NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

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January 11, 1983

Docket No. 50-245
A02874

Director of Nuclear Reactor Regulation
Attn: Mr. Dennis M. Crutchfield, Chief
Operating Reactors Branch #5
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Reference: (1) D. M. Crutchfield letter to W. G. Counsil, dated November 5, 1982.

(2) Millstone Nuclear Power Station, Unit No. 3, Environmental Report Operating Licensing Stage (Docket No. 50-423).

Gentlemen:

Millstone Nuclear Power Station, Unit No. 1
Review of Final Environmental Statement

In preparation for the conversion of the provisional operating license for the Millstone Nuclear Power Station, Unit No. 1, to a full term operating license, the Staff requested in Reference (1) that a review of the existing June 1973 Final Environmental Statement (FES) be performed to determine what updating of the information contained in the FES is necessary. Our detailed review of the FES is contained in Attachment 1. No significant changes to the conclusions reached in the original FES were found to be necessary.

To facilitate Staff review, a copy of Reference (2) has been separately transmitted to the Millstone Unit No. 1 Project Manager. Reference (2), transmitted on October 29, 1982, is currently undergoing mini-review and approval for docketing is expected shortly.

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Should you have any questions on this matter, please contact us.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

W. G. Counsil
W. G. Counsil
Senior Vice President

J. P. Cagnetta
By: J. P. Cagnetta
Vice President Nuclear and
Environmental Engineering

Docket No. 50-245

Attachment No. 1
Millstone Nuclear Power Station Unit No. 1
Final Environmental Statement Review

JANUARY, 1983

Abbreviations Used in Attachment 1

MP1	Millstone Point Unit No. 1
MP2	Millstone Point Unit No. 2
MP3	Millstone Point Unit No. 3
DEP	Department of Environmental Protection
ERCPS	Environmental Report, Construction Permit Stage
EROLS	Environmental Report, Operating License Stage
FSAR	Final Safety Analysis Report
PUC	Public Utilities Commission

Section	Page	Comment
-	i	Delete Hartford Electric Light Company (merged with Connecticut Light and Power Company). Revise power ratings and dates using data from section 1.1 comments below.
1.1	1-1	Revise section to note higher net electrical output of MP1, commercial operation of MP2, and construction of MP3. MP1 operates at 660 MWe (2011 Mwt). MP2 commenced commericial operation on December 26, 1975, and operates at 870 MWe (2700 Mwt). MP3 is presently under construction and was approximately 60% complete as of December, 1982. MP3 is a pressurized water reactor and when complete (commericial operation anticipated in May, 1986) will generate 1150 MWe (3411 Mwt).
1.2	1-2	Environmental Protection Agency - discharge permit issued on December 30, 1974, and renewed on July 2, 1980.
1.2	1-4	Army Corps of Engineers, Item 2 - permit issued January 4, 1974.
1.2	1-4	Environmental Protection Agency - see comment for section 1.2, page 1-2, above.
1.2	1-5	Connecticut PUC, Item 2 - approval granted in March, 1974.
1.2	1-5	Connecticut DEP, Item 1 - permit approved June 29, 1973, and reapproved on March 8, 1982.
1.2	-	Insert new section for MP3 Applications and Approvals: see Table 12.0-1 of Millstone Unit 3 EROLS.
References	1-6,1-7	Add MP3's Construction Permit (CPPR-113, AEC, August 9, 1974), Environmental Report Construction Permit Stage (October 31, 1972), and Environmental Report Operating License Stage (October 29, 1982) to list of references.
2.2	2-1,2-5	See Tables and Figures in MP3 EROLS for current population data. For your convenience, Appendix A to this attachment contains population distribution tables (in

Section	Page	Comment
		miles) for 1980, 1985, and 1990 based on the 1980 census. The slower rate of population increase (than previously predicted) results in an environmental impact less than previously postulated (also see Section 5.0).
2.2	2-5	U. S. Navy Underwater Systems Center laboratory vacated the site during 1976.
2.6	2-9 to 2-14	Update Section 2.6 (including Tables 2.3, 2.4, and Figure 2.5) to reflect current meteorological information. See Millstone Unit 3 EROLS, Section 2.3.
2.7.1	2-15	The bay scallop population in the Niantic River has increased to a sustainable level of approximately 15,000 bushels/year.
2.7.1	2-15	Since 1980 Northeast Utilities Service Co. (NUSCO) personnel have conducted all environmental studies. Many of these personnel were retained from previous contracts. Dr. Marshall is still an ecological advisor for NUSCO programs. Dr. William Pearcy, Oregon State University, school of Oceanography; Dr. Saul Saila, University of Rhode Island, Graduate School of Oceanography; and Dr. John Tietjen, City College of the City University of New York are also ecological advisors (Millstone Ecological Advisory Committee).
2.7.1.1	2-15, 2-16	See MP3 EROLS Section 2.2.2.2 for revised phytoplankton data.
2.7.1.2	2-16	From 1976 to 1982, relative to daylight abundances, more amphipods than copepods were collected at night. *Pseudodiaptomas coronatus*, though most abundant in samples taken at night, is rarely if ever more abundant than *Acartia tonsa* at night. Also, see MP3 EROLS Section 2.2.2.3 for additional zooplankton data.
2.7.1.3	2-17	MP3 EROLS Sections 2.2.2.3 (Ichthyoplankton) and 2.2.2.5 (Finfish) provide current data on fishes.

Section	Page	Comment
2.7.1.4	2-17	See MP3 EROLS Section 2.2.2.4.2 for revised intertidal data.
2.7.1.5	2-17, 2-18	See MP3 EROLS Sections 2.2.2.4.3 (Benthic Infauna) and 2.2.2.4.4 (American Lobster) for more detail regarding Benthos.
2.7.1.6	2-18	In 1975 Teredo bartschi, a southern species of shipworm, was first collected in the undiluted effluent waters and has remained there to date. The distribution of this species has not expanded since 1975 and is not expected to in 1986 with MP3 in operation. See MP3 EROLS 2.2.2.4.1 for more information regarding fouling and woodboring organisms.
2.7.2	2-19	The terrestrial environment at the Millstone site was quantitatively surveyed from 1973 - 1974 by Hazelton Environmental Sciences Corporation (formerly Industrial Bio-test Laboratories, Inc.); this is the most extensive survey to date. In 1977, Stone and Webster ecologists reevaluated the status of the terrestrial ecology on site. See MP3 EROLS section 2.2.1.2 for more information.
2.7.2.2 & 2.7.2.3	2-19 to 2-24	Construction of MP3 on site has increased the amount of land being utilized and decreased some recreational area and terrestrial habitats, but aside from habitat reduction the wildlife appears to be accommodating the changes, esp. in the Wildlife Management Area. Five new species of migratory birds plus a number of duck and passerine species were spotted in the Wildlife Management Area in 1977. Osprey nestings have continued to be successful with 18% of the States fledglings being reared on site during 1971 -1981. MP3 EROLS Sections 2.2.1.1, 2.2.1.2, and 2.2.1.3 provide more detailed data in this area.
2.7.2.3.8	2-24	No endangered or threatened species have been identified on-site.
3.1	3-1	Revise to reflect changes to station appearance due to MP3. See Section 3.1 of MP3 ERCPS (Reference (1)).

Section	Page	Comment
3.2	3-1	A description of MP3's steam and electric system is provided in Section 3.2 of the MP-3 EROLS.
3.3	3-1, 3-7	A description of MP3's heat dissipation system is provided in Section 3.4 of the MP3 EROLS.
3.4	-	Expand section to include solid, liquid, and gaseous radwaste systems for MP3. See MP3 EROLS Section 3.5 for system details.
3.4.1	3-7	Radioactive releases to the environment as a result of MP1 operation are described in Reference (2).
3.4.1 & 3.4.1.1	3-7, 3-13, 3-18	The augmented liquid radwaste system has been installed and is in operation at MP1. The system is described in Section 9.3.3 of the MP1 FSAR (Reference(3)). Section 9.3.3 is included as Appendix B to this report.
3.4.1.2	3-17	The augmented gaseous radioactive waste system has been installed and is in operation at MP1. The system is described in Section 9.2.3 of the MP1 FSAR (Reference (3)). Section 9.2.3 is included as Appendix C to this report.
3.4.1.3	3-19	The MP1 solid radwaste system has been modified and is described in Section 9.4.3 of the MP1 FSAR (Reference (3)). Section 9.4.3 is included as Appendix D to this report.
3.4.2	3-20	Radioactive releases to the environment as a result of MP2 operation are described in Appendices 11A, B, C, D, and E in the MP2 FSAR (Reference (4)).
3.4.2.1	3-20, 3-22	The aerated liquid waste evaporator is no longer in use at MP2.
3.5	3-30	A description of MP3's chemical and biocide systems is provided in Section 3.6 of the MP3 EROLS.
3.5.1	3-30 to 3-34	Actual quantity of chlorine used at the station is much less than indicated (see Table 3.8). Note b (chlorination times) must be revised. Section 3.1.1.1 of the annual Environmental Operating Report (Reference (5)) provides corrections to both of the

Section	Page	Comment
		above-noted discrepancies. Table 3.8 does not account for chlorine decay (which occurs upon introduction into the circulating water system) which results in chlorine concentrations near or below detectable limits when discharged. Also, a gaseous chlorine solution is used instead of sodium hypochlorite.
3.5.1	3-33	Correct figures for sodium sulfate and boron releases are provided in Part A of the annual Environmental Operating Report (Reference (5)).
3.5.3	3-34	Phosphates are not used at MP2 and should be eliminated from Table 3-8, Figure 3-9, and Section 3.5.3.
3.6	3-36	Table 3.9, note (1), should be 22,000 gallon/year instead of 22,000 gallon/hour.
3.7	3-37 to 3-39	Additional transmission facilities which are being built for MP3 are described in Section 3.9 of the MP3 EROLS.
4.1.1	4-1	Total acreage has remained the same but proportions being used for parking, temporary storage, construction, permanent building, and fill areas have changed. MP1 and MP2 areas are approximately the same but a new approximate MP3 breakdown follows:

construction site - 50 acres
temporary parking - 16 acres
temporary storage - 10 acres
batch plant (cement) - 8 acres
fill - 22 acres in transmission line right-of-way, 8 acres elsewhere
switchyard - 8 acres
new support buildings - 10 acres & parking
recreational areas - 27 acres

In all nearly 50% of the 500 acre site has been altered for station activities as compared to 25% in 1973. During 1973 land utilization south of the plant sites and the Transmission Corridor across the property

Section	Page	Comment
		may not have been accounted for in the 119 acres listed. Fifty acres remain undisturbed as the Wildlife Management Area and 34 acres previously designated for public bathing, fishing, picnicking and parking have been reclassified for nonpublic access for safety and security reasons.
4.1.2	4-2	The Connecticut DEP ruled on June 29, 1973 that an overhead crossing (one-345 kV and one-115 kV) was approved at the Haddam -East Haddam location, to be removed and replaced underground within five years. Ensuing court actions and regulatory body hearings were culminated in an agreement that the crossing would remain overhead without future undergrounding restriction. This agreement was affirmed by the DEP on March 8, 1982.
		The towers to be installed for the Haddam-East Haddam crossing were to be about 30' taller than the towers at that time existing at this location. Subsequent changes resulted in the towers being slightly shorter than the old three-circuit towers.
		Section 4.2.2 of MP3 ERCPS (Reference (1)) provides additional data for MP3 transmission lines.
4.2.2	4-3	The cofferdam for Unit 2 was removed with no permanent environmental impacts.
		A cofferdam for Unit 3 is presently in place.
4.2.3	4-3	The Navy Underwater Sound Lab vacated their facility in the quarry in 1976.
		The oyster program started by Long Island Oyster Farms was never completed, but in 1976 a four year aquaculture feasibility study was begun by Marine Research, Inc.
4.3	4-4, 4-5	The MP2 cofferdam did not affect impingement on MP1.

Section	Page	Comment
		The quarry fish barrier has prevented populations of large fish from entering the quarry. The populations that inhabit the quarry are suspected of entering the basin when both Units are not pumping or during periods when the gratings are removed for cleaning.
		See MP3 ERCPS Section 4.3.1 (Reference (1)) for MP3 circulating water system construction effects.
4.4	4-5	MP1 and MP2 still only occupy 22 acres of land, however there is another 30 acres of land South of MP1 which is utilized for parking, employee recreation, the meterological tower, the Northeast Utilities Environmental facility and dock, and the discharge barrier for the quarry. Only two to three acres of this are undisturbed.
		Since 1979, two additional osprey nests have been located on the site: 1) in the Wildlife Management Area east of the Power Plant and 2) on Fox Island south of the Power Plant. Site construction has had little if any effect on osprey reproduction and, in the last 2 years, 2 nesting pairs, rather than 1 (as in the previous 11 years), have produced 9 fledglings.
4.5	4-5, 4-6	Approximately 310 employees are required for station operation. Section 4.4 of MP3 ERCPS (Reference (1)) provides additional data on community effects.
5.1.1	5-1	Fogging and icing on land areas have not been a problem.
		The U. S. Navy Underwater System Center laboratory vacated the site in 1976.
5.2.2	5-3	Intermittent chlorination is used most of the time: continuous chlorination is used when sea water temperature is 45-55^{o}F. Chlorine levels at the discharge barrier are maintained within the 0.1 mg/liter limit.

Section	Page	Comment
		Further studies of the shape and extent of the Millstone Point thermal plume during two unit operations were conducted by Environmental Devices Corporation (ENDECO) (1977) and Texas Instruments (TI) (1977). At each tidal phase, ENDECO mapped the plume at pre-selected transects and TI photographed the plume at several elevations using thermal infrared imagery. These data were then used by Stone and Webster Corporation (1978) to determine the three-dimensional temperature characteristics of the thermal plume and verify existing computer predictions of thermal patterns during the operation of Units 1 and 2.
		In addition, Massachusetts Institute of Technology (MIT) was contracted in 1978 to use the above-mentioned data to prepare state-of-the-art computer predictions of the Millstone plume after Unit 3 becomes operational. These three-unit predictions are presented in Reference (6). The results of this study led Northeast Utilities to request, in June 1979, a change in the stations National Pollutant Discharge Elimination System permit and requesting that the limitation on the 4° isotherm ("mixing zone") be extended from 4000' to 8000'. This was approved in July 1980.
		The combined discharge at the quarry cut has a delta T of 25°F with both units at full load. MP3's delta T at full level will be 17°F which will lower the combined delta T to approximately 21°F.
5.3.1	5-9, 5-11	Species alive after impingement are released to Jordan Cove.
		No large numbers of menhaden have been reported since the 1971 intake screen clogging incident.
		The hypothesis that the MP2 cofferdam increased impingement at MP1 cannot be substantiated from the present data base.

Section	Page	Comment
		Special studies have been conducted to evaluate fish deterrent devices in front of the intakes at Millstone. These include: a surface fish barrier, a benthic fish barrier, an electric screen guidance system, acoustic stimuli, light stimuli and sluiceway studies. A sluiceway is now planned for Units 1 and 3, but was found not cost effective at Unit 2. These sluiceways should reduce impingement mortalities dramatically (ranging from 13-96% depending on the species and water temperatures).
5.3.2	5-11	To concentrate on determining the entrainment impacts for fish eggs and larvae, phytoplankton research has been reduced below 1973 levels.
5.3.2	5-11	Based on a Millstone study, a conservative estimate of copepod mortality caused from passage through the power plants is 70% rather than 20%.
		Since 1973, cunner, tautog, and anchovy eggs have generally accounted for over 90% of all the fish eggs collected within a year and larvae of these three taxa plus those of sand lance, winter flounder, and sculpins have accounted for over 90% of all the fish larvae collected. Consistent with the 1973 data, ichthyoplankton is lowest in abundance during fall-winter periods and highest in abundance in the spring-summer months.
		Losses to winter flounder populations in the Millstone area were forecasted using a deterministic model. It was calculated that not more than [illegible]% of the Niantic Bay population in 35 years of 3 unit operation would be lost due to entrainment of larvae. Further, it was estimated that this population would recover to within 1% of its equilibrium density within 65 years of the decommissioning of the power plants. This is considered a minor impact.
5.3.4	5-14, 5-15	Thermal plume studies have been done for both 1 and 2 unit operation and predictions

Section	Page	Comment
		have been made for 3 unit operation (see 5.2.2 this document). The plume moves back and forth in the Two Tree Island Channel with the tidal currents and its size has increased with the addition of each unit.
		The Long Island Oyster Farm program was terminated, but an aquaculture feasibility study was conducted by Marine Research, Inc. from 1976-1980 to determine if the effluent water could be used for raising lobsters, oysters, or bay scallops. See MP3 EROLS Appendix C-2 for a summary of findings.
		The fish barrier was modified and incorporated into the Environmental Technical Specifications in 1977. At this time the gratings were changed from vertical bars to louvered grates having horizontal bars 1" apart at an angle of 10-15 degrees. Presently, this barrier is being widened to accommodate the future Unit 3 discharge. This will temporarily lower the velocity of water passing through the barrier.
		Two fish kills, which most likely resulted from cold shock, have occurred at the discharge since 1972. These were minor and apparently confined to fish living in the effluent. The mechanism allowing fish to get past the barrier and into the quarry has only been hypothesized. Either the fish swim through as juveniles - against the flow or during double shut downs - or adult fish swim through when the gratings are removed for cleaning.
5.3.5	5-15, 5-16	See comments on sections 3.5.1 and 5.2.2 regarding chlorination.
		Boric acid is now being discharged in excess of the level stated in Table 3.8 (FES 1973). In 1978 Northeast Utilities Service Co. requested that the National Pollutant Discharge Elimination System (NPDES) Permit (CT0003263) be changed to allow only a maximum quantity limitation be placed on

Section	Page	Comment
		the discharges of Units 1, 2, and 3. These limits were set at 200, 700, and 800 Kg/batch for each unit respectively, as long as at least two cooling water circulating pumps are in operation. The reason for this request was based on the fact that one of the two aerated waste evaporators used for removal of boric acid from the Unit 2 discharge became inoperative and its replacement was not cost effective because a 2% increase in the natural levels of boric acid in seawater, which would result from the discontinued use of evaporators, would not constitute a significant environmental impact. Evaporator replacement option would have cost the company from \$109,000 - \$6,542,100 and a yearly operating cost of \$144,320 - \$1,586,400. In 1980, over 7,000 lbs of boric acid were discharged at a rate not to exceed 10 g/liter before dilution.
5.3.5	5-16	The projection of corrosion rates and the combined releases of copper from the condensers of Units 1 and 2 was high since maximum flow from both units with a constant loss of copper 3 ug/l through out the year were assumed. In 1972, Unit 1 condensers were retubed using a copper-nickel alloy instead of the aluminum-brass with which it was initially fitted. In 1980, a study of Units 1 & 2 discharge waters concluded concentrations of dissolved copper were approximately 1.1 ug/l higher than at the intakes. Making the same assumptions of maximum flow and constant loss of copper, the amount of copper lost a year is calculated as only 4,700 lbs/yr (instead of 13,700 lbs/yr.).
		Concentrations of copper in oysters taken from the effluent and surrounding areas have had higher concentrations of metals in their tissues during May and July samples (709 - 2134 ppm) than those reported in the 1973 FES (144-640 ppm). In general, the effluent waters at the quarry cut still appear elevated in copper content over those from surrounding areas (White Point, Fox Island

Section	Page	Comment
		North, and Giants Neck). No differences were found between the annual levels in Fox Island North and White Point oyste as compared to Giants Neck. No significant differences are discerned in tissue contents of zinc, iron, and chromium between the Quarry Cut and Giants Neck oysters. Mussel tissue samples are also being monitored at Giants Neck and Fox Island South, but no significant differences in their tissue contents of heavy metals, including copper, have been detected.
5.3.6	5-16	Scouring at the discharge has been reassessd with two units operating and still only 1 acre of Long Island is affected. Three unit operation may double the area impacted because the width of the cut will be doubled to maintain the same velocity of water being discharged. Negligible impacts are still expected.
5.4.1	5-16, 5-17	The osprey program has been maintained at the Millstone site (see 2.7.2.2 this document). The osprey have done well since 1973. On site the number of nesting pairs have gone from 1 to 2 (three nests are now available); similarly, nesting have also doubled (10 to 22) throughout the State of Connecticut. The 50 acre Wildlife Management Area has remained preserved and wildlife is abundant.
5.4.2	5-17	The use of herbicides along transmission lines has been changed. Use of 2,4,5-T herbicide was discontinued in 1979, because of an EPA suspension order followed by cancellation proceedings. Garlin 4 and Banvel 520 are now used as first and second choice herbicides, respectively. Alternatively, Kenite and Ammate x-N1 are used around wells and other water supplies.
5.5.2	5-19	The lower dose values presented are more appropriate due to the continued operation of the MP1 augmented liquid radwaste system.

Section	Page	Comment
5.5.3.1 & 5.5.3.2	5-19 to 5-25	The models used for off-site dose calculations have changed. Since 1976, the Regulatory Guide 1.109 values have been used. Many of the values in the FES for bioaccumulation factors, usage factors, etc. differ (both higher and lower) from the Regulatory Guide 1.109 values. Dose conversion factors have also changed. Some values have increased and some have decreased. The use of GALE codes and NUREG-0016 also give different values for the amount of radioactive material released in liquid and gaseous effluents from those presented in Tables 3.6 and 3.7 of the FES. Again, some values have increased and some have decreased. There have also been some changes in cow and goat farm locations as well as meteorological data and models. This has resulted in different X/Q's and D/Q's from those used in the FES.

Maximum individual and population doses were calculated in Reference (2) using the models of NUREG-0016 and Regulatory Guide 1.109. These calculations assumed operation of the augmented liquid and gaseous waste treatment systems. (The augmented liquid system was already operational. The gaseous system would not become operational until 1978, but the design was fixed. Both systems have continued to operate to the assumptions made in Reference (2) to the present time). Appendix E presents a comparison of the doses calculated in Reference (2) to those calculated in the FES for assumed operation of the augmented treatment systems.

For the maximum individual, in general, the results are within a factor of 6 of each other and in most cases the doses calculated in Reference (2) are less than those in the FES. The only significant change was a 130 factor decrease in the thyroid dose due to liquid releases. This is a result of a significant decrease in calculated iodine releases due to the operation of the waste concentrator and demineralizer on the floor drain system. All

Section	Page	Comment
		doses are within 10CFR50 Appendix I design guidelines and, hence, the FES conclusions are still valid.
5.5.3.3.2	5-25	The visitor center and the beach near the center are no longer open to the public. Therefore, no one should receive the 1 mrem N-16 skyshine dose at this location. However, the annual dose at the critical residence (NNW site boundary) is approximately 1 mrem/year from MP1 N-16 skyshine. Additional shielding by the MP1 turbine was only added on the north side of the turbine. Hence, the doses near the intake structure remain the same as those given.
5.5.3.3.3	5-26	There is no waste gas surge sphere. There is a MP2 waste gas surge tank, but this is in a shielded building and is insignificant compared to other sources. All calculated direct shine dose rates at site boundaries are insignificant in comparison with N-16 turbine shine.
5.5.3.4	5-26	See comments on Section 5.6 in regard to transportation doses.
5.5.4	5-26	As described in the comments for Section 5.5.3, Appendix E presents a comparison of the population doses calculated in the FES vs those in the 10CFR50 Appendix I submittal. The table shows that the doses are within a factor of 5 for gaseous effluents. However, for liquid effluents, Reference (2) calculated a population whole body dose 60 times that of the FES. The primary reason for this is that the FES assumed a total fish consumption of 2×10^5 lb whereas the Reference (2) submittal assumed 4.5×10^7 lb. Shellfish consumption was approximately equal. The Appendix I population dose of 0.3 man-rem is still less than 10% of the population dose due to gaseous effluents and still insignificant in comparison to the 370,000 man-rem from natural background.

Section	Page	Comment
5.5.5	5-26	Use values for augmented system.
5.6.2	5-28	Except for a few special shipments of fuel rods for special tests, no fuel elements have ever been shipped from MP1 or MP2. There are also no plans to ship fuel in the near future. Hence, the number, type, and destination of shipments indicated in this section are no longer valid. Revised information cannot be provided at this time, other than the fact that the number of required shipments will probably decrease due to the substantial decay of the fission products.
5.6.3	5-29	Most radioactive waste shipments are presently shipped to Barnwell, S. C. instead of Moorehead, Kentucky. A few shipments go to Richland, Washington. There are approximately 100 shipments per year consisting of 55 gallon drums, solidified liners and LSA boxes.
5.6.4	5-30	No changes other than to indicate that routing restrictions have become commonplace.
5.6.5.2	5-31	As discussed in Section 5.6.2, there will be several years of decay of spent fuel prior to shipment. Hence, dose rates and integrated doses will be much less than the values indicated in Section 5.6.5.2.
6.1.2	6-2, 6-3	Studies for the units have changed over the years to improve sampling methods to better temporally and spatially quantify differences between communities. Changes in programs have always been made to maximize the compatibility of data collected before and after the change. Data from some of these programs span 14 years. See the descriptions of these programs as described in MP3 EROLS Sections 6.1, 6.2, and 6.3. Many of these same programs are proposed for preoperational and operational phases of Unit 3, providing a long time series of data from which to draw conclusions concerning power plant impacts.

Section	Page	Comment
6.1.5	6-4	The present radiological environmental monitoring program is described in the Technical Specifications, the appropriate pages of which are included here as Appendix F. This program represents an expansion of that presented in the FES Tables 6.3 and 6.4. The only reduction has been the deletion of precipitation sampling which never provided useful information. All of the recommendations on page 6-12 of the FES have been incorporated into the present program.
6.2.5	6-12	Update to reflect current information regarding the NPDES monitoring program: see MP3 EROLS Section 6.
6.2.6	6-13	Meteorological monitoring program upgraded in 1973: see MP3 EROLS Section 6.1.3.
6.3.4	6-13, 6-14	The states' milk sampling program is no longer the only such program as it is also included in the licensee's program.
6.3.6	6-14	No reports have been received from either the state or the NRC regarding the outcome of the independent program.
8.3	8-9	The 375 acres to be left in its natural state or be available for public use in 1973 will be reduced to 250 acres because of the construction of MP3 and other permanent buildings on site with their respective parking lots and landscaping (see 4.1.1 this document). Much of this additionally disturbed area will be restored to its natural state. Some of the recreational area, for safety and security reasons, will not be reclassified for public use after construction is finished.
12.6	12-2	Aquaculture studies were funded between 1976-1980 to investigate the feasibility of raising shellfish in the thermal effluents of Units 1 and 2. Three species were studied: lobsters, <u>Homarus americanus</u>; oysters,

Section	Page	Comment
		Crassostrea virginica; and bay scallops, Argopecten irradians. Lobsters were found to be too difficult as fourth and fifth stage larvae to monitor in the natural environment for survival. Oysters were felt to be inappropriate for year round culturing at effluent temperatures. Bay scallops were found to be the best suited for aquaculture in the effluent waters. Bay scallop growth in effluent waters was twice that of bay scallops cultured in ambient temperature waters and a harvestable product could be reached within a single year. However, cultured bay scallops experienced severe mortality (50%), due to predation, when placed on the bottom of Jordan Cove.
		Several special studies have been done to investigate various aspects of the relationship between power plant operation and the marine environment.
		A mussel study in 1979 was conducted to evaluate the biofouling control techniques used at Units 1 and 2. As a result a back flushing schedule was suggested which would reduce down time for Unit 1 and 2 and reduce operating costs by approximately $100,000/year for each unit.
		An eelgrass study was conducted in 1979-1980 to determine if eelgrass beds were effected by power plant production. It was concluded that the increase in eelgrass beds in Jordan Cove was natural trend and that 1, 2, and 3 unit operation would not impact these benthic plants.
12.8	12-3	Five fish deterrent devices have been tested: surface fish barrier, benthic fish barrier, electric screen guidance, acoustic stimuli, and light stimuli. These devices were studied to determine their effectiveness in reducing impingement at the coolant water intakes and all were proven ineffective. However, a fish return study has led to the recommendation for sluiceways for Units 1 and 3.

Section	Page	Comment
12.10	12-5	Qualitative observation of algae in the Millstone effluent began in 1979. This study has helped to evaluate the effects of the undiluted discharge on the marine flora. The Exposure Panel Program and Benthic Infauna Program have also collected information in the species living in the discharge quarry.
Appendix A	--	The species lists reported in 1972 have grown with the subsequent years of sampling. Emphasis on some species and groups have changed as the programs themselves changed, but most of these same species have remained as components of the 1982 communities. Researchers have never found a species eliminated or severely impacted by plant operation. Teredo bartschi, a southern species of shipworm, is the only species whose distribution has been altered because of the warm water effluent and this species has been confined to the undiluted effluent waters.
Notes:		In 1976 several statements were made referring to environmental impacts which were attributed to the thermal effluent. Since, it has been concluded that these impacts were not power plant related, but normal fluctuations in the communities. Reductions of Fucus and Ascophyllum, rock-weeds, reported in 1976, returned to normal percent covers by 1978. Ascophyllum nodosum has been shown to be thermally sensitive and is excluded from a 25 meter area around the quarry cut by the warm effluent. In contrast, this species experiences enhancement of growth at 75 meters from the discharge. Oysters drills were stated as being potentially attracted to the quarry cut, southern tip of Fox Island, by metabolities released from oysters living in the quarry. This does not appear to be the case. The elevated abundances (1974, 1975) of these snails returned to normal levels despite the continued existence of oysters in the effluent.

Section	Page	Comment
		Effluent toxicity tests on fish and mysids were started in 1981 and are continuing. These studies provide a method of continuously monitoring the effluent for toxic effects.

References

1. Millstone Nuclear Power Station, Unit 3, Applicant's Environmental Report Construction Permit Stage.

2. D. C. Switzer letter to G. Lear dated November 5, 1976, Compliance with 10CFR50, Appendix I.

3. Millstone Nuclear Power Station, Unit 1, Final Safety Analysis Report.

4. Millstone Nuclear Power Station, Unit 2, Final Safety Analysis Report.

5. Millstone Nuclear Power Station, Unit Nos. 1 and 2, Annual Environmental Operating Reports.

6. Stolzenbach, K. D., and Adams, E. E. 1979. Thermal Plume Modeling at the Millstone Nuclear Power Station, prepared for Northeast Utilities Service Company, Berlin, Connecticut.

POPULATION DISTRIBUTION FOR 1980

SHELL NO. - MILES	1 0.0- 0.5	2 0.5- 1.0	3 1.0- 1.5	DISTANCE 4 1.5- 2.0	5 2.0- 2.5	6 2.5- 3.0	7 3.0- 3.5
DIRECTION							
1 N	0	0	116	495	119	357	773
2 N-NE	0	0	31	325	475	806	614
3 NE	23	153	57	439	410	191	1036
4 E-NE	6	68	160	210	111	108	514
5 E	0	16	528	165	212	250	844
6 E-SE	0	0	73	89	68	11	0
7 SE	0	0	0	0	0	0	0
8 S-SE	0	0	0	0	0	0	0
9 S	0	0	0	0	0	0	0
10 S-SW	0	0	0	0	0	0	0
11 SW	0	0	0	0	29	132	0
12 W-SW	0	0	0	0	1302	179	204
13 W	0	0	0	257	1019	383	409
14 W-NW	0	0	0	516	723	504	524
15 NW	0	0	37	580	364	147	645
16 N-NW	0	122	458	198	438	272	246
SHELL TOTALS	29	359	1460	3274	5270	3340	5809

APPENDIX A

POPULATION DISTRIBUTION FOR 1980

SHELL NO.- MILES	8 3.5- 4.0	9 4.0- 4.5	10 4.5- 5.0	DISTANCE 11 5.0- 6.0	12 6.0- 7.0	13 7.0- 8.5	14 8.5-10.0	INNER RINGS TOTAL
DIRECTION								
1 N	91	17	45	317	359	1697	1823	6209
2 N-NE	241	288	1904	1850	1295	1862	3623	13314
3 NE	2595	5649	6537	5717	4020	3728	2643	33198
4 E-NE	4127	1182	140	7223	1364	4475	4387	24075
5 E	1871	209	76	751	0	621	2263	7806
6 E-SE	0	0	0	0	0	219	415	875
7 SE	0	0	0	0	0	0	0	0
8 S-SE	0	0	0	0	0	0	0	0
9 S	0	0	0	0	0	147	157	304
10 S-SW	0	0	0	0	0	6	112	118
11 SW	0	0	0	0	0	0	0	161
12 W-SW	112	0	1009	1103	1510	35	18	5472
13 W	694	23	295	435	187	525	765	4992
14 W-NW	23	40	32	157	52	518	421	3510
15 NW	297	89	319	573	52	513	392	4008
16 N-NW	232	400	155	455	75	1074	1268	5395
SHELL TOTALS	10283	7897	10512	18581	8914	15422	18287	109437

POPULATION DISTRIBUTION FOR 1980

SHELL NO.- MILES	15 10.0-12.5	16 12.5-15.0	17 15.0-17.5	18 17.5-20.0	19 20.0-25.0	20 25.0-30.0	21 30.0-35.0	22 35.0-40.0	23 40.0-45.0	24 45.0-50.0	TOTAL 0-50.0
DIRECTION					DISTANCE						
1 N	3585	3801	4215	2394	3819	22992	15034	16350	9419	9416	97234
2 N-NE	3449	7323	12988	13256	16095	7918	10604	14725	14430	15579	129501
3 NE	3521	4375	2492	1747	4426	3753	9235	16357	49825	108963	237692
4 E-NE	8129	3167	4347	6244	8012	6631	11430	21117	44766	74063	212781
5 E	613	1898	2910	4632	7414	1652	4908	6921	1135	1592	41401
6 E-SE	125	0	0	0	0	0	615	0	0	0	1615
7 SE	0	0	0	154	889	0	0	0	0	0	1043
8 S-SE	0	119	125	395	1676	0	0	0	0	0	2315
9 S	0	292	226	2128	6674	262	0	0	0	0	9806
10 S-SW	721	138	581	1826	6602	8465	8756	518	0	0	27725
11 SW	0	472	3149	1681	5897	8206	13479	22557	56346	82561	194529
12 W-SW	335	0	0	0	0	0	0	310	10562	45270	61949
13 W	6324	5059	3739	8566	10729	14997	32277	120757	142931	109444	459815
14 W-NW	2782	3485	4311	2175	6066	18007	39549	94929	65705	138140	378659
15 NW	673	979	1287	1810	6905	21332	39104	118751	280731	98897	574477
16 N-NW	1104	1089	1389	2881	6608	9153	16221	82445	56488	46438	229291
SHELL TOTALS	31361	32197	41759	49889	91892	123368	201212	515737	732338	731103	2660373

POPULATION DISTRIBUTION FOR 1985

SHELL NO.- MILES	1 0.0- 0.5	2 0.5- 1.0	3 1.0- 1.5	DISTANCE 4 1.5- 2.0	5 2.0- 2.5	6 2.5- 3.0	7 3.0- 3.5
DIRECTION							
1 N	0	0	119	507	122	365	791
2 N-NE	0	0	32	333	487	824	628
3 NE	23	156	58	449	420	196	1060
4 E-NE	6	70	164	215	114	110	513
5 E	0	17	541	169	216	256	854
6 E-SE	0	0	75	92	69	12	0
7 SE	0	0	0	0	0	0	0
8 S-SE	0	0	0	0	0	0	0
9 S	0	0	0	0	0	0	0
10 S-SW	0	0	0	0	0	0	0
11 SW	0	0	0	0	30	139	0
12 W-SW	0	0	0	0	1367	188	215
13 W	0	0	0	264	1062	402	429
14 W-NW	0	0	0	531	748	529	550
15 NW	0	0	38	597	375	155	377
16 N-NW	0	125	469	203	450	279	253
SHELL TOTALS	29	368	1496	3360	5460	3455	5970

POPULATION DISTRIBUTION FOR 1985

SHELL NO.- MILES	8 3.5- 4.0	9 4.0- 4.5	10 4.5- 5.0	DISTANCE 11 5.0- 6.0	12 6.0- 7.0	13 7.0- 8.5	14 8.5-10.0	INNER RINGS TOTAL
DIRECTION								
1 N	93	17	46	324	368	1746	1886	6384
2 N-NE	246	293	1916	1860	1325	1907	3775	13626
3 NE	2588	5621	6505	5728	4064	3790	2753	33411
4 E-NE	4107	1176	142	7336	1389	4500	4455	24297
5 E	1862	208	77	762	0	628	2282	7872
6 E-SE	0	0	0	0	0	246	466	960
7 SE	0	0	0	0	0	0	0	0
8 S-SE	0	0	0	0	0	0	0	0
9 S	0	0	0	0	0	165	176	341
10 S-SW	0	0	0	0	0	7	126	133
11 SW	0	0	0	0	0	0	0	169
12 W-SW	118	0	1082	1182	1619	38	18	5827
13 W	729	24	316	466	201	553	791	5247
14 W-NW	24	42	33	166	56	557	453	3689
15 NW	312	94	342	602	54	542	410	4206
16 N-NW	237	413	165	470	79	1119	1320	5593
SHELL TOTALS	10316	7891	10624	18904	9155	15800	18919	111755

POPULATION DISTRIBUTION FOR 1985

SHELL NO.- MILES	15 10.0-12.5	16 12.5-15.0	17 15.0-17.5	DISTANCE 18 17.5-20.0	19 20.0-25.0	20 25.0-30.0	21 30.0-35.0	22 35.0-40.0	23 40.0-45.0	24 45.0-50.0	TOTAL 0-50.0
DIRECTION											
1 N	3709	3912	4284	2455	3957	23609	15179	16554	10076	9761	99800
2 N-NE	3588	7467	13148	13437	16421	8508	11390	15482	15051	15949	134057
3 NE	3719	4624	2596	1782	4584	4114	9967	17574	51922	113306	247599
4 E-NE	8299	3323	4506	6464	8543	7069	12579	24369	50548	84619	234616
5 E	650	1960	3029	4847	7741	1695	5414	7094	1389	1947	43658
6 E-SE	141	0	0	0	0	0	633	0	0	0	1734
7 SE	0	0	0	173	998	0	0	0	0	0	1171
8 S-SE	0	134	141	444	1881	0	0	0	0	0	2600
9 S	0	328	254	2388	7492	294	0	0	0	0	11097
10 S-SW	809	155	652	2051	7409	9502	9828	582	0	0	31121
11 SW	0	530	3534	1886	6619	9210	15131	25316	63246	92690	218331
12 W-SW	343	0	0	0	0	0	0	347	11855	50813	69165
13 W	6469	5248	3892	8923	11397	15836	32973	120630	143186	111192	464993
14 W-NW	2858	3573	4490	2340	6618	19025	40663	96648	68167	139857	387938
15 NW	722	1034	1350	1911	7399	22266	41515	122277	280976	101434	585090
16 N-NW	1191	1188	1500	3103	7290	10122	17299	84245	58860	48278	233629
SHELL TOTALS	32498	33476	43376	52204	98349	131250	212571	531118	755276	759656	2771729

POPULATION DISTRIBUTION FOR 1990

SHELL NO.- MILES	1 0.0- 0.5	2 0.5- 1.0	3 1.0- 1.5	DISTANCE 4 1.5- 2.0	5 2.0- 2.5	6 2.5- 3.0	7 3.0- 3.5
DIRECTION							
1 N	0	0	121	515	124	371	804
2 N-NE	0	0	32	330	494	837	637
3 NE	24	159	59	456	427	199	1075
4 E-NE	6	71	166	218	116	112	521
5 E	0	17	549	172	220	260	869
6 E-SE	0	0	76	93	70	12	0
7 SE	0	0	0	0	0	0	0
8 S-SE	0	0	0	0	0	0	0
9 S	0	0	0	0	0	0	0
10 S-SW	0	0	0	0	0	0	0
11 SW	0	0	0	0	0	0	0
12 W-SW	0	0	0	0	31	142	0
13 W	0	0	0	0	1395	191	219
14 W-NW	0	0	0	275	1092	411	438
15 NW	0	0	0	553	775	540	562
16 N-NW	0	0	40	621	390	158	691
	0	127	477	209	468	286	257
SHELL TOTALS	30	374	1520	3450	5602	3519	6073

POPULATION DISTRIBUTION FOR 1990

SHELL NO.- MILES / DIRECTION	8 3.5- 4.0	9 4.0- 4.5	10 4.5- 5.0	DISTANCE 11 5.0- 6.0	12 6.0- 7.0	13 7.0- 8.5	14 8.5-10.0	INNER RINGS TOTAL
1 N	94	18	47	330	374	1792	1956	6546
2 N-NE	249	298	1948	1892	1346	1943	3980	13994
3 NE	2630	5712	6610	5799	4093	3835	2880	33958
4 E-NE	4173	1195	142	7368	1390	4558	4472	24508
5 E	1892	211	77	765	0	632	2297	7961
6 E-SE	0	0	0	0	0	274	518	1043
7 SE	0	0	0	0	0	0	0	0
8 S-SE	0	0	0	0	0	0	0	0
9 S	0	0	0	0	0	184	196	380
10 S-SW	0	0	0	0	0	8	140	148
11 SW	0	0	0	0	0	0	0	173
12 W-SW	120	0	1173	1282	1755	41	18	6194
13 W	744	25	341	505	217	611	814	5473
14 W-NW	25	43	34	170	61	603	488	3854
15 NW	318	96	371	614	56	560	439	4354
16 N-NW	241	424	176	488	84	1146	1358	5741
SHELL TOTALS	10486	8022	10919	19213	9376	16187	19556	114327

POPULATION DISTRIBUTION FOR 1990

SHELL NO. - MILES	15 10.0-12.5	16 12.5-15.0	17 15.0-17.5	18 17.5-20.0	19 20.0-25.0	20 25.0-30.0	21 30.0-35.0	22 35.0-40.0	23 40.0-45.0	24 45.0-50.0	TOTAL 0-50.0
DIRECTION											
1 N	3845	4038	4382	2508	4030	24188	15349	16732	10618	10065	102330
2 N-NE	3756	7704	13492	13794	16796	9080	12173	16265	15654	16533	139251
3 NE	3995	4972	2701	1783	4660	4432	10726	18817	53874	115930	255069
4 E-NE	8470	3404	4611	6662	8984	7708	13903	25912	52328	85862	242352
5 E	678	2036	3125	5030	8085	1877	5978	7758	1466	2004	43059
6 E-SE	157	0	0	0	0	0	694	0	0	0	1854
7 SE	0	0	0	193	1111	0	0	0	0	0	1304
8 S-SE	0	149	157	494	2093	0	0	0	0	0	2893
9 S	0	364	283	2659	8339	327	0	0	0	0	12352
10 S-SW	901	172	726	2283	8245	10576	10938	647	0	0	34536
11 SW	0	590	3934	2100	7367	10251	16841	28181	70395	103171	243603
12 W-SW	348	0	0	0	0	0	0	387	13194	56556	73579
13 W	6556	5355	3992	9230	11849	16307	33430	121678	144531	113578	472079
14 W-NW	2933	3649	4691	2480	7057	19843	41837	98320	70148	141086	395530
15 NW	767	1079	1401	1995	7804	23217	43848	126477	285359	104063	600364
16 N-NW	1260	1266	1583	3301	7820	10959	18379	85327	61444	50254	240334
SHELL TOTALS	33666	34778	45078	54512	104249	138765	224096	547521	779031	600063	2576106

TABLE 9.3.2-1 (Cont'd)

Component	Control Function	Indicated	Recorded	Alarmed
Floor Drain Sample Tanks				
Level	X	X	X	X
Floor Drain Sample Pump Discharge				
Pressure		X		
Discharge to Canal				
Flow	X	X	X	
Radiation Monitor	X	X	X	X
Waste Neutralizer Tank				
Level	X	X	X	X
Waste Neutralizer Pump Discharge				
Pressure		X		
Waste Concentrator				
Density	X	X	X	X
Flow	X	X	X	
Steam	X	X	X	X
AP Demister		X		
Pressure		X		X
Temperature	X	X	X	X
Centrifuge				
Level		X	X	X
Torque	X	X	X	X

9.3.3 Description of System After Modifications

To maintain liquid radioactive discharges at or below levels recommended in 10CFR50 Appendix I, modifications to the liquid radioactive waste system were made in 1974. These modifications consisted of increased tank capacity, a new waste concentrator, a new waste demineralizer and a waste solidification system. The additional components are shown on Figure 9.3.3-1, "Modified Liquid Radioactive Waste System - Flow Diagram."

As an adjunct to the improved liquid radwaste system, an ultrasonic resin cleaner has been installed in the condensate demineralizer system to reduce chemical radioactive wastes requiring treatment. The ultrasonic resin cleaner is a counter flow unit (demineralized water flowing up, resin flowing down) which utilizes the vibration generated by sonic transducers in the ultrasonic range to physically separate the particulate material from the resin beads facilitating its removal by the demineralized water. This waste water is essentially pure water, with high suspended solids content that can be treated by filtration alone, thus further reducing the required waste treatment.

9.3.4 Design Evaluation

Activity released with the liquid wastes is difficult to define since liquid wastes come from a number of sources and the quantities of activity is a strong function of plant operation and holdup time. The total amount of activity and the relative quantities of each isotope will vary significantly from day to day with varying power levels and leakage from fuel elements.

The distribution of radioisotopes as shown in Table 9.3.4-1 is based on data obtained from operation of Millstone in late 1971 and early 1972. Table 9.3.4-2 lists the maximum activities and quantities that will be stored in radwaste tanks. In addition, tritium content of the liquid wastes is estimated to be approximately 2×10^{-4} μci/cc normally, or 2×10^{-3} μci/cc maximum. This would place the maximum curie quantity of tritium in radwaste building tankage at about 1.5 curies and at about 0.4 curies in the waste surge tank.

Liquid radioactive wastes are diluted in the condenser cooling water. At the time of discharge, the concentration of these wastes, based upon operating experience to date, has been approximately equal to the levels of 10CFR50 Appendix I. Addi-

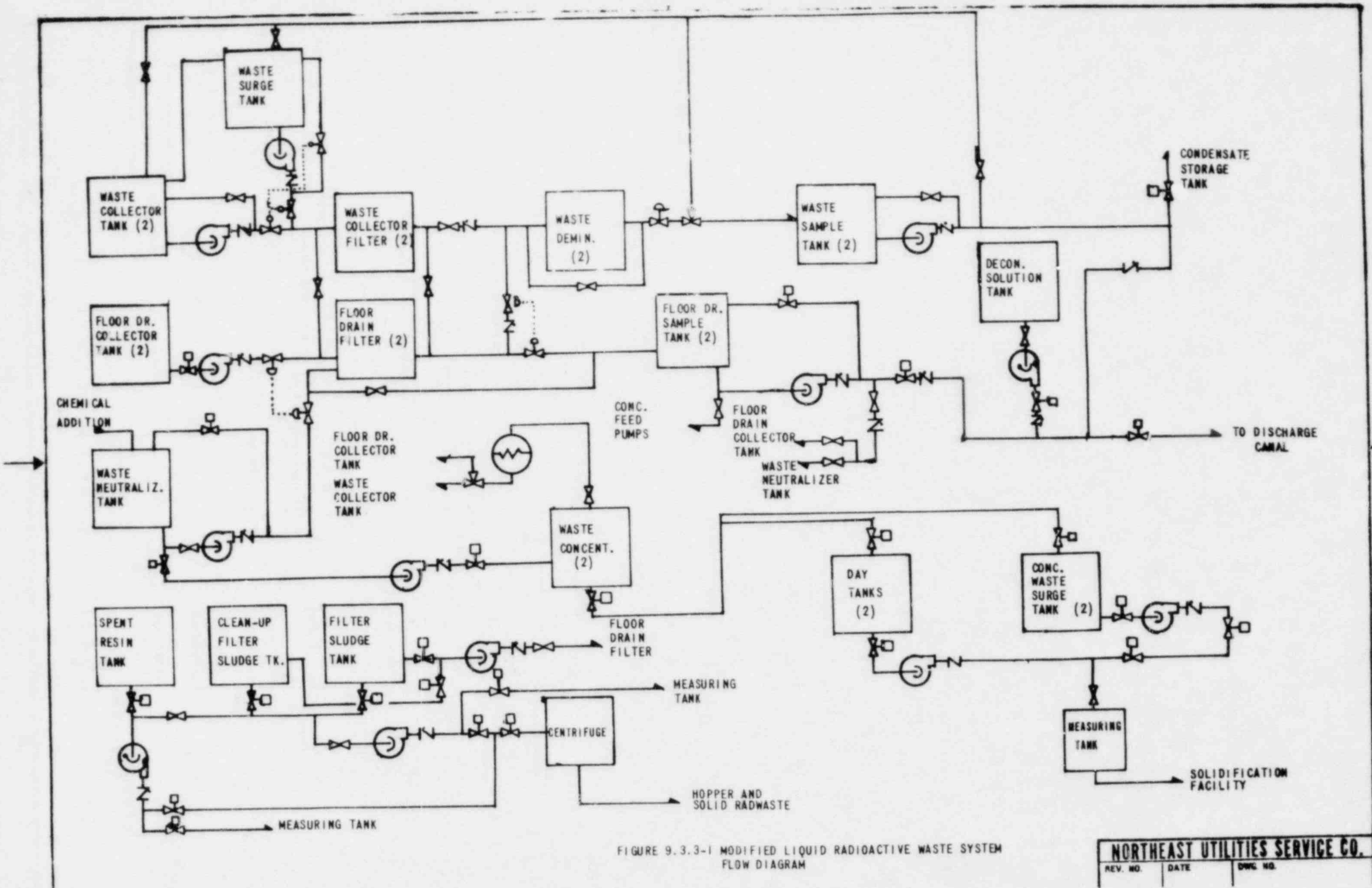

FIGURE 9.3.3-1 MODIFIED LIQUID RADIOACTIVE WASTE SYSTEM FLOW DIAGRAM

9.2.3 Description of Steam Dilution Off Gas Recombiner/Augmented Off Gas System

In a BWR Plant, steam jet air ejectors are used to remove air inleakage, water vapor, radiolytic hydrogen and oxygen along with trace quantities of fission product and activation gases from the main condenser for processing by the off-gas system. The gas flow into the first stage ejectors will be controlled by adjustable butterfly valves which will limit the flow to a maximum of 50 SCFM. This will allow operation of the off-gas system during plant startup and during transients. The existing second stage ejectors are modified to bypass the aftercondensers and discharge the motive steam and gas to the process pipe. The process stream, containing a gas/steam mixture raised to the necessary inlet pressure, with the hydrogen concentration diluted below 4.0 volume percent, is transported to the recombiner system.

The gas/steam mixture is preheated in a shell-and-tube type heat exchanger to the necessary recombiner inlet temperature. The hydrogen and oxygen react stoichiometrically in a catalytic recombiner to form steam. The motive steam, no longer needed for hydrogen dilution, and the reaction product steam are cooled and condensed in the off-gas condenser. The gas remaining consists of a residual quantity of hydrogen, water vapor, the inleakage air, and traces of non-condensible radioactive isotopes. A jet compressor will raise the pressure of the gas to that required for transport to and processing by the xenon-krypton treatment system. The gas then goes to the plant stack for discharge.

9.2.3.1 Recombiner System

The Recombiner System consists of two full capacity redundant trains each containing a preheater, a catalytic recombiner, an off-gas condenser, a jet compressor, an after-cooler condenser, an instrumentation and control system and the required interconnecting valves and piping. The two trains are designed to be operated separately. A flow diagram of the off-gas system is shown in Figures 9.2.3-1 and 9.2.3-2.

The preheaters are standard shell and tube heat exchangers utilizing plant auxiliary steam which has been throttled to 270 psia and 408°F to preheat the incoming gas/steam mixture from 250°F to 320°F. The temperature rise furnished by the preheater provides the required superheat for initiation of the exothermic reaction in the recombiner. The superheated, diluted mixture enters the recombiner where the free hydrogen and oxygen react in the presence of the catalyst to form water. The recombiners are full flow units employing a precious metal-coated metal base grid catalyst bed. Each bed has approximately twice the quantity of catalyst required to completely react the free hydrogen and oxygen. Due to the exothermic reaction the temperature will be increased by approximately 125°F per percent hydrogen in the inlet stream. Thermocouples are provided at three points in each bed and at the inlet and outlet of each recombiner. These temperatures are for monitoring recombiner performance. Strip heaters are provided to maintain the standby recombiner at 320°F and for preheating the unit during startup.

The gas exits the recombiner at approximately 730°F and enters the off-gas condenser where it is cooled to 130°F. The condensed water is drained to a subcooler; cooled to 110°F and returned to the main condenser. Cooling water to the off-gas condensers and subcoolers is supplied from main cycle condensate entering at a maximum of 105°F.

A jet compressor which provides the motive force for the recombiner system, increases the pressure of the gas leaving the off-gas condenser from approximately 12 psia to 19 psia. The steam supply for the compressor is provided from the same source that furnishes steam to the preheater.

The gas exists the jet compressor approximately 340°F and enters the after-cooler condenser where it is cooled to 130°F. The condensed water is drained to the hot gas stream entering the off-gas condenser. The off-gas leaving the after-cooler condenser is transported to the xenon-krypton treatment system which was described in Millstone Nuclear Power Station Unit 1, Radwaste Modification, US AEC Docket 50-245, submitted in July, 1973.

The minimum flow of 25 SCFM required by the xenon-krypton treatment system is provided by makeup air from the plant station air system and injected automatically into the gas stream at the preheater. A flow bypass loop is provided from the discharge of the after-cooler condenser to the suction of the jet compressor, so the jet will operate with constant suction conditions. The discharge pressure is determined by the non-condensible flow rate through the xenon-krypton system. The jet compressor is capable of discharging 50 SCFM at about 22.7 psia.

9.2.3.2 Xenon-Krypton System

The xenon-krypton treatment system is a low temperature (-20F) charcoal absorption system, housed in a separate building about 1400 feet from the recombiner building and about 400 feet from the stack.

The system consists of two sections: pretreatment and charcoal adsorption. After catalytic recombination and transport to the xenon-krypton system, the off-gas enters the pretreatment equipment. This consists of two full capacity systems, each containing a cooler-condenser, a moisture separator, cyclic dryer, glycol cooler units, interconnecting piping and instrumentation and control. The pretreatment glycol cooler unit contains two (2) full capacity pumps, two (2) 500 gallon storage tanks and two (2) full capacity refrigeration machines.

The pretreatment system is designed to cool the off-gas to -20F and dry the stream to a dewpoint of -90F.

After drying and precooling, the off-gas flows through a gas cooler to two (2) charcoal beds in series maintained at -20F. Each bed contains 11,000 pounds of activated charcoal. Two beds operating in series will provide a delay of 1.3 days for krypton isotopes and 50 days for xenon isotopes at the normal flow of 25 SCFM. After decay in the charcoal beds, the off-gas flows to the existing high efficiency particulate filters prior to release to the environs from the 375 foot stack.

The process and physical details of the xenon-krypton treatment system were presented in the Radwaste Modification submittal dated July 1973, Docket 50-245.

9.2.3.3 Recombiner System General Arrangement

The recombiner system is located at grade elevation in a building which has been specifically designed to house this system. The recombiner building is located adjacent to the present office building and turbine building.

Each of the redundant recombiner systems is housed in a separate shielded compartment to enable maintenance to be performed on the standby unit. Instrumentation racks are located in a third separate compartment which is accessible during operation of either system.

Valving has been provided to divert the main condenser steam jet air ejector outlet flow to either the delay pipe (original mode of operation) or to the inlet of the preheaters for treatment through the new system. These valves are operated from a panel in the main control room.

The recombiner system utilizes main plant condensate, auxiliary steam, service air, instrument air and station A-C electric power. The main plant condensate can be isolated from the recombiner system by redundant safety class valves controlled by the plant safety systems. Partial or total loss of these support services may result in shutdown of the recombiner system, however the system is designed to preclude off-site consequences and damage to the recombiner or xenon-krypton systems from such losses. The loss of a support system will be either directly alarmed in the main control room, or indirectly alarmed as a result of creating an upset condition in the gas stream.

9.2.3.4 Codes and Standards

The equipment and piping will be designed to meet the following codes and standards:

Quality Group	Branch Technical Position ETSB No. 11-1 Rev. 1 dated 11/24/75
ANSI B 16.34	Welded Valves
ANSI B 16.5	Flanged Valves
ANSI B 31.1	Valves and Piping - 1973 issue including summer 1976 addenda
ASME Section VIII, Div. 1	Off-Gas Preheater Shell Catalytic Recombiner Off-Gas Condenser Shell After-Cooler Condenser Shell
TEMA Standards	Off-Gas Preheater Tubes Off-Gas Condenser Tubes After-Cooler Condenser Tubes

9.2.3.5 Instrumentation and Control

Instrumentation for the control and monitoring of the recombiner system is listed in Table 9.2.3-1.

The off-gas flow in each of the redundant systems is instrumented for temperature, pressure and flow. In addition, the cooling condensate flow is instrumented for flow and differential pressure across the off-gas condenser waterboxes. The off-gas inlet valve to each system is so interlocked that if there is no condensate flow through the off-gas condenser as reflected by low waterbox differential pressure, the valve cannot be opened. Furthermore, high gas temperature at the recombiner discharge will close this valve. A low gas flow, measured at the off-gas condenser discharge, will open the makeup air valve admitting air to the preheater to maintain the flow requirements of the xenon-krypton treatment system. The majority of the recombiner system is maintained at a subatmospheric pressure by controlling the off-gas condenser outlet pressure with the jet compressor bypass control valve.

TABLE 9.2.3-1

INSTRUMENTATION

Parameter	Control Function	Indicated	Recorded	Alarmed
Recombiner System Inlet Pressure		X		
Preheater Inlet Temperature			X	
Preheater Outlet Temperature		X		High/Low
Recombiner Bed Temperature			X	High/Low
Recombiner Outlet Temperature	X		X	High
Off-Gas Condenser Outlet Temperature				High
Off-Gas Condenser Outlet Pressure	X	X		
Off-Gas Condenser Hotwell Level	X	X		High/Low
Jet Compressor Discharge Temperature		X		High
Jet Compressor Suction Flow	X	X	X	High/Low
Transport Pipe Hydrogen Concentration			X	High
Jet Compressor Discharge Pressure		X		
Cooling Condensate Flow		X		
Off-Gas Condenser Waterbox Differential	X			Low
Transport Line Drain Level	X			High/Low

9.2.4 System Operation

The augmented off-gas system will be operated from the main control room. The system will operate using one of the recombiner subsystems, one of the Xenon-Krypton pretreatment subsystems, one of the Xenon-Krypton charcoal subsystems, and one of the stack filters, before discharge through the plant stack. The recombiner and Xenon-Krypton pretreatment subsystems may be selected remotely from the main control room.

The expected performance of the augmented off-gas system is presented in Table 9.2.4-1.

shipment. The solids handling facility is located in the radwaste storage building. The drum handling and conveyor systems are located on the ground level and are fed from a hopper located in the upper levels of the building.

Used reactor equipment is first stored for sufficient time in the fuel storage pool to obtain decay of the short-lived isotopes before removal for off-site shipment.

The activity of most other categories of solid wastes is low enough to permit handling of packages by contact. These wastes are collected in containers located in appropriate zones around the plant, as dictated by the volume of wastes generated during operating and maintenance. The containers are then sealed and moved to a controlled-access, enclosed storage area for temporary storage. Compressible wastes are compacted by a hydraulic press-baling machine to reduce their volume and then packaged and stored. Ventilation is provided to prevent dispersion of contaminated particles when operating packaging equipment. Compacted and noncompressible wastes are eventually shipped to an approved off-site facility for storage or burial.

Equipment too large to be handled in this way will require special procedures. Since the need for handling of large equipment occurs infrequently, providing storage facilities in advance is not justified. Handling of such equipment depends upon the radiation level, transportation facilities and available storage sites. Suitable procedures for decontamination, shielding, shipment and storage of such items will be developed as necessary.

9.4.3 <u>Description of Major Modifications to Solid Radwaste System</u>

In conjunction with the modification to the liquid radioactive waste system, a solidification system has been installed. This solidification system is located in the radwaste storage building. An access to the drum filling aisle, through a hatch provided in the original plant design, is used to fill the drums with dewatered resins and solka floc. Drum handling, conveying and capping will be done by the present drum handling and conveyor system.

The system receives concentrated liquid wastes from either the concentrated waste sludge storage tank or the concentrated waste day tank and mixes it with the solidifying agent, Urea Formaldehyde, to form a slurry. The mixed slurry is then transferred by pipe to a shipping container on the transport vehicle where it is mixed with the solidification catalyst. This solidification of concentrated waste will reduce the releases of liquid waste to the environs.

9.4.4 Design Evaluation

The solid radwaste system utilizes a number of mechanical operations that are designed to process the solid wastes remotely with a minimum of personal handling and exposure. The equipment supplied to accomplish this handling has been designed to be remotely operated and to accomplish the functions described in Sections 9.4.2 and 9.4.3. The handling and processing will be capable of being performed without exceeding established dose limits.

Ample shielding of the processing and storage areas has been provided to assure personnel safety during operation. Viewing equipment is provided in all locations where visible control is required in a radioactive area. In addition, ventilation is provided for contamination control during maintenance and cleanup.

9.4.5 Tests and Inspections

Proper operation of this equipment is demonstrated prior to the actual handling of radioactive wastes. Normal operations preclude the necessity for periodic testing of equipment con-

APPENDIX E

COMPARISON OF MAX INDIVIDUAL AND POPULATION DOSES

	ANNUAL DOSE	
MAXIMUM INDIVIDUAL	FROM 1973 FES*	FROM 1976 APPX I SUBMITTAL
Liquid Effluents - whole body	0.041 mrem	0.007 mrem
Liquid Effluents - thyroid	1.9 mrem	0.014 mrem
Liquid Effluents Max - other organs	0.23 mrem	0.05 mrem
Gaseous Effluents - whole body	0.055 mrem	0.21 mrem
Gaseous Effluents - thyroid	4.8 mrem	4.1 mrem
50 MILE POPULATION		
Liquid Effluents - whole body	0.005 man-rem	0.3 man-rem
Liquid Effluents - thyroid	not calculated	0.3 man-rem
Gaseous Effluents - whole body	3.5 man-rem	5.1 man-rem
Gaseous Effluents - thyroid	3.0 man-rem	15 man-rem

* Values are those given for the assumed operation of the MP1 augmented liquid and gaseous waste systems. They also include MP2 doses but these were insignificant compared to MP1 doses.

Table 3.2-1
Millstone Radiological Environmental
Monitoring Program--Terrestrial Stations

Locations	Distance and Direction(a)	Gamma Dose	Air Particulate(e)(i)	Soil	
1. Onsite--Old Millstone Road	0.5 miles NW	M	W1 - M2 - Q5	--	
2. Onsite--Weather Shack	0.5 miles S	M	W1 - M2 - Q5	--	
3. Onsite--Bird Sanctuary	0.5 miles NE	M	W1 - M2 - Q5(f)	A2,5	
4. Onsite--Albacore Drive	1.0 miles N	M	W1 - M2 - Q5(f)	A2,5	
5. Onsite--Navy Laboratory	0.5 miles SE	M	--	--	
6. Onsite--Quarry Discharge Canal Fence	0.5 miles SSE	M	--	--	
7. Onsite--Fox Island	0.5 miles ESE	M	--	--	
8. Onsite--Millstone Environmental Lab.	0.5 miles ESE	M	--	--	
9. Onsite--Bay Point Beach (Information Center)	0.5 miles NNW	M	--	--	
10. Pleasure Beach	1.0 miles E	M	W1 - M2 - Q5	A2,5	
11. New London Country Club	1.5 miles NE	M	W1 - M2 - Q5(f)	A2,5	
12. Fisher's Island, New York *	8.0 miles ESE	M	W1 - M2 - Q5	--	
13. Mystic, Connecticut *	11.5 miles ENE	M	W1 - M2 - Q5	--	
14. Ledyard, Connecticut *	11.5 miles NE	M	W1 - M2 - Q5(f)	A2,5	
15. Montville, Connecticut *	14.0 miles N	M	W1 - M2 - Q5	A2,5	
16. Old Lyme, Connecticut *	9.0 miles W	M	W1 - M2 - Q5	--	
		Milk(d, g)	Groundwater	Fruit	Vegetables
17. Well No. 1	1.5 miles NE	--	SA1,2,4,5	--	--
18. Well No. 2	1.0 miles NE	--	SA1,2,4,5	--	--
19. Dairy Farm No. 1	5.0 miles NW	M3,5	--	--	--
20. Dairy Farm No. 2	8.0 miles NNW	M3,5	--	--	--
21. Dairy Farm No. 3	11.0 miles NE	M3,5	--	--	--
22. Dairy Farm No. 4 *	11.0 miles WNW	M3,5	--	--	--
23. Goat Farm No. 1	2.5 miles ENE	TM3-M5 (composite)	--	--	--
24. Goat Farm No. 2 *	11.0 miles NNE	TM3-M5 (composite)	--	--	--
25. Fruit and Vegetables	--	--	--	SA2,5(h)	SA2,5(h)

Sample Type(b) and Analysis(c)

a. From Millstone Unit 1 to nearest half mile
b. W = weekly, TM = twice a month, M = monthly, Q = quarterly, SA = semiannual, A = annual
c. 1 = gross beta; 2 = gamma spectrum; 3 = I-131; 4 = H-3; 5 = Sr-89, Sr 90, Cs-137.
d. During the period April through October and once in February.
e. Analyses are done on monthly and quarterly composites of the weekly air particulate samples collected at each station.
f. Includes a charcoal filter to be analyzed weekly for I-131 at inhalation dose levels.
g. Grass is substituted if milk is not available.
h. To be collected at the middle and end of the harvest season when available from representative commercial farms.
i. Comparisons between inner stations (within 1.5 miles) and outer stations (greater than 1.5 miles) will be made instead of using a control station concept.
* Control Station

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Table 3.2-2
Millstone Radiological Environmental
Monitoring Program--Aquatic Stations

Locations	Distance and Direction(a)	Bottom Sediment	Flora	Mussels	Oysters or Clams(e)	Lobster(e)	Fin Fish(d,e)	Water
		Type, Frequency(b) and Analysis(c)						
1. Golden Spur*	4.5 miles NNW	SA2,3	--	Q2,3,5	Q2,3,5	--	--	--
2. Niantic Shoals	2.5 miles NNW	SA2,3	SA2,3	Q2,3,5	Q2,3,5	--	--	--
3. Within 500 Feet of Discharge Canal	0.5 miles SSE	SA2,3	SA2,3	Q2,3,5	Q2,3,5	Q2,3,5	Q2,3,5	Q1,2,3,4
4. Seaside Point	2.0 miles ESE	SA2,3	SA2,3	--	--	--	--	Q1,2,3,4
5. Thames River (Yacht Club)	4.5 miles ENE	SA2,3	SA2,3	--	Q2,3,5	--	--	--
6. Niantic Bay	1.0 miles W	--		--	--	Q2,3,5	Q2,3,5	Q1,2,3,4
7. Black Point	2.5 miles SW	SA2,3	SA2,3	--	Q2,3,5	--	--	--
8. Giants Neck*	3.5 miles WSW	SA2,3	SA2,3	--	Q2,3,5	Q2,3,5	--	Q1,2,3,4
9. Commercial Shellfish Bed #316	0.1 miles S	--	--	--	Q2,3,5	--	--	--
10. Waterford Shell fish Bed #1	0.5 miles NNW	--	--	--	Q2,3,5	--	--	--

a. From Millstone Unit 1 to nearest half mile.
b. Q = quarterly, SA = semi-annual
c. 1 = gross beta, 2 = gamma spectrum, 3 = Sr-89, Sr-90, Cs-137, Co-60, 4 = H-3, 5 = I-131
d. Flounder and one other type of edible fin fish.
e. Sampling of crustacea, mollusk and fin fish to be staggered for each month of the quarter.
* Control Stations

AUG 1 1975