02 | 1.90E+06 | 0.0005 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0137 | |
| | | | | Cs-134 | 0.0001 | 5.98E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.50E+05 | 4.86E+07 | 0.0093 | | 6.17E+08 | 0.0007 | | 1.79E+06 | 0.2515 | |
| 24 | A012 Position#3 | 3 | 5.81E+05 | Co-60 | 0.0121 | 7.01E+03 | 6.95E+06 | 0.0010 | 0.0137 | 8.82E+07 | 0.0001 | 0.0011 | 5.98E+06 | 0.0012 | 0.3459 |
| | | | | Ni-63 | 180 | 1.26E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0068 | |
| | | | | Sr-90 | 0.002 | 1.15E+03 | 1.90E+06 | 0.0006 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0174 | |
| | | | | Cs-134 | 0.0001 | 7.62E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | Cs-137 | 0.9878 | 5.74E+05 | 4.86E+07 | 0.0118 | | 6.17E+08 | 0.0009 | | 1.79E+06 | 0.3204 | |
| 25 | A019 Position#1 | 1 | 3.94E+05 | Co-60 | 0.0121 | 4.75E+03 | 6.95E+06 | 0.0007 | 0.0093 | 8.82E+07 | 0.0001 | 0.0007 | 5.98E+06 | 0.0008 | 0.2345 |
| | | | | Ni-63 | 180 | 8.57E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0046 | |
| | | | | Sr-90 | 0.002 | 7.78E+02 | 1.90E+06 | 0.0004 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0118 | |
| | | | | Cs-134 | 0.0001 | 5.16E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 3.89E+05 | 4.86E+07 | 0.0080 | | 6.17E+08 | 0.0006 | | 1.79E+06 | 0.2172 | |
| 26 | A019 Position#2 | 2 | 3.92E+05 | Co-60 | 0.0121 | 4.73E+03 | 6.95E+06 | 0.0007 | 0.0092 | 8.82E+07 | 0.0001 | 0.0007 | 5.98E+06 | 0.0008 | 0.2334 |
| | | | | Ni-63 | 180 | 8.53E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0046 | |
| | | | | Sr-90 | 0.002 | 7.74E+02 | 1.90E+06 | 0.0004 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0118 | |
| | | | | Cs-134 | 0.0001 | 5.14E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 3.87E+05 | 4.86E+07 | 0.0080 | | 6.17E+08 | 0.0006 | | 1.79E+06 | 0.2162 | |
| 27 | A019 Position#3 | 3 | 4.29E+05 | Co-60 | 0.0121 | 5.18E+03 | 6.95E+06 | 0.0007 | 0.0101 | 8.82E+07 | 0.0001 | 0.0008 | 5.98E+06 | 0.0009 | 0.2556 |
| | | | | Ni-63 | 180 | 9.34E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0050 | |
| | | | | Sr-90 | 0.002 | 8.48E+02 | 1.90E+06 | 0.0004 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0129 | |
| | | | | Cs-134 | 0.0001 | 5.63E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.24E+05 | 4.86E+07 | 0.0087 | | 6.17E+08 | 0.0007 | | 1.79E+06 | 0.2368 | |
| 28 | A015 Position#1 | 1 | 5.50E+05 | Co-60 | 0.0121 | 6.64E+03 | 6.95E+06 | 0.0010 | 0.0129 | 8.82E+07 | 0.0001 | 0.0010 | 5.98E+06 | 0.0011 | 0.3278 |
| | | | | Ni-63 | 180 | 1.20E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0065 | |
| | | | | Sr-90 | 0.002 | 1.09E+03 | 1.90E+06 | 0.0006 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0165 | |
| | | | | Cs-134 | 0.0001 | 7.22E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | Cs-137 | 0.9878 | 5.44E+05 | 4.86E+07 | 0.0112 | | 6.17E+08 | 0.0009 | | 1.79E+06 | 0.3037 | |
| 29 | A015 Position#2 | 2 | 5.46E+05 | Co-60 | 0.0121 | 6.59E+03 | 6.95E+06 | 0.0009 | 0.0128 | 8.82E+07 | 0.0001 | 0.0010 | 5.98E+06 | 0.0011 | 0.3255 |
| | | | | Ni-63 | 180 | 1.19E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0064 | |
| | | | | Sr-90 | 0.002 | 1.08E+03 | 1.90E+06 | 0.0006 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0164 | |
| | | | | Cs-134 | 0.0001 | 7.16E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | Cs-137 | 0.9878 | 5.40E+05 | 4.86E+07 | 0.0111 | | 6.17E+08 | 0.0009 | | 1.79E+06 | 0.3015 | |
| 30 | A015 Position#3 | 3 | 6.26E+05 | Co-60 | 0.0121 | 7.55E+03 | 6.95E+06 | 0.0011 | 0.0147 | 8.82E+07 | 0.0001 | 0.0012 | 5.98E+06 | 0.0013 | 0.3730 |
| | | | | Ni-63 | 180 | 1.36E+06 | 5.35E+09 | 0.0003 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0074 | |
| | | | | Sr-90 | 0.002 | 1.24E+03 | 1.90E+06 | 0.0007 | | 2.41E+07 | 0.0001 | | 6.58E+04 | 0.0188 | |
| | | | | Cs-134 | 0.0001 | 8.21E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | Cs-137 | 0.9878 | 6.18E+05 | 4.86E+07 | 0.0127 | | 6.17E+08 | 0.0010 | | 1.79E+06 | 0.3455 | |

## Penetration Survey Data Assessment (continued)

| No. | Sample ID | Feet into Pipe | Gamma Result ($pCi/m^2$) | ROC | Gamma Mixture/ HTD Ratio | Activity per ROC ($pCi/m^2$) | Auxiliary $OpDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $OpSOF_{PN}$ | Auxiliary Total $OpSOF_{PN}$ | Auxiliary $BcDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $BcSOF_{PN}$ | Auxiliary Total $BcSOF_{PN}$ | Turbine $OpDCGL_B$ ($pCi/m^2$) | Turbine ROC $OpSOF_B$ | Turbine Total $OpSOF_B$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31 | A005 Position#1 | 1 | 3.74E+05 | Co-60 | 0.0121 | 4.51E+03 | 6.95E+06 | 0.0006 | 0.0088 | 8.82E+07 | 0.0001 | 0.0007 | 5.98E+06 | 0.0008 | 0.2228 |
| | | | | Ni-63 | 180 | 8.14E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0044 | |
| | | | | Sr-90 | 0.002 | 7.39E+02 | 1.90E+06 | 0.0004 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0112 | |
| | | | | Cs-134 | 0.0001 | 4.90E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 3.69E+05 | 4.86E+07 | 0.0076 | | 6.17E+08 | 0.0006 | | 1.79E+06 | 0.2064 | |
| 32 | A005 Position#2 | 2 | 3.73E+05 | Co-60 | 0.0121 | 4.50E+03 | 6.95E+06 | 0.0006 | 0.0088 | 8.82E+07 | 0.0001 | 0.0007 | 5.98E+06 | 0.0008 | 0.2222 |
| | | | | Ni-63 | 180 | 8.12E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0044 | |
| | | | | Sr-90 | 0.002 | 7.37E+02 | 1.90E+06 | 0.0004 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0112 | |
| | | | | Cs-134 | 0.0001 | 4.89E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 3.68E+05 | 4.86E+07 | 0.0076 | | 6.17E+08 | 0.0006 | | 1.79E+06 | 0.2058 | |
| 33 | A005 Position#3 | 3 | 4.20E+05 | Co-60 | 0.0121 | 5.07E+03 | 6.95E+06 | 0.0007 | 0.0099 | 8.82E+07 | 0.0001 | 0.0008 | 5.98E+06 | 0.0008 | 0.2504 |
| | | | | Ni-63 | 180 | 9.15E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0049 | |
| | | | | Sr-90 | 0.002 | 8.30E+02 | 1.90E+06 | 0.0004 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0126 | |
| | | | | Cs-134 | 0.0001 | 5.51E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.15E+05 | 4.86E+07 | 0.0085 | | 6.17E+08 | 0.0007 | | 1.79E+06 | 0.2319 | |
| 34 | A020 Position#1 | 1 | 4.25E+05 | Co-60 | 0.0121 | 5.13E+03 | 6.95E+06 | 0.0007 | 0.0100 | 8.82E+07 | 0.0001 | 0.0008 | 5.98E+06 | 0.0009 | 0.2533 |
| | | | | Ni-63 | 180 | 9.26E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0050 | |
| | | | | Sr-90 | 0.002 | 8.40E+02 | 1.90E+06 | 0.0004 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0128 | |
| | | | | Cs-134 | 0.0001 | 5.58E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.20E+05 | 4.86E+07 | 0.0086 | | 6.17E+08 | 0.0007 | | 1.79E+06 | 0.2346 | |
| 35 | A020 Position#2 | 2 | 4.96E+05 | Co-60 | 0.0121 | 5.98E+03 | 6.95E+06 | 0.0009 | 0.0117 | 8.82E+07 | 0.0001 | 0.0009 | 5.98E+06 | 0.0010 | 0.2955 |
| | | | | Ni-63 | 180 | 1.08E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0058 | |
| | | | | Sr-90 | 0.002 | 9.80E+02 | 1.90E+06 | 0.0005 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0149 | |
| | | | | Cs-134 | 0.0001 | 6.51E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.90E+05 | 4.86E+07 | 0.0101 | | 6.17E+08 | 0.0008 | | 1.79E+06 | 0.2737 | |
| 36 | A020 Position#3 | 3 | 4.93E+05 | Co-60 | 0.0121 | 5.95E+03 | 6.95E+06 | 0.0009 | 0.0116 | 8.82E+07 | 0.0001 | 0.0009 | 5.98E+06 | 0.0010 | 0.2937 |
| | | | | Ni-63 | 180 | 1.07E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0058 | |
| | | | | Sr-90 | 0.002 | 9.74E+02 | 1.90E+06 | 0.0005 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0148 | |
| | | | | Cs-134 | 0.0001 | 6.47E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.87E+05 | 4.86E+07 | 0.0100 | | 6.17E+08 | 0.0008 | | 1.79E+06 | 0.2721 | |
| 37 | A021 Position#1 | 1 | 5.53E+05 | Co-60 | 0.0121 | 6.67E+03 | 6.95E+06 | 0.0010 | 0.0130 | 8.82E+07 | 0.0001 | 0.0010 | 5.98E+06 | 0.0011 | 0.3295 |
| | | | | Ni-63 | 180 | 1.20E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0065 | |
| | | | | Sr-90 | 0.002 | 1.09E+03 | 1.90E+06 | 0.0006 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0166 | |
| | | | | Cs-134 | 0.0001 | 7.25E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | Cs-137 | 0.9878 | 5.46E+05 | 4.86E+07 | 0.0112 | | 6.17E+08 | 0.0009 | | 1.79E+06 | 0.3052 | |
| 38 | A021 Position#2 | 2 | 4.64E+05 | Co-60 | 0.0121 | 5.59E+03 | 6.95E+06 | 0.0008 | 0.0109 | 8.82E+07 | 0.0001 | 0.0009 | 5.98E+06 | 0.0009 | 0.2762 |
| | | | | Ni-63 | 180 | 1.01E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0055 | |
| | | | | Sr-90 | 0.002 | 9.16E+02 | 1.90E+06 | 0.0005 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0139 | |
| | | | | Cs-134 | 0.0001 | 6.08E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.58E+05 | 4.86E+07 | 0.0094 | | 6.17E+08 | 0.0007 | | 1.79E+06 | 0.2558 | |

## Penetration Survey Data Assessment (continued)

| No. | Sample ID | Feet into Pipe | Gamma Result ($pCi/m^2$) | ROC | Gamma Mixture/ HTD Ratio | Activity per ROC ($pCi/m^2$) | Auxiliary $OpDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $OpSOF_{PN}$ | Auxiliary Total $OpSOF_{PN}$ | Auxiliary $BcDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $BcSOF_{PN}$ | Auxiliary Total $BcSOF_{PN}$ | Turbine $OpDCGL_B$ ($pCi/m^2$) | Turbine ROC $OpSOF_B$ | Turbine Total $OpSOF_B$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 39 | A021 Position#3 | 3 | 4.66E+05 | Co-60 | 0.0121 | 5.63E+03 | 6.95E+06 | 0.0008 | 0.0110 | 8.82E+07 | 0.0001 | 0.0009 | 5.98E+06 | 0.0009 | 0.2779 |
| | | | | Ni-63 | 180 | 1.02E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0055 | |
| | | | | Sr-90 | 0.002 | 9.22E+02 | 1.90E+06 | 0.0005 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0140 | |
| | | | | Cs-134 | 0.0001 | 6.12E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.61E+05 | 4.86E+07 | 0.0095 | | 6.17E+08 | 0.0007 | | 1.79E+06 | 0.2574 | |
| 40 | A022 Position#1 | 1 | 3.68E+05 | Co-60 | 0.0121 | 4.44E+03 | 6.95E+06 | 0.0006 | 0.0087 | 8.82E+07 | 0.0001 | 0.0007 | 5.98E+06 | 0.0007 | 0.2193 |
| | | | | Ni-63 | 180 | 8.01E+05 | 5.35E+09 | 0.0001 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0043 | |
| | | | | Sr-90 | 0.002 | 7.27E+02 | 1.90E+06 | 0.0004 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0111 | |
| | | | | Cs-134 | 0.0001 | 4.83E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 3.64E+05 | 4.86E+07 | 0.0075 | | 6.17E+08 | 0.0006 | | 1.79E+06 | 0.2031 | |
| 41 | A022 Position#2 | 2 | 3.70E+05 | Co-60 | 0.0121 | 4.46E+03 | 6.95E+06 | 0.0006 | 0.0087 | 8.82E+07 | 0.0001 | 0.0007 | 5.98E+06 | 0.0007 | 0.2205 |
| | | | | Ni-63 | 180 | 8.06E+05 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0044 | |
| | | | | Sr-90 | 0.002 | 7.31E+02 | 1.90E+06 | 0.0004 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0111 | |
| | | | | Cs-134 | 0.0001 | 4.85E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 3.66E+05 | 4.86E+07 | 0.0075 | | 6.17E+08 | 0.0006 | | 1.79E+06 | 0.2042 | |
| 42 | A022 Position#3 | 3 | 5.00E+05 | Co-60 | 0.0121 | 6.03E+03 | 6.95E+06 | 0.0009 | 0.0118 | 8.82E+07 | 0.0001 | 0.0009 | 5.98E+06 | 0.0010 | 0.2979 |
| | | | | Ni-63 | 180 | 1.09E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0059 | |
| | | | | Sr-90 | 0.002 | 9.88E+02 | 1.90E+06 | 0.0005 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0150 | |
| | | | | Cs-134 | 0.0001 | 6.56E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.94E+05 | 4.86E+07 | 0.0102 | | 6.17E+08 | 0.0008 | | 1.79E+06 | 0.2759 | |
| 43 | A023 Position#1 | 1 | 5.16E+06 | Co-60 | 0.0121 | 6.23E+04 | 6.95E+06 | 0.0090 | 0.1214 | 8.82E+07 | 0.0007 | 0.0096 | 5.98E+06 | 0.0104 | 3.0764 |
| | | | | Ni-63 | 180 | 1.12E+07 | 5.35E+09 | 0.0021 | | 6.79E+10 | 0.0002 | | 1.85E+08 | 0.0608 | |
| | | | | Sr-90 | 0.002 | 1.02E+04 | 1.90E+06 | 0.0054 | | 2.41E+07 | 0.0004 | | 6.58E+04 | 0.1550 | |
| | | | | Cs-134 | 0.0001 | 6.77E+02 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0005 | |
| | | | | Cs-137 | 0.9878 | 5.10E+06 | 4.86E+07 | 0.1050 | | 6.17E+08 | 0.0083 | | 1.79E+06 | 2.8497 | |
| 44 | A023 Position#2 | 2 | 7.02E+06 | Co-60 | 0.0121 | 8.47E+04 | 6.95E+06 | 0.0122 | 0.1650 | 8.82E+07 | 0.0010 | 0.0130 | 5.98E+06 | 0.0142 | 4.1811 |
| | | | | Ni-63 | 180 | 1.53E+07 | 5.35E+09 | 0.0029 | | 6.79E+10 | 0.0002 | | 1.85E+08 | 0.0826 | |
| | | | | Sr-90 | 0.002 | 1.39E+04 | 1.90E+06 | 0.0073 | | 2.41E+07 | 0.0006 | | 6.58E+04 | 0.2107 | |
| | | | | Cs-134 | 0.0001 | 9.20E+02 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0007 | |
| | | | | Cs-137 | 0.9878 | 6.93E+06 | 4.86E+07 | 0.1426 | | 6.17E+08 | 0.0112 | | 1.79E+06 | 3.8729 | |
| 45 | A023 Position#3 | 3 | 5.40E+06 | Co-60 | 0.0121 | 6.52E+04 | 6.95E+06 | 0.0094 | 0.1270 | 8.82E+07 | 0.0007 | 0.0100 | 5.98E+06 | 0.0109 | 3.2190 |
| | | | | Ni-63 | 180 | 1.18E+07 | 5.35E+09 | 0.0022 | | 6.79E+10 | 0.0002 | | 1.85E+08 | 0.0636 | |
| | | | | Sr-90 | 0.002 | 1.07E+04 | 1.90E+06 | 0.0056 | | 2.41E+07 | 0.0004 | | 6.58E+04 | 0.1622 | |
| | | | | Cs-134 | 0.0001 | 7.09E+02 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0005 | |
| | | | | Cs-137 | 0.9878 | 5.34E+06 | 4.86E+07 | 0.1098 | | 6.17E+08 | 0.0087 | | 1.79E+06 | 2.9817 | |
| 46 | A017 Position#1 | 1 | 8.21E+05 | Co-60 | 0.0121 | 9.91E+03 | 6.95E+06 | 0.0014 | 0.0193 | 8.82E+07 | 0.0001 | 0.0015 | 5.98E+06 | 0.0017 | 0.4893 |
| | | | | Ni-63 | 180 | 1.79E+06 | 5.35E+09 | 0.0003 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0097 | |
| | | | | Sr-90 | 0.002 | 1.62E+03 | 1.90E+06 | 0.0009 | | 2.41E+07 | 0.0001 | | 6.58E+04 | 0.0247 | |
| | | | | Cs-134 | 0.0001 | 1.08E+02 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | Cs-137 | 0.9878 | 8.11E+05 | 4.86E+07 | 0.0167 | | 6.17E+08 | 0.0013 | | 1.79E+06 | 0.4533 | |

## Penetration Survey Data Assessment (continued)

| No. | Sample ID | | Feet into Pipe | Gamma Result ($pCi/m^2$) | ROC | Gamma Mixture/ HTD Ratio | Activity per ROC ($pCi/m^2$) | Auxiliary $OpDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $OpSOF_{PN}$ | Auxiliary Total $OpSOF_{PN}$ | Auxiliary $BcDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $BcSOF_{PN}$ | Auxiliary Total $BcSOF_{PN}$ | Turbine $OpDCGL_B$ ($pCi/m^2$) | Turbine ROC $OpSOF_B$ | Turbine Total $OpSOF_B$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47 | A017 | Position#2 | 2 | 8.85E+05 | Co-60 | 0.0121 | 1.07E+04 | 6.95E+06 | 0.0015 | 0.0208 | 8.82E+07 | 0.0001 | 0.0016 | 5.98E+06 | 0.0018 | 0.5272 |
| | | | | | Ni-63 | 180 | 1.93E+06 | 5.35E+09 | 0.0004 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0104 | |
| | | | | | Sr-90 | 0.002 | 1.75E+03 | 1.90E+06 | 0.0009 | | 2.41E+07 | 0.0001 | | 6.58E+04 | 0.0266 | |
| | | | | | Cs-134 | 0.0001 | 1.16E+02 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | | Cs-137 | 0.9878 | 8.74E+05 | 4.86E+07 | 0.0180 | | 6.17E+08 | 0.0014 | | 1.79E+06 | 0.4884 | |
| 48 | A017 | Position#3 | 3 | 1.07E+06 | Co-60 | 0.0121 | 1.29E+04 | 6.95E+06 | 0.0019 | 0.0251 | 8.82E+07 | 0.0001 | 0.0020 | 5.98E+06 | 0.0022 | 0.6357 |
| | | | | | Ni-63 | 180 | 2.32E+06 | 5.35E+09 | 0.0004 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0126 | |
| | | | | | Sr-90 | 0.002 | 2.11E+03 | 1.90E+06 | 0.0011 | | 2.41E+07 | 0.0001 | | 6.58E+04 | 0.0320 | |
| | | | | | Cs-134 | 0.0001 | 1.40E+02 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | | Cs-137 | 0.9878 | 1.05E+06 | 4.86E+07 | 0.0217 | | 6.17E+08 | 0.0017 | | 1.79E+06 | 0.5889 | |
| 49 | A010 | Position#1 | 1 | 6.97E+05 | Co-60 | 0.0121 | 8.41E+03 | 6.95E+06 | 0.0012 | 0.0164 | 8.82E+07 | 0.0001 | 0.0013 | 5.98E+06 | 0.0014 | 0.4153 |
| | | | | | Ni-63 | 180 | 1.52E+06 | 5.35E+09 | 0.0003 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0082 | |
| | | | | | Sr-90 | 0.002 | 1.38E+03 | 1.90E+06 | 0.0007 | | 2.41E+07 | 0.0001 | | 6.58E+04 | 0.0209 | |
| | | | | | Cs-134 | 0.0001 | 9.14E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | | Cs-137 | 0.9878 | 6.89E+05 | 4.86E+07 | 0.0142 | | 6.17E+08 | 0.0011 | | 1.79E+06 | 0.3846 | |
| 50 | A010 | Position#2 | 2 | 7.12E+05 | Co-60 | 0.0121 | 8.59E+03 | 6.95E+06 | 0.0012 | 0.0167 | 8.82E+07 | 0.0001 | 0.0013 | 5.98E+06 | 0.0014 | 0.4240 |
| | | | | | Ni-63 | 180 | 1.55E+06 | 5.35E+09 | 0.0003 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0084 | |
| | | | | | Sr-90 | 0.002 | 1.41E+03 | 1.90E+06 | 0.0007 | | 2.41E+07 | 0.0001 | | 6.58E+04 | 0.0214 | |
| | | | | | Cs-134 | 0.0001 | 9.33E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | | Cs-137 | 0.9878 | 7.03E+05 | 4.86E+07 | 0.0145 | | 6.17E+08 | 0.0011 | | 1.79E+06 | 0.3928 | |
| 51 | A010 | Position#3 | 3 | 8.35E+05 | Co-60 | 0.0121 | 1.01E+04 | 6.95E+06 | 0.0014 | 0.0196 | 8.82E+07 | 0.0001 | 0.0015 | 5.98E+06 | 0.0017 | 0.4975 |
| | | | | | Ni-63 | 180 | 1.82E+06 | 5.35E+09 | 0.0003 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0098 | |
| | | | | | Sr-90 | 0.002 | 1.65E+03 | 1.90E+06 | 0.0009 | | 2.41E+07 | 0.0001 | | 6.58E+04 | 0.0251 | |
| | | | | | Cs-134 | 0.0001 | 1.10E+02 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | | Cs-137 | 0.9878 | 8.25E+05 | 4.86E+07 | 0.0170 | | 6.17E+08 | 0.0013 | | 1.79E+06 | 0.4608 | |
| 52 | A001 | Position #1 | 3 | 3.48E+04 | Co-60 | 0.0121 | 4.20E+02 | 6.95E+06 | 0.0001 | 0.0008 | 8.82E+07 | 0.0000 | 0.0001 | 5.98E+06 | 0.0001 | 0.0208 |
| | | | | | Ni-63 | 180 | 7.59E+04 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0004 | |
| | | | | | Sr-90 | 0.002 | 6.88E+01 | 1.90E+06 | 0.0000 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0010 | |
| | | | | | Cs-134 | 0.0001 | 4.57E+00 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | | Cs-137 | 0.9878 | 3.44E+04 | 4.86E+07 | 0.0007 | | 6.17E+08 | 0.0001 | | 1.79E+06 | 0.0192 | |
| 53 | A001 | Position #2 | 2 | 3.82E+04 | Co-60 | 0.0121 | 4.61E+02 | 6.95E+06 | 0.0001 | 0.0009 | 8.82E+07 | 0.0000 | 0.0001 | 5.98E+06 | 0.0001 | 0.0228 |
| | | | | | Ni-63 | 180 | 8.33E+04 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0005 | |
| | | | | | Sr-90 | 0.002 | 7.56E+01 | 1.90E+06 | 0.0000 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0011 | |
| | | | | | Cs-134 | 0.0001 | 5.02E+00 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | | Cs-137 | 0.9878 | 3.78E+04 | 4.86E+07 | 0.0008 | | 6.17E+08 | 0.0001 | | 1.79E+06 | 0.0211 | |
| 54 | A001 | Position #3 | 1 | 3.62E+04 | Co-60 | 0.0121 | 4.37E+02 | 6.95E+06 | 0.0001 | 0.0009 | 8.82E+07 | 0.0000 | 0.0001 | 5.98E+06 | 0.0001 | 0.0216 |
| | | | | | Ni-63 | 180 | 7.89E+04 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0004 | |
| | | | | | Sr-90 | 0.002 | 7.16E+01 | 1.90E+06 | 0.0000 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0011 | |
| | | | | | Cs-134 | 0.0001 | 4.75E+00 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | | Cs-137 | 0.9878 | 3.58E+04 | 4.86E+07 | 0.0007 | | 6.17E+08 | 0.0001 | | 1.79E+06 | 0.0200 | |

## Penetration Survey Data Assessment (continued)

| No. | Sample ID | Feet into Pipe | Gamma Result ($pCi/m^2$) | ROC | Gamma Mixture/ HTD Ratio | Activity per ROC ($pCi/m^2$) | Auxiliary $OpDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $OpSOF_{PN}$ | Auxiliary Total $OpSOF_{PN}$ | Auxiliary $BcDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $BcSOF_{PN}$ | Auxiliary Total $BcSOF_{PN}$ | Turbine $OpDCGL_B$ ($pCi/m^2$) | Turbine ROC $OpSOF_B$ | Turbine Total $OpSOF_B$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 55 | A014 Position #1 | 3 | 2.24E+04 | Co-60 | 0.0121 | 2.71E+02 | 6.95E+06 | 0.0000 | 0.0005 | 8.82E+07 | 0.0000 | 0.0000 | 5.98E+06 | 0.0000 | 0.0134 |
| | | | | Ni-63 | 180 | 4.88E+04 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0003 | |
| | | | | Sr-90 | 0.002 | 4.43E+01 | 1.90E+06 | 0.0000 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0007 | |
| | | | | Cs-134 | 0.0001 | 2.94E+00 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 2.22E+04 | 4.86E+07 | 0.0005 | | 6.17E+08 | 0.0000 | | 1.79E+06 | 0.0124 | |
| 56 | A014 Position #2 | 2 | 2.92E+04 | Co-60 | 0.0121 | 3.53E+02 | 6.95E+06 | 0.0001 | 0.0007 | 8.82E+07 | 0.0000 | 0.0001 | 5.98E+06 | 0.0001 | 0.0174 |
| | | | | Ni-63 | 180 | 6.36E+04 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0003 | |
| | | | | Sr-90 | 0.002 | 5.78E+01 | 1.90E+06 | 0.0000 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0009 | |
| | | | | Cs-134 | 0.0001 | 3.83E+00 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 2.89E+04 | 4.86E+07 | 0.0006 | | 6.17E+08 | 0.0000 | | 1.79E+06 | 0.0161 | |
| 57 | A014 Position #3 | 1 | 3.36E+04 | Co-60 | 0.0121 | 4.06E+02 | 6.95E+06 | 0.0001 | 0.0008 | 8.82E+07 | 0.0000 | 0.0001 | 5.98E+06 | 0.0001 | 0.0200 |
| | | | | Ni-63 | 180 | 7.32E+04 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0004 | |
| | | | | Sr-90 | 0.002 | 6.65E+01 | 1.90E+06 | 0.0000 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0010 | |
| | | | | Cs-134 | 0.0001 | 4.41E+00 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 3.32E+04 | 4.86E+07 | 0.0007 | | 6.17E+08 | 0.0001 | | 1.79E+06 | 0.0186 | |
| 58 | A004 Position #1 | 3 | 3.14E+04 | Co-60 | 0.0121 | 3.79E+02 | 6.95E+06 | 0.0001 | 0.0007 | 8.82E+07 | 0.0000 | 0.0001 | 5.98E+06 | 0.0001 | 0.0187 |
| | | | | Ni-63 | 180 | 6.84E+04 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0004 | |
| | | | | Sr-90 | 0.002 | 6.21E+01 | 1.90E+06 | 0.0000 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0009 | |
| | | | | Cs-134 | 0.0001 | 4.12E+00 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 3.11E+04 | 4.86E+07 | 0.0006 | | 6.17E+08 | 0.0001 | | 1.79E+06 | 0.0173 | |
| 59 | A004 Position #2 | 2 | 2.80E+04 | Co-60 | 0.0121 | 3.38E+02 | 6.95E+06 | 0.0000 | 0.0007 | 8.82E+07 | 0.0000 | 0.0001 | 5.98E+06 | 0.0001 | 0.0167 |
| | | | | Ni-63 | 180 | 6.10E+04 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0003 | |
| | | | | Sr-90 | 0.002 | 5.54E+01 | 1.90E+06 | 0.0000 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0008 | |
| | | | | Cs-134 | 0.0001 | 3.68E+00 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 2.77E+04 | 4.86E+07 | 0.0006 | | 6.17E+08 | 0.0000 | | 1.79E+06 | 0.0155 | |
| 60 | A004 Position #3 | 1 | 3.58E+04 | Co-60 | 0.0121 | 4.32E+02 | 6.95E+06 | 0.0001 | 0.0008 | 8.82E+07 | 0.0000 | 0.0001 | 5.98E+06 | 0.0001 | 0.0214 |
| | | | | Ni-63 | 180 | 7.80E+04 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0004 | |
| | | | | Sr-90 | 0.002 | 7.08E+01 | 1.90E+06 | 0.0000 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0011 | |
| | | | | Cs-134 | 0.0001 | 4.70E+00 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 3.54E+04 | 4.86E+07 | 0.0007 | | 6.17E+08 | 0.0001 | | 1.79E+06 | 0.0198 | |
| 61 | A024 Position #1 | 3 | 3.72E+04 | Co-60 | 0.0121 | 4.49E+02 | 6.95E+06 | 0.0001 | 0.0009 | 8.82E+07 | 0.0000 | 0.0001 | 5.98E+06 | 0.0001 | 0.0222 |
| | | | | Ni-63 | 180 | 8.11E+04 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0004 | |
| | | | | Sr-90 | 0.002 | 7.36E+01 | 1.90E+06 | 0.0000 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0011 | |
| | | | | Cs-134 | 0.0001 | 4.88E+00 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 3.68E+04 | 4.86E+07 | 0.0008 | | 6.17E+08 | 0.0001 | | 1.79E+06 | 0.0206 | |
| 62 | A024 Position #2 | 2 | 6.31E+04 | Co-60 | 0.0121 | 7.61E+02 | 6.95E+06 | 0.0001 | 0.0015 | 8.82E+07 | 0.0000 | 0.0001 | 5.98E+06 | 0.0001 | 0.0376 |
| | | | | Ni-63 | 180 | 1.37E+05 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0007 | |
| | | | | Sr-90 | 0.002 | 1.25E+02 | 1.90E+06 | 0.0001 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0019 | |
| | | | | Cs-134 | 0.0001 | 8.27E+00 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 6.23E+04 | 4.86E+07 | 0.0013 | | 6.17E+08 | 0.0001 | | 1.79E+06 | 0.0348 | |

## Penetration Survey Data Assessment (continued)

| No. | Sample ID | Feet into Pipe | Gamma Result ($pCi/m^2$) | ROC | Gamma Mixture/ HTD Ratio | Activity per ROC ($pCi/m^2$) | Auxiliary $OpDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $OpSOF_{PN}$ | Auxiliary Total $OpSOF_{PN}$ | Auxiliary $BcDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $BcSOF_{PN}$ | Auxiliary Total $BcSOF_{PN}$ | Turbine $OpDCGL_B$ ($pCi/m^2$) | Turbine ROC $OpSOF_B$ | Turbine Total $OpSOF_B$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 63 | A024 Position #3 | 1 | 1.11E+05 | Co-60 | 0.0121 | 1.34E+03 | 6.95E+06 | 0.0002 | 0.0026 | 8.82E+07 | 0.0000 | 0.0002 | 5.98E+06 | 0.0002 | 0.0662 |
| | | | | Ni-63 | 180 | 2.42E+05 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0013 | |
| | | | | Sr-90 | 0.002 | 2.20E+02 | 1.90E+06 | 0.0001 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0033 | |
| | | | | Cs-134 | 0.0001 | 1.46E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 1.10E+05 | 4.86E+07 | 0.0023 | | 6.17E+08 | 0.0002 | | 1.79E+06 | 0.0613 | |
| 64 | A025 Position #1 | 3 | 2.74E+04 | Co-60 | 0.0121 | 3.31E+02 | 6.95E+06 | 0.0000 | 0.0006 | 8.82E+07 | 0.0000 | 0.0001 | 5.98E+06 | 0.0001 | 0.0163 |
| | | | | Ni-63 | 180 | 5.97E+04 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0003 | |
| | | | | Sr-90 | 0.002 | 5.42E+01 | 1.90E+06 | 0.0000 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0008 | |
| | | | | Cs-134 | 0.0001 | 3.60E+00 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 2.71E+04 | 4.86E+07 | 0.0006 | | 6.17E+08 | 0.0000 | | 1.79E+06 | 0.0151 | |
| 65 | A025 Position #2 | 2 | 2.60E+04 | Co-60 | 0.0121 | 3.14E+02 | 6.95E+06 | 0.0000 | 0.0006 | 8.82E+07 | 0.0000 | 0.0000 | 5.98E+06 | 0.0001 | 0.0155 |
| | | | | Ni-63 | 180 | 5.67E+04 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0003 | |
| | | | | Sr-90 | 0.002 | 5.14E+01 | 1.90E+06 | 0.0000 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0008 | |
| | | | | Cs-134 | 0.0001 | 3.41E+00 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 2.57E+04 | 4.86E+07 | 0.0005 | | 6.17E+08 | 0.0000 | | 1.79E+06 | 0.0144 | |
| 66 | A025 Position #3 | 1 | 2.94E+04 | Co-60 | 0.0121 | 3.55E+02 | 6.95E+06 | 0.0001 | 0.0007 | 8.82E+07 | 0.0000 | 0.0001 | 5.98E+06 | 0.0001 | 0.0175 |
| | | | | Ni-63 | 180 | 6.41E+04 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0003 | |
| | | | | Sr-90 | 0.002 | 5.81E+01 | 1.90E+06 | 0.0000 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0009 | |
| | | | | Cs-134 | 0.0001 | 3.86E+00 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 2.91E+04 | 4.86E+07 | 0.0006 | | 6.17E+08 | 0.0000 | | 1.79E+06 | 0.0162 | |

# **ATTACHMENT 3**
SIGN TEST

## Sign Test Auxiliary Building Basement Penetrations

| | | | | | |
|---|---|---|---|---|---|
| Survey Area | 05120 | | | Description | Auxiliary Building Basement |
| Survey Unit | S1-05120AF | | | Description | Penetrations |
| Classification | 1 | Type I Error | 0.05 | # of Measurements | 66 |

| # | SOF (Ws) | 1-Ws | Sign |
|---|---|---|---|
| 1 | 0.0094 | 0.99 | +1 |
| 2 | 0.0097 | 0.99 | +1 |
| 3 | 0.0100 | 0.99 | +1 |
| 4 | 0.0123 | 0.99 | +1 |
| 5 | 0.0112 | 0.99 | +1 |
| 6 | 0.0111 | 0.99 | +1 |
| 7 | 0.0103 | 0.99 | +1 |
| 8 | 0.0101 | 0.99 | +1 |
| 9 | 0.0103 | 0.99 | +1 |
| 10 | 0.0102 | 0.99 | +1 |
| 11 | 0.0096 | 0.99 | +1 |
| 12 | 0.0121 | 0.99 | +1 |
| 13 | 0.0133 | 0.99 | +1 |
| 14 | 0.0144 | 0.99 | +1 |
| 15 | 0.0335 | 0.97 | +1 |
| 16 | 0.0155 | 0.98 | +1 |
| 17 | 0.0162 | 0.98 | +1 |
| 18 | 0.0166 | 0.98 | +1 |
| 19 | 0.2427 | 0.76 | +1 |
| 20 | 0.2794 | 0.72 | +1 |
| 21 | 0.2352 | 0.76 | +1 |
| 22 | 0.0106 | 0.99 | +1 |
| 23 | 0.0107 | 0.99 | +1 |
| 24 | 0.0137 | 0.99 | +1 |
| 25 | 0.0093 | 0.99 | +1 |
| 26 | 0.0092 | 0.99 | +1 |
| 27 | 0.0101 | 0.99 | +1 |
| 28 | 0.0129 | 0.99 | +1 |
| 29 | 0.0128 | 0.99 | +1 |
| 30 | 0.0147 | 0.99 | +1 |
| 31 | 0.0088 | 0.99 | +1 |

| # | SOF (Ws) | 1-Ws | Sign |
|---|---|---|---|
| 34 | 0.0100 | 0.99 | +1 |
| 35 | 0.0117 | 0.99 | +1 |
| 36 | 0.0116 | 0.99 | +1 |
| 37 | 0.0130 | 0.99 | +1 |
| 38 | 0.0109 | 0.99 | +1 |
| 39 | 0.0110 | 0.99 | +1 |
| 40 | 0.0087 | 0.99 | +1 |
| 41 | 0.0087 | 0.99 | +1 |
| 42 | 0.0118 | 0.99 | +1 |
| 43 | 0.1214 | 0.88 | +1 |
| 44 | 0.1650 | 0.83 | +1 |
| 45 | 0.1270 | 0.87 | +1 |
| 46 | 0.0193 | 0.98 | +1 |
| 47 | 0.0208 | 0.98 | +1 |
| 48 | 0.0251 | 0.97 | +1 |
| 49 | 0.0164 | 0.98 | +1 |
| 50 | 0.0167 | 0.98 | +1 |
| 51 | 0.0196 | 0.98 | +1 |
| 52 | 0.0008 | 1.00 | +1 |
| 53 | 0.0009 | 1.00 | +1 |
| 54 | 0.0009 | 1.00 | +1 |
| 55 | 0.0005 | 1.00 | +1 |
| 56 | 0.0007 | 1.00 | +1 |
| 57 | 0.0008 | 1.00 | +1 |
| 58 | 0.0007 | 1.00 | +1 |
| 59 | 0.0007 | 1.00 | +1 |
| 60 | 0.0008 | 1.00 | +1 |
| 61 | 0.0009 | 1.00 | +1 |
| 62 | 0.0015 | 1.00 | +1 |
| 63 | 0.0026 | 0.99 | +1 |
| 64 | 0.0006 | 1.00 | +1 |

## Sign Test (continued) Auxiliary Building Basement Penetrations

| # | SOF (Ws) | 1-Ws | Sign |
|---|---|---|---|
| 32 | 0.0088 | 0.99 | +1 |
| 33 | 0.0099 | 0.99 | +1 |

| # | SOF (Ws) | 1-Ws | Sign |
|---|---|---|---|
| 65 | 0.0006 | 1.00 | +1 |
| 66 | 0.0007 | 1.00 | +1 |

Number of Positive Differences (S+) = 66

Critical Value = 40

Survey Unit Meets the Acceptance Criteria

# ATTACHMENT 4
QC DATA

## Penetration QC Survey Data

| No. | Sample ID | Feet into Pipe | Gamma Result ($pCi/m^2$) | ROC | Gamma Mixture/ HTD Ratio | Activity per ROC ($pCi/m^2$) | Auxiliary $OpDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $OpSOF_{PN}$ | Auxiliary Total $OpSOF_{PN}$ | Auxiliary $BcDCGL_{PN}$ ($pCi/m^2$) | Auxiliary ROC $BcSOF_{PN}$ | Auxiliary Total $BcSOF_{PN}$ | Turbine $OpDCGL_B$ ($pCi/m^2$) | Turbine ROC $OpSOF_B$ | Turbine Total $OpSOF_B$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 54 QC | A014 Position #3 | 1 | 2.90E+04 | Co-60 | 0.0121 | 3.50E+02 | 6.95E+06 | 0.0001 | 0.0007 | 8.82E+07 | 0.0000 | 0.0001 | 5.98E+06 | 0.0001 | 0.0173 |
| | | | | Ni-63 | 180 | 6.32E+04 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0003 | |
| | | | | Sr-90 | 0.002 | 5.74E+01 | 1.90E+06 | 0.0000 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0009 | |
| | | | | Cs-134 | 0.0001 | 3.81E+00 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 2.87E+04 | 4.86E+07 | 0.0006 | | 6.17E+08 | 0.0000 | | 1.79E+06 | 0.0160 | |
| 66 QC | A025 Position #3 | 1 | 2.40E+04 | Co-60 | 0.0121 | 2.90E+02 | 6.95E+06 | 0.0000 | 0.0006 | 8.82E+07 | 0.0000 | 0.0000 | 5.98E+06 | 0.0000 | 0.0143 |
| | | | | Ni-63 | 180 | 5.23E+04 | 5.35E+09 | 0.0000 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0003 | |
| | | | | Sr-90 | 0.002 | 4.75E+01 | 1.90E+06 | 0.0000 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0007 | |
| | | | | Cs-134 | 0.0001 | 3.15E+00 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 2.37E+04 | 4.86E+07 | 0.0005 | | 6.17E+08 | 0.0000 | | 1.79E+06 | 0.0133 | |
| 38 QC | A021 Position #2 | 2 | 4.66E+05 | Co-60 | 0.0121 | 5.62E+03 | 6.95E+06 | 0.0008 | 0.0109 | 8.82E+07 | 0.0001 | 0.0009 | 5.98E+06 | 0.0009 | 0.2773 |
| | | | | Ni-63 | 180 | 1.01E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0055 | |
| | | | | Sr-90 | 0.002 | 9.20E+02 | 1.90E+06 | 0.0005 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0140 | |
| | | | | Cs-134 | 0.0001 | 6.11E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.60E+05 | 4.86E+07 | 0.0095 | | 6.17E+08 | 0.0007 | | 1.79E+06 | 0.2569 | |
| 10 QC | A002 Position #1 | 1 | 4.81E+05 | Co-60 | 0.0121 | 5.81E+03 | 6.95E+06 | 0.0008 | 0.0113 | 8.82E+07 | 0.0001 | 0.0009 | 5.98E+06 | 0.0010 | 0.2867 |
| | | | | Ni-63 | 180 | 1.05E+06 | 5.35E+09 | 0.0002 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0057 | |
| | | | | Sr-90 | 0.002 | 9.51E+02 | 1.90E+06 | 0.0005 | | 2.41E+07 | 0.0000 | | 6.58E+04 | 0.0144 | |
| | | | | Cs-134 | 0.0001 | 6.31E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0000 | |
| | | | | Cs-137 | 0.9878 | 4.75E+05 | 4.86E+07 | 0.0098 | | 6.17E+08 | 0.0008 | | 1.79E+06 | 0.2656 | |
| 50 QC | A010 Position #2 | 2 | 7.21E+05 | Co-60 | 0.0121 | 8.71E+03 | 6.95E+06 | 0.0013 | 0.0170 | 8.82E+07 | 0.0001 | 0.0013 | 5.98E+06 | 0.0015 | 0.4298 |
| | | | | Ni-63 | 180 | 1.57E+06 | 5.35E+09 | 0.0003 | | 6.79E+10 | 0.0000 | | 1.85E+08 | 0.0085 | |
| | | | | Sr-90 | 0.002 | 1.43E+03 | 1.90E+06 | 0.0008 | | 2.41E+07 | 0.0001 | | 6.58E+04 | 0.0217 | |
| | | | | Cs-134 | 0.0001 | 9.46E+01 | 2.58E+07 | 0.0000 | | 3.28E+08 | 0.0000 | | 1.35E+06 | 0.0001 | |
| | | | | Cs-137 | 0.9878 | 7.13E+05 | 4.86E+07 | 0.0147 | | 6.17E+08 | 0.0012 | | 1.79E+06 | 0.3982 | |

# ATTACHMENT 5
# QC MEASUREMENT ASSESSMENTS

# Replicate Measurement Assessment

Survey Unit # 05120 Survey Unit Name Auxiliary Building Penetrationst

Sample Plan # S1-05120A-F

Sample Description: Comparison of replicate gross-gamma measurements for QC from A002, position 1, A010, position 2, A014, position 3, A021, position 2 and A025 position 3.

| STANDARD | | | | DUPLICATE | | |
|---|---|---|---|---|---|---|
| ID | ACTIVITY (pCi/m2) | +20% (pCi/m2) | -20% (pCi/m2) | ID | ACTIVITY (pCi/m2) | ACCEPTABLE (Y/N) |
| A014 Position 3 | 3.36E+04 | 4.04E+04 | 2.69E+04 | A014 Position 3 QC | 2.90E+04 | Y |
| A025 Position 3 | 2.94E+04 | 3.53E+04 | 2.35E+04 | A025 Position 3 QC | 2.40E+04 | Y |
| A021 Position 2 | 4.64E+05 | 5.56E+05 | 3.71E+05 | A021 Position 2 QC | 4.66E+05 | Y |
| A002 Position 1 | 4.32E+05 | 5.18E+05 | 3.46E+05 | A002 Position 1 QC | 4.81E+05 | Y |
| A010 Position 2 | 7.12E+05 | 8.54E+05 | 5.69E+05 | A010 Position 2 QC | 7.21E+05 | Y |

Comments/Corrective Actions: There was acceptable agreement between the standard measurement and the duplicate measurement. No further action is necessary.

The acceptance criteria for replicate static measurements and scan surveys is that the same conclusion is reached for each measurement. That is defined as ± 20% of the standard

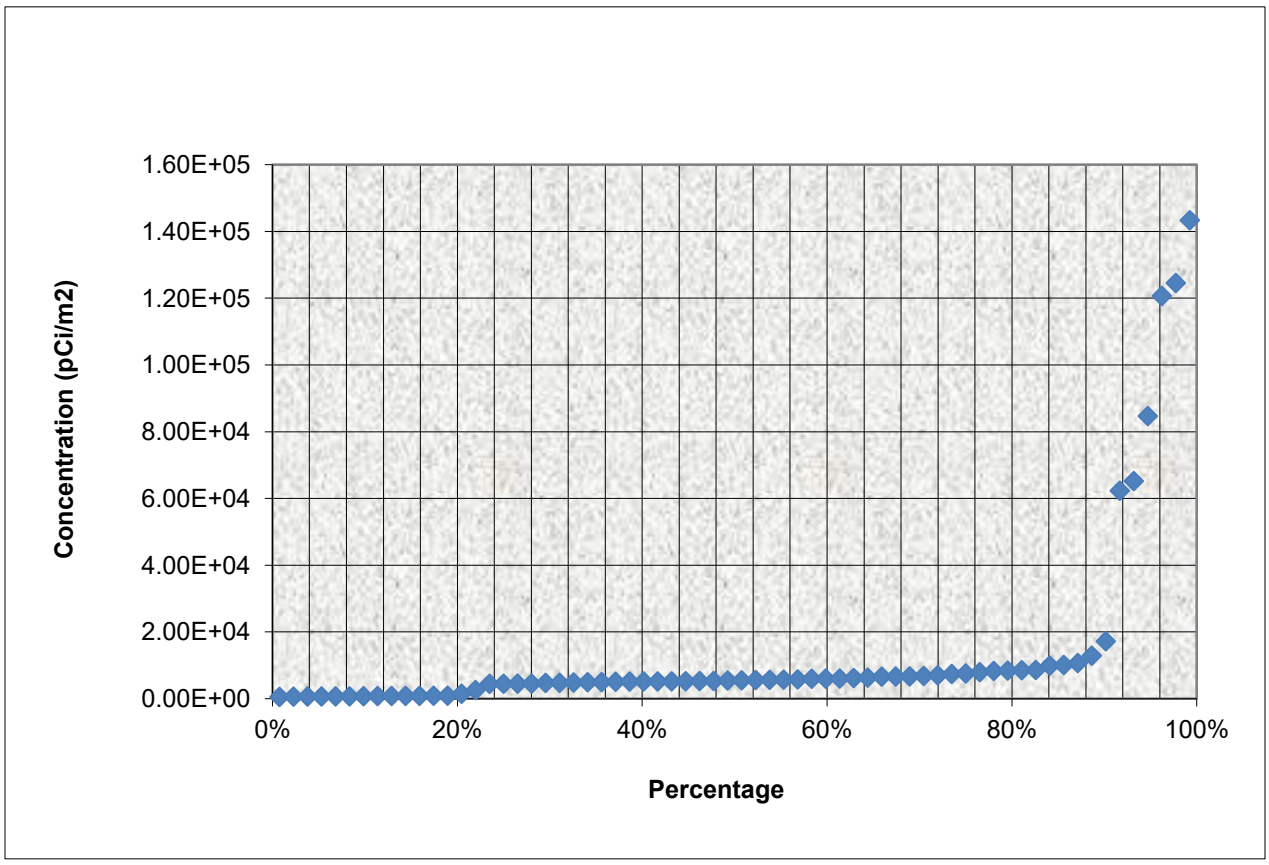
# ATTACHMENT 6
# GRAPHICAL PRESENTATIONS

**Quantile Plot for Co-60**

Survey Unit: S1-05120A-F

Description: Aux Building Penetrations

Mean: 1.38E+04pCi/$m^2$

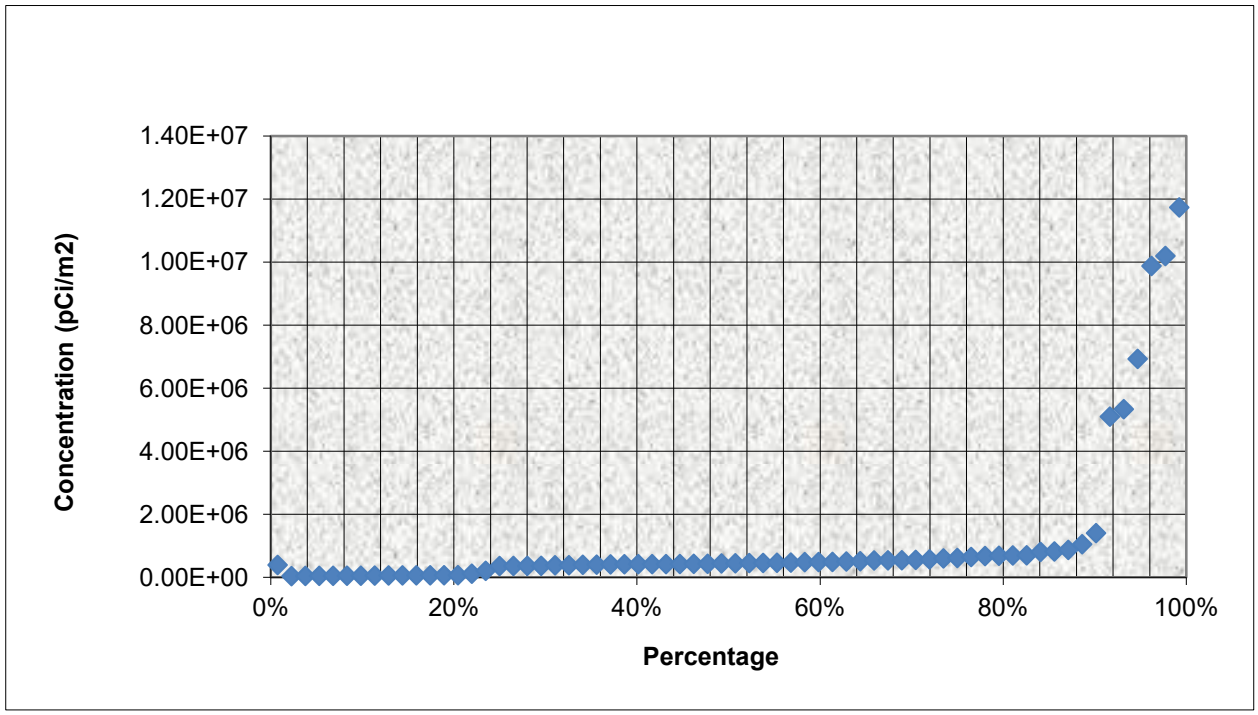


**Quantile Plot for Cs-137**

Survey Unit: S1-05120A-F

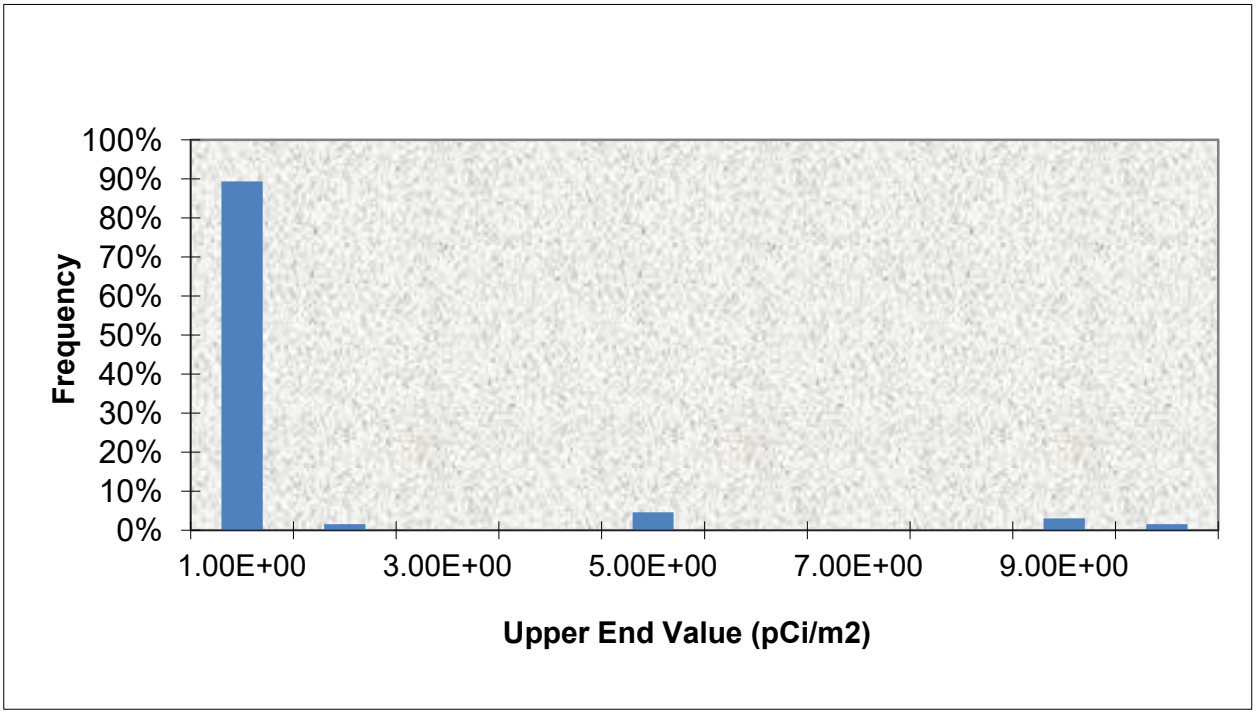
Description: Aux Building Penetrations

Mean: 1.13E+06 pCi/$m^2$



## Histogram for Co-60

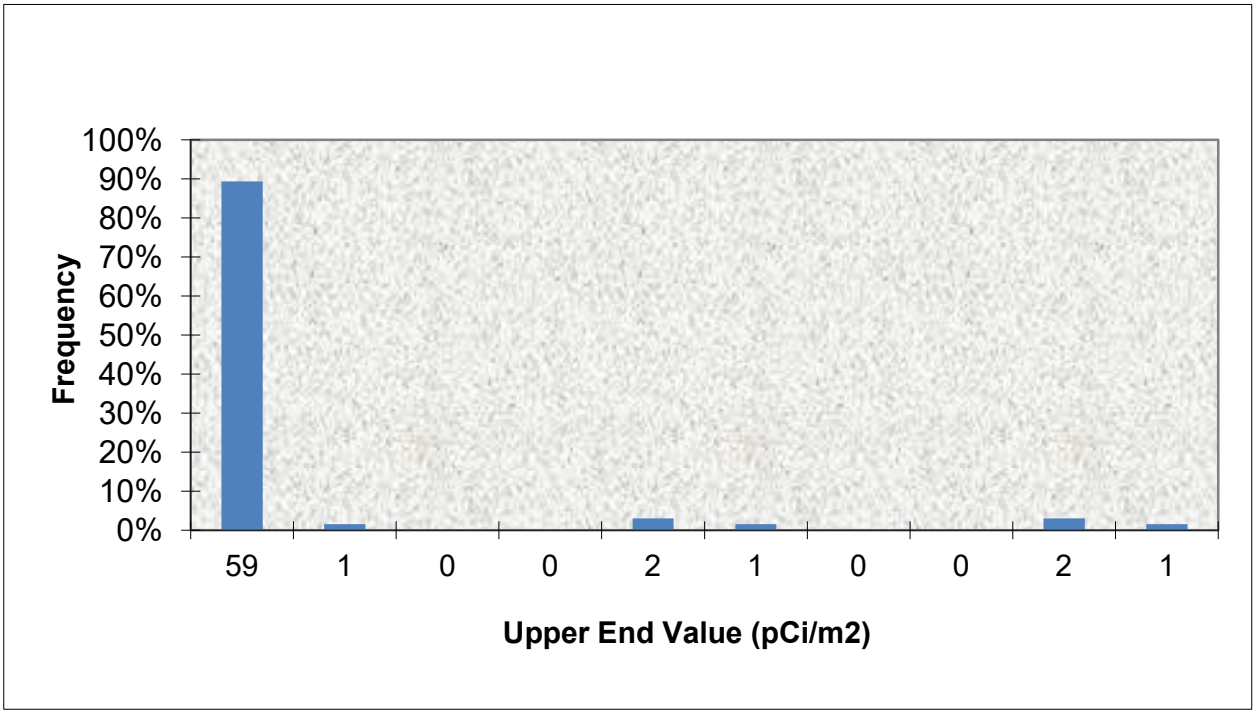
Survey Unit: S1-05120A-F
Description: Aux Building Penetrations
Mean: 1.38E+04 pCi/$m^2$
Median: 5.47E+03pCi/$m^2$
ST Dev.: 2.92E+04
Skew: 3.37E+00




| Upper Value | Observation Frequency | Observation % |
|---|---|---|
| 1.49E+04 | 59 | 89% |
| 2.92E+04 | 1 | 2% |
| 4.35E+04 | 0 | 0% |
| 5.79E+04 | 0 | 0% |
| 7.22E+04 | 3 | 5% |
| 8.65E+04 | 0 | 0% |
| 1.01E+05 | 0 | 0% |
| 1.15E+05 | 0 | 0% |
| 1.30E+05 | 2 | 3% |
| 1.44E+05 | 1 | 2% |
| TOTAL | 66 | 100% |

**Histogram for Cs-137**

Survey Unit: S1-05120A-F
Description: Aux Building Penetrations
Mean: 1.13E+05 pCi/$m^2$
Median: 4.48E+05pCi/$m^2$
ST Dev.: 2.39E+06
Skew: 3.37E+00




| Upper Value | Observation Frequency | Observation % |
|---|---|---|
| 1.22E+06 | 59 | 89% |
| 2.39E+06 | 1 | 2% |
| 3.56E+06 | 0 | 0% |
| 4.74E+06 | 0 | 0% |
| 5.91E+06 | 2 | 3% |
| 7.08E+06 | 1 | 2% |
| 8.26E+06 | 0 | 0% |
| 9.43E+06 | 0 | 0% |
| 1.06E+07 | 2 | 3% |
| 1.18E+07 | 1 | 2% |
| TOTAL | 66 | 100% |