VOLUME 2

PRELIMINARY ASSESSMENT/ SITE INVESTIGATION REPORT – RADIOLOGICAL

GPU NUCLEAR, INC. OYSTER CREEK NUCLEAR GENERATING STATION

U.S. ROUTE NO. 9 FORKED RIVER, NEW JERSEY

Site Remediation Program
Case No. E99575

Prepared for:

GPU Nuclear, Inc.
U.S. Route No. 9
Forked River, New Jersey 08731

and

AmerGen Energy Co, LLC
2301 Market Street S22-1
P.O. Box 8699
Philadelphia, Pennsylvania

February 28, 2000

McLaren/Hart, Inc.

Blue Bell Executive Campus
470 Norristown Road, Suite 300
Blue Bell, Pennsylvania 19422

SCIENCE : STRATEGY : TECHNOLOGY : SOLUTIONS

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APPENDIX N

SITE INVESTIGATION – RADIOLOGICAL REPORT

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1.0 INTRODUCTION

McLaren/Hart, Inc. (McLaren/Hart) was retained by GPU Nuclear, Inc. ("GPU") and AmerGen to perform a Radiological Preliminary Assessment (PA) at the Oyster Creek Nuclear Generating Station (OCNGS or Facility). The OCNGS is located in Forked River, New Jersey. A site location map and site plan map are provided as Figures 1.1 and 1.2, respectively. The Radiological PA was conducted in conjunction with a request by GPU to defer radiological remedial activites until the decommissioning of OCNGS.

OCNGS site personnel interviewed included James Vouglitois - Manager, Environmental Affairs; Michael Slobodien - Director of Radiological Health & Safety; William Cooper - Facility Manager Radiological Engineering; Robert Barbieri - Facility Engineer and David Moore – Environmental Scientist.

The documents, which have been reviewed extensively, include the following:

- *Preliminary Assessment Report – Non-Radiological* – URS Greiner Woodward Clyde (URSGWC), December 20, 1999;
- *Site Investigation/Remedial Investigation – Non-Radiological* – URSGWC, January 2000;
- *Theoretical Release Study* – URSGWC, December, 1999; and
- *1998 Radiological Environmental Monitoring Report* – GPU – 1999.

This document is divided in to four sections. Section 2.0 provides a discussion of the property description, including site operations, site history and environmental settings. Section 3.0 provides a discussion of the two methods of radiological monitoring at the facility including sampling information and analytical results. Limitations of liability are provided in Section 4.0.

2.0 PROPERTY DESCRIPTION

The OCNGS is located in Lacey Township, Ocean County, New Jersey, about 35 miles north of Atlantic City. Access to the site is provided by U.S. Route 9, passing through the site and separating a 576-acre eastern portion from the balance of the property west of the highway. The OCNGS covers 720 acres extending approximately 2 1/4 miles inland from Barnegat Bay. The maximum width in the north-south direction is approximately 0.8 mile. The site location is part of the New Jersey coastal area with relatively flat topography and extensive freshwater and saltwater marshlands. The south branch of Forked River runs across the northern side of the site and Oyster Creek partly borders the southern side.

2.1 SITE OPERATIONS

The property can be divided into the developed portion of the site west of Route 9 within the intake and discharge canals, and the area located east of Route 9 which is primarily heavily vegetated and undeveloped.

2.1.1 Western Portion of the Property

The western portion of the property consists of a single boiling-water nuclear reactor and a turbine-generator to produce electrical power. This equipment and auxiliary support structures are located within the area bounded on the east by U.S. Route 9 and on the north, south and west by the Intake/Discharge Canal.

Three basics steps are involved in the process of producing electricity at the OCNGS. First, heat produced by fission in the nuclear reactor converts high-purity water to steam. Second, the steam is used to drive a turbine to produce mechanical energy. Third, the turbine is connected to a generator, which converts the mechanical energy of the rotating turbine into electrical energy.

Saltwater from Barnegat Bay is used to cool the steam exhausted from the turbine and to condense the steam back into water. This condensed high-purity water is returned from the main station condensers to the heat source to be converted into steam again to continue to drive the turbine.

2.1.2 Eastern Portion of the Property

The eastern portion of the property is heavily vegetated and largely undeveloped. JCP&L/GPUN have used the property in the following manner:

1) To deposit excavated/dredged soil and sediment during the construction and periodic maintenance dredging of the Intake and Discharge Canals for the OCNGS.

2) As a source of topsoil for re-vegetation projects on and around the OCNGS.

3) As an Environmental Laboratory (in buildings formerly located on the Property) from 1975-1988.

4) As a location for environmental monitoring activities including continuous air monitoring, groundwater monitoring and the planting of gardens to provide vegetables for radiological analyses.

The Barge Unloading Facility, located along the south shore of Oyster Creek adjacent to U.S. Route 9, has been used to deliver large equipment components, such as the turbine rotor, to the OCNGS. This facility is currently used on an intermittent basis by the Ocean County Engineering Department to load reef construction materials (concrete and used tires) onto vessels for delivery to artificial reefs in the Atlantic Ocean.

2.2 SITE HISTORY

2.2.1 Western Portion of Property

The western portion of the property was purchased by Jersey Central Power and Light Company (JCP&L), a subsidiary of GPU, from Norman C. and Elsie H. Finninger (husband and wife) on January 28, 1961. This property is approximately 132-acres in size and is located in Lacey township as a portion of Block 1001, Lot 4. Approximately 12.01 acres of land located in Ocean Township, along the south bank of Oyster Creek (Block 41, Lot 43) was also purchased as part of that transaction. Prior to construction of the OCNGS, the site was vacant and undeveloped.

JCP&L initiated construction of OCNGS in December 1963. Commercial operations began on December 23, 1969. The OCNGS was operated by JCP&L until 1980 when GPU Nuclear, Inc. (GPUN), another subsidiary of GPU, assumed responsibility for operations. GPUN continues to operate the OCNGS for JCP&L, doing business as GPU Energy.

2.2.2 Eastern Portion of Property

The eastern portion of the property was purchased by JCP&L from NOR-RU-EL, Inc. on June 28, 1996. The 548.07 property is located in Lacey Township as Block 100, Lots 1-20 & 20.01 and Ocean Township as Block 63, Lot 7. Prior to that purchase, the portion of the property located in Lacey Township (536.03 acres) was used for raising beef cattle while the 12.04 acre parcel located in Ocean Township was undeveloped.

JCP&L purchased an undeveloped 25.25-acre parcel (Lacey Township Block 101, Lot) located adjacent to the north side of the Finninger Farm Property, from Mayer Construction Company on March 8, 1971.

As part of the land acquisition for the construction of the intake canal for the OCNGS, JCP&L purchased a 2.01 acre undeveloped parcel (Lacey Township Block 138, Lot 2) from Charles R. Pearl and Marie D. Pearl on January 18, 1966, and an undeveloped lot comprising of 1.01 acres (Lacey Township Block 139, Lot 11) from Wilnor Realty Company on November 11, 1965.

2.3 ENVIRONMENTAL SETTING

2.3.1 Climate

The climate in the coastal region is dominated by the Atlantic Ocean. In the autumn and early winter months, the coastal region will experience warmer temperatures than the interior regions of the state. During the spring months, ocean breezes keep temperatures along the coast cooler. Coastal storms are most frequent between October and April. Tropical storms and hurricanes are also a special concern along the coast.

2.3.2 Wind

During 1998, wind direction frequencies were normal. Winds were from the northwest, west-northwest, west and southwest. Seasonal winds, including the sea breeze circulation, exist during the late spring through early autumn season. Resulting winds during a sea breeze are from the south and southeast. The number of occurrences of this thermally induced wind was reduced due to the strong west-southwesterly flow during the summer months.

2.3.3 Temperature

The annual average temperature for 1998 was 54.93 degrees Fahrenheit. The highest average temperature was recorded in July and the lowest average temperature was recorded in February. The historical average annual temperature is 53 degrees. Seven of the twelve months experienced below normal temperatures, although differences from the historical average were small.

2.3.4 Precipitation

In 1998, Oyster Creek experienced above normal precipitation. The annual total precipitation amount was 54.24 inches. This amount is more than the average amount of 41.50 inches. The highest amount of precipitation was recorded in May while the lowest amount was recorded in September. During the first six months, precipitation was greater than the monthly historical value.

2.4 GEOLOGY/HYDROGEOLOGY

2.4.1 Regional Geology

Site geology has been extensively investigated with a long history of core sampling, soil boring investigations and excavation work that began with a preliminary survey in 1960. Surface elevation in the vicinity of plant structures is 23 feet mean sea level. A stratigraphy typical of the Atlantic Coastal Plain physiographic province is found at OCNGS.

The Coastal Plain Physiographic Province is characterized by beds of sand, gravel, clay, and marl dipping gently to the southeast. In descending order, from ground surface are found the following: The Cape May (Pleistocene age - 1-2 million years before present), Cohansey Formation (Miocene age – 7-25 million years before present) and the Kirkwood Formation (Miocene age) Formation.

The Cape May Formation has an average thickness of 40 feet and is comprised of a light gray to tan, medium to fine sand, with trace silt and coarse sand (Woodward-Clyde Consultants, 1982). It is poorly compacted and commonly contains a thin, shallow black clay bed in coastal areas (New Jersey Department of Conservation and Economic Development, 1969).

The Cohansey Formation lies beneath the Cape May Formation. Its average thickness is 60 feet and is primarily composed of a red-brown and tan, medium to fine sand, trace silt, coarse sand, and some coarse to fine gravel. Lenticular beds of clay are sometimes found and the lower portions are densely compacted (Woodward-Clyde Consultants, 1982).

The Cohansey is underlain by the Kirkwood Formation consisting of light gray to yellow-brown micaceous ilmenitic, lignitic, very fine to fine grained quartz sand and some coarse to fine gravel. (New Jersey Department of Conservation and Economic Development, 1969). It is densely compacted and extends from a depth of about 100 feet to at least 250 feet below the surface (JCP&L).

2.4.2 Regional Hydrogeology

Both the Cape May and Cohansey Formations contain unconfined aquifers. An artesian aquifer exists in the Kirkwood Formation. Occasional clay layers in the Cape May and the Cohansey cause slightly artesian conditions in localized areas, but these two formations communicate hydrogeologically. A clay layer separates the Kirkwood from the Cohansey. The clay layer acts as a confining layer and artesian heads as high as 22 feet above mean sea level have been found in the Kirkwood (JCP&L, 1972).

On a regional scale, groundwater flows generally to the southeast toward the coast, following the trend of the coastal basin sedimentary bedding. Water supplies in the area are derived from wells. These wells are generally 60 to 70 or more feet in depth, penetrating at least one clay boundary to preclude contamination from salt-water intrusion or leachate from the many septic tanks in the area. The deeper wells penetrate the Kirkwood aquifer and yield higher quality water. There are also many shallower wells that provide domestic water supplies, mainly for irrigation of lawns (Woodward-Clyde Consultants, 1984).

2.4.3 Site Geology

There are five stratigraphic units found at the Site (exclusive of fill). These include (in descending order):

- Fill Material;
- The Cape May Formation;
- The Upper Clay;

- The Upper Cohansey Formation;
- The Lower Clay; and,
- The Kirkwood Formation

Descriptions of these formations presented below are based on boring logs from this and previous investigations, and previous reports; principally the "Geotechnical Study, Proposed Radwaste and Off-Gas Building" (February 1975), the "Phase II Report, Ground Water Monitoring System" (March 1984), and additional boring log review.

FILL

Description: The fill is a tan, medium to fine grained sand with trace to some silt. No evidence of soft sediment structures such as lenses of silt or coarse sand. The density is typically less than the Cape May.

Thickness: The fill thickness from soil boring logs varies from 0 to 38 feet below ground surface (bgs) (el. 23 ft. to el. –15 ft). The maximum thickness of fill was in the borings closest to the Turbine Building. The maximum fill thickness must be 53 feet (el. –30 vs. surface elevation of +23 feet) in the vicinity of the Reactor Building. This is based on the depth of the excavation for these structures (no boring log was found indicating 53 feet of fill).

CAPE MAY FORMATION

Description: The Cape May Formation is the youngest formation encountered at OCNGS. It is described as a light gray to tan medium to fine grained sand with trace to some silt and occasional coarse sand. It is generally poorly compacted.

Thickness: The Cape May Formation in the study area varies from 0 feet to 21.5 feet thick. The variation is largely due to the amount of material excavated and replaced by fill as part of construction activities. The thickness of the Cape May Formation in undisturbed areas is generally in the range of 17 to 20 feet (presuming a ground surface elevation of 23 feet).

UPPER CLAY

Description: The description is as follows: stiff to hard, gray, plastic organic clay containing inclusions (also described as lenses or partings) of dense fine sand with trace to some organic silt. The deposits of fine sand within the Upper Clay layer have high relative densities and are believed to be in the form of lenses or inclusions. Some boring logs describe the "sand lenses" as the dominant feature over a 1 to 5 feet thickness. In the area southwest of the Turbine Building, approximately half of the total thickness of the Upper Clay, is silty sand (not clay).

Thickness: The Upper Clay is typically on the order of 15 to 18 feet thick (where not impacted by excavation). Early reports suggest a thinning trend from east to west. This trend is best observed by reviewing information from outside the study area, specifically boring logs from the western portion of the property and preliminary data from the Route 9 area (eastern portion of the property). These data suggest the Upper Clay may be as thick as 25 feet east of Route 9 to 0 feet at the western portion of the property. The lack of a map identifying the locations of these borings makes correlation difficult and very speculative.

COHANSEY FORMATION

Description: Yellow-brown or tan, medium to fine sand with trace to some silt. Also contains pockets of coarse fine sand, and occasional gravel and pockets of sandy silt. The lower portion of the Cohansey Formation was deposited in a beach or barrier bar environment, while the upper portion is a fluvial deposit.

Thickness: The thickness of the Cohansey is estimated to be approximately 60-75 feet. There is insufficient data to identify a trending of the thickness of this formation beneath the Facility.

Lower Clay

Description: The Lower Clay is a dense gray medium to fine sand containing a trace to some organic silt and layers or inclusions of very stiff to hard gray organic clay.

Thickness: The thickness of the Lower Clay is on the order of 10 to 20 feet. Again, there is limited thickness information on this formation. The majority of the borings reviewed for this study terminate above the Lower Clay.

KIRKWOOD FORMATION

Description: This is a medium to fine sand with trace silt. Casagrande and Casagrande (1968) reported two hard clay layers within the Kirkwood Formation at elevations less than –198 feet mean sea level.

Thickness: Unknown in the study area.

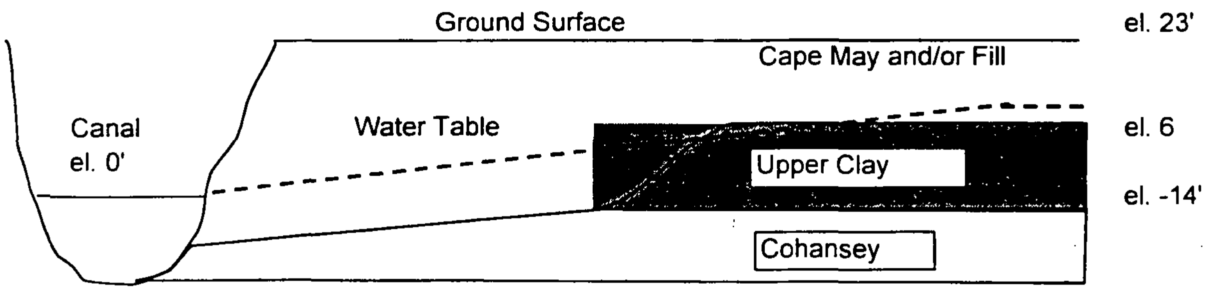
Construction activities have impacted stratigraphy at OCNGS. Construction activities of the major structures at the site (Reactor Building, Turbine Building, Old Radwaste building, New Radwaste Building, Intake/Discharge Structure and tunnel systems) included extensive soil removal for the construction of foundations and associated structures. Foundation depths are shown with respect to site buildings on Figure 2.4.3.1.

Based on Figure 2.4.3.1, construction activities have caused the removal of the Cape May and the Upper Clay from various parts of OCNGS. The Cape May Formation and the Upper Clay Formation were removed during the excavation of 7 of the 8 major structures at OCNGS. In addition, the Cohansey Formation was partially removed during construction of the Reactor Building, the Intake Structure and the Discharge Tunnels. Cross sections depicting the current stratigraphy with respect to current OCNGS structures are provided in Figure 2.4.3.2.

2.4.4 Site Hydrogeology

Extensive hydrogeologic investigations have been conducted at the site since 1983/1984 (Woodward Clyde Consultants, 1984). The results of the recent site investigations corroborate the earlier studies as summarized below.

Water level measurements from wells screened in the Cape May Formation (shallow wells) and wells screened in the Cohansey Formation (intermediate wells) indicate downward vertical gradient. The general groundwater flow direction in both Formations is from areas of higher ground elevation towards the canal, which acts as a local groundwater discharge point. The influence of the canal on groundwater flow decreases with distance from the canal.



NOT TO SCALE

The site hydrogeology is dominated by the excavation of the Upper Clay. The construction of the Reactor Building, Turbine Building, Intake & Discharge Structures, etc. resulted in the excavation of the Upper Clay. The excavation of the Upper Clay has resulted in a hydraulic connection between the Cape May Formation and the Cohansey Formation. East of the Reactor Building the water table is several feet above the Upper Clay. West of the Turbine Building, the water table is several feet below the top of the Upper Clay (Figure 2.4.3.2).

The groundwater flow direction within Cape May Formation and, at a minimum the upper portion of the Cohansey Formation has been reversed. Groundwater in both the Cape May and the Cohansey formerly flowed east, towards Barnegat Bay. However, groundwater in the vicinity of the plant now flows west toward the Canal. A groundwater trough has been created in areas in which the Upper Clay has been excavated. The elevation of the water table is now less than average elevation of the Upper Clay in the area west of Route 9. A groundwater contour map is provided as Figure 2.4.4.1.

3.0 RADIOLOGICAL MONITORING

Based on document review and interviews with GPU personnel, OCGNS conducts radiological monitoring via two processes. The first process is a comprehensive radiological environmental monitoring program (REMP) to monitor radiation and radioactive materials around the Facility. The second method includes independent onsite soil, sediment and groundwater sampling events. This section of the report will detail information associated with each sampling event as reported in the most recent (1998) REMP Report and the other independent sampling events.

3.1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

GPUN conducts a REMP to monitor radiation and radioactive materials in the environment around the OCNGS. The REMP program evaluates the relationship between radioactive material released to the environment as gaseous and liquid effluents and resultant radiation doses to individuals. The monitoring program also serves as an effective method of monitoring the potential migration of any radiologically contaminated soil or groundwater from the OCNGS to the off-site environment. The United States Nuclear Regulatory Commission (NRC) has established regulatory guidelines, which contain acceptable monitoring practices. The OCNGS REMP was designed on the basis of these regulatory guides along with the NRC Radiological Assessment Branch Technical Position on Environmental Monitoring. The OCNGS REMP meets or exceeds all of these guidelines. The REMP was initiated in 1966, prior to the operation of the OCNGS, in order to obtain information on background levels of radiation and radioactive materials in the environment. Summaries and interpretations of the REMP have been published semiannually from 1969-1985 and annually since 1986. Additional information concerning releases of radioactive materials to the environment is contained in the Semi-Annual and Annual Effluent Release Reports submitted to the NRC.

Radioactive materials considered in the REMP are normally present in the environment, either naturally or as a result of non-OCNGS activities such as prior atmospheric nuclear weapons testing, medical industry activities, and the 1986 Chernobyl accident. Samples of air, surface water, groundwater, clams, sediment, fish, crabs and vegetables are collected and compared to background measurements to evaluate any impact of OCGNS operations. Samples are analyzed for radioactivity including tritium, gross beta, and gamma-emitting radionuclides. In addition, external penetrating radiation dose measurements are also made using thermoluminescent dosimeters (TLDs) in the vicinity of the OCNGS.

More than 40,000 environmental samples have been collected during the 33 years that the REMP has been implemented. The results of that effort have clearly demonstrated that any radionuclide contamination of the on-site soil or groundwater has not impacted the off-site environment. There are only barely detectable concentrations of radionuclides in the off-site environment that can be attributed to routine effluents from the OCNGS, and those concentrations are a small fraction of any existing or proposed, State or Federal, limits or cleanup standards. Independent monitoring programs conducted by the New Jersey Department of Environmental Protection (NJDEP) and the US Nuclear Regulatory Commission have confirmed these results. The results of this offsite Radiological Environmental Monitoring Program satisfy any requirements for a Baseline Ecological Evaluation and Ecological Risk Assessment as specified by the Technical Requirements for Site Remediation (N.J.A.C. 7:26E).

The 1998 Radiological Environmental Report is provided in Appendix A of this report, however the results are summarized in the following:

- During 1998, 638 samples were taken from the aquatic, atmospheric and terrestrial environments around the OCNGS. A total of 893 analyses were performed on these samples. TLDs were also utilized to provide 170 direct radiation dose measurements. Forty groundwater samples, taken primarily from local municipal water supplies and on-site wells, were collected and eighty analyses were performed on those samples.

- OCNGS specific radionuclides were not detected in any samples of air, vegetables, fish, clams, crabs, or off-site groundwater.

- The results of the analyses of 28 samples collected from the on-site groundwater monitoring well network showed that tritium was the only detectable plant specific radionuclide. The highest tritium concentration observed in these on-site wells (840 picoCuries per liter (pCi/L)) was only

4.2 percent of the USEPA drinking water limit of 20,000 pCi/L. An increase in the frequency of occurrence of tritium in the on-site monitoring wells, when compared to prior years, can be attributed to an increase in the amount of tritium in airborne effluents from the OCNGS during 1997 and 1998, thought to be associated with control rod blade leakage. This source of tritium was significantly reduced during the 17R outage in the autumn of 1998.

- Off-site REMP groundwater monitoring during 1998 demonstrated that, as in previous years, the radioactive effluents associated with the OCNGS did not have any measurable effects on off-site drinking water.

- Minute levels of Cesium-137 (Cs-137) detected in aquatic sediment samples were attributable in part to past effluents from the OCNGS. This is the second consecutive annual reporting period during which Cobalt-60 (Co-60) was not detected in any environmental media.

- The amount of radioactivity released in effluents from the OCNGS during 1998 was the fifth smallest in the history of Facility operation. The predominant radionuclide in gaseous and liquid effluents was tritium. The maximum radiation dose to the public attributable to 1998 effluents was only 0.15 percent of applicable regulatory limit.

- During 1998, the maximum total body dose potentially received by an individual from liquid and airborne effluents was conservatively estimated to be 0.017 millirems. The total body dose to the surrounding population from liquid and airborne effluents was conservatively calculated to be 0.1 person-rem. This is approximately 12.3 million times lower than the population dose attributable to natural background sources.

Although the 1999 REMP has not been published, McLaren/Hart obtained groundwater monitoring data for 1999. In 1999, a total of 30 groundwater samples were collected from the onsite monitoring well network in 1999. Monitoring well locations are shown in Figure 3.1.1. Tritium was detected in 13 samples at concentrations ranging from 140 pCi/L to 580 pCi/L. All concentrations are below USEPA Drinking Water Standards. Groundwater analytical results are summarized in Table 3.1.1.

3.2 ONSITE SAMPLING EVENTS

OCNGS has performed on-site soil, groundwater, sediment and surface water sampling to evaluate potential radiological impacts to the environment. These events are associated with various construction activities, miscellaneous releases from tanks or related appurtenances and investigations in conjunction with GPU's request to defer radiological remedial activites until decommissioning. Based on document review and interviews with facility personnel, the following sampling events were conducted at OCNGS.

3.2.1 March 1981 - New Radwaste Building - Tank Leak

In March 1981 a tank containing radiologically contaminated water located in the New Radwaste Building (NRW) overflowed to the floor. The water was contained in the isolated tank vault. After a period of time the water began to seep out of the building through the walls on the west and north side. In order to evaluate potential radiological impacts of the seepage, a total of 15 soil samples were collected north and west of the NRW in the area of the seepage from ground surface to approximately 17.5 feet below ground surface (bgs) and analyzed for gamma emitting radionuclides. Approximate sample locations are shown in Figure 3.2.1.

Concentrations of Co-60 ranged from below laboratory detection limits to 1.4 picoCuries per gram (pCi/g). Concentrations of Cs-137 ranged from below laboratory detection limits to 2.4 pCi/g. Sample concentrations were below the NRC decommissioning guidelines of 3.8 pCi/g for Co-60 and 11.0 pCi/g for Cs-137. Table 3.2.1 summarizes all sampling information and results.

3.2.2 October 1982 - Old Radwaste Building - Waste Surge Tank Release

In October 1982, a release of radiologically contaminated water was reported from the waste surge tank located on the northern side of the Old Radwaste (ORW) Building located on the central portion of OCNGS. In order to evaluate the radiological impact, soil samples were collected on four separate events. Approximate sample locations are located on Figure 3.2.2.

October 7, 1982

On October 7, 1982, a total of 12 samples were collected from ground surface to 3.5 feet bgs south of the ORW waste surge tank to evaluate the radiological impacts from the release. Elevated concentrations of gamma emitting radionuclides were detected in all 12 samples. Concentrations of Co-60 ranged from 0.674 to 205.46 pCi/g. Concentrations of CS-137 ranged from 1.156 pCi/g to 337.87 pCi/g. A total of 8 samples exceeded the NRC decommissioning guidelines for Co-60 and 8 samples exceeded the NRC decommissioning guidelines for Cs-137. Table 3.2.2 summarizes all sampling information and results.

October 13, 1982

On October 13, 1982, a total of 12 samples were collected from approximately 0.5 feet to 5 feet bgs south of the ORW waste surge tank inside and outside the berm to further delineate radiological impacts from the waste surge tank release. In addition, one sample was collected from ground surface to 1.5 feet below the ORW surge tank pipe. Elevated concentrations of gamma emitting radionuclides were detected in all 13 samples. Concentrations of Co-60 ranged from 1.15 pCi/g to 163 pCi/g. Concentrations of Cs-137 ranged from 4.16 pCi/g to 192 pCi/g. A total of 9 samples exceeded the NRC decommissioning guidelines for Co-60 and 7 samples exceeded the NRC decommissioning guidelines for Cs-137. Table 3.2.2 summarizes all sampling information and results.

October 27, 1982

On October 27, 1982, a total of 13 samples were collected from ground surface to 7.5 feet bgs south of the ORW waste surge tank inside and outside the berm to further delineate radiological impacts from the waste surge tank release. In addition, one sample was collected from 8 feet bgs below the ORW surge tank pipe located outside the berm. Elevated concentrations of Cs-137 were detected in all samples and Co-60 was detected in 9 of 13 samples. Concentrations of Co-60 ranged from below laboratory detection limits to 47.387 pCi/g. Concentrations of Cs-137 ranged from 0.4814 pCi/g to 66.695 pCi/g. A total of 5 samples exceeded the NRC decommissioning guidelines for Co-

60 and 6 samples exceeded the NRC decommissioning guidelines for Cs-137. Table 3.2.2 summarizes all sampling information and results.

October 31, 1982

On October 31, 1982, a total of 42 samples were collected from ground surface to approximately 12 feet bgs east, west and south of the ORW waste surge tank to further delineate radiological impacts from the waste surge tank release. Elevated concentrations of gamma emitting radionuclides were detected in all samples. Concentrations of Co-60 ranged from 0.074 pCi/g to 79.807 pCi/g. Concentrations of Cs-137 ranged from 0.094 pCi/g to 125.78 pCi/g. A total of 4 samples exceeded the NRC decommissioning guidelines for Co-60 and 4 samples exceeded the NRC decommissioning guidelines for Cs-137. Table 3.2.2 summarizes all sampling information and results.

3.2.3 October 1982 – Old Radwaste Building – Truck Ramp Paving

During the period October 10-11, 1982 a truck ramp was under construction at the ORW. As part of construction activities, soil was removed. In order to evaluate potential radiological impacts of the excavated soil, a total of 55 surface soil samples (0-0.5 feet bgs) were collected from east, west and north of the ORW for gamma emitting radionuclides. Sample locations are shown in Figure 3.2.3.

Concentrations of Co-60 ranged from below laboratory detection limits to 40 pCi/g. Concentrations of Cs-137 ranged from below laboratory detection limits to 28.366 pCi/g. A total of 9 samples exceeded the NRC decommissioning guidelines for Co-60 and 3 samples exceeded the NRC decommissioning guidelines for Cs-137. Table 3.2.3 summarizes all sampling information and results.

3.2.4 June 1985 – Proposed Emergency Safe Shutdown Facility (ESSF) Location

On June 1, 1985 and April 29, 1986 soil samples were collected to evaluate proposed locations for a new building to be constructed known as the ESSF (ultimately, the building was never built). As part of potential construction activities, soil would be removed for offsite disposal. In order to evaluate potential radiological impacts, a total of 84 soil samples were collected from the surface (0-6 inches) and analyzed for gamma emitting radionuclides. Sample locations are shown in Figure 3.2.4.

Concentrations of Co-60 ranged from below laboratory detection limits to 5.29 pCi/g. Concentrations of Cs-137 ranged from below laboratory detection limits to 4.6 pCi/g. One sample exceeded the NRC standard for Co-60 at a concentration of 5.29 pCi/g. All Cs-137 concentrations were below the NRC standard. Table 3.2.4 summarizes all sampling information and results.

3.2.5 March 1991 - Condensate Storage Tank - Bottom Leakage

In March 1991, a leakage of radioactive contaminated water was reported from the bottom of the Condensate Storage Tank (CST) located on the western portion of the Facility. In order to evaluate the radiological impact, a total of 35 soil samples were collected from ground surface to 7 feet bgs from around and below the CST and analyzed for gamma emitting radionuclides. In addition, one water sample was collected from the CST and analyzed for gamma emitting radionuclides. Sample locations are shown in Figure 3.2.5.

Concentrations of Co-60 in soil ranged from below laboratory detection limits to 20 pCi/g. A total of two samples exceeded the NRC standard for Co-60 at a concentrations of 20 pCi/g and 6.81 pCi/g.

The concentration of Co-60 in the water sample was reported at 30.9 pCi/L. Table 3.2.5 summarizes all soil and CST water sampling information and results.

3.2.6 April 1991 - CST Yard Spill

A spill from the CST discharge valve in the CST yard located on the western portion of OCNGS was reported in April 1991. In order to evaluate the radiological impact two surface (0-6 inches bgs) samples were collected from the CST Yard. One soil sample was collected in the collection pit under the transfer pipe and one sample was collected in the CST Yard at the tank discharge valve. Samples were analyzed for gamma emitting radionuclides. Sample locations are shown in Figure 3.2.6.

Elevated concentrations above NRC decommissioning guidelines were reported in both samples. The soil sample collected at the discharge valve exhibited a Co-60 concentration of 157 pCi/g while the other sample exhibited a concentration of 22.2 pCi/g. Table 3.2.6 summarizes all soil sampling information and results.

3.2.7 August 1992 – Proposed Independent Spent Fuel Storage Installation (ISFSI) Concrete Pad Construction

On August 6, 1992, soil samples were collected to evaluate the proposed location for the construction of a concrete pad at the ISFSI area. As part of potential construction activities, soil would be removed for offsite disposal. In order to evaluate potential radiological impacts for disposal purposes, a total of 28 soil samples were collected from the surface (0-6 inches) and analyzed for gamma emitting radionuclides. Sample locations are shown in Figure 3.2.7.

Concentrations of Co-60 ranged from below laboratory detection limits to 0.0996 pCi/g. Concentrations of Cs-137 ranged from below laboratory detection limits to 0.211 pCi/g. All concentrations were below the NRC decommissioning guidelines. Table 3.2.7 summarizes all sampling information and results.

3.2.8 August 1997 –Upland Confined Disposal Facility Investigation

The Upland Confined Disposal Facility (CDF) is a portion of the site located east of U.S. Route 9, on the Finninger Farm Property, that has been used for the deposition of dredged material resulting from periodic maintenance dredging in the intake and discharge canals. Maintenance dredging was conducted in 1978, 1984 and 1997.

Prior to the most recent dredging project (1997), an investigation of the soil at the CDF was conducted. All samples were collected in August of 1997, and represent sediment from previous dredging projects. Eighty-six samples were collected and analyzed for the gamma-emitting nuclides. Only one of the 86 samples detected Co-60 at 0.075 pCi/g. Forty of the 86 samples detected Cs-137, with a maximum concentration of 0.20 pCi/g. All detections of both nuclides were well below the NRC decommissioning guidelines. Sample information and results are summarized in Table 3.2.8.

Additionally, prior to the 1997 dredging project, nine sediment cores were collected from the Forked River in areas that were to be dredged and deposited in the CDF. For both Co-60 and Cs-137, eight of nine samples exhibited detectable concentrations. All concentrations for both nuclides were well below the NRC decommissioning guidelines; the maximum concentrations for gamma emitting radionuclides were 0.088 pCi/g and 0.27 pCi/g, respectively.

3.2.9 September 1996 – Condensate Transfer Overboard Discharge Event

On September 17, 1996, approximately 148,800 gallons of condensate water was discharged to the Circulating Water discharge tunnel via the Fire Protection System, and ultimately released to the Oyster Creek discharge canal.

Following the release, an investigation of potentially impacted surface water, sediments and biota (clams) was conducted. Sampling locations are provided in Figure 3.2.9. In surface water, tritium levels in the condenser intake were slightly elevated (330 pCi/L). The maximum tritium concentration observed in surface water samples (16,000 pCi/L) did not exceed the USEPA drinking water limit (20,000 pCi/L), and USNRC effluent limitations were not exceeded. Cobalt-60 was the only gamma emitting radionuclide to be detected in surface water, detected in only one of 23 samples, downstream of the 30" header (2.0 pCi/L). Concentration levels of Co-60 in all sediment samples from the Barnegat Bay and the intake canal were less than the limit of detection. In Oyster Creek sediment, Co-60 was detected in 4 of 16 samples. The maximum sediment concentration was 0.056 pCi/g, well below the NRC decommissioning guideline of 3.8 pCi/L. All Co-60 concentrations were less than or equal to those observed in REMP samples prior to the release. Clams in Barnegat Bay were also sampled and determined to be non-detect for Co-60; this was consistent with previous REMP sampling results. Tritium was not found in clams collected near the mouth of Oyster Creek, however, low levels attributable to background were found in clams from Stouts Creek to the north and Manahawkin Bay to the south. Sample information and results are summarized in Table 3.2.9.

3.2.10 August 1999 – Old Radwaste Building Concrete Pad – Spill Event

In August 1999, a release of radiologically contaminated water was reported from a container of mop water located at the ORW. In order to evaluate the radiological impact, three soil samples were collected and analyzed for gamma emitting radionuclides. Soil sampling locations are shown in Figure 3.2.10.

Concentrations of Co-60 ranged from 1.28 pCi/g to 10.2 pCi/g. Concentrations of Cs-137 ranged from 0.64 pCi/g to 6.04 pCi/g. Two samples were above the NRC decommissioning guideline for Co-60. Concentrations of Cs-137 were below the NRC decommissioning guideline. Table 3.2.10 summarizes all sampling information and results.

3.2.11 Non-Radiological ISRA Investigation

As part of the due diligence associated with the sale of OCNGS, as well as to anticipate the potential requirements of compliance with the Industrial Site Recovery Act (ISRA),URS Greiner Woodward Clyde (URSGWC) was retained to perform a Site Investigation (SI) and Remedial Investigation (RI) for non-radiological concerns conducted at OCNGS in August, September, November and December 1999, and January 2000. The scope of work for the SI/RI was based on information obtained from a Preliminary Assessment - Non-Radiological submitted to the NJDEP in December 1999. As part of the SI/RI, soil, sediment, groundwater and surface water samples were collected and submitted offsite for non-radiological laboratory analysis. In order to screen the samples prior to offsite analyses, they were analyzed for gamma emitting radionuclides.

Approximately 231 soil samples were collected throughout OCNGS and analyzed for gamma emitting radionuclides. A total of 5 sediment samples and 1 groundwater sample was collected and analyzed for gamma emitting radionuclides. All sample locations are provided in Figure 3.2.11.

Concentrations of Co-60 ranged from below laboratory detection limits to 2.21 pCi/g. Concentrations of Cs-137 ranged from below laboratory detection limits to 33 pCi/g. Of the 231 soil samples, only one sample exhibited concentrations above NRC decommissioning guidelines. Sample information and results are summarized in Table 3.2.11.

Sediment samples exhibited concentrations below laboratory detection limits for Co-60. Concentrations of Cs-137 ranged from below laboratory detection limits to 0.0775 pCi/g. All concentrations were below NRC decommissioning guidelines. Sample information and results are summarized in Table 3.2.11.

3.2.12 Miscellaneous Sampling Events

Miscellaneous sampling events have occurred on six separate occasions. In order to evaluate the radiological impact, soil samples were collected. Each miscellaneous sampling event is provided below. Sample locations are provided on Figure 3.2.12. A summary of sampling information and analytical results is provided in Table 3.2.12.

March 21, 1986

On March 21, 1986 soil between the Main Fuel Oil Storage Tank (MFOST) and the railroad airlock was removed during construction activities. This area is located on the eastern portion of the OCNGS south of the ORW. In order to evaluate potential radiological impacts of the excavated soil, one soil sample was collected from the surface and analyzed for gamma emitting radionuclides.

Analytical results indicate elevated concentrations of gamma emitting radionuclides. Co-60 was detected above NRC decommissioning guidelines at a concentration of 8.54 pCi/g. Cs-137 was detected at a concentration of 2.68 pCi/g below NRC decommissioning guidelines.

June/July 1990

Soils from the OCNGS plant area were placed on the firing range parking lot, located on the adjacent Forked River Site (not a part of this transaction), during an excavation project in late June and early July of 1990. These soils contained low levels of Co-60 and Cs-137 at the time that they were placed on the parking area. Co-60 and Cs-137 concentrations in 14 soil samples, collected in October of 1990, ranged from less than the lower limit of detection to 0.200 pCi/g and 0.370 pCi/g, respectively. These concentrations are minute fractions of the NRC decommissioning guidelines. The soils were removed from the parking lot and returned to the OCNGS plant area in December of 1990. In order to verify that there was no residual plant specific radioactive material in this area, the firing range parking lot area was extensively surveyed in July of 1998 as a part of the Forked River property sale process. Fifty-two soil samples were collected from the parking lot and analyzed for gamma emitting radionuclides. All soil samples were split with the NJ Department of Environmental Protection to allow for independent radiological analyses. No Co-60 was detected in these soil samples. Cs-137 was detected in only one sample at a concentration (0.110 pCi/g) consistent with background levels. These results were verified by the independent analyses performed by the NJDEP. In addition to the soil sampling, a moving gamma spectroscopic scan of approximately 25% of the potentially affected parking lot area was performed. Confirming the results of the soil analyses, no plant related nuclides could be detected with spectroscopic scanning.

March 2, 1992

On March 2, 1992 a leak was reported from the waste surge tank pipe at the ORW. In order to evaluate potential radiological impacts of the excavated soil, one surface soil sample was collected and analyzed for gamma emitting radionuclides.

Analytical results indicated elevated concentrations of gamma emitting radionuclides. Concentrations of CO-60 and Cs-137 were detected above NRC decommissioning guidelines at concentrations of 1100 pCi/g and 390 pCi/g, respectively.

April 3, 1992

Prior to installing an impermeable liner in the containment around the MFOST, four soil samples were collected to evaluate the extent of any radiological contamination.

Concentrations of CO-60 ranged from 0.247 pCi/g to 0.892 pCi/g. Concentrations of Cs-137 ranged from 0.395 pCi/g to 1.17 pCi/g. All sample concentrations were below NRC decommissioning guidelines.

September 3, 1997

On September 3, 1997, a 30 cubic yard dumpster containing approximately one ton of sand, that may have contained trace amounts of plant specific radionuclides, was inadvertently removed from the OCNGS and transferred to the Ocean County Landfill in Manchester Township, New Jersey. The soil had been removed from an on-site excavation and was placed in the dumpster during the fall of 1996. Samples of the soil were collected at that time and analyzed for gamma emitting radionuclides. The maximum observed Co-60 concentration was 0.028 pCi/g, a minute fraction of the NRC decommissioning guideline of 3.8 pCi/g. The maximum Cs-137 concentration was 0.031 pCi/g, consistent with background levels. The dumpster was moved to a storage area to allow evaluation of alternatives for ultimate disposition and to allow for decay. Approximately one year later it was inadvertently taken to the landfill. Since the removal was unintended, no recent sample results were available. Therefore, to be conservative, GPUN assumed that there was remaining activity in the soil. The owner of the landfill and the NJ Department of Environmental Protection were immediately notified of the event. Representatives of GPUN, the landfill owner, the NJDEP (Dr. Gerald Nicholls) and numerous other State and local officials met at the landfill on September 5, 1997 to discuss this event. It was agreed that although no occupational or public health concerns existed, GPUN would remove the soil that originated at the OCNGS from the landfill. On September 6, 1997, approximately 90 cubic yards of debris and sand was excavated from the area of the landfill where the soil from the OCNGS had been deposited, and delivered to the OCNGS. Subsequent sampling of the retrieved material showed that it was not contaminated with plant specific radionuclides. Independent radiological analyses of the material were also performed by the NJ Bureau of Nuclear Engineering and the NRC. The material was subsequently transferred to a licensed solid waste facility with the concurrence of the NJDEP Division of Solid and Hazardous Waste.

June 30, 1999

On June 30, 1999, OCNGS personnel conducted a search for a potential fuel oil pipeline leak under the floor of the maintenance shop (Building #4). One soil sample was collected and screened for radiological contamination prior to being sent offsite for non-radiological analysis.

Concentrations of Co-60 were not detected above laboratory detection limits and Cs-137 was detected at 0.0366 pCi/g, below the NRC guideline of 11 pCi/g.

July 16, 1999

On June 30, 1999 a diesel fuel spill was reported on the north side of the diesel generating building (DG). In order to screen diesel fuel contaminated soil for radiological impact prior to offsite disposal, one surface soil sample was collected and analyzed for gamma emitting radionuclides on July 16, 1999.

Concentrations of Co-60 were not detected above laboratory detection limits and CS-137 was detected at 0.0936, below NRC decommissioning guidelines.

August 27, 1999

A salt water system leak was identified under the chiller pad east of the Reactor Building. In order to gain access to the leak soil samples were collected to evaluate potential radiological impacts prior to accessing the leak under the concrete pad. Two soil samples were collected. One sample was collected along the eastern wall of the Reactor Building and one sample was collected along the west wall of the excavation. Both samples were analyzed for gamma emitting radionuclides.

Concentrations of Co-60 for the eastern and western excavation wall samples were detected at 0.75 pCi/g and 1.39 pCi/g, respectively. Concentrations of Cs-137 for the eastern and western excavation wall samples were detected at 1.68 pCi/g and 2.04 pCi/g, respectively. Both samples were below NRC decommissioning guidelines.

January 6, 2000

On January 6, 2000, three surface soil samples were collected from three separate soil berms located west of the dilution pump house, the main fuel oil storage tank and the south parking lot at the protected area fence line. As part of the effort to obtain additional site characterization data for the decommissioning planning effort, one surface soil sample was collected from each location and analyzed for Gamma emitting radionuclides.

Gamma emitting radionuclides were not detected above laboratory detection limits.

4.0 LIMITATION OF LIABILITY

McLaren/Hart undertakes all assignments in its role as an environmental engineering consulting firm using our professional effort consistent with generally accepted environmental assessment practices. McLaren/Hart has attempted to assess OCNGS, utilizing reasonably ascertainable information obtained during the site visits, reviews of available historical information; and interviews with employees and other parties believed to be reliable and knowledgeable of the Property. McLaren/Hart has not conducted its own soil, groundwater, air or other environmental sampling and analysis. Findings presented herein are the are result of the review of documents presented by site personnel and interviews of site personnel.

This report was prepared solely for the use of AmerGen and their Assignees. The use of this report by these parties shall be consistent with the agreed Terms and Conditions of the engagement and no other parties shall rely on the contents of the report without written authorization from McLaren/Hart.

TABLES

Table 5.1.1
1999 Groundwater Data
Oyster Creek Nuclear Generating Station

Station	March 1999 Tritium (pCi/L)	March 1999 K-40* (pCi/L)	March 1999 Ra-226* (pCi/L)	March 1999 Th-232* (pCi/L)	September 1999 Tritium (pCi/L)	September 1999 K-40* (pCi/L)	September 1999 Ra-226* (pCi/L)	September 1999 Th-232* (pCi/L)
WW-1	< 130	< 30	< 40	< 7	< 130	< 40	< 60	< 13
WW-2	200 +/- 90	< 20	< 50	< 8	< 130	< 50	< 80	< 14
WW-3	< 130	< 40	< 60	< 12	160 +/- 90	< 20	< 40	< 7
WW-4	140 +/- 80	< 50	< 80	< 14	< 130	< 20	< 50	< 7
WW-5	380 +/- 100	< 60	< 70	< 14	230 +/- 90	< 40	< 50	< 13
WW-6	< 130	< 40	< 60	< 11	< 130	< 50	< 70	< 13
WW-7	580 +/- 100	< 50	< 70	< 13	190 +/- 90	< 50	< 70	< 14
WW-9	340 +/- 90	< 40	< 70	< 10	140 +/- 90	< 110	< 120	< 20
WW-10	< 130	< 50	< 70	< 15	< 130	< 19	< 40	< 6
WW-12	280 +/- 90	< 40	< 60	< 13	280 +/- 90	< 50	< 70	< 14
WW-13	< 130	< 100	< 110	< 20	< 130	< 40	< 60	< 12
WW-14	< 130	< 20	< 40	< 6	< 130	< 40	< 60	< 11
WW-15	320 +/- 90	28 +/- 17	< 40	< 6	< 130	< 50	< 70	< 13
WW-16	340 +/- 90	< 20	< 40	< 6	< 130	< 40	< 60	< 11
WW-17	< 130	< 40	< 50	< 11	< 130	< 19	< 30	< 4
Number of Wells Sampled	15	15	15	15	15	15	15	15
Maximum	580	28	N/A	N/A	280	N/A	N/A	N/A
Average	322.5	28	N/A	N/A	200	N/A	N/A	N/A
Minimum	140	28	N/A	N/A	140	N/A	N/A	N/A
Number of Positive Results	8	1	0	0	5	1	0	0

* Gamma isotopic nuclides.

Table 3.2.1
March 1981 - New Radwaste Building - Tank Leak

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
81-YAA-SB-0002	NRW1A	3/1/81	18-36"	East of NRW - 35' south of rollup door, 4' east of building	0.310	1.30
81-YAA-SB-0004	NRW1D	3/1/81	192-197.5"	East of NRW - 35' south of rollup door, 4' east of building	<MDA	0.100
81-YAA-SB-0001	NRW1D2	3/1/81	197.5-210"	East of NRW - 35' south of rollup door, 4' east of building	<MDA	<NDA
81-YAA-SB-0003	NRW1B	3/1/81	48-64"	East of NRW - 35' south of rollup door, 4' east of building	0.18	0.250
81-YAA-SB-0015	NRW1C	3/1/81	96-114"	East of NRW - 35' south of rollup door, 4' east of building	<MDA	<MDA
81-YAA-SB-0005	NRW2A	3/1/81	18-36"	North of NRW - 4' East of NW Corner, 4' north of building	0.89	1.60
81-YAA-SB-0006	NRW2B	3/1/81	48-66"	North of NRW - 4' East of NW Corner, 4' north of building	0.41	0.610
81-YAA-SB-0007	NRW2C	3/1/81	96-114"	North of NRW - 4' East of NW Corner, 4' north of building	<MDA	<MDA
81-YAA-SB-0011	NRW4A	3/1/81	18-30"	West of NRW - 14.5' north of NW girder of stairwell, 6' West of building	1.40	2.40
81-YAA-SB-0012	NRW5A	3/1/81	18-36"	West of NRW - 6' north of NW girder of stairwell, 6' West of building	1.20	2.40
81-YAA-SB-0013	NRW5B	3/1/81	48-66"	West of NRW - 6' north of NW girder of stairwell, 6' West of building	1.20	2.30
81-YAA-SB-0008	NRW3A	3/1/81	18-36"	West of NRW - 9' South of NW corner, 6.5' west of building	not listed	not listed
81-YAA-SB-0014	NRW3B	3/1/81	48-66"	West of NRW - 9' South of NW corner, 6.5' west of building	1.30	3.50
81-YAA-SB-0010	NRW3C	3/1/81	96-114"	West of NRW - 9' South of NW corner, 6.5' west of building	0.24	0.490
81-YAA-SB-0009	NRW6A	3/1/81	18-30"	West of NRW - 9' south of stairwell pad, 5.5' west of building	0.47	0.88

Notes:
Depth - inches below ground surface
Co-60 - Cobalt 60
Cs-137 - Cesium 137
< MDA - Below Method Detection Limits
(shaded) Greater than NRC Guideline (3.8 pCi/g - Co-60; 11 pCi/g - Cs-137)
N/A - Not Analyzed

Table 3.2.2
October 1982 - Old Radwaste Building - Waste Surge Tank Release

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
82-YAA-SB-0012	TSS3	10/7/82	0-33"	S. of ORW Surge Tank	1.612	2.454
82-YAA-SB-0010	TSS4	10/7/82	0-33"	S. of ORW Surge Tank	2.550	14.589
82-YAA-SB-0007	TSS2	10/7/82	0-40'	S. of ORW Surge Tank	68.180	38.746
82-YAA-SB-0005	TSS3A	10/7/82	33-36"	S. of ORW Surge Tank	0.674	1.156
82-YAA-SB-0004	TSS4A	10/7/82	33-36"	S. of ORW Surge Tank	2.767	7.578
82-YAA-SB-0006	TSS2A	10/7/82	40-42"	S. of ORW Surge Tank	37.758	38.746
82-YAA-SB-0008	TSS1	10/7/82	0-33'	SE of ORW Surge Tank	6.489	20.172
82-YAA-SB-0011	TSS1A	10/7/82	33-36"	SE of ORW Surge Tank	4.452	16.435
82-YAA-SB-0003	TSS5	10/7/82	0-33"	SW of ORW Surge Tank	129.810	295.780
82-YAA-SB-0002	TSS5A	10/7/82	33-36"	SW of ORW Surge Tank	205.460	337.870
82-YAA-SB-0001	TSS6	10/7/82	0-33"	SW of ORW Surge Tank o/s berm	259.24	[illegible]
82-YAA-SB-0009	TSS6A	10/7/82	33-36"	SW of ORW Surge Tank o/s of berm	4.065	8.407
82-YAA-SB-0075	TSS3-3	10/13/82	12-45"	S. of ORW Surge Tank	2.460	4.160
82-YAA-SB-0076	TSS2-2	10/13/82	15-48"	S. of ORW Surge Tank	82.800	38.800
82-YAA-SB-0072	TSS4-4A	10/13/82	40-43"	S. of ORW Surge Tank	2.450	4.680
82-YAA-SB-0074	TSS3-3A	10/13/82	45-48"	S. of ORW Surge Tank	5.190	6.570
82-YAA-SB-0079	TSS2-2A	10/13/82	48-51"	S. of ORW Surge Tank	12.500	16.800
82-YAA-SB-0073	TSS4-4	10/13/82	7-40"	S. of ORW Surge Tank	14.550	9.580
82-YAA-SB-0078	TSS1-1	10/13/82	24-57"	SE of ORW Surge Tank	[illegible]	[illegible]
82-YAA-SB-0068	TSS1-1A	10/13/82	57-60"	SE of ORW Surge Tank	1.150	4.590
82-YAA-SB-0077	TSS5-5A	10/13/82	41-44"	SW of ORW Surge Tank	[illegible]	192.000
82-YAA-SB-0071	TSS5-5	10/13/82	8-41"	SW of ORW Surge Tank	[illegible]	126.000
82-YAA-SB-0069	TSS7A	10/13/82	0-18" below pipe	SW of ORW Surge Tank o/s berm	[illegible]	143.000
82-YAA-SB-0070	TSS6-6	10/13/82	19-52"	SW of ORW Surge Tank o/s berm	[illegible]	18.700
82-YAA-SB-0080	TSS6-6A	10/13/82	52-55"	SW of ORW Surge Tank o/s berm	3.200	5.350
82-YAA-SB-0085	TSS3-3-3	10/27/82	15-45"	S. of ORW Surge Tank	0.3958	1.993
82-YAA-SB-0092	TSS4-4-4	10/27/82	22-48"	S. of ORW Surge Tank	[illegible]	14.785
82-YAA-SB-0082	TSS3-3-3A	10/27/82	45-49"	S. of ORW Surge Tank	ND	0.4814
82-YAA-SB-0091	TSS4-4-4A	10/27/82	48-52"	S. of ORW Surge Tank	[illegible]	16.602
82-YAA-SB-0084	TSS2-2-2	10/27/82	60-86"	S. of ORW Surge Tank	ND	1.723

Table 3.2.2

October 1982 - Old Radwaste Building - Waste Surge Tank Release

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
82-YAA-SB-0081	TSS2-2-2A	10/27/82	86-90"	S. of ORW Surge Tank	2.014	1.925
82-YAA-SB-0083	TSS1-1-1	10/27/82	20-50"	SE of ORW Surge Tank	0.7899	2.578
82-YAA-SB-0093	TSS1-1-1A	10/27/82	50-55"	SE of ORW Surge Tank	0.3958	1.993
82-YAA-SB-0090	TSS5-5-5	10/27/82	36-61"	SW of ORW Surge Tank	ND	41.809
82-YAA-SB-0089	TSS5-5-5A	10/27/82	61-65"	SW of ORW Surge Tank	34.875	1.611
82-YAA-SB-0088	TSS6-6-6	10/27/82	0-30"	SW of ORW Surge Tank o/s berm	6.074	1.100
82-YAA-SB-0087	TSS6-6-6A	10/27/82	30-33"	SW of ORW Surge Tank o/s berm	ND	2.646
82-YAA-SB-0086	TSS7A-7A	10/27/82	96", below pipe	SW of ORW Surge Tank o/s berm	47.687	66.695
82-YAA-SB-0112	82-4A	10/31/82	0-30"	East of ORW Surge Tank (10')	0.745	0.534
82-YAA-SB-0126	82-4E	10/31/82	103-120"	East of ORW Surge Tank (10')	0.710	0.308
82-YAA-SB-0127	82-4F	10/31/82	120-140"	East of ORW Surge Tank (10')	0.137	0.197
82-YAA-SB-0113	82-4B	10/31/82	30-60"	East of ORW Surge Tank (10')	0.351	0.765
82-YAA-SB-0114	82-4C	10/31/82	60-80"	East of ORW Surge Tank (10')	0.368	1.045
82-YAA-SB-0125	82-4D	10/31/82	80-103"	East of ORW Surge Tank (10')	0.136	0.356
82-YAA-SB-0109	82-3A	10/31/82	0-30"	East of ORW Surge Tank (5')	0.792	1.355
82-YAA-SB-0124	82-3B	10/31/82	30-60"	East of ORW Surge Tank (5')	0.428	1.681
82-YAA-SB-0110	82-3C	10/31/82	60-90"	East of ORW Surge Tank (5')	0.131	1.083
82-YAA-SB-0111	82-3D	10/31/82	90-120"	East of ORW Surge Tank (5')	1.698	1.844
82-YAA-SB-0103	82-9A	10/31/82	0-30"	NE of ORW Surge Tank (10')	79.807	125.780
82-YAA-SB-0094	82-9E	10/31/82	120-150"	NE of ORW Surge Tank (10')	11.184	19.217
82-YAA-SB-0104	82-9B	10/31/82	30-60"	NE of ORW Surge Tank (10')	16.072	35.653
82-YAA-SB-0108	82-9C	10/31/82	60-90"	NE of ORW Surge Tank (10')	2.121	6.301
82-YAA-SB-0106	82-9D	10/31/82	90-120"	NE of ORW Surge Tank (10')	2.263	6.173
82-YAA-SB-0098	82-8A	10/31/82	0-22"	NE of ORW Surge Tank (25')	[illegible]	[illegible]
82-YAA-SB-0102	82-8E	10/31/82	113-143"	NE of ORW Surge Tank (25')	NA	0.246
82-YAA-SB-0099	82-8B	10/31/82	22-53"	NE of ORW Surge Tank (25')	0.258	1.600
82-YAA-SB-0100	82-8C	10/31/82	53-83"	NE of ORW Surge Tank (25')	0.155	0.649
82-YAA-SB-0101	82-8D	10/31/82	83-113"	NE of ORW Surge Tank (25')	0.629	1.542
82-YAA-SB-0115	82-1A	10/31/82	0-28"	ORW Surge Tank SW of tank (15')	0.500	0.370
82-YAA-SB-0116	82-1B	10/31/82	28-58"	ORW Surge Tank SW of tank (15')	0.2766	0.281

Table 3.2.2
October 1982 - Old Radwaste Building - Waste Surge Tank Release

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
82-YAA-SB-0117	82-1C	10/31/82	53-77"	ORW Surge Tank SW of tank (15')	0.551	1.120
82-YAA-SB-0118	82-1D	10/31/82	77-101"	ORW Surge Tank SW of tank (15')	0.440	0.660
82-YAA-SB-0119	82-2A	10/31/82	0-30"	ORW Surge Tank SW of tank (20')	1.600	0.800
82-YAA-SB-0123	82-2E	10/31/82	120-145"	ORW Surge Tank SW of tank (20')	0.200	0.650
82-YAA-SB-0120	82-2B	10/31/82	30-60"	ORW Surge Tank SW of tank (20')	NA	0.232
82-YAA-SB-0121	82-2C	10/31/82	60-90"	ORW Surge Tank SW of tank (20')	NA	0.420
82-YAA-SB-0135	82-2D	10/31/82	90-120"	ORW Surge Tank SW of tank (20')	NA	0.730
82-YAA-SB-0128	82-5A	10/31/82	0-30'	ORW Surge Tank, South of tank (15')	0.223	0.893
82-YAA-SB-0132	82-5E	10/31/82	120-150'	ORW Surge Tank, South of tank (15')	0.074	0.094
82-YAA-SB-0129	82-5B	10/31/82	30-60"	ORW Surge Tank, South of tank (15')	0.343	0.517
82-YAA-SB-0130	82-5C	10/31/82	60-90"	ORW Surge Tank, South of tank (15')	0.670	0.597
82-YAA-SB-0131	82-5D	10/31/82	90-120"	ORW Surge Tank, South of tank (15')	0.438	0.639
82-YAA-SB-0133	82-6A	10/31/82	0-30"	SW of ORW Surge Tank (25')	1.591	1.848
82-YAA-SB-0134	82-6B	10/31/82	30-60"	SW of ORW Surge Tank (25')	0.823	1.333
82-YAA-SB-0107	82-6C	10/31/82	60-90"	SW of ORW Surge Tank (25')	0.541	1.325
82-YAA-SB-0122	82-6D	10/31/82	90-120"	SW of ORW Surge Tank (25')	0.280	0.430
82-YAA-SB-0105	82-7A	10/31/82	0-30"	West of ORW Surge Tank (5')	1.606	7.225
82-YAA-SB-0095	82-7B	10/31/82	30-60"	West of ORW Surge Tank (5')	1.054	9.514
82-YAA-SB-0096	82-7C	10/31/82	60-90"	West of ORW Surge Tank (5')	2.631	2.668
82-YAA-SB-0097	82-7D	10/31/82	90-120'	West of ORW Surge Tank (5')	0.945	5.624

Notes:

Depth - inches below ground surface

Co-60 - Cobalt 60

Cs-137 - Cesium 137

< MDA - Below Method Detection Limits

[shaded box] Greater than NRC Guideline (3.8 pCi/g - Co-60; 11 pCi/g - Cs-137)

N/A - Not Analyzed

Table 3.2.3
October 1982 - Old Radiological Waste Building - Truck Ramp Paving

Sample Number	Reference Number	Date	Depth	Sample Location	Co-60 Concentration (pCi/g)	Cs-137 Concentration (pCi/g)
82-YAA-SS-0040	C2	10/10/82	0-6"	NW of ORW - Truck ramp area paving	14.090	11.110
82-YAA-SS-0032	C13	10/10/82	0-6"	NW of ORW - Truck ramp area paving	0.605	0.553
82-YAA-SS-0031	C3	10/10/82	0-6"	NW of ORW - Truck ramp area paving	3.017	1.967
82-YAA-SS-0030	C4	10/10/82	0-6"	NW of ORW - Truck ramp area paving	4.055	4.927
82-YAA-SS-0029	C5	10/10/82	0-6"	NW of ORW - Truck ramp area paving	1.567	1.348
82-YAA-SS-0028	C6	10/10/82	0-6"	NW of ORW - Truck ramp area paving	3.103	3.511
82-YAA-SS-0027	C7	10/10/82	0-6"	NW of ORW - Truck ramp area paving	3.651	3.585
82-YAA-SS-0026	C8	10/10/82	0-6"	NW of ORW - Truck ramp area paving	4.009	3.807
82-YAA-SS-0025	C9	10/10/82	0-6"	NW of ORW - Truck ramp area paving	1.190	1.347
82-YAA-SS-0024	C10	10/10/82	0-6"	NW of ORW - Truck ramp area paving	4.744	3.066
82-YAA-SS-0022	C12	10/10/82	0-6"	NW of ORW - Truck ramp area paving	0.768	0.819
82-YAA-SS-0020	C1	10/10/82	0-6"	NW of ORW - Truck ramp area paving	0.8264	0.6884
82-YAA-SS-0013	C11	10/10/82	0-6"	NW of ORW - Truck ramp area paving	1.787	1.723
82-YAA-SS-0050	A9	10/10/82	0-6"	South of ORW - Truck ramp area	<MDA	<MDA
82-YAA-SS-0049	A10	10/10/82	0-6"	South of ORW - Truck ramp area	<MDA	<MDA
82-YAA-SS-0048	A11	10/10/82	0-6"	South of ORW - Truck ramp area	<MDA	0.0573
82-YAA-SS-0023	A8	10/10/82	0-6"	South of ORW - Truck ramp area	0.7018	0.7458
82-YAA-SS-0021	A7	10/10/82	0-6"	South of ORW - Truck ramp area	<MDA	<MDA
82-YAA-SS-0019	A1	10/10/82	0-6"	South of ORW - Truck ramp area	<MDA	<MDA
82-YAA-SS-0018	A2	10/10/82	0-6"	South of ORW - Truck ramp area	<MDA	0.3067
82-YAA-SS-0017	A3	10/10/82	0-6"	South of ORW - Truck ramp area	0.1264	0.0974
82-YAA-SS-0016	A4	10/10/82	0-6"	South of ORW - Truck ramp area	1.594	1.814
82-YAA-SS-0015	A5	10/10/82	0-6"	South of ORW - Truck ramp area	<MDA	0.1094
82-YAA-SS-0014	A6	10/10/82	0-6"	South of ORW - Truck ramp area	0.3449	0.4689

Table 3.2.3

October 1982 - Old Radiological Waste Building - Truck Ramp Paving

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
82-YAA-SS-0051	B11	10/10/82	0-6"	West of ORW - Truck ramp area paving	24.251	5.714
82-YAA-SS-0047	B1	10/10/82	0-6"	West of ORW - Truck ramp area paving	2.762	2.432
82-YAA-SS-0046	B2	10/10/82	0-6"	West of ORW - Truck ramp area paving	0.184	0.2643
82-YAA-SS-0045	B3	10/10/82	0-6"	West of ORW - Truck ramp area paving	2.135	2.435
82-YAA-SS-0044	B14	10/10/82	0-6"	West of ORW - Truck ramp area paving	40,000	[illegible]
82-YAA-SS-0043	B4	10/10/82	0-6"	West of ORW - Truck ramp area paving	14.312	8.002
82-YAA-SS-0042	B12	10/10/82	0-6"	West of ORW - Truck ramp area paving	1.479	1.514
82-YAA-SS-0041	B15	10/10/82	0-6"	West of ORW - Truck ramp area paving	1.966	4.299
82-YAA-SS-0039	B10	10/10/82	0-6"	West of ORW - Truck ramp area paving	1.690	1.663
82-YAA-SS-0038	B9	10/10/82	0-6"	West of ORW - Truck ramp area paving	[illegible]	8.570
82-YAA-SS-0037	B8	10/10/82	0-6"	West of ORW - Truck ramp area paving	1.455	1.071
82-YAA-SS-0036	B7	10/10/82	0-6"	West of ORW - Truck ramp area paving	2.484	2.296
82-YAA-SS-0035	B6	10/10/82	0-6"	West of ORW - Truck ramp area paving	3.621	2.900
82-YAA-SS-0034	B5	10/10/82	0-6"	West of ORW - Truck ramp area paving	39,066	28,366
82-YAA-SS-0033	B13	10/10/82	0-6"	West of ORW - Truck ramp area paving	3.054	1.909
82-YAA-SS-0066	D2	10/11/82	0-6"	North of ORW - Paving	2.014	1.594
82-YAA-SS-0065	D3	10/11/82	0-6"	North of ORW - Paving	0.503	0.446
82-YAA-SS-0064	D4	10/11/82	0-6"	North of ORW - Paving	0.618	0.0624
82-YAA-SS-0063	D5	10/11/82	0-6"	North of ORW - Paving	1.722	1.422
82-YAA-SS-0062	D6	10/11/82	0-6"	North of ORW - Paving	0.863	0.625
82-YAA-SS-0061	D7	10/11/82	0-6"	North of ORW - Paving	1.126	0.777
82-YAA-SS-0060	D9	10/11/82	0-6"	North of ORW - Paving	1.575	1.677
82-YAA-SS-0056	D1	10/11/82	0-6"	North of ORW - Paving	not collected	not collected

Table 3.2.3
October 1982 - Old Radiological Waste Building - Truck Ramp Paving

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
82-YAA-SS-0054	D8	10/11/82	0-6"	North of ORW - Paving	0.689	0.634
82-YAA-SS-0067	E7	10/11/82	0-6"	North of ORW/South of NRW-Paving	1.004	0.784
82-YAA-SS-0059	E2	10/11/82	0-6"	North of ORW/South of NRW-Paving	0.540	0.377
82-YAA-SS-0058	E3	10/11/82	0-6"	North of ORW/South of NRW-Paving	0.913	0.844
82-YAA-SS-0057	E4	10/11/82	0-6"	North of ORW/South of NRW-Paving	3.470	5.051
82-YAA-SS-0055	E6	10/11/82	0-6"	North of ORW/South of NRW-Paving	1.292	0.615
82-YAA-SS-0053	E5	10/11/82	0-6"	North of ORW/South of NRW-Paving	0.581	0.412
82-YAA-SS-0052	E1	10/11/82	0-6"	North of ORW/South of NRW-Paving	1.110	0.510

Notes:

Depth - inches below ground surface

Co-60 - Cobalt 60

Cs-137 - Cesium 137

< MDA - Below Method Detection Limits

N/A - Not Analyzed

[shaded box] Greater than NRC Guideline (3.8 pCi/g - Co-60; 11 pCi/g - Cs-137)

Table 3.2.4
June 1985 - Proposed ESSF Location

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
85-XWN-SS-0081	11	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0080	20	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0079	18	6/1/85	0-6"	Proposed ESSF Location	1.89	1.90
85-XWN-SS-0078	17	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0077	B7	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0076	16	6/1/85	0-6"	Proposed ESSF Location	ND	0.501
85-XWN-SS-0075	15	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0074	14	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0073	13	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0072	33	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0071	12	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0070	10	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0069	9	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0068	8	6/1/85	0-6"	Proposed ESSF Location	1.36	ND
85-XWN-SS-0067	7	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0066	6	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0065	5	6/1/85	0-6"	Proposed ESSF Location	ND	0.521
85-XWN-SS-0064	4	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0063	3	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0062	B12	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0061	B4	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0060	21	6/1/85	0-6"	Proposed ESSF Location	ND	0.954
85-XWN-SS-0059	2	6/1/85	0-6"	Proposed ESSF Location	2.1	0.726
85-XWN-SS-0058	57	6/1/85	0-6"	Proposed ESSF Location	ND	ND

Table 3.2.4
June 1985 - Proposed ESSF Location

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
85-XWN-SS-0057	49	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0056	65	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0055	64	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0054	63	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0053	61	6/1/85	0-6"	Proposed ESSF Location	ND	0.718
85-XWN-SS-0052	60	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0051	67	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0050	58	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0049	68	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0048	31	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0047	55	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0046	22	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0045	53	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0044	52	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0043	51	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0042	50	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0041	59	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0040	76	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0039	89	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0038	87	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0037	85	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0036	84	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0035	82	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0034	80	6/1/85	0-6"	Proposed ESSF Location	ND	ND

Table 3.2.4
June 1985 - Proposed ESSF Location

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
85-XWN-SS-0033	66	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0032	78	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0031	54	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0030	75	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0029	74	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0028	73	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0027	72	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0026	71	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0025	70	6/1/85	0-6"	Proposed ESSF Location	ND	0.443
85-XWN-SS-0024	69	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0023	79	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0022	56	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0021	46	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0020	45	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0019	44	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0018	43	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0017	42	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0016	41	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0015	40	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0014	39	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0013	47	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0012	35	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0011	36	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0010	32	6/1/85	0-6"	Proposed ESSF Location	ND	ND

Table 3.2.4
June 1985 - Proposed ESSF Location

Sample Number	Reference Number	Date	Depth	Sample Location	Co-60 Concentration (pCi/g)	Cs-137 Concentration (pCi/g)
85-XWN-SS-0009	30	6/1/85	0-6"	Proposed ESSF Location	ND	4.60
85-XWN-SS-0008	29	6/1/85	0-6"	Proposed ESSF Location	ND	1.30
85-XWN-SS-0007	28	6/1/85	0-6"	Proposed ESSF Location	ND	0.968
85-XWN-SS-0006	25	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0005	25	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0004	24	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0003	23	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0002	48	6/1/85	0-6"	Proposed ESSF Location	ND	ND
85-XWN-SS-0001	34	6/1/85	0-6"	Proposed ESSF Location	ND	ND
86-YAA-SS-0004	C-1 (2360-86)	4/29/86	0-6"	Proposed ESSF Location Along RMA Fence	1.21	0.662
86-YAA-SS-0003	A-1 (2358-86)	4/29/86	0-6"	Proposed ESSF Location Along RMA Fence	[illegible]	2.81
86-YAA-SS-0002	B-1 (2359-86)	4/29/86	0-6"	Proposed ESSF Location Along RMA Fence	2.35	1.48

Notes:

Depth - inches below ground surface

Co-60 - Cobalt 60

Cs-137 - Cesium 137

< MDA - Below Method Detection Limits

[shaded] Greater than NRC Guideline (3.8 pCi/g - Co-60; 11 pCi/g - Cs-137)

N/A - Not Analyzed

Table 3.2.5
March 1991 - Condensate Storage Tank - Bottom Leakage

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)
91-XWW-SB-0010	B9-1	3/13/91	0-1'	Circ Water Discharge Structure	<0.020
91-XWW-SB-0011	B9-5	3/13/91	4-5'	Circ Water Discharge Structure	<0.011
91-XWW-SB-0012	B9-7	3/13/91	6-7'	Circ Water Discharge Structure	<0.013
91-XWW-SB-0006	B7-1	3/13/91	0-1'	East of CST	20,000
91-XWW-SB-0007	B7-5	3/13/91	4-5'	East of CST	0.062
91-XWW-SB-0015	B7-7	3/13/91	6-7'	East of CST	0.180
91-XWW-SB-0008	B7-9	3/13/91	8-9'	East of CST	0.420
91-CAA-SB-0001	B8-1	3/13/91	0-1'	North of CST	0.045
91-CAA-SB-0009	B8-5	3/13/91	4-5'	North of CST	<0.020
91-CAA-SB-0029	B4-1	3/13/91	0-1'	NW of CST	0.470
91-CAA-SB-0013	B5-1	3/13/91	0-1'	NW of CST	0.480
91-CAA-SB-0031	B5-5	3/13/91	4-5'	NW of CST	<0.030
91-CAA-SB-0025	B4-5	3/13/91	4-5'	NW of CST	0.079
91-CAA-SB-0017	B5-7	3/13/91	6-7'	NW of CST	<0.030
91-XWW-SB-0018	B1-1	3/13/91	0-1'	SE of CST o/s fence	0.340
91-XWW-SB-0014	B6-1	3/13/91	0-1'	SE of CST o/s fence	0.073
91-XWW-SB-0005	B6-11	3/13/91	10-11'	SE of CST o/s fence	<0.070
91-XWW-SB-0016	B1-5	3/13/91	4-5'	SE of CST o/s fence	0.230
91-XWW-SB-0002	B6-5	3/13/91	4-5'	SE of CST o/s fence	<0.030
91-XWW-SB-0019	B1-7	3/13/91	6-7'	SE of CST o/s fence	1.300
91-XWW-SB-0003	B6-7	3/13/91	6-7'	SE of CST o/s fence	<0.020
91-XWW-SB-0020	B1-9	3/13/91	8-9'	SE of CST o/s fence	0.190
91-XWW-SB-0004	B6-9	3/13/91	8-9'	SE of CST o/s fence	<0.050
91-XWW-SB-0021	B1-10	3/13/91	9-10'	SE of CST o/s fence	0.340

Table 3.2.5
March 1991 - Condensate Storage Tank - Bottom Leakage

Sample Number	Reference Number	Date	Depth	Sample Location	Co-60 Concentration (pCi/g)
91-CAA-SB-0022	B2-1	3/13/91	0-1'	SW of CST in yard	6.810
91-CAA-SB-0023	B2-5	3/13/91	4-5'	SW of CST in yard	0.035
91-CAA-SB-0024	B2-7	3/13/91	6-7'	SW of CST in yard	0.034
91-CAA-SB-0030	B2-9	3/13/91	8-9'	SW of CST in yard	<0.015
91-CAA-SB-0026	B3-1	3/13/91	0-1'	West of CST	0.160
91-CAA-SB-0027	B3-5	3/13/91	4-5'	West of CST	<0.020
91-CAA-SB-0028	B3-7	3/13/91	6-7'	West of CST	<0.014
91-CAA-SB-0034	B10-1	4/17/91	0-1'	Under tank	0.037
91-CAA-SB-0033	B10-5	4/17/91	4-5'	Under tank	0.170
91-CAA-SB-0035	B10-7	4/17/91	6-7'	Under tank	0.140
91-CAA-SB-0032	B10-9	4/17/91	9-10'	Under tank	0.190
(Unknown)	---	3/13/91	---	Water Sample	[illegible]

Notes:

Depth - feet below ground surface

Co-60 - Cobalt 60

Cs-137 - Cesium 137

< MDA - Below Method Detection Limits

(shaded) Greater than NRC Guideline (3.8 pCi/g - Co-60)

Table 3.2.6
April 1991 - Condensate Yard Spill

Sample Number	Reference Number	Date	Depth	Sample Location	Co-60 Concentration (pCi/g)
91-CAA-SB-0037		5/4/91	0-6"	Spill in CST Yard - Collection pit under transfer pipe.	22
91-CAA-SB-0036		5/4/91	0-6"	Spill in CST Yard at tank discharge valve.	15.7

Notes:

Depth - inches below ground surface

Co-60 - Cobalt 60

< MDA - Below Method Detection Limits

(shaded) Greater than NRC Guideline (3.8 pCi/g - Co-60; 11 pCi/g - Cs-137)

N/A - Not Analyzed

Table 3.2.7

August 1992 - Proposed ISFSI Concrete Pad Construction

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
92-XCD-SS-0033	10	8/6/92	0-6"	Proposed ISFSI Construction	<0.0233	0.0106
92-XCD-SS-0032	16	8/6/92	0-6"	Proposed ISFSI Construction	0.0159	<0.0236
92-XCD-SS-0031	15	8/6/92	0-6"	Proposed ISFSI Construction	0.0194	0.0111
92-XCD-SS-0030	14	8/6/92	0-6"	Proposed ISFSI Construction	<0.0277	<0.0236
92-XCD-SS-0029	13	8/6/92	0-6"	Proposed ISFSI Construction	<0.0246	<0.0225
92-XCD-SS-0028	12	8/6/92	0-6"	Proposed ISFSI Construction	0.0279	0.0319
92-XCD-SS-0027	11	8/6/92	0-6"	Proposed ISFSI Construction	0.0287	<0.0220
92-XCD-SS-0026	9	8/6/92	0-6"	Proposed ISFSI Construction	0.0558	0.0973
92-XCD-SS-0019	17	8/6/92	0-6"	Proposed ISFSI Construction	<0.0284	<0.0230
92-XCD-SS-0017	19	8/6/92	0-6"	Proposed ISFSI Construction	<0.0299	<0.0207
92-XCD-SS-0016	20	8/6/92	0-6"	Proposed ISFSI Construction	<0.0228	<0.0207
92-XCD-SS-0015	21	8/6/92	0-6"	Proposed ISFSI Construction	0.0996	0.211
92-XCD-SS-0014	22	8/6/92	0-6"	Proposed ISFSI Construction	<0.0190	<0.0232
92-XCD-SS-0013	23	8/6/92	0-6"	Proposed ISFSI Construction	<0.0276	0.0211
92-XCD-SS-0012	24	8/6/92	0-6"	Proposed ISFSI Construction	<0.0177	<0.0176
92-XCD-SS-0011	25	8/6/92	0-6"	Proposed ISFSI Construction	<0.0223	<0.0218
92-XCD-SS-0010	26	8/6/92	0-6"	Proposed ISFSI Construction	<0.0246	<0.0212
92-XCD-SS-0009	27	8/6/92	0-6"	Proposed ISFSI Construction	<0.0256	<0.0228
92-XCD-SS-0008	28	8/6/92	0-6"	Proposed ISFSI Construction	<0.0217	<0.0216
92-XCD-SS-0007	18	8/6/92	0-6"	Proposed ISFSI Construction	0.0235	<0.0247
92-YFS-SS-0025	8	8/6/92	0-6"	Proposed ISFSI Location	0.0215	0.0292
92-YFS-SS-0024	7	8/6/92	0-6"	Proposed ISFSI Location	0.0474	0.0590
92-YFS-SS-0023	6	8/6/92	0-6"	Proposed ISFSI Location	<0.0214	<0.0225
92-YFS-SS-0022	1	8/6/92	0-6"	Proposed ISFSI Location	0.068	0.0578
92-YFS-SS-0021	2	8/6/92	0-6"	Proposed ISFSI Location	0.0392	0.0728
92-YFS-SS-0020	5	8/6/92	0-6"	Proposed ISFSI Location	0.0382	0.130
92-YFS-SS-0018	4	8/6/92	0-6"	Proposed ISFSI Location	ND	0.0492
92-YFS-SS-0006	3	8/6/92	0-6"	Proposed ISFSI Location	0.0271	0.0328

<u>Notes:</u>

Depth - inches below ground surface
Co-60 - Cobalt 60
Cs-137 - Cesium 137
< MDA - Below Method Detection Limits
Greater than NRC Guideline (3.8 pCi/g - Co-60; 11 pCi/g - Cs-137)
N/A - Not Analyzed

Table 3.2.8

August 1992 - Proposed ISFI Concrete Pad Construction

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
97-ZFS-SB-0001	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.080	0.190
97-ZFS-SB-0002	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.030	<0.040
97-ZFS-SB-0003	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.030	0.028
97-ZFS-SB-0004	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.030	0.059
97-ZFS-SB-0005	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.017	<0.030
97-ZFS-SB-0006	ZFS	8/12/97	36-72"	Dredge Spoils Retention Basin	<0.040	<0.050
97-ZFS-SB-0007	ZFS	8/12/97	72-108"	Dredge Spoils Retention Basin	<0.030	0.025
97-ZFS-SB-0008	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.050	0.110
97-ZFS-SB-0009	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.020	0.072
97-ZFS-SB-0010	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.090	<0.080
97-ZFS-SB-0011	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	0.075	0.200
97-ZFS-SB-0012	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.020	0.042
97-ZFS-SB-0013	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.030	0.043
97-ZFS-SB-0014	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.060	<0.070
97-ZFS-SB-0015	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.070	0.140
97-ZFS-SB-0016	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.060	0.077
97-ZFS-SB-0017	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.020	<0.020
97-ZFS-SB-0018	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.060	<0.040
97-ZFS-SB-0019	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.020	0.036
97-ZFS-SB-0020	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.020	<0.020
97-ZFS-SB-0021	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.030	0.035
97-ZFS-SB-0022	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.030	<0.030
97-ZFS-SB-0023	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.016	<0.030
97-ZFS-SB-0024	ZFS	8/12/97	0-36"	Dredge Spoils Retention Basin	<0.060	<0.060
97-ZFS-SB-0025	ZFS	8/13/97	72-108"	Dredge Spoils Retention Basin	<0.020	0.037
97-ZFS-SB-0026	ZFS	8/13/97	36-72"	Dredge Spoils Retention Basin	<0.020	0.056
97-ZFS-SB-0027	ZFS	8/13/97	0-36"	Dredge Spoils Retention Basin	<0.020	<0.020
97-ZFS-SB-0028	ZFS	8/13/97	72-108"	Dredge Spoils Retention Basin	<0.019	0.040
97-ZFS-SB-0029	ZFS	8/13/97	36-72"	Dredge Spoils Retention Basin	<0.018	<0.019
97-ZFS-SB-0030	ZFS	8/13/97	0-36"	Dredge Spoils Retention Basin	<0.060	<0.060
97-ZFS-SB-0031	ZFS	8/13/97	72-108"	Dredge Spoils Retention Basin	<0.080	<0.070
97-ZFS-SB-0032	ZFS	8/13/97	36-72"	Dredge Spoils Retention Basin	<0.060	<0.070
97-ZFS-SB-0033	ZFS	8/13/97	0-36"	Dredge Spoils Retention Basin	<0.020	0.023
97-ZFS-SB-0034	ZFS	8/13/97	72-108"	Dredge Spoils Retention Basin	<0.015	0..053

Table 3.2.8
August 1992 - Proposed ISFI Concrete Pad Construction

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
97-ZFS-SB-0035	ZFS	8/13/97	36-72"	Dredge Spoils Retention Basin	<0.020	<0.030
97-ZFS-SB-0036	ZFS	8/13/97	0-36"	Dredge Spoils Retention Basin	<0.030	<0.020
97-ZFS-SB-0037	ZFS	8/13/97	0-36"	Dredge Spoils Retention Basin	<0.020	0.026
97-ZFS-SB-0038	ZFS	8/13/97	36-72"	Dredge Spoils Retention Basin	<0.030	0.079
97-ZFS-SB-0039	ZFS	8/13/97	0-36"	Dredge Spoils Retention Basin	<0.030	<0.030
97-ZFS-SB-0040	ZFS	8/13/97	36-72"	Dredge Spoils Retention Basin	<0.020	<0.030
97-ZFS-SB-0041	ZFS	8/13/97	72-108"	Dredge Spoils Retention Basin	<0.040	<0.050
97-ZFS-SB-0042	ZFS	8/13/97	36-72"	Dredge Spoils Retention Basin	<0.020	0.053
97-ZFS-SB-0043	ZFS	8/13/97	0-36"	Dredge Spoils Retention Basin	<0.040	<0.050
97-ZFS-SB-0044	ZFS	8/13/97	72-108"	Dredge Spoils Retention Basin	<0.018	<0.016
97-ZFS-SB-0045	ZFS	8/13/97	72-108"	Dredge Spoils Retention Basin	<0.040	0.190
97-ZFS-SB-0046	ZFS	8/13/97	0-36"	Dredge Spoils Retention Basin	<0.020	<0.030
97-ZFS-SB-0047	ZFS	8/13/97	72-108"	Dredge Spoils Retention Basin	<0.030	<0.040
97-ZFS-SB-0048	ZFS	8/13/97	36-72"	Dredge Spoils Retention Basin	<0.020	0.043
97-ZFS-SB-0049	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.030	<0.030
97-ZFS-SB-0050	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.040	<0.040
97-ZFS-SB-0051	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.020	<0.030
97-ZFS-SB-0052	ZFS	8/14/97	36-72"	Dredge Spoils Retention Basin	<0.060	<0.060
97-ZFS-SB-0053	ZFS	8/14/97	72-108"	Dredge Spoils Retention Basin	<0.060	0.150
97-ZFS-SB-0054	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.030	0.038
97-ZFS-SB-0055	ZFS	8/14/97	72-108"	Dredge Spoils Retention Basin	<0.030	0.035
97-ZFS-SB-0056	ZFS	8/14/97	36-72"	Dredge Spoils Retention Basin	<0.050	<0.050
97-ZFS-SB-0057	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.020	<0.030
97-ZFS-SB-0058	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.070	0.077
97-ZFS-SB-0059	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.020	0.036
97-ZFS-SB-0060	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.020	0.037
97-ZFS-SB-0061	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.030	<0.020
97-ZFS-SB-0062	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.013	<0.020
97-ZFS-SB-0063	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.030	<0.040
97-ZFS-SB-0064	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.019	<0.020
97-ZFS-SB-0065	ZFS	8/14/97	36-72"	Dredge Spoils Retention Basin	<0.020	0.027
97-ZFS-SB-0066	ZFS	8/14/97	72-108"	Dredge Spoils Retention Basin	<0.018	<0.030
97-ZFS-SB-0067	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.020	<0.020
97-ZFS-SB-0068	ZFS	8/14/97	72-108"	Dredge Spoils Retention Basin	<0.015	<0.040
97-ZFS-SB-0069	ZFS	8/14/97	36-72"	Dredge Spoils Retention Basin	<0.040	0.170
97-ZFS-SB-0070	ZFS	8/14/97	36-72"	Dredge Spoils Retention Basin	<0.018	0.034
97-ZFS-SB-0071	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.020	<0.030

Table 3.2.8

August 1992 - Proposed ISFI Concrete Pad Construction

Sample Number	Reference Number	Date	Depth	Sample Location	Co-60 Concentration (pCi/g)	Cs-137 Concentration (pCi/g)
97-ZFS-SB-0072	ZFS	8/14/97	36-72"	Dredge Spoils Retention Basin	<0.019	<0.030
97-ZFS-SB-0073	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.040	<0.050
97-ZFS-SB-0074	ZFS	8/14/97	72-108"	Dredge Spoils Retention Basin	<0.020	0.041
97-ZFS-SB-0075	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.030	<0.030
97-ZFS-SB-0076	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.020	<0.040
97-ZFS-SB-0077	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.080	0.190
97-ZFS-SB-0078	ZFS	8/14/97	72-108"	Dredge Spoils Retention Basin	<0.020	0.033
97-ZFS-SB-0079	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.050	0.150
97-ZFS-SB-0080	ZFS	8/14/97	36-72"	Dredge Spoils Retention Basin	<0.040	0.120
97-ZFS-SB-0081	ZFS	8/14/97	72-108"	Dredge Spoils Retention Basin	<0.030	0.059
97-ZFS-SB-0082	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.030	<0.030
97-ZFS-SB-0083	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.020	0.064
97-ZFS-SB-0084	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.060	0.091
97-ZFS-SB-0085	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.030	<0.030
97-ZFS-SB-0086	ZFS	8/14/97	0-36"	Dredge Spoils Retention Basin	<0.020	<0.020

Notes:

Table does not include the nine sediment cores collected prior to the 1997 dredging project.

Depth - inches below ground surface

Co-60 - Cobalt 60

Cs-137 - Cesium 137

< MDA - Below Method Detection Limits

Greater than NRC Guideline (3.8 pCi/g - Co-60; 11 pCi/g - Cs-137)

N/A - Not Analyzed

Table 3.2.9
September 1996 - Condensate Transfer Overboard Discharge Event

Sample #	Date	Sample Location	Co60		Tritium
		Surface Water	pCi/L		
1	9/18/96	South branch of Forked River, west of Route 9	N/A		1,100
2	9/19/96	South branch of Forked River, west of Route 9	N/A		660
3	10/3/96	South branch of Forked River, west of Route 9	N/A	<	150
4	9/20/96	Near OCNGS intake tunnel	N/A		1,700
5	10/3/96	Near OCNGS intake tunnel	N/A		330
6	9/19/96	Near condenser discharge	N/A		6,500
7	9/18/96	Near 30" header	N/A		16,000
8	9/19/96	Near 30" header	N/A		9,300
9	10/3/96	Near 30" header	N/A	<	150
10	9/18/96	OCNG discharge canal	N/A		6,400
11	9/19/96	Midway between discharge Canal and Route 9 at Oyster Creek inlet	N/A		970
12	10/3/96	Midway between discharge Canal and Route 9 at Oyster Creek inlet	N/A	<	150
13	9/18/96	Oyster Creek, east of Route 9	N/A		7,000
14	9/19/96	Oyster Creek, east of Route 9	N/A		1,700
15	10/3/96	North Shore of Oyster Creek midway between Route 9 and Barneget Bay	N/A	<	150
16	9/19/96	North Shore of Oyster Creek midway between Route 9 and Barneget Bay	N/A		2,900
17	10/3/96	North Shore of Oyster Creek midway between Route 9 and Barneget Bay	N/A	<	150
18	9/19/96	Residential Lagoons (south)	N/A		4,100
19	10/3/96	Residential Lagoons (south)	N/A	<	150
20	9/19/96	Residential Lagoons (south)	N/A		1,300
21	10/3/96	Residential Lagoons (south)	N/A	<	150
22	9/19/96	Mouth of Oyster Creek into Barnegat Bay	N/A		2,300

Table 3.2.9

September 1996 - Condensate Transfer Overboard Discharge Event

Sample #	Date	Sample Location		Co60		Tritium
23	10/3/96	Mouth of Oyster Creek into Barnegat Bay		N/A	<	150
		Sediment		pCi/g		
1	9/19/96	South branch of Forked River, west of Route 9	<	0.008		N/A
2	10/3/96	South branch of Forked River, west of Route 9	<	0.008		N/A
3	9/19/96	Near 30" header		0.027		N/A
4	10/3/96	Near 30" header		0.046		N/A
5	9/19/96	Oyster Creek inlet, west of Route 9		0.047		N/A
6	10/1/96	Oyster Creek inlet, west of Route 9	<	0.020		N/A
7	9/19/96	Oyster Creek, east of Route 9	<	0.006		N/A
8	9/30/96	Oyster Creek, east of Route 9	<	0.014		N/A
9	9/19/96	North Shore of Oyster Creek midway between Route 9 and Barneget Ba	<	0.015		N/A
10	10/3/96	North Shore of Oyster Creek midway between Route 9 and Barneget Bay		0.056		N/A
11	9/19/96	Residential Lagoons (south)	<	0.016		N/A
12	10/1/96	Residential Lagoons (south)	<	0.007		N/A
13	9/19/96	Residential Lagoons (south)	<	0.010		N/A
14	10/1/96	Residential Lagoons (south)	<	0.015		N/A
15	9/19/96	Mouth of Oyster Creek into Barnegat Bay	<	0.013		N/A
16	9/30/96	Mouth of Oyster Creek into Barnegat Bay	<	0.009		N/A
17	9/30/96	Barnegat Bay, out from mouth of Oyster Creek	<	0.012		N/A
18	9/30/96	Barnegat Bay, south of Oyster Creek Mouth	<	0.008		N/A
19	10/1/96	Manahawkin Bay	<	0.017		N/A
20	10/1/96	Great Bay	<	0.013		N/A
21	9/30/96	Stout's Creek	<	0.03		N/A

Table 3.2.9

September 1996 - Condensate Transfer Overboard Discharge Event

Sample #	Date	Sample Location	Co60		Tritium	
		Clams	pCi/g wet			
1	9/30/96	Stout's Creek	<	0.017		0.118
2	9/30/96	Barnegat Bay, out from mouth of Oyster Creek	<	0.018	<	0.090
3	9/30/96	Barnegat Bay, south of Oyster Creek Mouth	<	0.03	<	0.09
4	10/1/96	Manahawkin Bay	<	0.040		0.110
5	10/1/96	Great Bay	<	0.012	<	0.090

Notes: Not analyzed

Depth - inches below ground surface

Co-60 - Cobalt 60

Cs-137 - Cesium 137

< MDA - Below Method Detection Limits

Greater than NRC Guideline (3.8 pCi/g - Co-60; 11 pCi/g - Cs-137)

N/A - Not Analyzed

Table 3.2.10

August 1999 - Old Rad Waste Building Concrete Pad - Spill Event

Sample Number	Reference Number	Date	Depth	Sample Location	Co-60 Concentration (pCi/g)	Cs-137 Concentration (pCi/g)
99-YAA-SS-0003		8/19/99	0-6"	North of ORW conc pad - background away from spill area	1.28	0.64
99-YAA-SS-0001		8/19/99	0-6"	North of ORW conc pad - Mop water spill	10.2	6.04
99-YAA-SS-0002		8/19/99	0-6"	North or ORW conc pad - adjacent to mop water spill area	[illegible]	2.43

Notes:

Depth - inches below ground surface

Co-60 - Cobalt 60

Cs-137 - Cesium 137

< MDA - Below Method Detection Limits

Greater than NRC Guideline (3.8 pCi/g - Co-60; 11 pCi/g - Cs-137)

N/A - Not Analyzed

Table 3.2.11

Non-Radiological ISRA Investigation

Sample Number	Reference Number	Date	Depth	Sample Location	Co-60 Concentration (pCi/g)	Cs-137 Concentration (pCi/g)
99-XWE-SS-0022	SS-1A-2A	9/1/99	0-12"	MFOST Collection Sump	0.086	0.210
99-XWE-SB-0019	SS-1A-2B	9/1/99	36-48"	MFOST Collection Sump	<0.030	0.074
99-XWE-SS-0014	SS-1A-3A	9/1/99	0-12"	MFOST North of pad at RCA fence	0.480	2.400
99-XWE-SB-0023	SS-1A-3B	9/1/99	36-48"	MFOST North of pad at RCA fence	<0.015	0.040
99-XWE-SS-0018	SS-1A-5A	9/1/99	0-12"	MFOST NW by RCA fence	0.950	3.200
99-XWE-SB-0017	SS-1A-5B	9/1/99	36-48"	MFOST NW by RCA fence	0.052	0.260
99-XWE-SS-0016	SS-1A-6A	9/1/99	0-12"	MFOST South of Pad	ND	0.211
99-XWE-SB-0021	SS-1A-6B	9/1/99	36-48"	MFOST South of Pad	ND	0.105
99-XWW-SS-0012	SS-1I-3A	9/1/99	0-12"	South of TWST Yard (~3 feet)	0.025	0.087
99-XWW-SB-0011	SS-1I-3B	9/1/99	36-48"	South of TWST Yard (~3 feet)	<0.010	<0.015
99-EAA-SS-0020	SS-1I-2A	9/1/99	0-12"	TWST Yard east of tank (by pump pad)	0.860	0.150
99-EAA-SB-0013	SS-1I-2B	9/1/99	36-48"	TWST Yard east of tank (by pump pad)	<0.050	0.110
99-EAA-SS-0010	SS-1I-1A	9/1/99	0-12"	TWST Yard north of tank	<0.019	0.054
99-EAA-SB-0015	SS-1I-1B	9/1/99	36-48"	TWST Yard north of tank	<0.015	0.032
99-XWW-SS-0009	SS-1I-4A	9/1/99	0-12"	West of TWST Yard at well location	<0.016	0.038
99-XWW-SB-0008	SS-1I-4B	9/1/99	36-48"	West of TWST Yard at well location	<0.015	<0.018
99-XWE-SS-0048	SS-1A-1A	9/2/99	0-12"	MFOST Moat North Plug	<0.020	0.140
99-XWE-SB-0047	SS-1A-1B	9/2/99	36-48"	MFOST Moat North Plug	<0.014	0.016
99-XWE-SS-0033	SS-1A-4A	9/2/99	0-12"	MFOST Moat South Plug	ND	0.179
99-XWE-SB-0049	SS-1A-4B	9/2/99	36-48"	MFOST Moat South Plug	ND	ND
99-XWN-SS-0037	SS-16E-1A	9/2/99	0-12"	North of D/W Support Center	<0.030	0.068
99-XWN-SB-0032	SS-16E-1A2	9/2/99	192.5-204.5"	North of D/W Support Center	ND	ND
99-XWN-SB-0050	SS-16E-1A1	9/2/99	36-48"	North of D/W Support Center	<0.020	0.044
99-YAA-SS-0044	SS-16D-2A	9/2/99	0-12"	North of NRW, North of sidewalk, I/S RCA fence	0.210	1.700
99-YAA-SB-0024	SS-16D-2A2	9/2/99	156.25-168.25"	North of NRW, North of sidewalk, I/S RCA fence	ND	ND
99-YAA-SB-0043	SS-16D-2A1	9/2/99	36-48"	North of NRW, North of sidewalk, I/S RCA fence	0.052	0.390
99-YAA-SS-0036	SS-16F-2A	9/2/99	0-12"	North of ORW, NE Corner of filter pad	0.800	4.200
99-YAA-SB-0035	SS-16F-2A2	9/2/99	168-180	North of ORW, NE Corner of filter pad	ND	ND
99-YAA-SB-0030	SS-16F-2A1	9/2/99	36-48"	North of ORW, NE Corner of filter pad	0.036	0.330
99-YAA-SS-0027	SS-16F-1A	9/2/99	0-12"	North of ORW, NW Corner of filter pad	0.950	3.000
99-YAA-SB-0025	SS-16F-1A2	9/2/99	192-204"	North of ORW, NW Corner of filter pad	ND	0.745

Table 3.2.11
Non-Radiological ISRA Investigation

Sample Number	Reference Number	Date	Depth	Sample Location	Co-60 Concentration (pCi/g)	Cs-137 Concentration (pCi/g)
99-YAA-SB-0028	SS-16F-1A1	9/2/99	36-48"	North of ORW, NW Corner of filter pad	0.190	6.400
99-YAA-SS-0040	SS-16D-4A	9/2/99	0-12"	South of NRW HX Building (~30 feet)	0.240	1.600
99-YAA-SB-0039	SS-16D-4A1	9/2/99	12-24"	South of NRW HX Building (~30 feet)	<0.020	0.250
99-YAA-SB-0031	SS-16D-4A2	9/2/99	48.5-60.5"	South of NRW HX Building (~30 feet)	ND	0.386
99-XWN-SS-0029	SS-16E-3A	9/2/99	0-12"	SW corner of D/W Support Center	<0.020	0.079
99-XWN-SB-0034	SS-16E-3A2	9/2/99	216-228"	SW corner of D/W Support Center	ND	ND
99-XWN-SB-0026	SS-16E-3A1	9/2/99	36-48"	SW corner of D/W Support Center	<0.040	0.130
99-YAA-SS-0042	SS-16D-3A	9/2/99	0-12"	West of NRW at macadam repair area	<0.020	0.073
99-YAA-SB-0038	SS-16D-3A2	9/2/99	144-156"	West of NRW at macadam repair area	ND	ND
99-YAA-SB-0041	SS-16D-3A1	9/2/99	36-48"	West of NRW at macadam repair area	<0.014	<0.012
99-XWN-SS-0046	SS-16D-1A	9/2/99	0-12"	West of NRW O/S RCA fence	0.095	0.510
99-XWN-SB-0045	SS-16D-1A1	9/2/99	36-48"	West of NRW O/S RCA fence	<0.015	0.094
99-XWN-SS-0053	SS-16E-4A	9/3/99	0-12"	North of RB, Near transformers west of D/W Process Facility	ND	0.194
99-XWN-SB-0055	SS-16E-4A2	9/3/99	204.75-216.75"	North of RB, Near transformers west of D/W Process Facility	ND	ND
99-XWN-SB-0054	SS-16E-4A1	9/3/99	36-48"	North of RB, Near transformers west of D/W Process Facility	<0.040	0.130
99-XWN-SS-0051	SS-16E-2A	9/3/99	0-12"	NW corner of Outage Command Center	0.041	0.016
99-XWN-SB-0052	SS-16E-2A2	9/3/99	180-192"	NW corner of Outage Command Center	ND	ND
99-XWN-SB-0056	SS-16E-2A1	9/3/99	36-48"	NW corner of Outage Command Center	0.027	0.120
99-XCD-SS-0062	SS-6A-2A	11/15/99		drum storage area SW level D	ND	ND
99-XCD-SS-0059	SS-6B-2A	11/15/99	0-24"	Level D Storage Area, former drum collection area	ND	0.111
99-XCD-SS-0058	SS-6B-1A	11/15/99	0-24"	Level D Storage Area, former drum collection area	ND	0.066
99-XCD-SS-0060	SS-6C-1A	11/15/99	0-24"	Level D Storage Area, southwest drum storage area	ND	ND
99-XWS-SS-0071	SS-6C-2A	11/15/99	0-6"	Level D Storage Area, southwest drum storage area	ND	ND
99-XCD-SS-0065	SS-6A-1A	11/15/99	0-24"	North of Level D Storage Area at access road	ND	0.072
99-XWS-SS-0068	SS-14C-2A	11/15/99	0-6"	Seepage pit-pretreatment backwash	ND	ND
99-XWS-SS-0063	SS-14C-3A	11/15/99	0-6"	Seepage pit-pretreatment backwash	ND	0.058
99-XWS-SS-0057	SS-14C-4A	11/15/99	0-6"	Seepage pit-pretreatment backwash	ND	0.084
99-XWS-SB-0069	SS-14C-1B	11/15/99	9.5-10'	Seepage pit-pretreatment backwash(deep)	ND	ND
99-XWS-SS-0070	SS-14C-1A	11/15/99	0-6"	Seepage pit-pretreatment backwash(shallow)	ND	ND
99-XWS-SB-0067	SS-16C-4B	11/15/99		Southeast corner of Building 4	ND	ND
99-XWS-SS-0061	SS-16C-4A	11/15/99	0-6"	Southeast corner of Building 4	ND	0.100

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Non-Radiological ISRA Investigation

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
99-XWS-SB-0066	SS-16C-6B	11/15/99		Southwest of Building 4	ND	ND
99-XWS-SS-0064	SS-16C-6A	11/15/99		Southwest of Building 4	ND	0.095
99-XWS-SB-0083	SS-16C-2B	11/16/99		East of Building 4	ND	ND
99-XWS-SS-0080	SS-16C-2A	11/16/99		East of Building 4	ND	ND
99-XWS-SB-0072	SS-16C-3B	11/16/99		East side South end of Building 4	ND	ND
99-XWS-SS-0081	SS-16C-3A	11/16/99		East side South end of Building4	ND	0.065
99-XTL-SS-0089	SS-18B-1A	11/16/99	0-6"	NE laydown and sandblast	ND	ND
99-XTL-SS-0087	SS-18B-2A	11/16/99	0-6"	NE laydown and sandblast	ND	ND
99-XTL-SS-0082	SS-18B-4A	11/16/99	0-6"	NE laydown and sandblast	ND	ND
99-XTL-SS-0075	SS-18B-3A	11/16/99	0-6"	NE laydown and sandblast	ND	0.037
99-XTL-SB-0088	SS-18B-2A	11/16/99	1'-2'	NE laydown and sandblast	ND	ND
99-XWN-SS-0074	SS-19A-1A	11/16/99	0-6"	North of TB at Joy Compressor Building	ND	0.039
99-XWN-SS-0076	SS-19B-1A	11/16/99	0-6"	North of TB at old compressor area	ND	0.101
99-XWS-SS-0094	SS-16C-1A	11/16/99		Northeast corner of Building 4	ND	0.080
99-XWS-SB-0091	SS-16C-1B	11/16/99		Northeast corner of Building 4	ND	ND
99-XWN-SS-0090	SS-17H-1A	11/16/99		Northwest corner of TB at oil spill from 8/87	0.114	0.068
99-XWS-SB-0078	SS-16C-5B	11/16/99		South of Building 4	ND	ND
99-XWS-SS-0077	SS-16C-5A	11/16/99		South of Building 4	ND	0.094
99-XCD-SS-0092	SS-15D-1A	11/16/99	0-6"	Spare Main Transformer	ND	ND
99-XCD-SS-0086	SS-15D-3A	11/16/99	0-6"	Spare Main Transformer	ND	ND
99-XCD-SB-0093	SS-15D-3B	11/16/99	12-24"	Spare Main Transformer	ND	ND
99-XCD-SB-0084	SS-15D-1B	11/16/99	18-24"	Spare Main Transformer	ND	ND
99-XWN-SS-0085	SS-1F-1A	11/16/99	0-6"	Turbine Lube Oil Tank and Purification System	ND	0.117
99-XWS-SS-0073	SS-16B-1A	11/16/99	0-24"	West of Old Machine Ship	ND	ND
99-XWS-SS-0079	SS-16B-2A	11/16/99	0-24"	West of Old Machine Shop	ND	0.033
99- -SD-0117	SED-2	11/17/99	0-3"		ND	0.0601
99- -SD-0116	SED-4	11/17/99	0-3"		ND	ND
99- -SD-0115	SED-5	11/17/99	0-3"		ND	ND
99- -SD-0113	SED-6	11/17/99	0-3"		ND	0.0775
99- -SD-0108	SED-7	11/17/99	0-3"		ND	0.0621
99-XWS-SS-0101	SS-17C-2B	11/17/99	0-6"	South of DG Building at oil spill area from 10/80	ND	0.0894

Table 3.2.11
Non-Radiological ISRA Investigation

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
99-XWS-SS-0100	SS-17C-1A	11/17/99	0-6"	South of DG Building at oil spill area from 10/80	ND	ND
99-XWN-SB-0109	SS-5C-1A	11/17/99	2.5-3'	Torus piping to Rx Bldg	ND	0.0615
99-XWN-SB-0105	SS-5C-6A	11/17/99	2.5-3'	Torus piping to Rx Bldg	ND	ND
99-XWN-SB-0096	SS-5C-5A	11/17/99	2.5-3'	Torus piping to Rx Bldg	ND	0.0841
99-XWN-SB-0103	SS-5C-2A	11/17/99	4.5-5'	Torus piping to Rx Bldg	ND	ND
99-XWW-SB-0099	SS-15K-3A	11/17/99	2-2.5'	Transformer Area, East of northern transfromer	ND	ND
99-XWW-SB-0112	SS-15K-2A	11/17/99	2-2.5'	Transformer Area, North of all transformers	ND	0.0359
99-XWW-SB-0110	SS-15K-2B	11/17/99	4-4.5'	Transformer Area, North of all transformers	ND	ND
99-XWW-SB-0114	SS-15K-1A	11/17/99	2-2.5'	Transformer Area, Northeast of all transformers	ND	0.0675
99-XWW-SB-0095	SS-15K-1B	11/17/99	4-4.5'	Transformer Area, Northeast of all transformers	ND	ND
99-XWW-SB-0107	SS-15K-5A	11/17/99	2-2.5'	Transformer Area, Southeast of southern transformer	ND	ND
99-XWW-SB-0106	SS-15K-5B	11/17/99	4-4.5'	Transformer Area, Southeast of southern transformer	ND	ND
99-XWW-SB-0097	SS-15K-6A	11/17/99	2-2.5'	Transformer Area, Southwest of southern transformer	ND	ND
99-XWW-SB-0104	SS-15K-6B	11/17/99	4-4.5'	Transformer Area, Southwest of southern transformer	ND	ND
99-XWW-SB-0111	SS-15K-8A	11/17/99	2-2.5'	Transformer Area, West of northern transformer	ND	ND
99-XWW-SB-0102	SS-15K-8B	11/17/99	4-4.5'	Transformer Area, West of northern transformer	ND	ND
99-XWW-SB-0098	SS-15K-3B	11/17/99	4-4.5'	Transfromer Area, East of northern transformer	ND	ND
99-XWS-SS-0138	SS-17G-1A	11/18/99	0-6"	NE of DG Building, East of road	ND	ND
99-XWS-SS-0137	SS-17G-3A	11/18/99	0-6"	North of Building 4	ND	ND
99-XWS-SS-0144	SS-16A-1A	11/18/99	0-6"	North of Hazardous Waste Collection Area	ND	0.0258
99-XWS-SS-0126	SS-17G-2A	11/18/99	0-6"	South of Blackout transformer, center of road.	ND	ND
99-XWW-SB-0125	SS-15K-4A	11/18/99	2-2.5'	Transformer Area, Southeast of center transformer	ND	ND
99-XWW-SB-0119	SS-15K-4B	11/18/99	4-4.5'	Transformer Area, Southeast of center transformer	ND	ND
99-XWW-SB-0142	SS-15K-7A	11/18/99	2-2.5'	Transformer Area, Southwest of center transformer	ND	0.0321
99-XWW-SB-0139	SS-15K-7B	11/18/99	4-4.5'	Transformer Area, Southwest of center transformer	ND	ND
99-XWS-SS-0121	SS-17G-7A-1	11/18/99	0-6"	West of Building 4	ND	ND
99-XWS-SS-0118	SS-17G-7A	11/18/99	0-6"	West of Building 4	ND	0.165
99-XWS-SS-0140	SS-17G-8A	11/18/99	0-6"	West of DG Building	ND	ND
99-XWS-SS-0141	SS-16A-6A	11/18/99	0-6"	West of Hazardous Waste Collection Area	ND	0.0628
99-XWW-SS-0122	SS-15L-1A	11/18/99	0-6"	West of northern Start-Up Transformer	ND	ND
99-XWW-SB-0123	SS-15L-1B	11/18/99	1.5-2'	West of northern Start-Up Transformer	ND	ND

Table 3.2.11
Non-Radiological ISRA Investigation

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
99-XWS-SS-0143	SS-17G-6A	11/18/99	0-6"	West of RADIAC trailer	ND	ND
99-XWW-SS-0124	SS-15L-2A	11/18/99	0-6"	West of southern Start-Up Transformer	ND	ND
99-XWW-SB-0120	SS-15L-2B	11/18/99	1.5-2'	West of southern Start-Up Transformer	ND	ND
99-XWS-SS-0148	SS-16A-2A	11/19/99	0-6"	East of Hazardous Waste Collection Area	ND	ND
99-XWS-SS-0147	SS-16A-3A	11/19/99	0-6"	East of Hazardous Waste Collection Area	ND	ND
99-XWS-SS-0146	SS-16A-4A	11/19/99	0-6"	South of Hazardous Waste Collection Area	ND	0.0899
99-XWS-SS-0149	SS-16A-5A	11/19/99	0-6"	West of Hazardous Waste Collection Area	ND	ND
99-XWS-SS-0145	SS-16A-7A	11/19/99	0-6"	West of Hazardous Waste Collection Area	ND	ND
99-XWS-SS-0166	SS-5A-10A	11/22/99	0-6"	Oil Line east of Aux Office Building	ND	ND
99-XWS-SS-0163	SS-5A-12A	11/22/99	0-6"	Oil Line east of Building 4	ND	0.0233
99-XCS-SS-0161	SS-5A-9A	11/22/99	0-6"	Oil Line in OCAB Parking Lot near Site VP Space	ND	ND
99-XWE-SS-0157	SS-5A-3A	11/22/99	0-6"	Oil Line near MFOST	ND	0.332
99-XWE-SS-0155	SS-5A-5A	11/22/99	0-6"	Oil Line near MFOST	ND	ND
99-XWE-SS-0151	SS-5A-2A	11/22/99	0-6"	Oil Line near MFOST	ND	0.672
99-XCS-SS-0156	SS-5A-7A	11/22/99	0-6"	Oil Line near Protected Area fence by MFOST	ND	ND
99-XCS-SS-0154	SS-5A-6A	11/22/99	0-6"	Oil Line near Security outer gate for Sally Port	ND	ND
99-XWS-SS-0164	SS-5A-19A	11/22/99	0-6"	Oil Line north of DG Building	ND	0.0316
99-XWS-SS-0162	SS-5A-16A	11/22/99	0-6"	Oil Line north of DG Building	ND	0.0296
99-XWS-SS-0165	SS-5A-11A	11/22/99	0-6"	Oil Line west of Aux Office Building	ND	ND
99-YFS-SS-0160	SS-11A-1A	11/22/99	0-6"	Runoff trench east of ISFSI area	ND	ND
99-YFS-SS-0158	SS-11A-2A	11/22/99	0-6"	Runoff trench east of ISFSI area	ND	ND
99-XCD-SS-0153	SS-15D-2A	11/22/99	0-6"	Spare Main Transformer	ND	ND
99-XCD-SS-0152	SS-15D-4B	11/22/99	0-6"	Spare Main Transformer	ND	ND
99-XCD-SS-0150	SS-15D-4A	11/22/99	0-6"	Spare Main Transformer	ND	0.0521
99-XCD-SB-0159	SS-15D-2B	11/22/99	18-24"	Spare Main Transformer	ND	ND
99-XWN-SB-0167	SS-5C-7A	11/22/99	4.5-5'	Torus piping to Rx Bldg	ND	0.117
99-XWS-SS-0194	SS-15I-4A	11/23/99	0-6"	Transformer area east of Aux Office Building	ND	0.0777
99-XWS-SS-0193	SS-15I-1A	11/23/99	0-6"	Transformer area east of Aux Office Building	ND	0.11
99-XWS-SS-0192	SS-15I-2A	11/23/99	0-6"	Transformer area east of Aux Office Building	ND	0.0876
99-XWS-SS-0173	SS-15I-3A	11/23/99	0-6"	Transformer area east of Aux Office Building	0.091	0.154
99-XWN-SS-0195	SS-15E-1A	11/23/99	0-6"	Transformer area east of Outage Command Center	ND	0.327

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Non-Radiological ISRA Investigation

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
99-XWN-SS-0181	SS-15E-2A	11/23/99	0-6"	Transformer area east of Outage Command Center	2.21	0.866
99-XWN-SS-0176	SS-15E-3A	11/23/99	0-6"	Transformer area east of Outage Command Center	0.352	0.307
99-XWN-SS-0179	SS-15P-2A	11/23/99	0'-0.5'	Transformer area north of Maintenance Building	ND	0.070
99-XWN-SS-0178	SS-15P-1A	11/23/99	0'-0.5'	Transformer area north of Maintenance Building	ND	0.050
99-XWN-SS-0177	SS-15P-4A	11/23/99	0'-0.5'	Transformer area north of Maintenance Building	ND	0.108
99-XWN-SS-0188	SS-15B-1A	11/23/99	0-6"	Transformer area north of NRW building	ND	0.0549
99-XWN-SS-0186	SS-15B-3A	11/23/99	0-6"	Transformer area north of NRW building	ND	0.0183
99-XWN-SS-0185	SS-15B-2A	11/23/99	0-6"	Transformer area north of NRW building	ND	0.117
99-XWN-SS-0182	SS-15B-4A	11/23/99	0-6"	Transformer area north of NRW building	ND	0.146
99-XWN-SS-0180	SS-15F-2A	11/23/99	0-6"	Transformer area west of DW Process Center	0.156	0.296
99-XWN-SS-0175	SS-15F-1A	11/23/99	0-6"	Transformer area west of DW Process Center	0.136	0.102
99-XWN-SS-0174	SS-15F-3A	11/23/99	0-6"	Transformer area west of DW Process Center	ND	ND
99-XWN-SS-0172	SS-15F-5A	11/23/99	0-6"	Transformer area west of DW Process Center	0.071	0.102
99-XWN-SS-0168	SS-15F-4A	11/23/99	0-6"	Transformer area west of DW Process Center	ND	ND
99-XLA-SS-0187	SS-15N-4A	11/23/99	0-6"	Transformer at Maintenance Fab Shop Area	ND	0.035
99-XLA-SS-0171	SS-15N-2A	11/23/99	0-6"	Transformer at Maintenance Fab Shop Area	ND	0.0672
99-XLA-SS-0170	SS-15N-1A	11/23/99	0-6"	Transformer at Maintenance Fab Shop Area	ND	0.0986
99-XLA-SS-0169	SS-15N-3A	11/23/99	0-6"	Transformer at Maintenance Fab Shop Area	ND	0.0368
99-XWE-SS-0191	SS-15C-2A	11/23/99	0-6"	Transformer at SW corner of warehouse	ND	0.177
99-XWE-SS-0190	SS-15C-3A	11/23/99	0-6"	Transformer at SW corner of warehouse	ND	0.179
99-XWE-SS-0184	SS-15C-1A	11/23/99	0-6"	Transformer at SW corner of warehouse	ND	0.15
99-XWE-SS-0183	SS-15C-4A	11/23/99	0-6"	Transformer at SW corner of warehouse	ND	0.215
99-XWN-SS-0189	SS-15B-5A	11/23/99	0-6"	Transfromer area north of NRW building	0.135	0.296
99-XWS-SS-0197	SS-15J-3A	11/24/99	0-6"	Transformer area at Demin Trailer	ND	ND
99-XIA-SS-0199	SS-15M-3A	11/24/99	0-6"	Transformer area east of intake structure	ND	ND
99-XIA-SS-0198	SS-15M-1A	11/24/99	0-6"	Transformer area east of intake structure	ND	ND
99-XIA-SS-0196	SS-15M-2A	11/24/99	0-6"	Transformer area east of intake structure	ND	ND
99- -SB-0200	SS-MA-2A	11/29/99	15.5'-16'		ND	ND
99-XWS-SB-0203	SS-14A-1A	11/29/99	14.5'-15.5'	Abandoned on-site waste water treatment facility	ND	ND
99-XWS-SS-0205	SS-15J-2A	11/29/99	0-6"	Transformer area at Demin Trailer	ND	0.088
99-XWS-SS-0204	SS-15J-1A	11/29/99	0-6"	Transformer area at Demin Trailer	ND	ND

Table 3.2.11

Non-Radiological ISRA Investigation

Sample Number	Reference Number	Date	Depth	Sample Location	Co60 Concentration (pCi/g)	Cs137 Concentration (pCi/g)
99-WAA-SS-0209	SS-15A-3A	11/29/99	0'-0.5'	Transformer area at LLRWSF	ND	ND
99-WAA-SS-0208	SS-15A-4A	11/29/99	0'-0.5'	Transformer area at LLRWSF	ND	ND
99-WAA-SS-0206	SS-15A-1A	11/29/99	0'-0.5'	Transformer area at LLRWSF	ND	ND
99-WAA-SS-0201	SS-15A-2A	11/29/99	0'-0.5'	Transformer area at LLRWSF	ND	0.017
99-XCS-SS-0213	SS-15G-2A	11/29/99	0'-0.5'	Transformer area south of OCAB	ND	ND
99-XCS-SS-0212	SS-15G-4A	11/29/99	0'-0.5'	Transformer area south of OCAB	ND	ND
99-XCS-SS-0211	SS-15G-5A	11/29/99	0'-0.5'	Transformer area south of OCAB	ND	0.030
99-XCS-SS-0210	SS-15G-3A	11/29/99	0'-0.5'	Transformer area south of OCAB	ND	ND
99-XCS-SS-0207	SS-15G-6A	11/29/99	0'-0.5'	Transformer area south of OCAB	ND	ND
99-XCS-SS-0202	SS-15G-7A	11/29/99	0'-0.5'	Transformer area south of OCAB	ND	ND
99-XCS-SS-0214	SS-15G-1A	11/29/99	0'-0.5'	Transfromer area south of OCAB	ND	ND
99-XWS-SB-0224	SS-14A-5A	11/30/99	16'-17'	Abandoned on-site waste water treatment facility	ND	0.036
99-YAA-SS-0220	SS-19D-1A	11/30/99	0-6"	North of NRW Building at compressor	1.51	0.844
99-YAA-SS-0219	SS-19D-2A	11/30/99	0-6"	North of NRW Building at compressor	1.44	0.956
99-YAA-SS-0223	SS-5G-1A	11/30/99	0-24"	Northeast corner of Boiler House Fuel Oil pumping station	1.75	10.3
99-YAA-SS-0222	SS-5A-4A	11/30/99	0'-2'	Oil Line near Boiler House	ND	0.145
99-YAA-SB-0221	SS-5A-1A	11/30/99	3.5'-4'	Oil Line near Boiler House	ND	ND
99-XCP-SS-0218	SS-15O-1A	11/30/99	0'-0.5'	Transformer south of Trailer 300 Complex	ND	ND
99-XCP-SS-0217	SS-15O-2A	11/30/99	0'-0.5'	Transformer south of Trailer 300 Complex	ND	ND
99-XCP-SS-0216	SS-15O-3A	11/30/99	0'-0.5'	Transformer south of Trailer 300 Complex	ND	0.068
99-XCP-SS-0215	SS-15O-4A	11/30/99	0'-0.5'	Transformer south of Trailer 300 Complex	ND	0.236
99-EAA-SB-0226	SS-MW-1I-2A	12/2/99	10'-12'	Monitoring Well installationSE of TWST	ND	ND
99-EAA-SB-0227	SS-MW-1I-2A	12/2/99	12'-14'	Monitoring Well installationSE of TWST	ND	ND
99-EAA-SB-0225	SS-MW-1I-2A	12/2/99	14'-18'	Monitoring Well installationSE of TWST	ND	ND
99-YAA-SB-0235	SS-MW-1A-1A	12/3/99	16'-18'	Monitoring well installation north of new Boiler House	ND	ND
99-EAA-SB-0236	SS-MW-1I-1A	12/3/99	13'-17'	Monitoring well installation NW of TWST	ND	ND
99-XIA-SS-0237	SS-8-1A	12/3/99	0'-1.5'	North of road to switchyard south of intake structure	ND	0.072
99-XIA-SS-0230	SS-8-2A	12/3/99	0'-2'	North of road to switchyard south of intake structure	ND	0.059
99-XWN-SS-0229	SS-1E-1A	12/3/99	0'-0.5'	North of Turbine Dirty Oil Collection Tank	ND	ND
99-XWS-SS-0234	SS-1D-1A	12/3/99	0'-2'	NW corner of DG Building at Oil Tank Moat	ND	ND
99-XCT-SS-0233	SS-15R-1A	12/3/99	0'-0.5'	Transformer area at North Trailer Park	ND	0.07

Table 3.2.11
Non-Radiological ISRA Investigation

Sample Number	Reference Number	Date	Depth	Sample Location	Co-60 Concentration (pCi/g)	Cs-137 Concentration (pCi/g)
99-XCT-SS-0232	SS-15R-2A	12/3/99	0'-0.5'	Transformer area at North Trailer Park	ND	0.12
99-XCT-SS-0231	SS-15R-3A	12/3/99	0'-0.5'	Transformer area at North Trailer Park	ND	ND
99-XCT-SS-0228	SS-15R-4A	12/3/99	0'-0.5'	Transformer area at North Trailer Park	ND	0.07
99-XWS-SB-0240	SS-5A-10A	12/8/99	1.5'-2.5'	Oil Line east of Aux Office Building	ND	0.050
99-XWW-SB-0242	SS-5B-2A	12/8/99	4'-4.5'	Oil Line from Dirty Oil Tank to TB	ND	ND
99-XWW-SB-0241	SS-5B-1A	12/8/99	5'-6'	Oil Line from Dirty Oil Tank to TB	ND	ND
99-XWE-SB-0243	SS-2A-2A	12/8/99	7'-7.5'	South of warehouse, north of laundry trailer	ND	0.125
99-XWE-SB-0239	SS-2A-1A	12/8/99	7'-7.5'	South of warehouse, north of laundry trailer	ND	0.10
99-XWE-SB-0238	SS-2A-3A	12/8/99	7'-7.5'	South of warehouse, north of laundry trailer	ND	ND
99-XWW-SB-0244	SS-MW-15K-1A	12/9/99	10'-11'	Monitoring well installation SW of Chlorination Building	ND	ND
99-XWE-SB-0245	SS-MW-1A-2A	12/9/99	15'-18'	Monitoring well installation SW of MFOST	ND	ND
99-XWS-SB-0247	SS-14A-4A	12/13/99	13.5'-14'	Abandoned on-site waste water treatment facility	ND	0.110
99-XWS-SB-0248	SS-14A-3A	12/13/99	17.5'-18'	Abandoned on-site waste water treatment facility	ND	ND
99-XWS-SB-0253	SS-15H-5A	12/13/99	2'-2.5'	Transformer area south of Site Emergency Building	ND	ND
99-XWS-SB-0252	SS-15H-4A	12/13/99	2'-2.5'	Transformer area south of Site Emergency Building	ND	ND
99-XWS-SB-0250	SS-15H-2A	12/13/99	2'-2.5'	Transformer area south of Site Emergency Building	ND	0.067
99-XWS-SB-0249	SS-15H-1A	12/13/99	2'-2.5'	Transformer area south of Site Emergency Building	ND	ND
99-XWS-SB-0246	SS-15H-6A	12/13/99	2'-2.5'	Transformer area south of Site Emergency Building	ND	ND
99-XWS-SB-0251	SS-15H-3A	12/13/99	3'-3.5'	Transformer area south of Site Emergency Building	ND	ND
MW-1A-1A	Groundwater	12/13/99	3'-3.5'	MW-1A-1A near MFOST	ND	ND

Notes:

Depth - inches below ground surface

Co-60 - Cobalt 60

Cs-137 - Cesium 137

< MDA - Below Method Detection Limits

Greater than NRC Guideline (3.8 pCi/g - Co-60; 11 pCi/g - Cs-137)

N/A - Not Analyzed

Table 3.2.12
Miscellaneous Sampling Events

Sample Number	Reference Number	Date	Depth	Sample Location	Co-60 Concentration (pCi/g)	Cs-137 Concentration (pCi/g)
86-YAA-SS-0001		3/21/86	0-6"	Soil between FOST and RR airlock	8.54	2.68
92-YAA-SS-0001		3/2/92	0-6"	ORW Surge Tank area - spill from tank	1100.0	90.0
92-XWE-SS-0003	XWE-MFOST-03	4/3/92	0-6"	MFOST Valve Shed East	0.610	1.17
92-XWE-SS-0002	XWE-MFOST-01	4/3/92	0-6"	MFOST Valve Shed North	0.247	0.395
92-XWE-SS-0005	XWE-MFOST-02	4/3/92	0-6"	MFOST Valve Shed South	0.519	0.968
92-XWE-SS-0004	XWE-MFOST-04	4/3/92	0-6"	MFOST Valve Shed West	0.892	1.07
99-X04-SS-0006		6/30/99	0-6"	Fuel Oil Leak	ND	0.0366
99-XDA-SS-0007		7/16/99	N/A	Spill excavation on the north side of the DG Building	<MDA	0.0936
99-YAA-SS-0005		8/27/99	Unknown	East wall Rx Building by chiller pad (SW elbow)	0.75	1.68
99-YAA-SS-0004		8/27/99	Unknown	West wall of excavation RB by chiller pad (SW Elbow)	1.39	2.04
00-XWW-SS-0002		1/6/00	0-6"	Soil Berm West of Dilution Pump House	ND	ND
00-XWE-SS-0003		1/6/00	0-6"	Soil from berm at Main Fuel Oil Storage Tank	ND	ND
00-XTS-SS-0001		1/6/00	0-6"	Soil Mound West of South Parking Lot at PA Fence line	ND	ND

Notes:

Data from June/July 1990 and September 1997 not included in table.

Depth - inches below ground surface

Co-60 - Cobalt 60

Cs-137 - Cesium 137

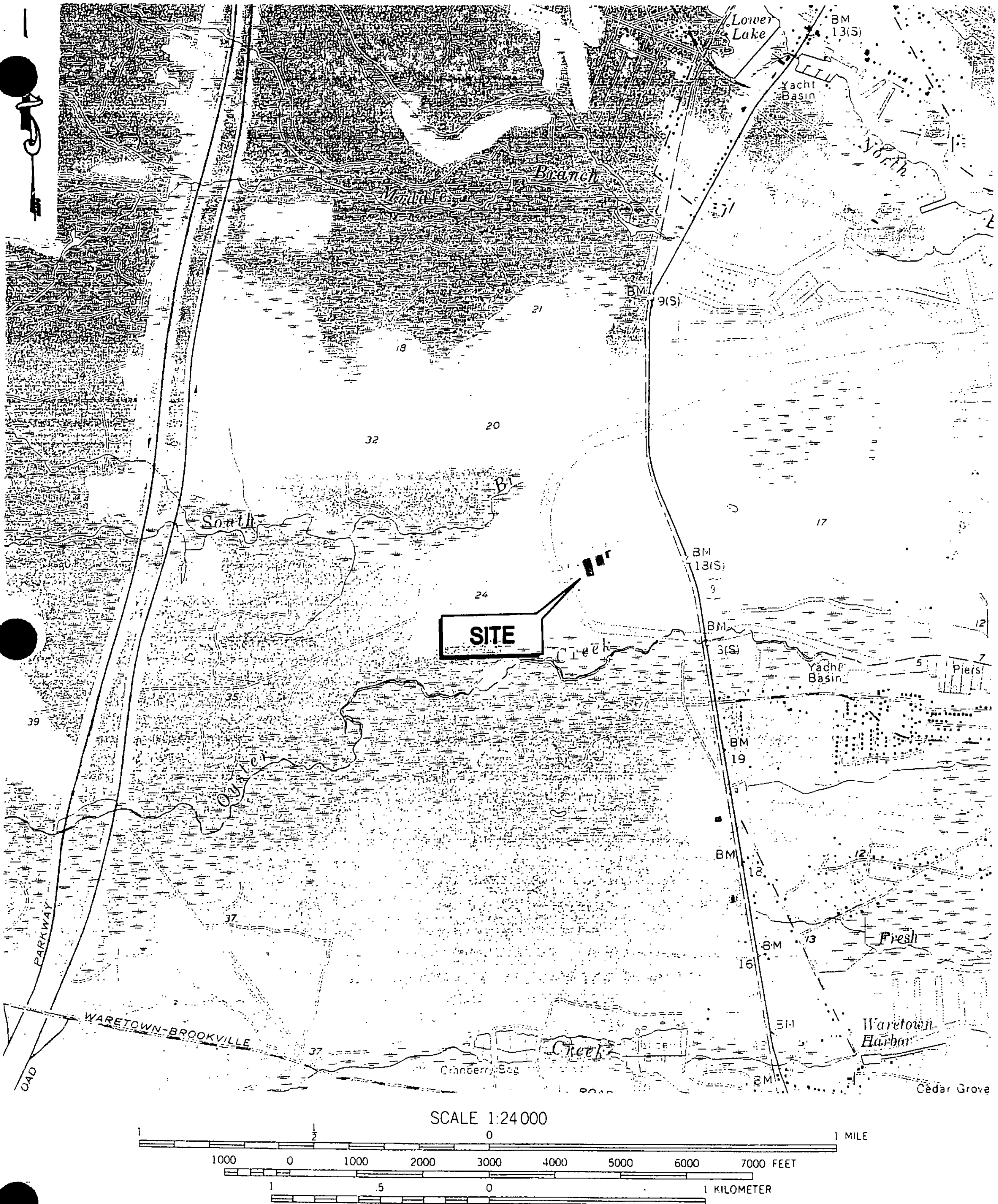
< MDA - Below Method Detection Limits

(shaded) Greater than NRC Guideline (3.8 pCi/g - Co-60; 11 pCi/g - Cs-137)

N/A - Not Analyzed

FIGURES

FILE NO. 1-1
DATE 02-15-00
CAD/OP TJG



McLaren Hart, INC.

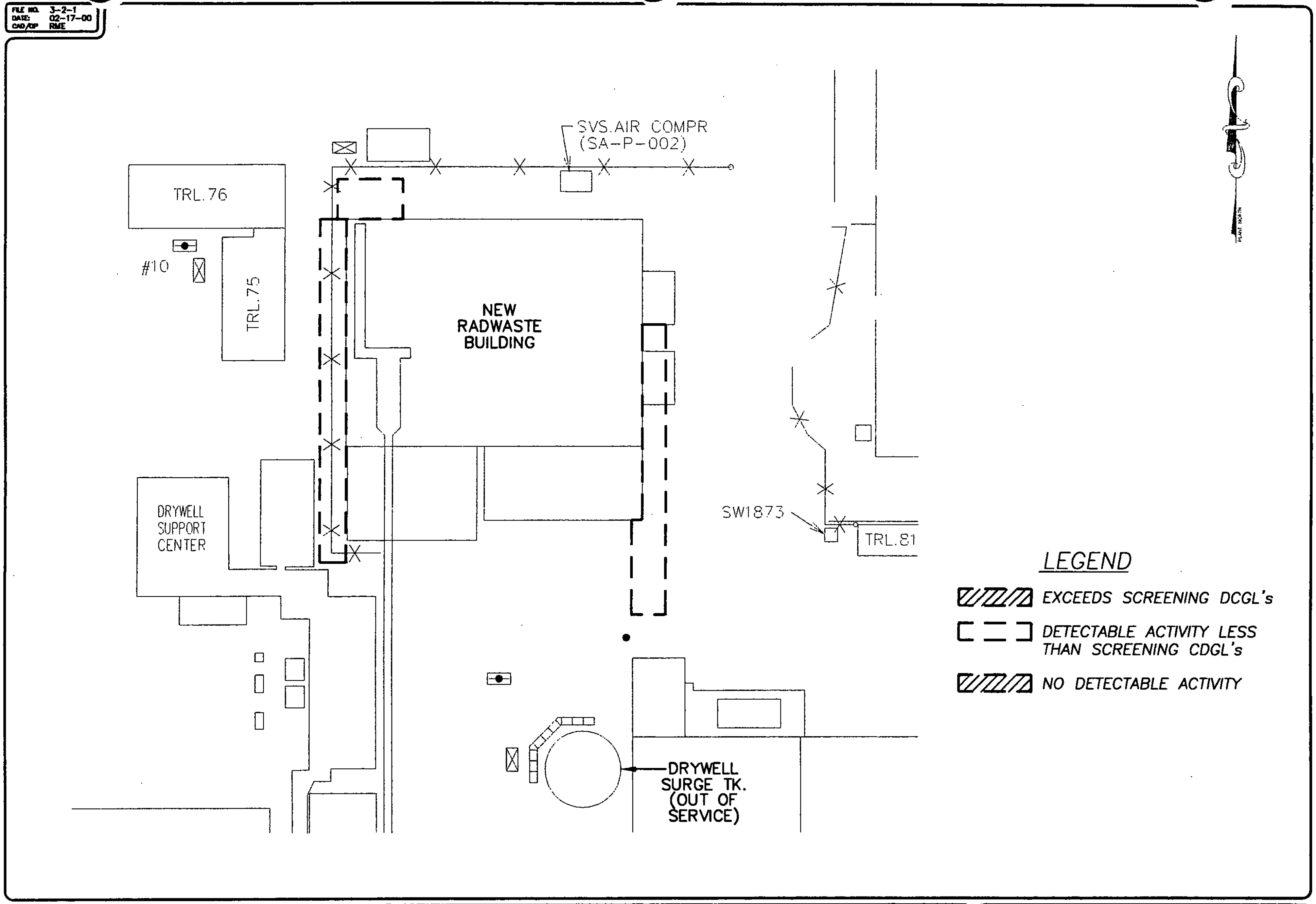
SITE LOCATION MAP
RADIOLOGICAL MONITORING REPORT

OYSTER CREEK NUCLEAR GENERATING STATION
FORKED RIVER, NEW JERSEY

DRWN: TJG	SCALE: AS NOTED
CHK'D:	DATE: 02/15/00
APP'D:	**FIGURE 1.1**

Figure 3.1.1
Site Investigation Report

Included as Figure L-5 of Preliminary Assessment



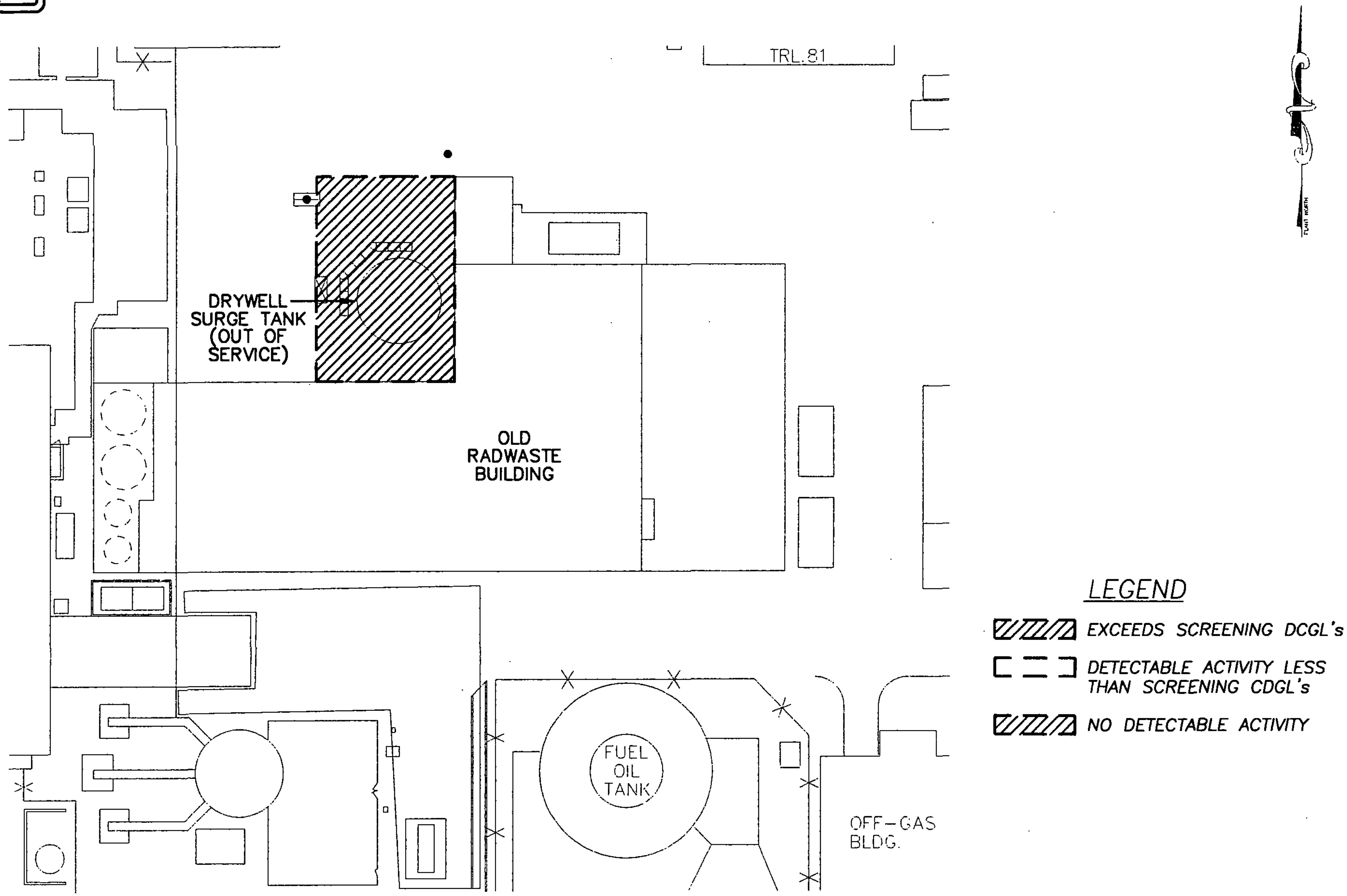
McLaren Hart, Inc.

MARCH 1981 - NEW RADWASTE BUILDING - TANK LEAK SITE INVESTIGATION - RADIOLOGICAL

OYSTER CREEK NUCLEAR GENERATING STATION
FORKED RIVER, NEW JERSEY

DRWN: TJG	SCALE: 1"=50'-0"
CHK'D:	DATE: 02/17/00
APP'D:	**FIGURE 3.2.1**

FILE NO. 3-2-2
DATE: 02-17-00
CAD/OP RME



McLaren Hart, Inc.

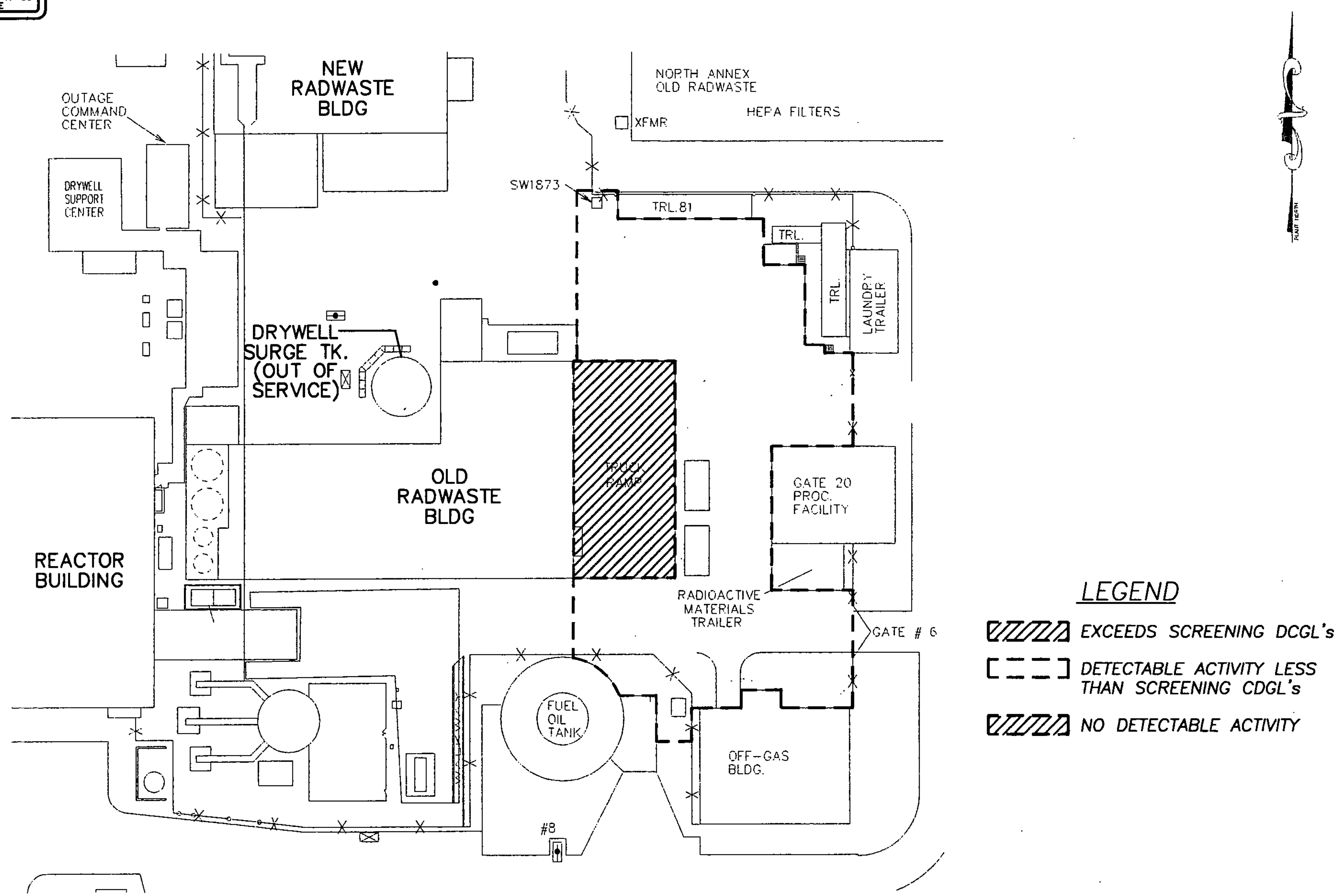
OCTOBER 1982 - OLD RADWASTE BUILDING - WASTE SURGE TANK RELEASE

SITE INVESTIGATION - RADIOLOGICAL

OYSTER CREEK NUCLEAR GENERATING STATION
FORKED RIVER, NEW JERSEY

DRWN: TJG	SCALE: 1"=50'-0"
CHK'D:	DATE: 02/17/00
APP'D:	**FIGURE 3.2.2**

FILE NO. 3-2-3
DATE: 02-17-00
CAD/OP RME



McLaren Hart, Inc.

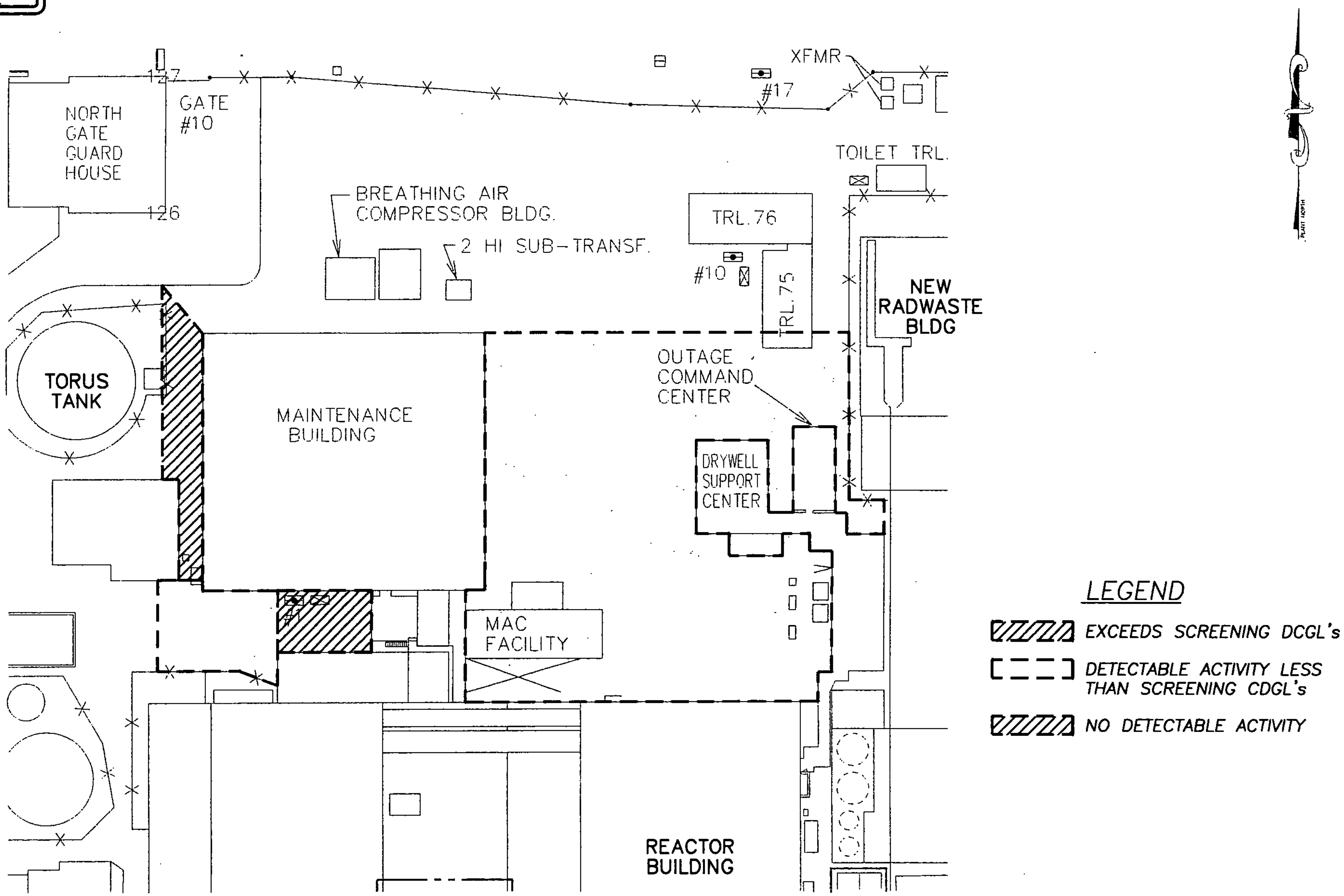
OCTOBER 1982 - OLD RADWASTE BUILDING - TRUCK RAMP PAVING

SITE INVESTIGATION - RADIOLOGICAL

OYSTER CREEK NUCLEAR GENERATING STATION
FORKED RIVER, NEW JERSEY

DRWN: TJG	SCALE: 1"=70'-0"
CHK'D:	DATE: 02/17/00
APP'D:	**FIGURE 3.2.3**

FILE NO. 3-2-4
DATE: 02-17-00
CAD/OP RME

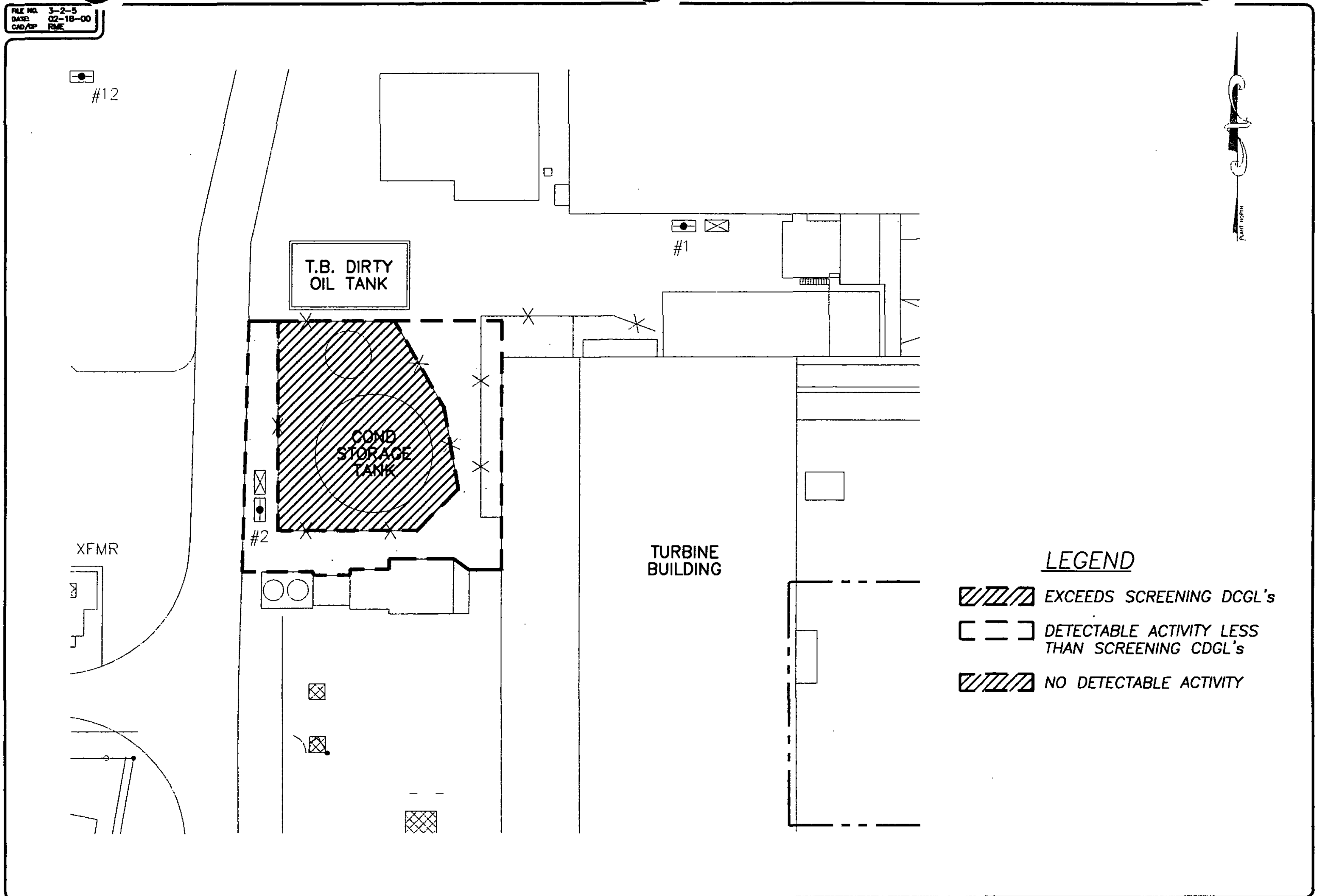


McLaren Hart, Inc.

JUNE 1985 - PROPOSED ESSF LOCATION
SITE INVESTIGATION - RADIOLOGICAL

OYSTER CREEK NUCLEAR GENERATING STATION
FORKED RIVER, NEW JERSEY

DRWN: TJG	SCALE: 1"=70'-0"
CHK'D:	DATE: 02/17/00
APP'D:	**FIGURE 3.2.4**



McLaren Hart, Inc.

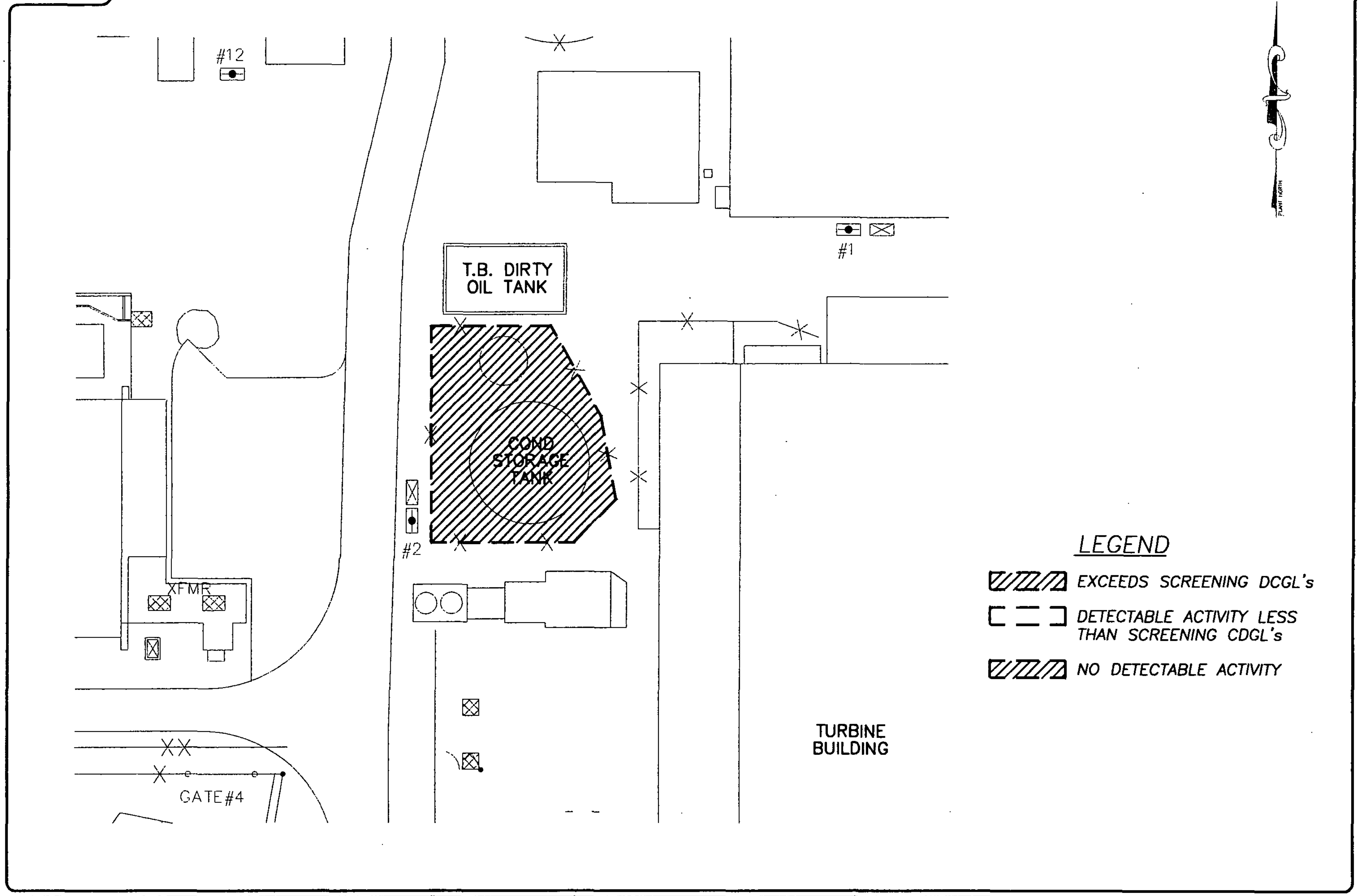
MARCH 1991 - CONDENSATE STORAGE TANK - BOTTOM LEAKAGE

SITE INVESTIGATION - RADIOLOGICAL

OYSTER CREEK NUCLEAR GENERATING STATION
FORKED RIVER, NEW JERSEY

DRWN: TJG	SCALE: 1"=50'-0"
CHK'D:	DATE: 02/17/00
APP'D:	**FIGURE 3.2.5**

FILE NO. 3-2-6
DATE: 02-17-00
CAD/OP RME



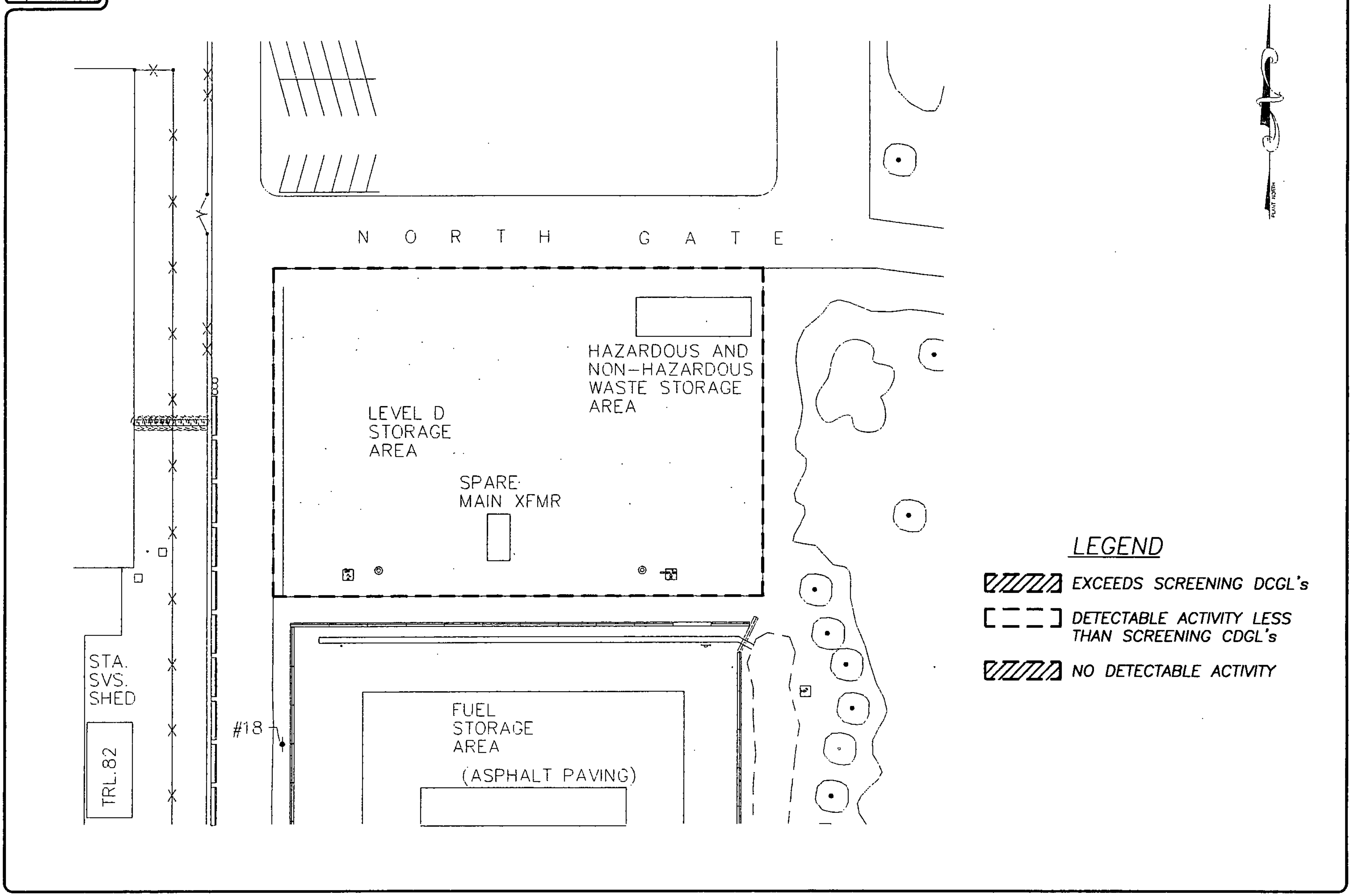
McLaren Hart, Inc.

APRIL 1991 - CONDENSATE YARD SPILL
RADIOLOGICAL MONITORING REPORT

OYSTER CREEK NUCLEAR GENERATING STATION
FORKED RIVER, NEW JERSEY

DRWN: TJG	SCALE: 1"=50'-0"
CHK'D:	DATE: 02/17/00
APP'D:	**FIGURE 3.2.6**

FILE NO. 3-2-7
DATE: 02-17-00
CAD/OP RME

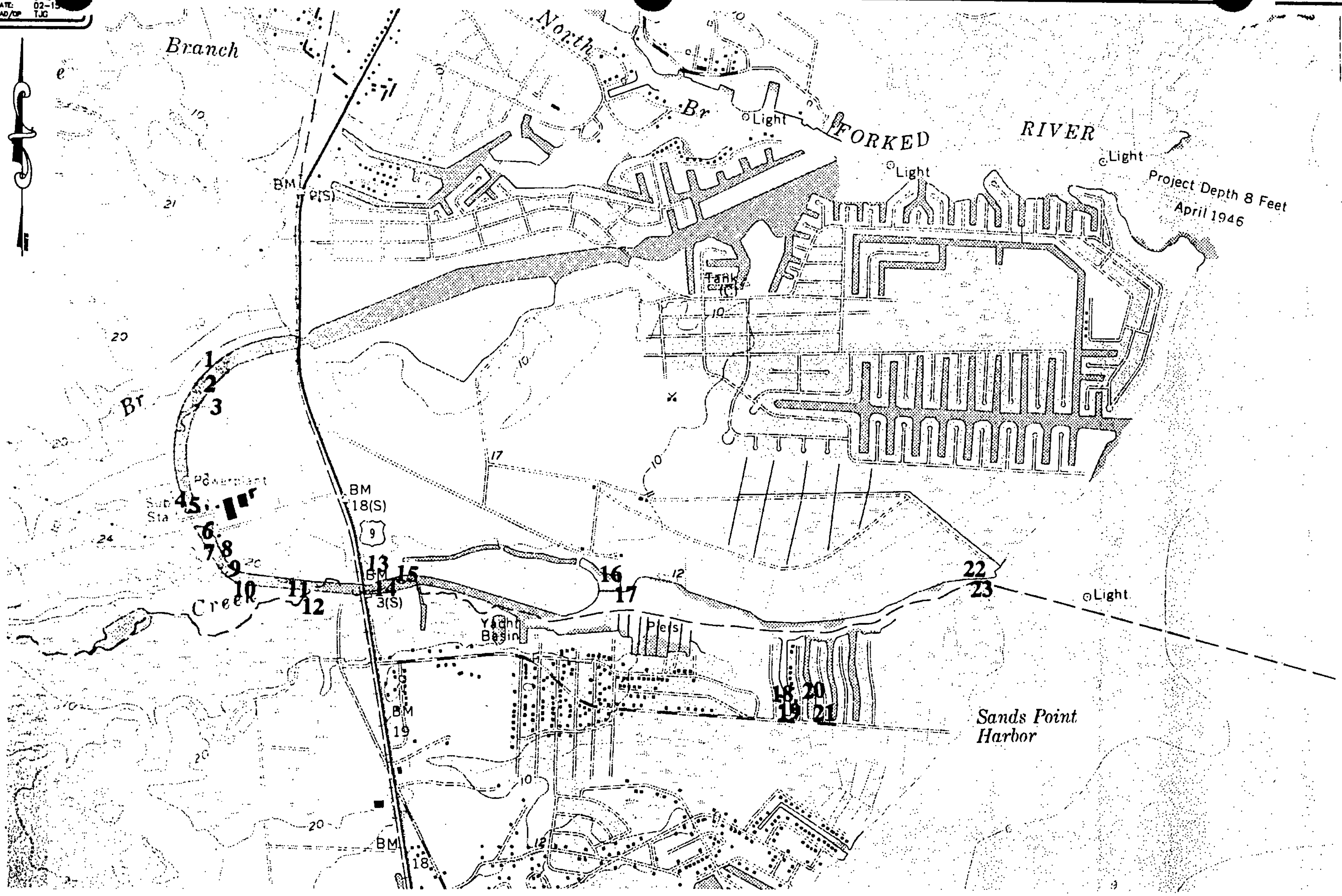


McLaren Hart, Inc.

AUGUST 1992 - PROPOSED ISFSI CONSTRUCTION SITE INVESTIGATION - RADIOLOGICAL

OYSTER CREEK NUCLEAR GENERATING STATION
FORKED RIVER, NEW JERSEY

DRWN: TJG	SCALE: 1"=70'-0"
CHK'D:	DATE: 02/17/00
APP'D:	**FIGURE 3.2.7**

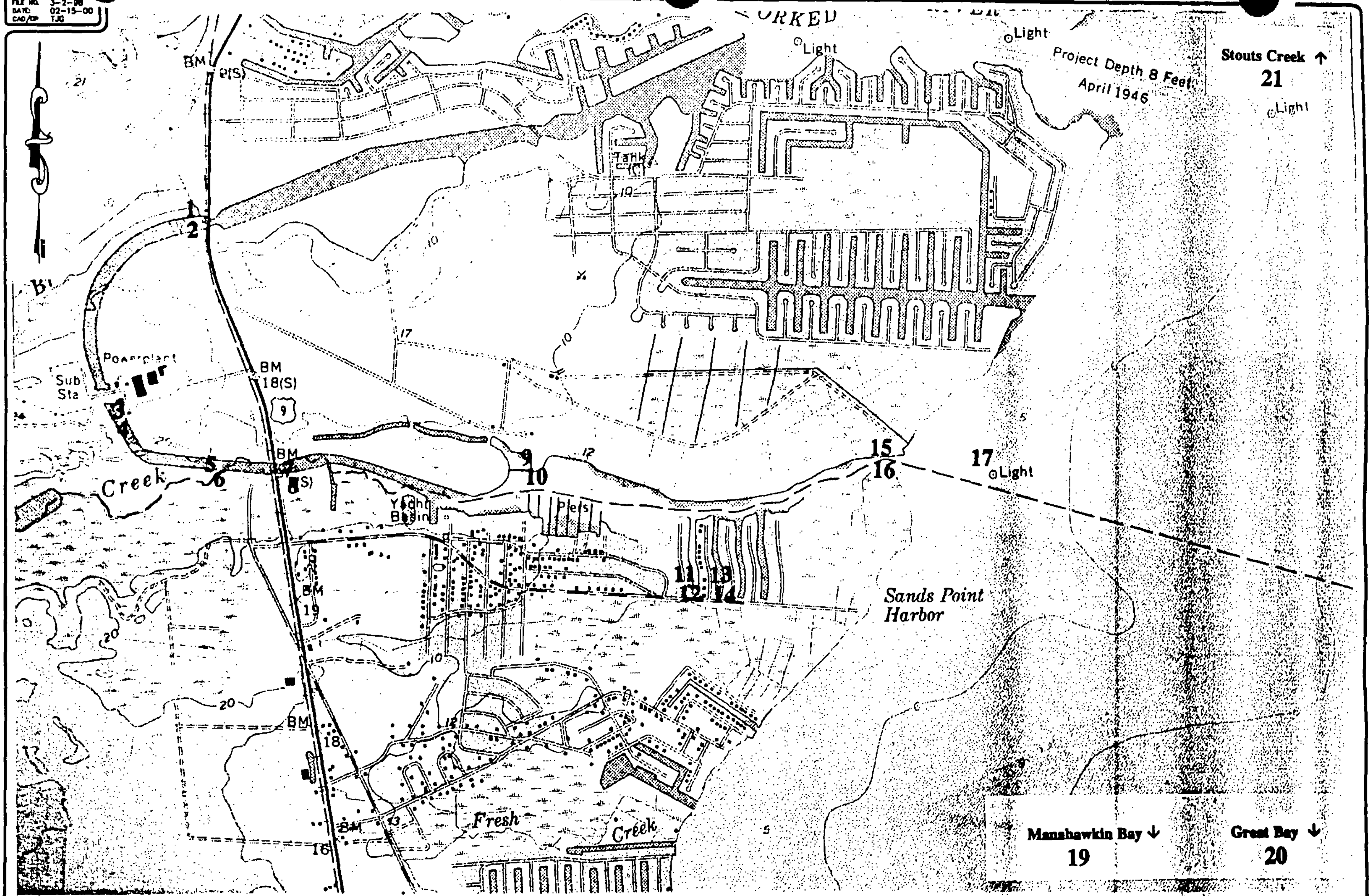


SOURCE: UNITED STATES GEOLOGICAL SURVEY – FORKED RIVER, NEW JERSEY QUADRANGLE, PHOTO REVISED 1972

McLaren• Hart, INC.

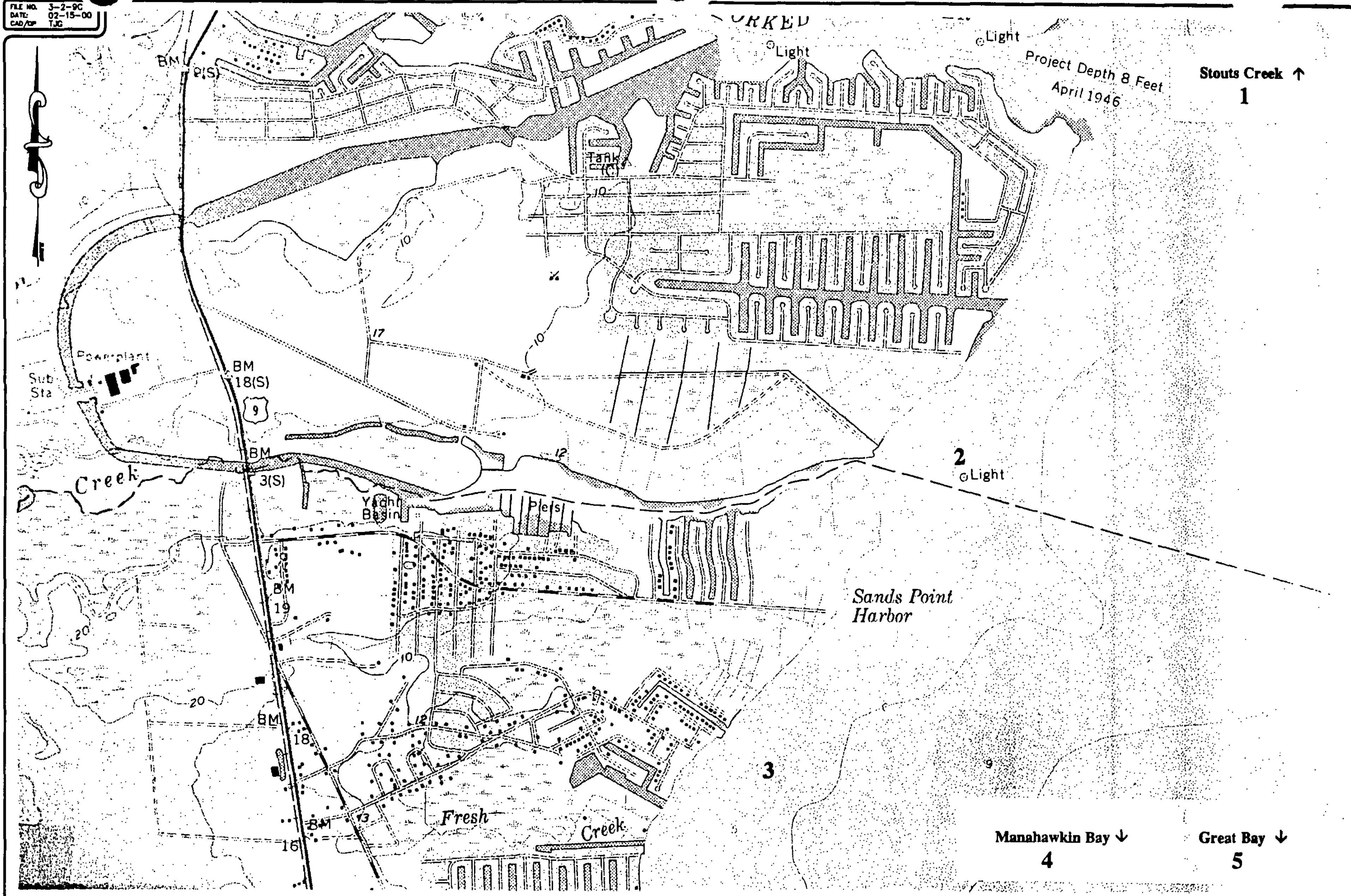
SEPTEMBER 1996 – CONDENSATE TRANSFER OVERBOARD DISCHARGE EVENT – SURFACE WATER SAMPLES RADIOLOGICAL MONITORING EVENT	
OYSTER CREEK NUCLEAR GENERATING STATION FORKED RIVER, NEW JERSEY	

DRWN: TJG	SCALE: AS NOTED
CHK'D:	DATE: 02-15-00
APP'D:	**FIGURE 3.2.9A**



SOURCE: UNITED STATES GEOLOGICAL SURVEY – FORKED RIVER, NEW JERSEY QUADRANGLE, PHOTO REVISED 1972

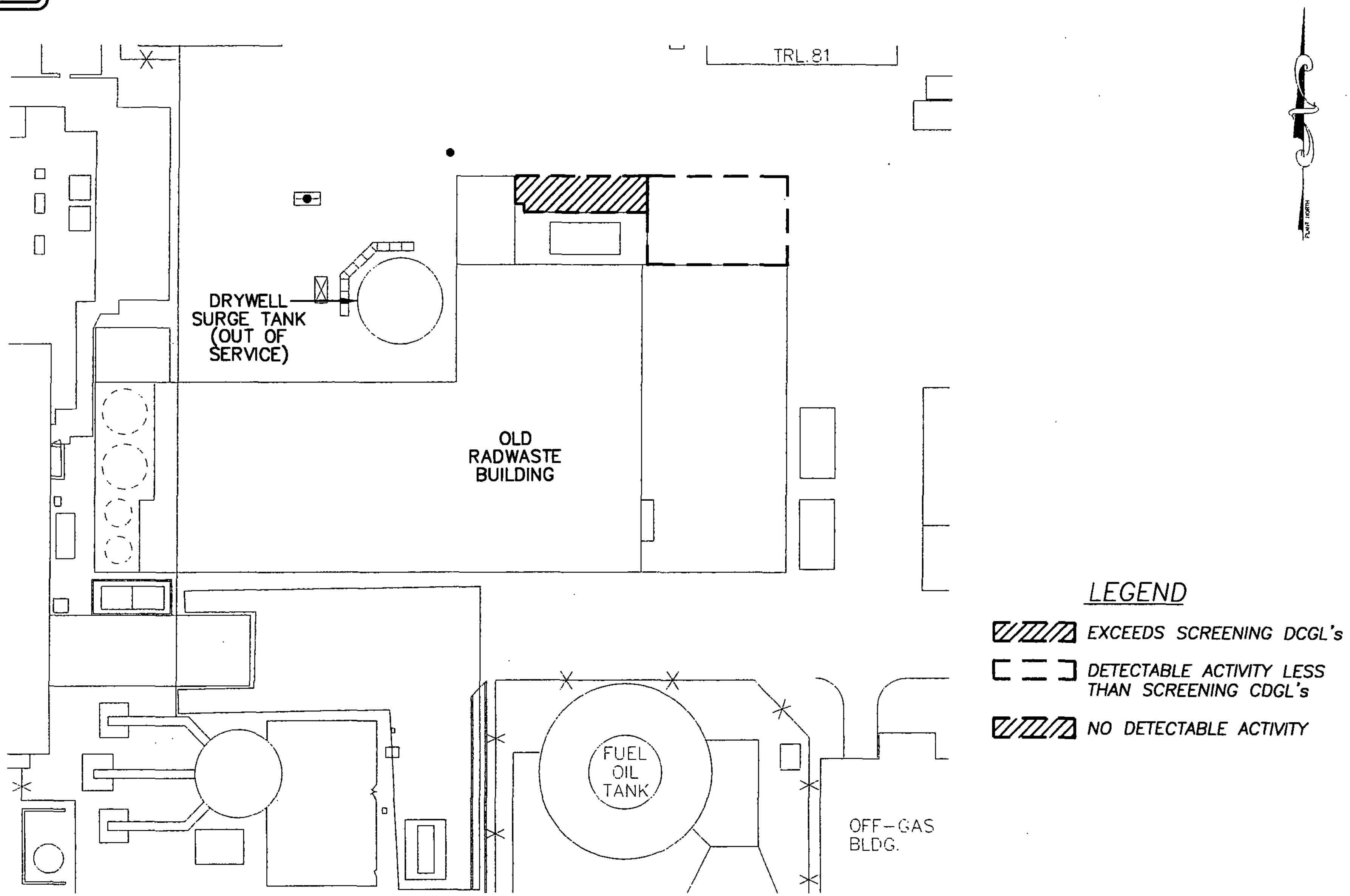
McLaren Hart, INC.	SEPTEMBER 1996 – CONDENSATE TRANSFER OVERBOARD DISCHARGE EVENT – SEDIMENT SAMPLES RADIOLOGICAL MONITORING EVENT OYSTER CREEK NUCLEAR GENERATING STATION FORKED RIVER, NEW JERSEY	DRWN: TJG CHK'D: APP'D:	SCALE: AS NOTED DATE: 02-15-00 **FIGURE 3.2.9B**



SOURCE: UNITED STATES GEOLOGICAL SURVEY – FORKED RIVER, NEW JERSEY QUADRANGLE, PHOTO REVISED 1972

McLaren• Hart, INC.	SEPTEMBER 1996 – CONDENSATE TRANSFER OVERBOARD DISCHARGE EVENT – CLAM SAMPLES RADIOLOGICAL MONITORING EVENT	DRWN: TJG	SCALE: AS NOTED
	OYSTER CREEK NUCLEAR GENERATING STATION FORKED RIVER, NEW JERSEY	CHK'D:	DATE: 02-15-00
		APP'D:	**FIGURE 3.2.9C**

FILE NO. 3-2-10
DATE: 02-17-00
CAD/DP RME



McLaren Hart, Inc.

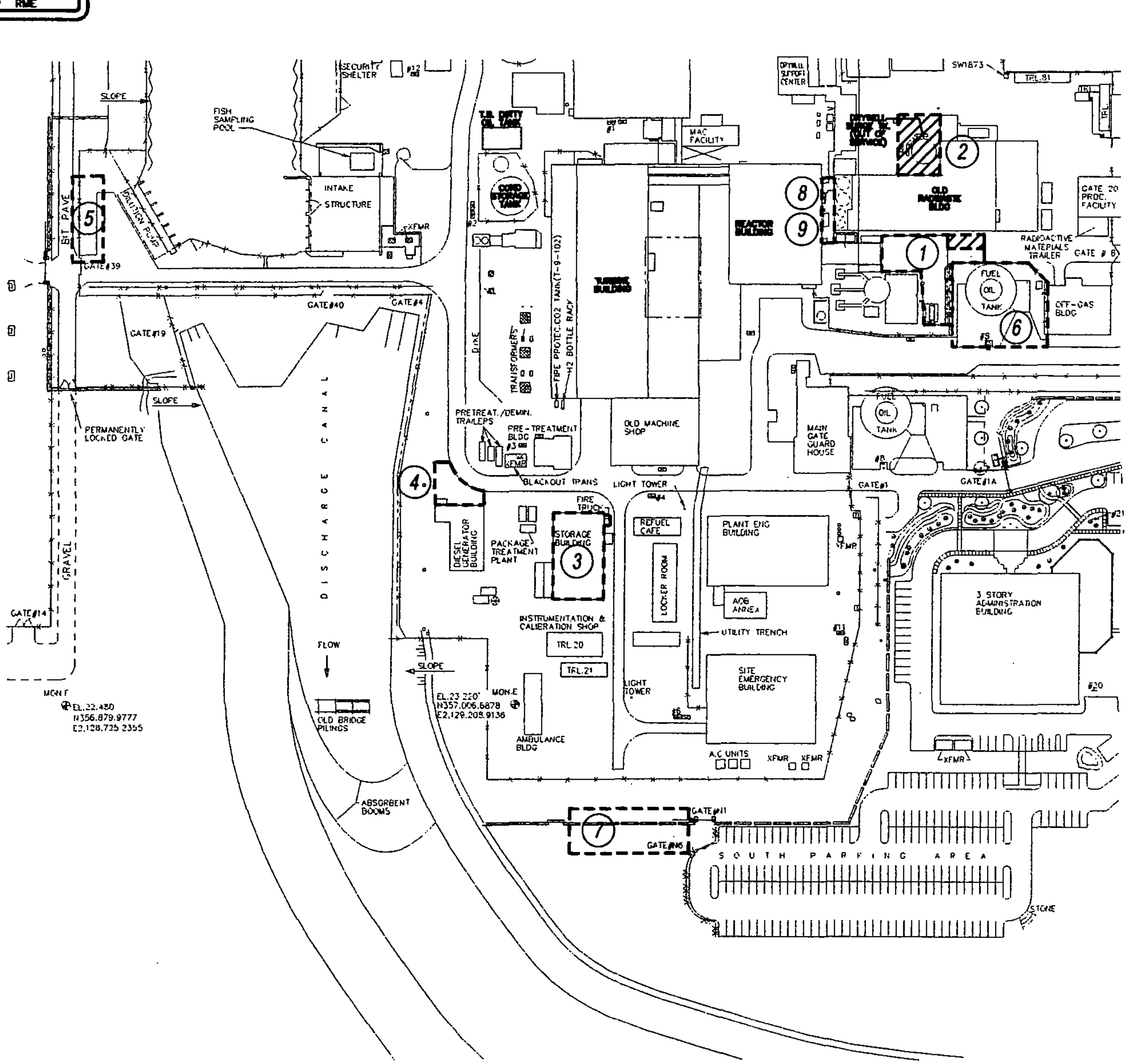
AUGUST 1999 - OLD RADWASTE BUILDING - CONCRETE PAD - SPILL EVENT

SITE INVESTIGATION - RADIOLOGICAL

OYSTER CREEK NUCLEAR GENERATING STATION
FORKED RIVER, NEW JERSEY

DRWN: TJG	SCALE: 1"=50'-0"
CHK'D:	DATE: 02/17/00
APP'D:	**FIGURE 3.2.10**

FILE NO. 3-2-12
DATE: 02-17-00
CAD/OP RME



LEGEND

(hatched)	EXCEEDS SCREENING DCGL's
(dashed)	DETECTABLE ACTIVITY LESS THAN SCREENING CDGL's
(hatched)	NO DETECTABLE ACTIVITY

1. Soil between FOST and RR airlock
2. ORW Surge Tank area – spill from tank
3. Bldg 4, Open trench inside building
4. Spill excavation on the north side of the DG Building
5. Soil Berm West of Dilution Pump House
6. Soil from berm at Main Fuel Oil Storage Tank
7. Soil Mound West of South Parking Lot at PA Fence line
8. East wall Rx Building by chiller pad (SW elbow)
9. West wall of excavation RB by chiller pad (SW Elbow)

McLaren Hart, Inc.

MISCELLANEOUS SAMPLING EVENTS
SITE INVESTIGATION - RADIOLOGICAL

OYSTER CREEK NUCLEAR GENERATING STATION
FORKED RIVER, NEW JERSEY

DRWN: TJG	SCALE: 1"=200'-0"
CHK'D:	DATE: 02/17/00
APP'D:	FIGURE 3.2.12

1998

RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

PREPARED BY

OYSTER CREEK ENVIRONMENTAL AFFAIRS

GPU NUCLEAR CORPORATION

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SUMMARY AND CONCLUSIONS

The radiological environmental monitoring performed during 1998 by the GPU Nuclear Environmental Affairs Department at the Oyster Creek Nuclear Generating Station (OCNGS) is discussed in this report. The operation of a nuclear power plant results in the release of small amounts of radioactive materials to the environment. A radiological environmental monitoring program (REMP) has been established to monitor radiation and radioactive materials in the environment around the OCNGS. The program evaluates the relationship between amounts of radioactive material released in effluents to the environment and resultant radiation doses to individuals. Summaries and interpretations of the data were published semiannually from 1969-1985 and annually since 1986 (Ref. 20 through 31). Additional information concerning releases of radioactive materials to the environment is contained in the Semi-Annual and Annual Effluent Release Reports submitted to the United States Nuclear Regulatory Commission (USNRC).

During 1998, as in previous years, the radioactive effluents associated with the OCNGS were a small fraction of the applicable federal regulatory limits and did not have significant effects on the quality of the environment. The calculated maximum hypothetical radiation dose to the public attributable to 1998 operations at the OCNGS was only 0.15 percent of the applicable regulatory limit and significantly less than doses received from other man-made sources and natural background sources of radiation.

Radioactive materials considered in this report are normally present in the environment, either naturally or as a result of non-OCNGS activities such as prior atmospheric nuclear weapons testing, medical industry activities, and the 1986 Chernobyl accident. Consequently, measurements made in the vicinity of the site were compared to background measurements to determine any impact of OCNGS operations. Samples of air, well water, surface water, clams, sediment, fish, crabs, and vegetables were collected. Samples were analyzed for radioactivity including tritium (H-3), gross beta, and gamma-emitting radionuclides. External penetrating radiation dose measurements also were made using thermoluminescent dosimeters (TLDs) in the vicinity of the OCNGS.

The results of these radiological measurements were used to assess the environmental impact of OCNGS operations, to demonstrate compliance with the Technical Specifications (Ref. 1), the Offsite Dose Calculation Manual Specifications (Ref. 2), applicable federal regulations, and to verify the adequacy of containment and radioactive effluent control systems. The data collected by the REMP also provide a historical record of the levels of radionuclides and radiation attributable to natural causes, worldwide fallout from prior nuclear weapons tests and the Chernobyl accident, as well as OCNGS operations.

Radiological impacts in terms of radiation dose as a result of OCNGS operations were calculated and also are discussed. The results provided in this report are summarized in the following highlights:

- During 1998, 638 samples were taken from the aquatic, atmospheric, and terrestrial environments around the OCNGS. A total of 893 analyses were performed on these samples. TLDs were also utilized to provide 170 direct radiation dose measurements. Forty groundwater samples, taken primarily from local municipal water supplies and on-site wells, were collected and eighty analyses were performed on those samples.

- Minute levels of cesium-137 (Cs-137) detected in aquatic sediment samples were attributable in part to past effluents from the OCNGS. This is the second consecutive annual reporting period during which cobalt-60 (Co-60) was not detected in any environmental media. This is a result of the minimization of liquid radioactive effluents and the natural radioactive decay process.

- The amount of radioactivity released in effluents from the OCNGS during 1998 was the fifth smallest in the history of Station operation. The predominant radionuclide in gaseous and liquid effluents was tritium (H-3). The maximum radiation dose to the public, attributable to 1998 effluents, was only 0.15 percent of applicable regulatory limit.

- During 1998, the maximum total body dose potentially received by an individual from liquid and airborne effluents was conservatively estimated to be 0.017 millirems. The total body dose to the surrounding population from liquid and airborne effluents was conservatively calculated to be 0.1 person-rem. This is approximately 12.3 million times lower than the dose that the total population in the OCNGS area receives from natural background sources.

INTRODUCTION

Characteristics of Radiation

Instability within the nucleus of radioactive atoms results in the release of energy in the form of radiation. Radiation is classified according to its nature - particulate and electromagnetic. Particulate radiation consists of energetic subatomic particles such as electrons (beta particles), protons, neutrons, and alpha particles. Because of its limited ability to penetrate the human body, particulate radiation in the environment contributes primarily to internal radiation exposure resulting from inhalation and ingestion of radioactivity.

Electromagnetic radiation in the form of x-rays and gamma rays has characteristics similar to visible light but is more energetic and, hence, more penetrating. Although x-rays and gamma rays are penetrating and can pass through varying thicknesses of materials, once they are absorbed, they produce energetic electrons which release their energy in a manner that is identical to beta particles. The principal concern for gamma radiation from radionuclides in the environment is their contribution to external radiation exposure.

The rate at which atoms undergo disintegration (radioactive decay) varies among radioactive elements, but is uniquely constant for each specific radionuclide. The term "half-life" defines the time it takes for half of any amount of an element to decay and can vary from a fraction of a second for some radionuclides to millions of years for others. In fact, the natural background radiation to which all mankind has been exposed is largely due to the radionuclides of uranium (U), thorium (Th), and potassium (K). These radioactive elements were formed with the creation of the universe and, owing to their long half-lives, will continue to be present for millions of years to come. For example, potassium-40 (K-40) has a half-life of 1.3 billion years and exists naturally within our bodies. As a result, approximately 4000 atoms of potassium emit radiation internally within each of us every second of our life.

In assessing the impact of radioactivity on the environment, it is important to know the quantity of radioactivity released and the resultant radiation doses. The common unit of radioactivity is the curie (Ci). It represents the radioactivity in one gram (g) of natural radium (Ra) which is also equal to a decay rate of 37 billion radiation emissions every second. Because the level of radioactive material in the environment is extremely small, it is more convenient to work with portions or fractions of a curie.

Subunits such as picocurie (pCi), (one trillionth of a curie), are frequently used to express the radioactivity present in environmental and biological samples.

The biological effects of a specific dose of radiation are the same whether the radiation source is external or internal to the body. The important factor is how much radiation energy or dose was deposited. The unit of radiation dose is the Roentgen Equivalent Man (rem), which also incorporates the variable effectiveness of different forms of radiation to produce biological change. For environmental radiation exposures, it is convenient to use the smaller unit of millirem (mrem) to express dose (1000 mrem equals 1 rem). When radiation exposure occurs over periods of time, it is appropriate to refer to the dose rate. Dose rates, therefore, define the total dose for a fixed interval of time, and for environmental exposures, are usually measured with reference to one year of time (mrem per year).

Sources of Radiation

Life on earth has evolved amid the constant exposure to natural radiation. In fact, the single major source of radiation to which the general population is exposed comes from natural sources. Although everyone on the planet is exposed to natural radiation, some people receive more than others. Radiation exposure from natural background has three components (i.e., cosmic, terrestrial, and internal) and varies with altitude and geographic location, as well as with living habits.

For example, cosmic radiation originating from deep interstellar space and the sun increases with altitude, because there is less air to act as a shield. Similarly, terrestrial radiation resulting from the presence of naturally occurring radionuclides in the soil varies and may be significantly higher in some areas of the country than in others. Even the use of particular building materials for houses, cooking with gas, and home insulation affect exposure to natural radiation.

The presence of radioactivity in the human body results from the inhalation and ingestion of air, food, and water containing naturally occurring radionuclides. For example, drinking water contains trace amounts of uranium and radium, and milk contains radioactive potassium. Table 1 summarizes the common sources of radiation and their average annual dose.

TABLE 1

(Adapted from Ref. 4)
Sources and Doses of Radiation*

Natural (82%)		**Man-made (18%)**	
Source	**Radiation Dose (mrem/year)**	**Source**	**Radiation Dose (mrem/year)**
Radon	200 (55%)	Medical X-ray	39 (11%)
Cosmic rays	27 (8%)	Nuclear Medicine	14 (4%)
Terrestrial	28 (8%)	Consumer products	10 (3%)
Internal	40 (11%)	Other (Releases from nat. gas, phosphate mining, burning of coal, weapons fallout, & nuclear fuel cycle)	<1 (<1%)
Approximate Total	295	Approximate Total	64

*Percentage contribution of the total dose is shown in parentheses.

The average person in the United States receives about 300 mrem/yr (0.3 rem/yr) from natural background radiation sources. This estimate was recently revised from (approximately) 100 to 300 mrem because of the inclusion of radon gas which has always been present but has not been previously included in the calculations. In some regions of the country, the amount of natural radiation is significantly higher. Residents of Colorado, for example, receive an additional 60 mrem/yr due to the increase in cosmic and terrestrial radiation levels. In fact, for every 100 feet above sea level, a person will receive an additional 1 mrem/yr from cosmic radiation. In several regions of the world, high concentrations of uranium and radium deposits result in doses of several thousand mrem/yr to their residents (Ref. 4).

Recently, public attention has focused on radon (Rn), a naturally occurring radioactive gas produced from uranium and radium decay. These elements are widely distributed in trace amounts in the earth's crust. Unusually high concentrations have been found in certain parts of eastern Pennsylvania and northern New Jersey. Radon levels in some homes in these areas are hundreds of times greater than levels found elsewhere in the United States. However, additional surveys are needed to determine the full extent of the problem nationwide. Radon is the largest component of natural background radiation and may be responsible for a substantial number of lung cancer deaths annually. The National Council on Radiation Protection and Measurements (NCRP) estimates that the average individual in the United States receives an annual dose of about 2,400 mrem to the lung from natural radon gas (Ref. 4). This lung dose is considered to be equivalent to a whole body dose of 200 millirems. The NCRP has recommended actions to control indoor radon sources and reduce exposures.

When radioactive substances are inhaled or swallowed, they are distributed within the body in a non-uniform fashion. For example, radioactive iodine selectively concentrates in the thyroid gland, radioactive cesium is distributed throughout the body water and muscles, and radioactive strontium concentrates in the bones. The total dose to organs by a given radionuclide also is influenced by the quantity and the duration of time that the radionuclide remains in the body, including its physical, biological, and chemical characteristics. Depending on their rate of radioactive decay and biological elimination from the body, some radionuclides stay in the body for very short times while others remain for years.

In addition to natural radiation, we are exposed to radiation from a number of man-made sources. The single largest of these sources comes from diagnostic medical x-rays and nuclear medical procedures. Some 180 million Americans receive medical x-rays each year. The annual dose to an individual from such radiation averages about 53 millirems. Much smaller doses come from nuclear weapons fallout and consumer products such as televisions, smoke detectors, and fertilizers. Production of commercial nuclear power and its associated fuel cycle contributes less than 1 mrem to the annual dose of about 300 mrem for the average individual living in the United States.

Fallout commonly refers to the radioactive debris that settles to the surface of the earth following the detonation of nuclear weapons. It is dispersed throughout the environment either by dry deposition or washed down to the earth's surface by precipitation. There are approximately 200 radionuclides produced in the nuclear weapon detonation process; a number of these are detected in fallout. The radionuclides found in fallout which produce most of the fallout radiation exposures to humans are iodine-131 (I-131), strontium-89 (Sr-89), strontium-90 (Sr-90), and cesium-137 (Cs-137). There has been no atmospheric nuclear weapon testing since 1980 and many of the radionuclides, still present in our environment, have decayed significantly. Consequently, doses to the public from fallout have been decreasing.

As a result of the nuclear accident at Chernobyl, USSR, on April 26, 1986, radioactive material was dispersed throughout the global environment and detected in various media such as air, milk, and soil.

Cesium-134, cesium-137, iodine-131, and other radionuclides released from Chernobyl were detected at the OCNGS in significant amounts following the accident. These radionuclides continue to decay toward a stable state in the environment.

Nuclear Reactor Operations

Common to the commercial production of electricity is the consumption of fuel which produces heat to make steam which turns the turbine-generator which generates electricity. Unlike the burning of coal, oil, or gas in fossil fuel powered plants to generate heat, the fuel of most nuclear reactors is comprised of the element uranium in the form of uranium oxide. The fuel produces power by the process called fission. In fission, the uranium atom absorbs a neutron (an atomic particle found in nature and also produced by the fissioning of uranium in the reactor) and splits to produce smaller atoms termed fission products, along with heat, radiation, and free neutrons. The free neutrons travel through the reactor and are similarly absorbed by the uranium, permitting the fission process to continue. As this process continues, more fission products, radiation, heat, and neutrons are produced and a sustained reaction occurs. The heat produced is transferred via reactor coolant (water) from the fuel to produce steam which drives a turbine-generator to produce electricity. The fission products are mostly radioactive; that is, they are unstable atoms which emit radiation as they decay to stable atoms. Neutrons which are not absorbed by the uranium fuel may be absorbed by stable atoms in the materials which make up the components and structures of the reactor. In such cases, stable atoms often become radioactive. This process is called activation and the radioactive atoms which result are called activation products.

The OCNGS reactor is a Boiling Water Reactor (BWR). The nuclear fuel is designed to be contained within sealed fuel rods arranged in arrays called bundles which are located within a massive steel reactor vessel. As depicted in Figure 1, cooling water boils within the reactor vessel producing steam which drives the turbine. After the energy is extracted from the steam in the turbine, it is cooled and condensed back into water in the main condensers. This condensate is then pumped back into the reactor vessel and the cycle repeats.

Several hundred radionuclides of some 40 different elements are created in a nuclear reactor during the process of generating electricity. Because of reactor engineering designs, the short half-lives of many radionuclides, and their chemical and physical properties, nearly all radioactivity is contained.

Oyster Creek Nuclear Generating Station
Simplified Schematic

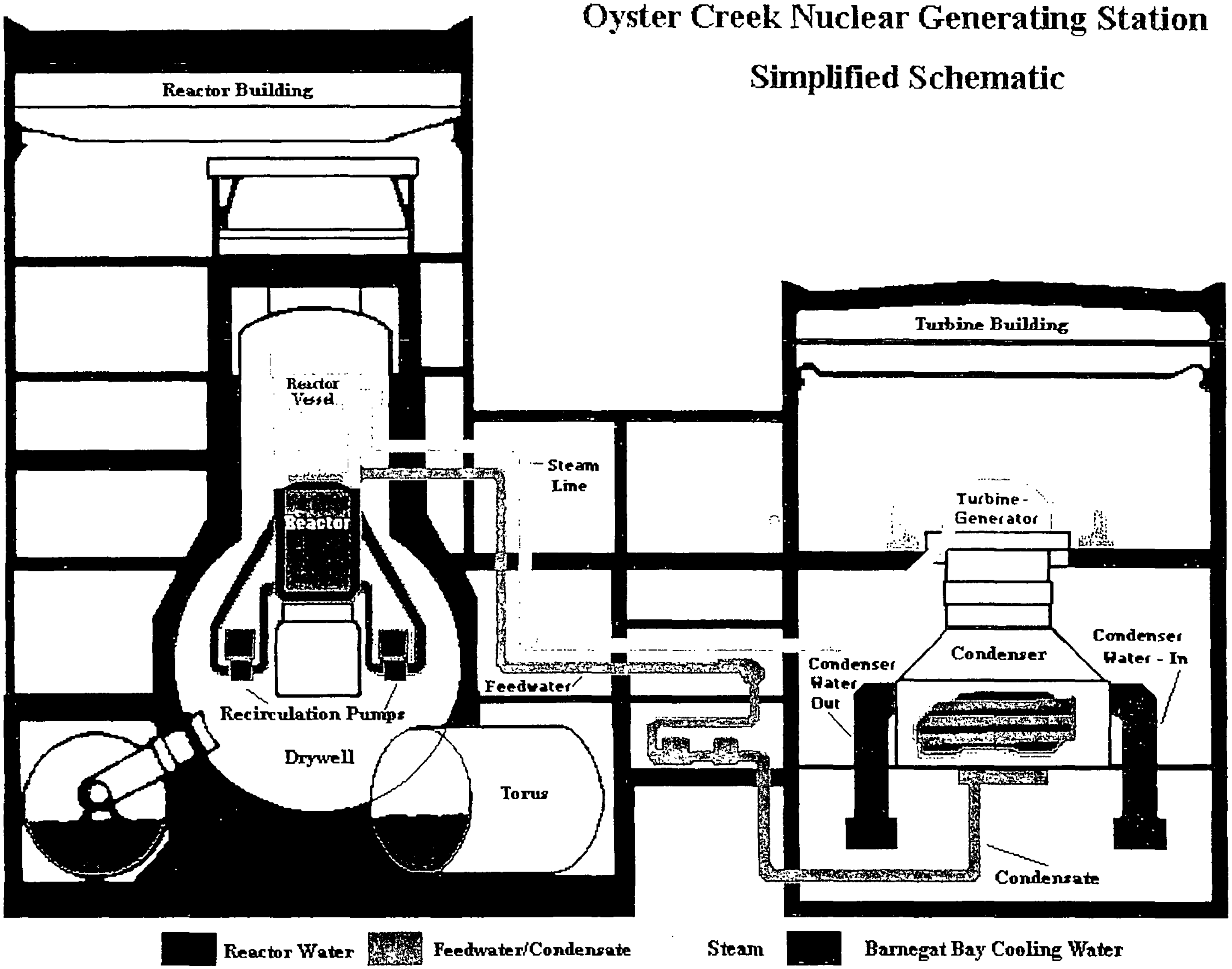


Figure 1

The OCNGS reactor has six independent barriers that confine radioactive materials produced in the reactor as it heats the water. Under normal operating conditions, essentially all radioactivity is contained within the first two barriers.

The ceramic uranium fuel pellets provide the first barrier. Most of the fission products are either trapped or chemically bound in the fuel where they remain. However, a few fission products which are volatile or gaseous at normal operating temperatures may not be contained in the fuel.

The second barrier consists of zirconium (Zr) alloy tubes (termed "fuel cladding") that resist corrosion and degradation due to high temperatures. The fuel pellets are contained within these tubes. There is a small gap between the fuel and the cladding, in which the noble gases and other volatile radionuclides collect and are contained.

The primary coolant water is the third barrier. Many of the fission products, including radioactive iodine, strontium, and cesium are soluble and are retained in water in an ionic (electrically charged) form. These materials can be removed in the reactor coolant purification system. However, krypton (Kr) and xenon (Xe) do not readily dissolve in the coolant, particularly at high temperatures. Krypton and xenon collect as a gas above the condensate when the steam is condensed.

The fourth barrier consists of the reactor pressure vessel, turbine, condenser, and associated piping of the coolant system. The reactor pressure vessel is a 63-foot high tank with steel walls approximately eight inches thick. It encases the reactor core. The remainder of the coolant system, including the turbine and condenser and associated piping, provides containment for radioactivity in the primary coolant.

The Drywell provides the fifth barrier. It is a steel-lined vessel, surrounded by concrete walls approximately 4 1/2 to 7 1/4 feet thick, that encloses the reactor pressure vessel and recirculating pumps and piping.

The Reactor Building provides the sixth barrier. It is a reinforced concrete and steel superstructure with walls approximately 5 feet thick that enclose the drywell and other plant components. The Reactor Building is always maintained at a negative pressure to prevent out-leakage.

Sources of Liquid and Airborne Effluents

Although the previously described barriers contain radioactivity with high efficiency, small amounts of radioactive fission products are nevertheless able to diffuse or migrate through minor flaws in the fuel cladding and into the reactor coolant. Trace quantities of reactor system component and structural surfaces which have been activated also get into the reactor coolant water. Many of the soluble fission and activation products such as iodines, strontiums, cobalts, and cesiums are removed by demineralizers in the purification system of the reactor coolant. The physical and chemical properties of noble gas fission products in the primary coolant prevent their removal by the demineralizers.

Because the reactor system has many valves and fittings, an absolute seal cannot be achieved. Minute drainage of radioactive liquids from valves, piping, and/or equipment associated with the coolant system may occur in the Reactor and/or Turbine Buildings. Noble gases, produced during the fission process, are collected as gaseous waste which is processed in the multistage systems in the OCNGS Augmented Off-Gas Building, while the remaining radioactive liquids are collected in floor and equipment drains and sumps and are pumped to and processed in the OCNGS Radwaste Facility.

Reactor off-gas, consisting primarily of hydrogen and radioactive non-condensable gases, is withdrawn from the reactor primary system by steam jet air ejectors. These air ejectors drive the process stream through a 60 minute holdup pipe at approximately 110 cubic feet per minute and then into the Augmented Off-Gas (AOG) System. The holdup pipe allows radionuclides with short half-lives to decay. The Augmented Off-Gas System is a gaseous processing system which provides hydrogen conversion to water via a catalytic recombiner, removes the water (vapor) from the process stream, holds up the process stream to allow further decay of short-lived nuclides, and filters the off-gas using charcoal beds and High Efficiency Particulate (HEPA) filters prior to discharge to the base of the stack. Once the process stream enters the stack, it is diluted by building ventilation, which averages approximately 200,000 cubic feet per minute, is monitored and sampled, and then is discharged out the top of the 368-foot stack.

The liquid waste processing system receives water contaminated with radioactivity and processes it by filtration, demineralization, and distillation. Purified radwaste water is routinely recycled to the plant. Occasionally, it may be necessary to discharge this purified water, under the guidelines of applicable permits, to the environment. Contaminants removed during the purification process are stored in the radwaste building and are eventually disposed of via the radioactive solids disposal systems. Before purified water is discharged to the environment, it is first sampled, analyzed, assigned a release rate, and then released to the discharge canal which has a flow rate of 460,000 to 980,000 gallons per minute.

DESCRIPTION OF THE OYSTER CREEK NUCLEAR GENERATING STATION SITE

General Information

The Oyster Creek Nuclear Generating Station is located in Lacey Township of Ocean County, New Jersey, about 60 miles south of Newark, 9 miles south of Toms River, and 35 miles north of Atlantic City. It lies approximately 2 miles inland from Barnegat Bay. The site, covering 1416 acres, is situated partly in Lacey Township and, to a lesser extent, in Ocean Township. The Garden State Parkway bounds the site on the west. Access is provided by U. S. Route 9, passing through the site and separating a 661-acre eastern portion from the balance of the property west of the highway. The station is about 1/4 mile west of the highway and 1-1/4 miles east of the Parkway. The site property extends about 3-1/2 miles inland from the bay; the maximum width in the north-south direction is almost 1 mile. The site location is part of the New Jersey shore area with its relatively flat topography and extensive freshwater and saltwater marshlands. The South Branch of Forked River runs across the northern side of the site and Oyster Creek partly borders the southern side.

It is estimated that approximately 3.3 million people reside within a 50 mile radius of the OCNGS (Ref. 3). The nearest population center is Ocean Township which lies less than two miles south-southeast of the site. Based on 1994 population estimates, 5908 people reside in Ocean Township. Two miles to the north of the OCNGS, 23,897 people reside in Lacey Township (estimated 1994 population). Dover Township, situated 9.5 miles to the north, is the nearest major population center with a population of 81,550 (estimated 1994 population). The region adjacent to Barnegat Bay is one of the State's most rapidly developing areas. In addition to the resident population, a sizable seasonal influx of people occurs during the summer. This influx occurs almost exclusively along the waterfront.

Climatological Summary

Meteorological data were obtained during 1998 from an on-site weather station. These data are subject to extensive quality assurance techniques and categorized for further analysis, including historical comparisons with both on-site and off-site sources as well as statistical processes to monitor instrument performance.

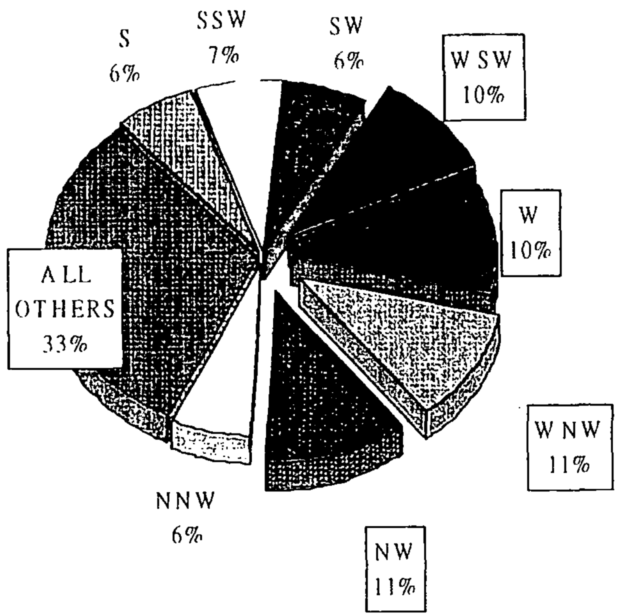
The climate of New Jersey and a great deal of the country was greatly influenced by the El Nino / Southern Oscillation (ENSO), a major warming of the ocean waters across the eastern and central tropical Pacific Ocean. The effects of the ENSO were felt from January through June. They include abnormal patterns of rainfall and cloudiness, especially over the tropics. North America typically receives its strongest ENSO influence during winter and early spring. The persistence of abnormally warm waters off the west coast have increased the occurrence of extra-tropical storms that have buffeted the west coast with prolonged storms and increased mudslides. In addition, the persistence of the sub-tropical jet stream has brought milder temperatures across the entire continental United States during the winter, when the ENSO is strongest. "La Nina", described as a period of cold and dry conditions will sometimes follow its counterpart. It is not as common as the ENSO and did not appear in the latter half of 1998.

Climatological highlights during the year included a third consecutive above normal temperature and precipitation pattern during the fall and winter, along with a fourth consecutive cooler than normal summer. Tropical storm/hurricane activity in the Atlantic Ocean increased to 9 storms including Hurricane Bonnie, which struck the North Carolina coast in August. Most of the storm's effects passed south of the region.

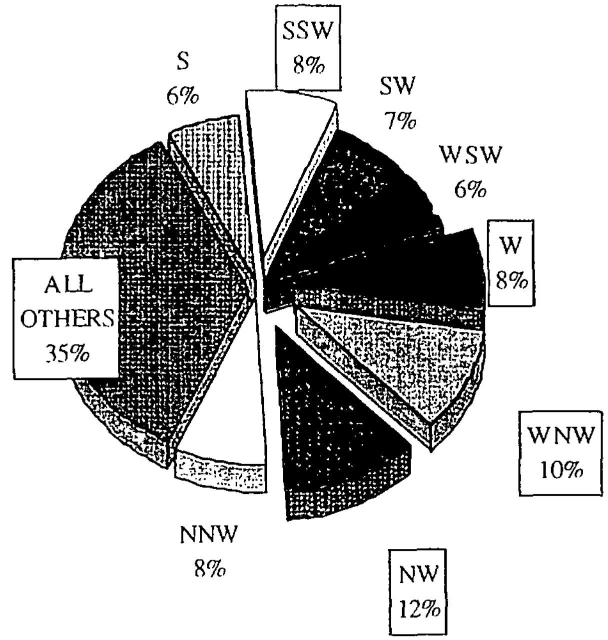
During the summer months, winds were predominantly from the south and southwest directions. This ushers in warm and humid weather conditions. Precipitation resulting from these conditions is generally of short duration but high intensity (showers and/or thundershowers). During the autumn, winter and early spring, winds are generally from the west and northwest. Air masses during this time originate from the upper mid-west United States and Canada. They are typically characterized by generally cold and dry conditions.

Wind direction frequencies were normal during the year. The four highest frequency of occurrence sectors for the year, as measured at the 33-foot level, were winds from the northwest, west-northwest, west, and west-southwest (Fig. 2). Seasonal winds were evident as well, including the sea breeze circulation, (Ref. 3) during the late spring through early autumn season. Resulting winds during a sea breeze are from the south and southeast. The number of occurrences of this thermally-induced wind, created due to the differential heating between the land and the ocean, was reduced due to the strong west-southwesterly flow during the summer months.

OYSTER CREEK NUCLEAR GENERATING STATION
WIND DIRECTION FREQUENCY OF OCCURRENCE - 1998
WIND DIRECTION "FROM" EACH COMPASS SECTOR
VALUES IN PERCENT OF HOURLY OCCURRENCE



33-FOOT WIND DIRECTION



380-FOOT WIND DIRECTION

NOTE: THE FOUR (4) HIGHEST FREQUENCY OF OCCURRENCE SECTORS ARE HIGHLIGHTED

FIGURE 2

The annual average temperature for the year was 54.93 degrees Fahrenheit, warmer than last year's average temperature of 52.56 degrees. The historical average annual temperature is 53 degrees. Seven of twelve months were characterized by below normal temperatures, although differences from the historical average were small. The largest differences occurred during the months of June and October (Fig. 3). The winter months of January, February and December experienced above normal temperatures for the third consecutive year. The lack of a sustained polar jet stream in the continental United States was the reason for the warmer temperatures. In addition, the ENSO and the sub-polar jet stream bringing warmer air masses originating over the Pacific Ocean were the dominating features, especially during the months of January and February. Normal continental polar air masses only penetrated as far south as Canada and retreated north. During the summer months, temperatures were below normal. A semi-permanent feature known as the sub-tropical high-pressure system usually settles over the southern half of the United States. This area produces southwest flow and ushers in warm, humid conditions. This feature was not strong during 1998 and although there were periods of high humidity over the region, temperatures remained near or slightly below normal with pronounced cloud cover.

For the third consecutive year, the area experienced above normal precipitation. The annual total precipitation amount was 54.24 inches, slightly higher than last years total of 50.93 inches. The 1998 total is over twelve inches more than the Atlantic City National Weather Service historical average (1946 –1981) of 41.50 inches. During the first six months, precipitation was greater than the monthly historical value. The greatest differences occurred in January, February, March, May and June (Fig 4). A total of 9.95 inches fell in May, highlighted by a 5-day rainfall total of 6.70 inches from May 8 through May 12, the result of several slow moving low pressure systems over the northeast United States. The absence of the semi-permanent sub-tropical high pressure belt over the southeast allowed an influx of moisture from the southwest. This moisture was enhanced by the ENSO over the eastern Pacific. This moisture also caused enhanced development of extra-tropical storms during the first half of the year. Typically, the ENSO will produce enhanced rainfall over the southern tier of the United States and along the southeast coast. Summer precipitation was also a result of showers and thunderstorms that develop in warm, humid air. These events are generally of short duration but high intensity. As described earlier, there was an increase in tropical storm/hurricane activity due to the

OYSTER CREEK NUCLEAR GENERATING STATION
MONTHLY MEAN AMBIENT AIR TEMPERATURE - 1998
COMPARED WITH HISTORICAL (1946-1981)
ATLANTIC CITY NATIONAL WEATHER SERVICE AVERAGE TEMPERATURE DATA

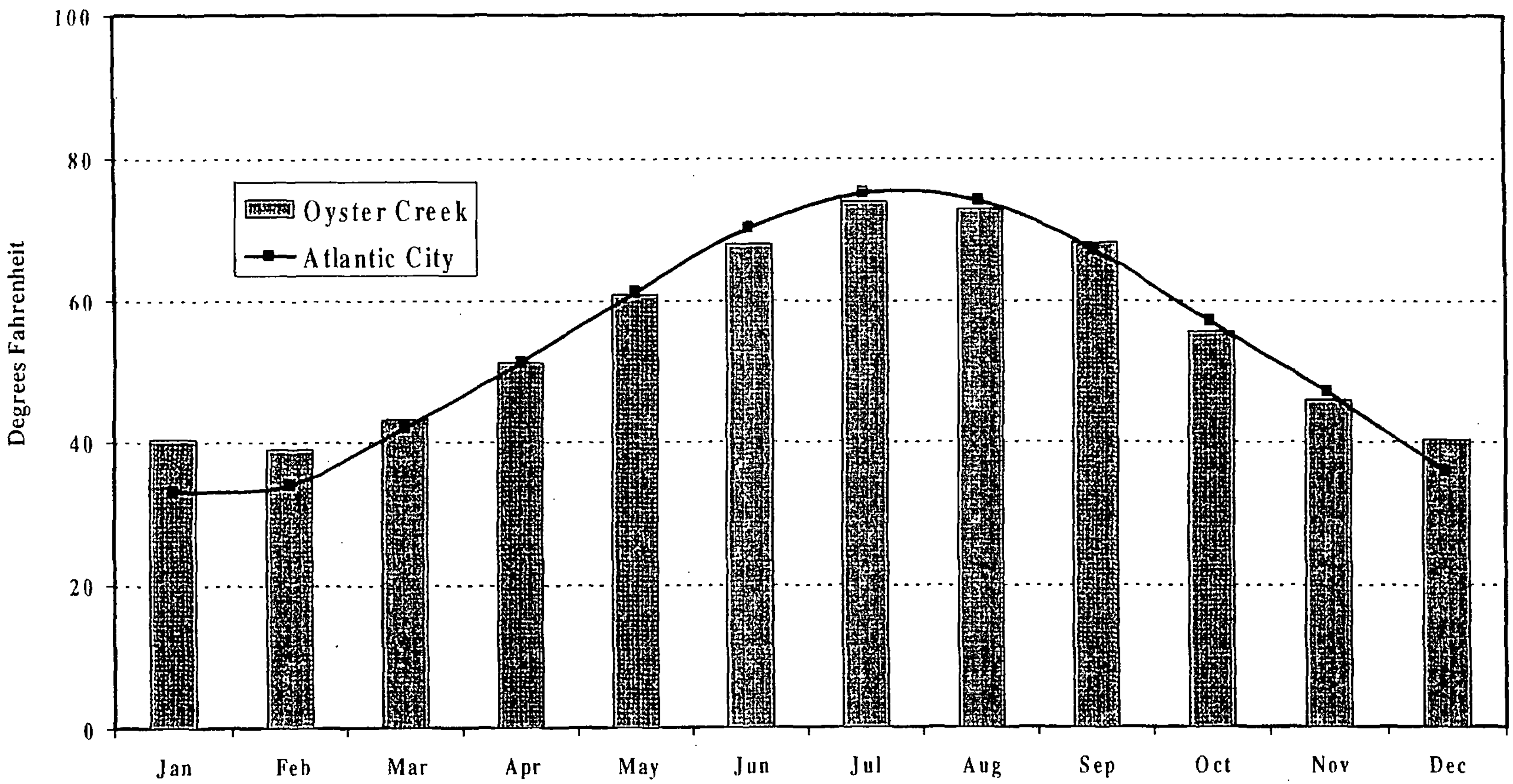


FIGURE 3

OYSTER CREEK NUCLEAR GENERATING STATION
MONTHLY PRECIPITATION - 1998
COMPARED WITH HISTORICAL (1946-1981)
ATLANTIC CITY NATIONAL WEATHER SERVICE AVERAGE PRECIPITATION DATA

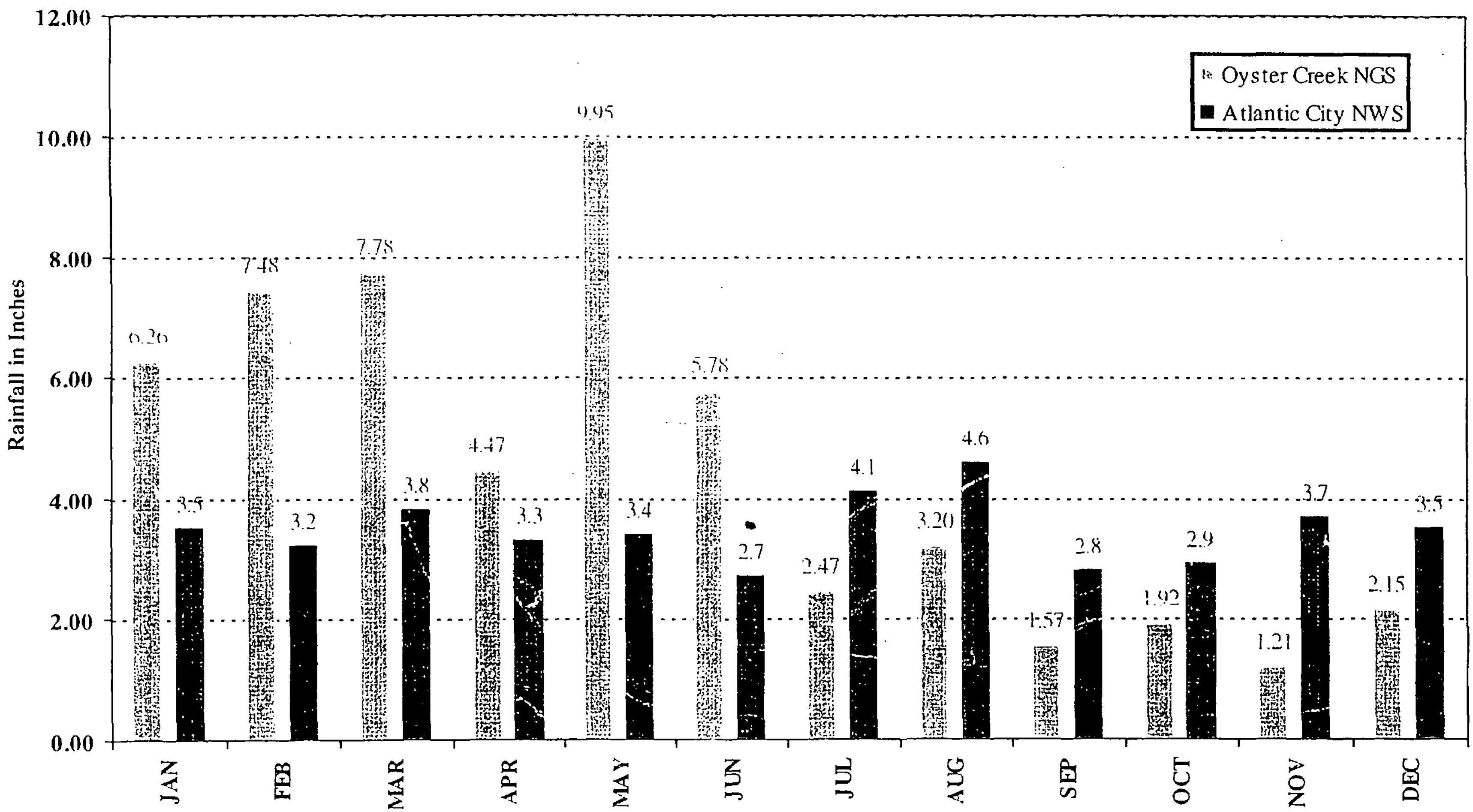


FIGURE 4

return of normal easterly flow in the tropics. Hurricane Bonnie passed east of the region on August 28, 1998 and produced high surf and gale force winds. Precipitation from Bonnie remained well off the coast. Typically, the main portion of winds and rain occur to the east and north of the hurricane's center. The moderate temperatures during the winter and late spring resulted in only a trace of snow for the months of January through April. A snowfall event of 5 inches occurred on December 23, 1998. Generally the region will see approximately 10 inches of snow. In summary, precipitation events in the region were a result of large extra-tropical storms, especially during the fall, winter and early spring along with warm frontal passages. A more frequent summer cloud cover reduced the frequency of violent weather associated with strong heating (thunderstorms, tornadoes, etc.) during 1998. The bulk of the year's precipitation occurred during the first half influenced by an active ENSO period.

For additional site-specific meteorological data, refer to the OCNGS Effluent and Off-Site Dose Report for 1998 (Ref. 32)

EFFLUENTS

Historical Background

Almost from the outset of the discovery of x-rays in 1895 by Wilhelm Roentgen, the potential hazard of ionizing radiation was recognized and efforts were made to establish radiation protection standards. The International Commission on Radiological Protection (ICRP) and the National Council on Radiation Protection and Measurements (NCRP) were established in 1928 and 1929, respectively. These organizations have the longest continuous experience in the review of radiation health effects and with making recommendations on guidelines for radiological protection and radiation exposure limits. In 1955, the United Nations created a Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) to summarize reports received on radiation levels and the effects on man and his environment. The National Academy of Sciences (NAS) formed a committee in 1956 to review the biological effects of atomic radiation (BEAR). A series of reports have been issued by this and succeeding NAS committees on the biological effects of ionizing radiation (BEIR), the most recent during 1990 (known as BEIR V).

These committees and commissions of nationally and internationally recognized scientific experts have been dedicated to the understanding of the health effects of radiation by investigating all sources of relevant knowledge and scientific data and by providing guidance for radiological protection. Their members are selected from universities, scientific research centers, and other national and international research organizations. The committee reports contain scientific data obtained from physical, biological, and epidemiological studies on radiation health effects and serve as scientific references for information presented in this report.

Since its inception, the USNRC has depended upon the recommendations of the ICRP, the NCRP, and the Federal Radiation Council (FRC) (incorporated in the United States Environmental Protection Agency (USEPA) in 1970) for basic radiation protection standards and guidance in establishing regulations for the nuclear industry (Ref. 6 through 9).

Effluent Release Limits

As part of routine plant operations, limited quantities of radioactivity are released to the environment in liquid and airborne effluents. An effluent control program is implemented by GPU Nuclear to ensure radioactivity released to the environment is minimal and does not exceed release limits. The Federal government establishes limits on radioactive materials released to the environment. These limits are set at low levels to protect the health and safety of the public and are specified in the OCNGS Technical Specifications and Offsite Dose Calculation Manual (ODCM) (Ref. 1 and 2). GPU Nuclear conducts operations in a manner that holds radioactive effluents to small percentages of the federal limits.

A recommendation of the ICRP, NCRP, and FRC is that radiation exposures should be maintained at levels which are "as low as reasonably achievable" (ALARA) and commensurate with the societal benefit derived from the activities resulting in such exposures. For this reason, dose limit guidelines were established by the USNRC for releases of radioactive effluents from nuclear power plants. These guidelines were then used as the basis for the development of the ODCM and Technical Specifications. In keeping with the ALARA principle, the OCNGS operates in a manner that results in radioactive releases that are a small fraction of these limits.

Applicable OCNGS Offsite Dose Calculation Manual limits are as follows:

- ODCM Specification 4.6.1.1.3.A

  Radioactivity Concentration in Liquid Effluent

  The concentration of radioactive material, other than noble gases, in liquid effluent in the discharge canal at the U.S. Route 9 bridge shall not exceed 10 times the liquid effluent concentrations specified in 10CFR Part 20.1001-20.2401, Appendix B, Table II, Column 2.

- ODCM Specification 4.6.1.1.3.B

  Radioactivity Concentration in Liquid Effluent

  The concentration of noble gases dissolved or entrained in liquid effluent in the discharge canal at the U.S. Route 9 bridge shall not exceed 2.0 E-4 uCi/ml.

- ODCM Specification 4.6.1.1.4.A

  Limit on Dose Due to Liquid Effluent

  The dose to a MEMBER OF THE PUBLIC due to radioactive material in liquid effluent in the UNRESTRICTED AREA shall not exceed:

  1.5 mrem to the Total Body during any calendar quarter

5.0 mrem to any body organ during any calendar quarter

3.0 mrem to the Total Body during any calendar year

or

10.0 mrem to any body organ during any calendar year.

- ODCM Specification 4.6.1.1.5.A

  Dose Rate Due to Gaseous Effluent

  The dose equivalent rate in the UNRESTRICTED AREA due to radioactive noble gas in gaseous effluent shall not exceed 500 mrem/year to the total body or 3000 mrem/year to the skin.

- ODCM Specification 4.6.1.1.5.B

  Dose Rate Due to Gaseous Effluent

  The dose equivalent rate in the UNRESTRICTED AREA due to tritium (H-3), I-131, I-133, and to radioactive material in particulate form having half-lives of 8 days or more in gaseous effluents shall not exceed 1500 mrem/year to any body organ when the dose rate due to H-3, Sr-89, Sr-90, and alpha-emitting radionuclides is averaged over no more than 3 months and the dose rate due to other radionuclides is averaged over no more than 31 days.

- ODCM Specification 4.6.1.1.6.A

  Air Dose Due to Noble Gas in Gaseous Effluent

  The air dose in the UNRESTRICTED AREA due to noble gas released in gaseous effluent shall not exceed:

  5 mRad/calendar quarter due to gamma radiation

  10 mRad/calendar quarter due to beta radiation

  10 mRad/calendar year due to gamma radiation

  20 mRad/calendar year due to beta radiation

- ODCM Specification 4.6.1.1.7.A

  Dose Due to Radioiodine and Particulates in Gaseous Effluent

  The dose to a MEMBER OF THE PUBLIC from I-131, I-133, and from radiodines in particulate form having half-lives of 8 days or more in gaseous effluent, in the UNRESTRICTED AREA shall not exceed 7.5 mrem to any body organ per calendar quarter or 15 mrem to any body organ per calendar year.

- ODCM Specification 4.6.1.1.8.A

  Annual Total Dose Due to Radioactive Effluent

  The annual dose to a MEMBER OF THE PUBLIC due to radioactive material in effluent from the OCNGS in the UNRESTRICTED AREA shall not exceed 75 mrem to his/her thyroid or 25 mrem to his/her total body or to any other organ.

Effluent Control Program

Effluent control includes plant components such as the ventilation system and filters, off-gas holdup components, demineralizers, and an evaporator system. In addition to minimizing the release of radioactivity, the effluent control program includes all aspects of effluent and environmental monitoring. This includes the operation of a complex radiation monitoring system, collection and analysis of effluent samples, environmental sampling and monitoring, and a comprehensive quality assurance program. Over the years, the program has evolved in response to changing regulatory requirements, industry events and plant conditions. For example, additional instruments and samplers have been installed to ensure that measurements of effluents remain onscale in the event of any accidental release of radioactivity.

Effluent Instrumentation: Liquid and airborne effluent measuring instrumentation is designed to monitor the presence and the amount of radioactivity in effluents. Many of these instruments provide continuous surveillance of radioactivity releases. Calibrations of effluent instruments are performed using reference standards certified by the National Institute of Standards and Technology (NIST). Instrument alarm setpoints are pre-set to ensure that effluent release limits will not be exceeded. If radiation monitor alarm setpoints are reached, releases are immediately terminated.

Where continuous surveillance is not practicable or possible, contingencies are specified in the Offsite Dose Calculation Manual and/or the Technical Specifications.

Effluent Sampling and Analysis: In addition to continuous radiation monitoring instruments, samples of effluents are taken and subjected to laboratory analysis to identify the specific radionuclide quantities being released. A sample must be representative of the effluent from which it is taken. Sampling and analysis provide a sensitive and precise method of determining effluent composition. Samples are analyzed using state-of-the-art laboratory counting equipment. Radiation instrument readings and sample results are compared to ensure correct correlation.

Effluent Data

As part of routine plant operations, limited quantities of radioactivity are released to the environment in effluents. The amounts of radioactivity released vary and are dependent upon operating conditions, power levels, fuel conditions, efficiency of liquid and gas processing systems, and proper functioning of plant equipment. The largest variations occur in the airborne effluents of fission and activation gases, which are proportional to the integrity of the fuel cladding and the operation of the OCNGS Augmented Off Gas system. In general, effluents have been decreasing with time due to improved fuel integrity and increased efficiency of processing systems.

The amount of radioactivity released in effluents from the OCNGS during 1998 was the fifth smallest in the history of Station operation. The predominant radionuclide in gaseous and liquid effluents was tritium (Table 2). Estimated doses to the public, attributable to these effluents, were a small fraction of the applicable regulatory limits (Tables 8 and 9). Summaries of OCNGS effluents can be found in Table 2 and in the Annual Effluent and Offsite Dose Report that is submitted to the USNRC (Ref. 32). Radioactive constituents of these effluents are discussed in the following sections:

Noble Gases: The predominant radioactive materials released in OCNGS airborne effluents are typically the noble gases krypton (Kr) and xenon (Xe). Small amounts of noble gases can also be released in liquid effluents. The total amounts of krypton and xenon released into the atmosphere in 1998 were 0.00323 curies and 8.29 curies, respectively, which is the lowest total in the history of the OCNGS. Noble gases are inert, which means they do not react chemically or biologically. Xenon-135 with a half-life of 9.1 hours was the most abundant noble gas released. These noble gases were readily dispersed into the atmosphere when released and because of their short half-lives, quickly decayed into stable, nonradioactive forms. No noble gas

TABLE 2

RADIONUCLIDE COMPOSITION OF OCNGS EFFLUENTS FOR 1998

Radionuclide	Half-Life	Liquid Effluents (Ci)	Airborne Effluents (Ci)
H-3	1.23E 1 Years	1.10E-2	3.07E2
Na-24	1.50E 1 Hours	<LLD	1.69E-6
Cr-51	2.78E 1 Days	<LLD	8.04E-5
Mn-54	3.12E 2 Days	<LLD	9.31E-5
Co-58	7.13E 1 Days	<LLD	3.38E-5
Co-60	5.26E 0 Years	<LLD	3.82E-4
Kr-85m	4.50E 0 Hours	<LLD	3.23E-3
Sr-89	5.05E 1 Days	<LLD	5.02E-4
Sr-90	2.88E 1 Years	<LLD	9.29E-6
Nb-95	3.50E 1 Days	<LLD	2.11E-6
Tc-99m	6.00E 0 Hours	<LLD	1.44E-6
I-131	8.05E 0 Days	<LLD	1.56E-3
I-132	2.26E 0 Hours	<LLD	1.50E-4
I-133	2.09E 1 Hours	<LLD	7.55E-3
I-134	5.20E 0 Minutes	<LLD	8.46E-7
I-135	6.68E 0 Hours	<LLD	1.32E-6
Xe-135	9.10E 0 Hours	<LLD	8.29E0
Cs-137	3.02E 1 Years	<LLD	6.51E-6
Ba-140	1.28E 1 Days	<LLD	1.21E-3
Gross Alpha	-	-	4.91E-6

NOTE: All effluents are expressed in scientific notation. No other nuclides were detected.

NOTE: < LLD = less than lower limit of detection.

activity was released in liquid effluents during 1998.

Iodines and Particulates: The discharge of iodines and particulates to the environment is minimized by factors such as their high chemical reactivity, solubility in water, and the high removal efficiency of airborne and liquid processing systems.

Of the gaseous radioiodines, iodine-131 is of particular interest because of its relatively long half-life of 8.05 days. Particulates of relative concern are the radiocesiums (Cs-134 and Cs-137), radiostrontiums (Sr-89 and Sr-90), and activation products, manganese-54 (Mn-54) and cobalt-60 (Co-60). The total amount of iodines and particulates released from the OCNGS in 1998 was 0.0116 curies in airborne effluents. No iodines or particulates were released in liquid effluents.

Tritium: Tritium (H-3) is typically the predominant radionuclide released in liquid effluents and is also released in airborne effluents. Tritium is a radioactive isotope of hydrogen. It is produced in the reactor fuel and components and in reactor coolant as a result of neutron interaction with the naturally-occurring deuterium (also a hydrogen isotope) present in water. Liquid effluents from the OCNGS in 1998 resulted in 0.011 curies of tritium being released. Tritium released in airborne effluents accounted for 307 curies of radioactivity. As in 1997, the amount of gaseous tritium released during 1998 was higher than the annual amounts released prior to 1997, most likely as a result of control rod blade leakage. However, to put these amounts of H-3 into perspective, the world inventory of natural cosmic ray-produced tritium is approximately 70 million curies, which corresponds to a production rate of 4 million curies per year (Ref. 10). Tritium contributions to the environment from OCNGS effluents are too small to have any measurable effect on the existing concentrations in the offsite environment.

Transuranics: Transuranics are produced by neutron capture in the fuel, and typically emit alpha and beta particles as they decay. Important transuranic isotopes produced in reactors are uranium-239 (U-239), plutonium-238 (Pu-238), plutonium-239 (Pu-239), plutonium-240 (Pu-240), plutonium-241 (Pu-241), americium-241 (Am-241), plutonium-243 (Pu-243), plus other isotopes of americium and curium. They have half-lives ranging from hundreds of days to millions of years. Greater than 99% of all transuranics are retained within the nuclear fuel.

These nuclides are insoluble and non-volatile and are not readily transported from in-plant pathways to the environment. Gaseous and liquid processing systems remove greater than 90% of transuranics that may be found in the reactor coolant. Because retention and removal efficiencies are so high, isotopic analyses for transuranics are not routinely performed. However, most transuranics are alpha emitters and are monitored by performing routine gross alpha analyses.

Carbon-14: Production of carbon-14 (C-14) in reactors is small. It is produced in the reactor coolant as a result of neutron interactions with oxygen (O) and nitrogen (N). Estimates for all nuclear power production worldwide show that 235,000 curies were released from 1970 through 1990 (Ref. 11). Carbon-14 also is produced naturally by the interactions of cosmic radiation with oxygen and nitrogen in the upper atmosphere. The worldwide inventory of natural C-14 is estimated at 241 million curies (Ref. 11). Since the inventory of natural carbon-14 is so large, releases from nuclear power plants do not result in a measurable change in the background concentration of carbon-14. Consequently, carbon-14 is not routinely monitored in plant effluents.

RADIOLOGICAL ENVIRONMENTAL MONITORING

GPUN conducts a comprehensive radiological environmental monitoring program (REMP) to monitor radiation and radioactive materials in the environment around the OCNGS. The information obtained from the REMP is then used to determine the effect of OCNGS operations, if any, on the environment and the public.

The USNRC has established regulatory guides which contain acceptable monitoring practices (Ref. 12). The OCNGS REMP was designed on the basis of these regulatory guides along with the USNRC Radiological Assessment Branch Technical Position on Environmental Monitoring (Ref. 13). The OCNGS REMP meets or exceeds all of these guidelines.

The objectives of the REMP are:

- to assess dose impacts to the public from OCNGS operations
- to verify in-plant controls for the containment of radioactive materials
- to monitor any buildup of long-lived radionuclides in the environment and changes in background radiation levels
- to provide reassurance to the public that the program is capable of adequately assessing impacts and identifying noteworthy changes in the radiological status of the environment
- to fulfill the requirements of the OCNGS Offsite Dose Calculation Manual (ODCM) and Technical Specifications

Environmental Exposure Pathways to Humans from Airborne and Liquid Effluents

As previously discussed in the "Effluents" section, small amounts of radioactive materials are released to the environment as a result of operating a nuclear generating station. Once released, these materials move through the environment in a variety of ways and may eventually reach humans via breathing, drinking, eating, and direct exposure. These routes of exposure are referred to as environmental exposure pathways. Figure 15 illustrates the important exposure routes.

While some pathways are relatively simple, such as inhalation of airborne radioactive materials, others may be complex. For example, radioactive airborne particulates may deposit onto forage, which when eaten by cows, may be transferred into milk, which is subsequently consumed by man. This route of exposure is known as the air-grass-cow-milk-human pathway.

Although radionuclides can reach humans by a number of pathways, some are more important than others. The critical pathway for a given radionuclide is the one that produces the greatest dose to a population or to a specific segment of the population. This segment of the population is known as the critical group and may be defined by age, diet, or other cultural factors. The dose may be delivered to the whole body or confined to a specific organ; the organ receiving the greatest fraction of the dose is known as the critical organ. This information was used to develop the OCNGS REMP.

Sampling

The OCNGS radiological environmental monitoring program consists of two phases - the preoperational and the operational. Data gathered in the preoperational phase were used as a basis for evaluating radiation levels and radioactivity in the vicinity of the plant after the plant became operational. The operational phase began in 1969 when the OCNGS attained initial criticality.

The program consists of taking radiation measurements and collecting samples from the environment, analyzing them for radioactive content, and interpreting the results. Emphasis is on the critical exposure pathways to humans with samples taken from the aquatic, atmospheric, and terrestrial environments. These samples include air, well water, surface water, clams, sediment, fish, crabs, and vegetables. Thermoluminescent dosimeters (TLDs) are placed in the environment to measure gamma radiation levels. The ODCM Specifications, along with recommendations from GPUN scientists, specify the sample types to be collected and analyses to be performed.

Sampling locations were established by considering meteorology, population distribution, hydrology, and land use characteristics of the local area. The sampling locations are divided into two classes, indicator and background. Indicator locations are those which are expected to show effects from OCNGS operations, if any exist. These locations were primarily selected on the basis of where the highest predicted environmental concentrations would occur. While the indicator locations are typically within a few miles of the plant, the background stations are generally at distances greater than 10 miles from the OCNGS. Therefore, background samples are collected at locations which are expected to be unaffected by station operations. They provide a basis for evaluating fluctuations at indicator locations relative to natural background radioactivity and fallout from prior nuclear weapon tests. Figures 5 and 6 show the current sampling locations around the OCNGS. Table A-1 in Appendix A describes the sampling locations by distance and azimuth (compass direction) from the OCNGS, along with type(s) of samples collected at each sampling location.

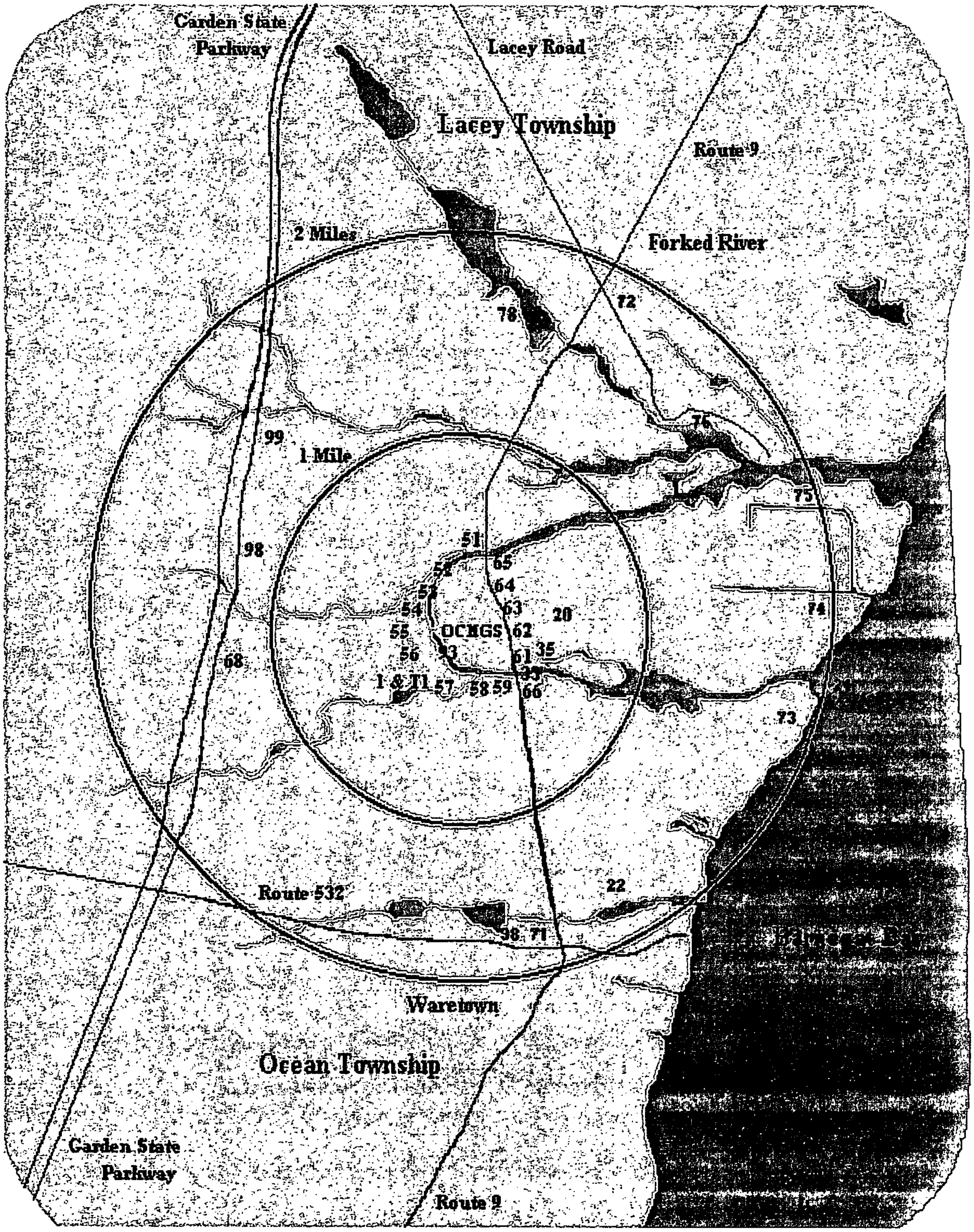
Analysis

In addition to specifying the minimum media to be collected and the minimum number of sampling locations, the ODCM Specifications stipulate the frequency of sample collection and the types and frequency of analyses to be performed. Also specified are analytical sensitivities (detection limits) and reporting levels. Table A-2 in Appendix A provides a synopsis of the sample types, number of sampling locations, collection frequencies, number of samples collected, types and frequencies of analyses, and number of samples analyzed. Table A-3 in Appendix A lists samples which were not collected or analyzed in accordance with the requirements of the ODCM Specifications. Sample analyses which did not meet the required analytical sensitivities are presented in Appendix B. Changes in sample collection and analysis are described in Appendix C.

The analytical results are routinely reviewed by GPUN scientists to assure that established sensitivities have been achieved and that the proper analyses have been performed. All analytical results are subjected to an automated review process which ensures that ODCM-required lower limits of detection are met and that reporting levels are not exceeded. Investigations are conducted when reporting levels are reached or when anomalous values are discovered.

Analytical REMP sample results are presented in Appendix D in this report. Table D-1 in Appendix D provides a tabular reporting of all analytical results for samples collected in 1998. Table D-1 summarizes the data in a format that closely resembles the suggested format presented in the USNRC Branch Technical Position (Ref. 13). Quality Assurance (QA) sample results for split and/or duplicate samples were used to verify the primary sample results. The QA program is described below.

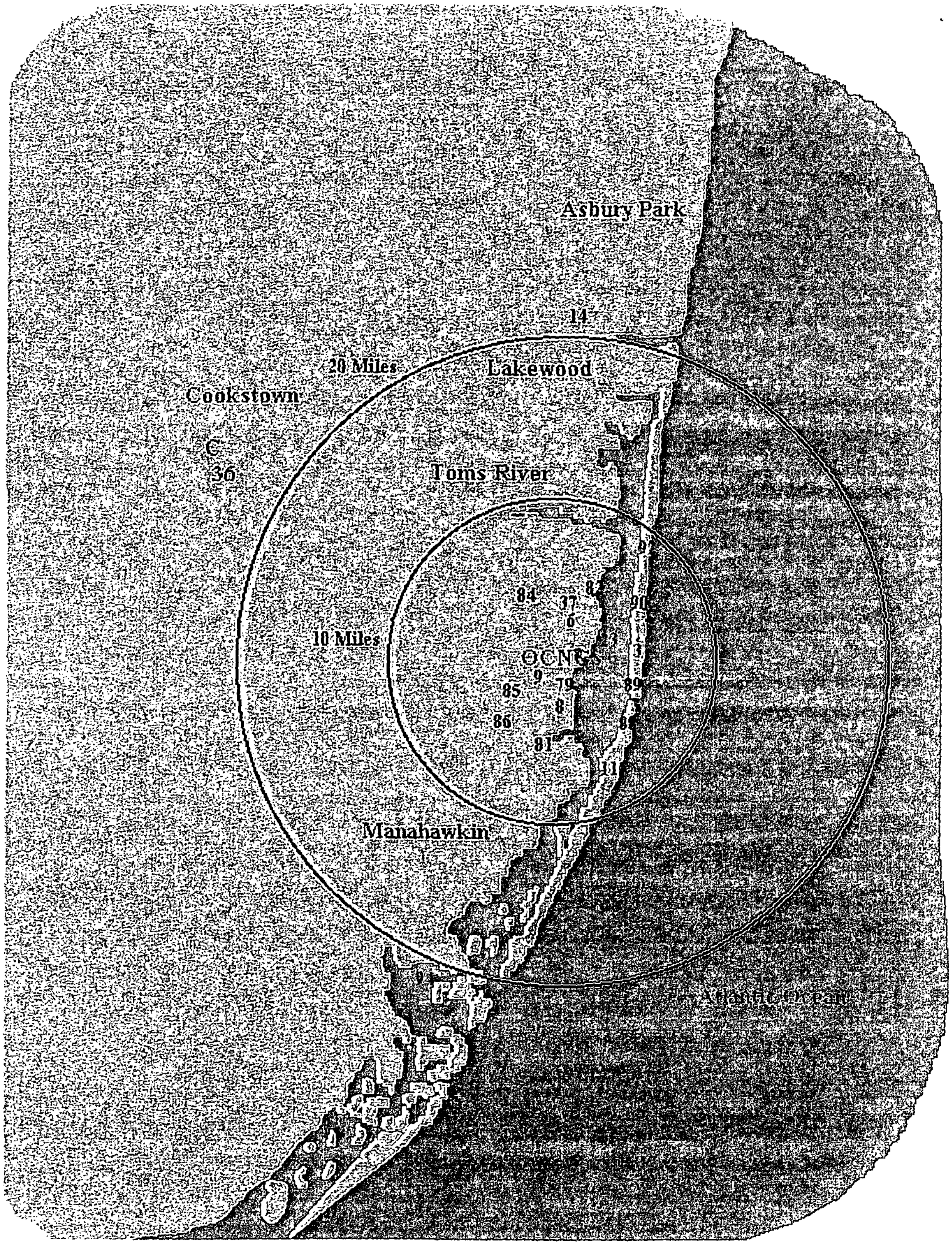
Figure 5



Oyster Creek Nuclear Generating Station (OCNGS)

Locations of Radiological Environmental Monitoring Program (REMP)
Stations within two miles of the OCNGS

Figure 6



Oyster Creek Nuclear Generating Station (OCNGS)
Locations of Radiological Environmental Monitoring Program (REMP)
Stations greater than 2 miles from the OCNGS

Measurement of low radionuclide concentrations in environmental media requires special analysis techniques. Analytical laboratories use state-of-the-art laboratory equipment designed to detect beta and gamma radiation. This equipment must meet the required analytical sensitivities. Examples of the specialized laboratory equipment used are germanium detectors with multichannel analyzers for identifying specific gamma emitting radionuclides, liquid scintillation detectors for detecting tritium, low level proportional counters for detecting gross beta radioactivity, and coincidence counters for low level I-131 detection. Computer hardware and software used in conjunction with the counting equipment perform calculations and provide data management. Analysis methods are described in Appendix J.

Quality Assurance Program

A Quality Assurance (QA) program is conducted in accordance with guidelines provided in Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs" (Ref. 16) and as required by the ODCM Specifications (Ref. 2) and Technical Specifications (Ref. 1). The QA program is documented by GPUN written policies, procedures, and records. These documents encompass all aspects of the REMP including sample collection, equipment calibration, laboratory analysis, and data review.

The QA program is designed to identify possible deficiencies so that immediate corrective action can be taken if warranted. It also provides a measure of confidence in the results of the monitoring program in order to assure the regulatory agencies and the public that the results are valid. The Quality Assurance program for the measurement of radioactivity in environmental samples is implemented by:

- auditing all REMP-related activities including analytical laboratories
- requiring analytical laboratories to participate in an NRC approved Environmental Radioactivity Intercomparison Program
- requiring analytical laboratories to split samples for separate analysis (recounts are performed when samples are not able to be split)
- splitting samples, having the samples analyzed by independent laboratories, and then comparing the results for agreement
- reviewing QA results of the analytical laboratories including spike and blank sample results and duplicate analysis results

The Quality Assurance program and the results of the Environmental Radioactivity Intercomparison Program are outlined in Appendices E and F, respectively.

The TLD readers are calibrated monthly against standard TLDs to within five percent of the standard TLD values. Also, each group of TLDs processed by a reader contains control TLDs that are used to correct for minor variations in the reader. The accuracy and variability of the results for the control TLDs are examined for each group of TLDs to assure the reader is functioning properly.

Other cross-checks, calibrations, and certifications are in place to assure the accuracy of the TLD program:

- Semiannually, randomly selected TLDs are sent to an independent laboratory where they are irradiated to set doses not known to GPUN. The GPUN dosimetry laboratory processes the TLDs and the results are compared against established limits

- Every two years, each TLD is checked for response within 10 percent of a known value

- Every two years, the GPUN dosimetry program is examined and recertified by the NIST National Voluntary Laboratory Accreditation Program (NVLAP)

- Four OCNGS REMP TLD stations have collocated quality assurance badges which are processed by an independent laboratory (Teledyne Brown Engineering). The results are compared against GPU Nuclear Panasonic TLD results

The environmental dosimeters were tested and qualified to the specifications in the American National Standard Institute's (ANSI) Publication N545-1975 and USNRC Regulatory Guide 4.13 (Ref.14 and 15).

DIRECT RADIATION MONITORING

Dose rates from external radiation sources were measured at a number of locations in the vicinity of the OCNGS using thermoluminescent dosimeters (TLDs). Naturally occurring sources, including radiation of cosmic origin and natural radioactive materials in the air and ground, as well as fallout from prior nuclear weapon testing, resulted in a certain amount of penetrating radiation being recorded at all monitoring locations. Indicator TLDs were placed systematically, with at least one station in each of 16 meteorological compass sectors (in a ring), typically within 0.25 miles of the OCNGS, or as close as reasonable highway access would permit. TLDs were also placed in each of the 16 sectors within a five mile radius of the OCNGS, located in areas where the potential for deposition of radioactivity was determined to be high, in areas of public interest, and population centers. Background locations were located greater than twenty miles distant from the OCNGS and generally in an upwind direction.

Sample Collection and Analysis

A state-of-the-art thermoluminescent dosimeter is used. Thermoluminescence is a process in which ionizing radiation, upon interacting with the sensitive material of the TLD (the phosphor or 'element') causes some of the energy deposited in the phosphor to be stored in stable 'traps' in the TLD material. These TLD traps are so stable that they do not decay appreciably over the course of years. This provides an excellent method of integrating the exposure received over a period of time. The energy stored in the TLDs as a result of interactions with radiation is removed and measured by a controlled heating process in a calibrated reading system. As the TLD is heated, the phosphor releases the stored energy as light. The amount of light given off is directly proportional to the radiation dose the TLD received. The reading process 'zeros' the TLD and prepares it for reuse.

The TLDs in use for environmental monitoring at the OCNGS are capable of accurately measuring exposures between 1 mrem (well below normal environmental levels for the quarterly monitoring periods) and 1000 rem.

TLDs were exposed quarterly at 44 monitoring locations ranging from less than 0.2 miles to 25 miles from the OCNGS. Two Panasonic Model 814 TLDs were exposed at each location. One of these locations was designated as a quality control station where two additional Model 814 badges were collocated. Four Teledyne Brown Engineering TLDs were also exposed at designated quality control stations. Panasonic Model 814 TLDs provide 4 independent detectors per badge and 8 detectors per station.

The scheduled exposure periods for 1998 were:

Table 3	
TLD EXPOSURE PERIODS DURING 1998	
Start Date	Collection Date
19 Jan 98	13 Apr 98
13 Apr 98	13 Jul 98
13 Jul 98	12 Oct 98
12 Oct 98	11 Jan 99

All TLD dose rate data presented in this report have been normalized to eliminate differences caused by slightly differing exposure periods. All results were normalized to a standard quarter (91.3 days). TLD dose rate data are presented in Tables K-1 and K-2 in Appendix K.

Results

The mean background dose exceeded the mean indicator dose during 1998 suggesting that the OCNGS had little if any affect on off-site exposure. The mean dose rate from indicator stations using Panasonic TLDs was 10.0 mrem/standard quarter with a range from 6.9 to 17.5 mrem/standard quarter (Table K-1). The mean background dose was 10.8 mrem/standard quarter with doses ranging from 9.2 to 12.4 mrem/standard quarter. Mean doses at background stations have historically exceeded mean doses at indicator stations, most probably due to differences in local geology. These results are consistent with the results of measurements from previous years (Fig. 7).

Dose rates were slightly higher at some locations within 0.4 miles of the OCNGS when compared to background doses (Table K-1 and Fig 8). However, these slightly higher doses were recorded at stations that were all located in the Owner Controlled Area where public access is restricted or completely denied. In contrast, doses recorded at stations located at approximately the same distance from the OCNGS where the public has unrestricted access (US Route 9) were less than those recorded at the background stations. Specifically, the mean dose recorded at locations along US Route 9 (Stations 61, 62, 63, 64, 65, and 66) was 9.3 mrem/standard quarter compared to a mean dose of 10.0 mrem/standard quarter recorded at the background stations. In addition, the maximum dose recorded at these indicator stations was 11.0 mrem/standard quarter while the highest recorded background dose was 12.4 mrem/standard quarter. These results suggest that OCNGS operation contributed little if any to off-site exposure.

MEAN PANASONIC TLD GAMMA DOSE - 1989 THROUGH 1998

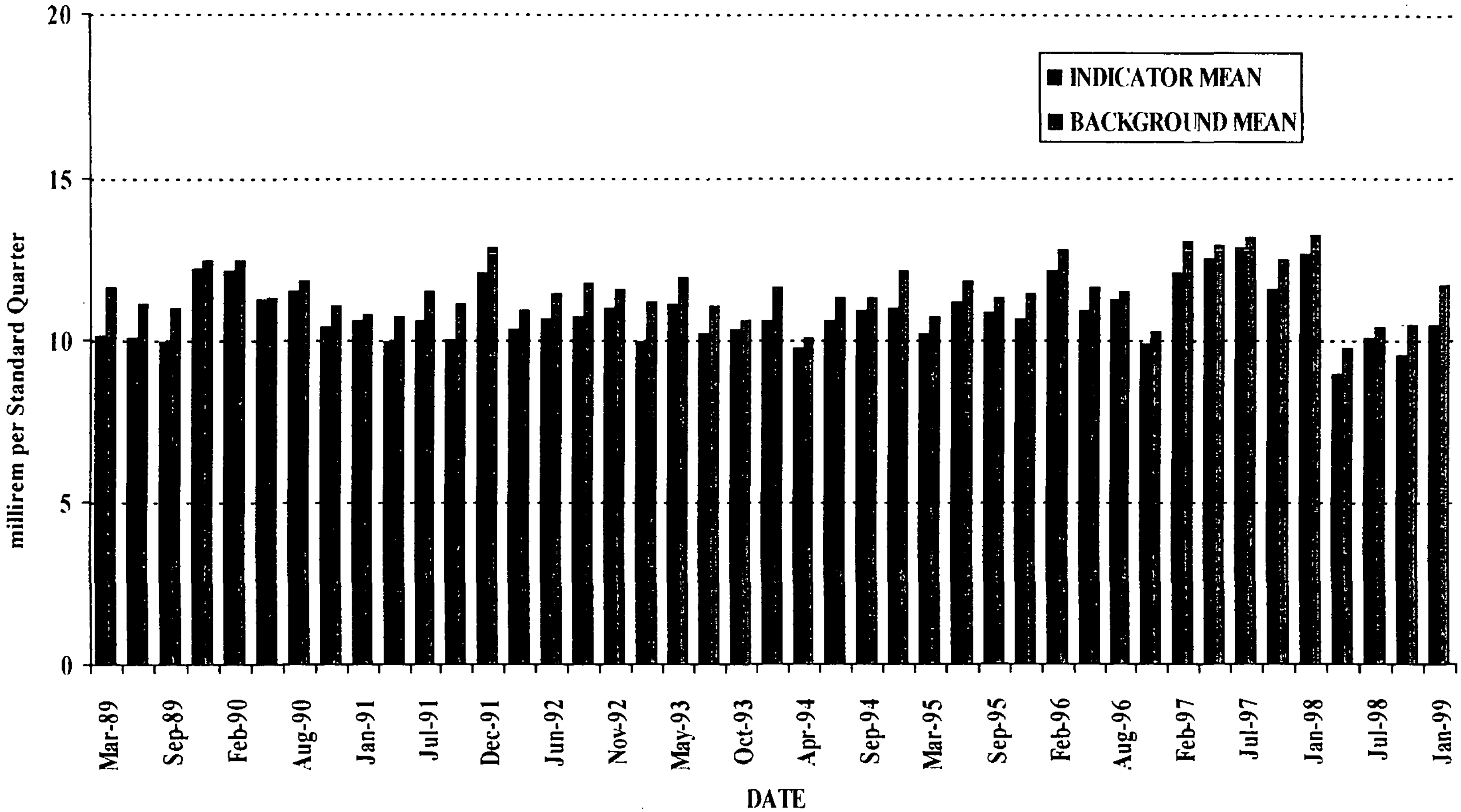


FIGURE 7

MEAN PANASONIC TLD GAMMA DOSE FOR 1998 BASED ON DISTANCE FROM OCNGS

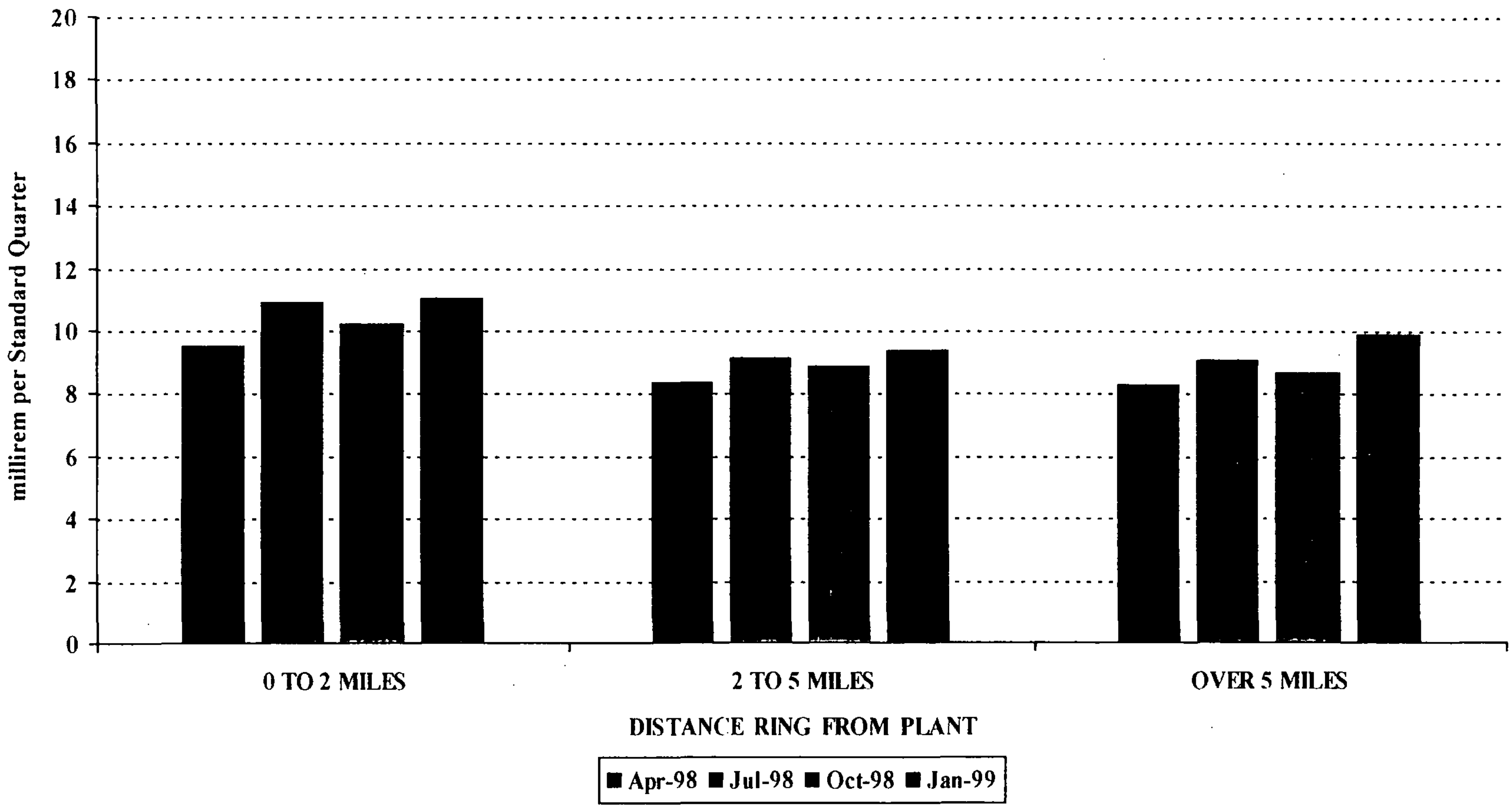


FIGURE 8

Regarding Teledyne Brown Engineering TLD data, the dose rate measured at indicator stations averaged 9.2 mrem/standard quarter and ranged from 7.9 to 10.0 mrem/standard quarter (Table K-2). The dose at background TLD stations averaged 10.3 mrem/standard quarter and ranged from 9.5 to 10.9 mrem/standard quarter. The mean dose rate from the background stations was higher than the mean dose rate from the indicator stations, again suggesting that OCNGS operation contributed little if any to off-site exposure.

ATMOSPHERIC MONITORING

A potential exposure pathway to man is the inhalation and ingestion of airborne radioactive materials. Air was sampled by a network of seven continuously operating air samplers and then analyzed for radioactivity content.

Indicator air sampling stations are located in prevailing downwind directions, local population areas, and areas of public and special interest. All indicator stations are located within 6.1 miles of the OCNGS. A background air sampling station is located 25 miles northwest of the OCNGS in Cookstown, NJ.

Sample Collection and Analysis

Mechanical air samplers are used to continuously draw a recorded volume of air first through a glass fiber (particulate) filter and then through a charcoal cartridge. A dry gas meter, which is temperature compensated, is used in line with the filters to record the volume of air sampled. Internal vacuums are also measured in order to pressure correct the indicated volume. All air samplers are maintained and calibrated by the OCNGS Instrument and Control Department.

The particulate filters were collected every two weeks and analyzed for gross beta radioactivity. The filters were then combined quarterly by individual stations and analyzed for gamma-emitting radionuclides.

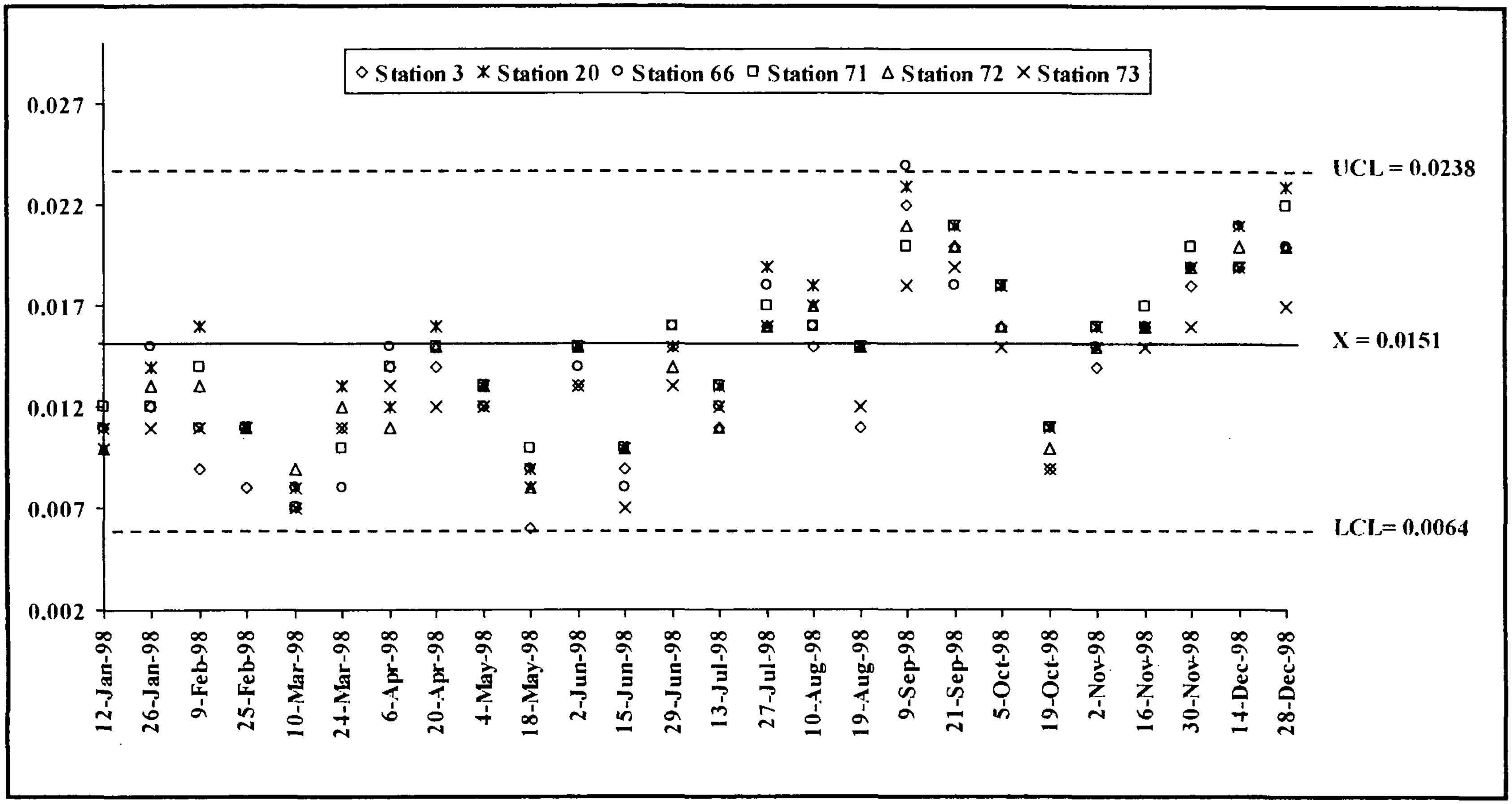
Charcoal cartridges, used to collect gaseous radioiodines, contain activated charcoal. Charcoal cartridges were collected weekly and analyzed for iodine-131 (I-131) activity.

Results

The results of the atmospheric monitoring during 1998 demonstrated that, as in previous years, the radioactive airborne effluents associated with the OCNGS did not have any measurable effects on the environment.

During 1998, 183 gross beta analyses were performed on air particulate filters (Table D-1). The background mean gross beta activity (0.0151 pCi/m^3) was slightly higher than the indicator mean (0.0142 pCi/m^3) and all gross beta analysis results were within two standard deviations of the historical mean. A quality control check of indicator station results shows that all but one of the 157 observations were within statistical control limits (Fig. 9).

AIR PARTICULATE GROSS BETA - 1998
MOVING RANGE QUALITY CONTROL CHART
INDICATOR STATION RESULTS COMPARED TO BACKGROUND LIMITS



NOTE: Upper (UCL) and lower (LCL) control limits (3-sigma theta) computed from lowest wind affected background station (Cookstown - NW of OCNGS)

FIGURE 9

Comparison of the 1998 bi-weekly mean air particulate gross beta concentrations from indicator and background stations shows that indicator and background concentrations were essentially identical (Fig. 10). In all but three of the comparisons, the mean background concentration equaled or exceeded the mean indicator concentration. The results are consistent with the results of gross beta analyses of air samples from previous years (Fig. 11). The air particulate gross beta analysis results indicate that effluent containing gross beta radioactivity from OCNGS operation did not have any measurable impact on the local environment.

Gamma emitting radionuclides attributable to effluents from the OCNGS were not identified in any of the 28 air particulate filter composites subjected to gamma isotopic analysis (Table D-1). The only radionuclide identified was naturally occurring beryllium-7, which was seen in similar concentrations at both indicator and background stations.

Air charcoal cartridges (364) were analyzed for iodine-131 (I-131) and no radioiodine was detected in any of the samples (Table D-1). This is consistent with results from past years.

BI-WEEKLY MEAN AIR PARTICULATE GROSS BETA CONCENTRATIONS - 1998

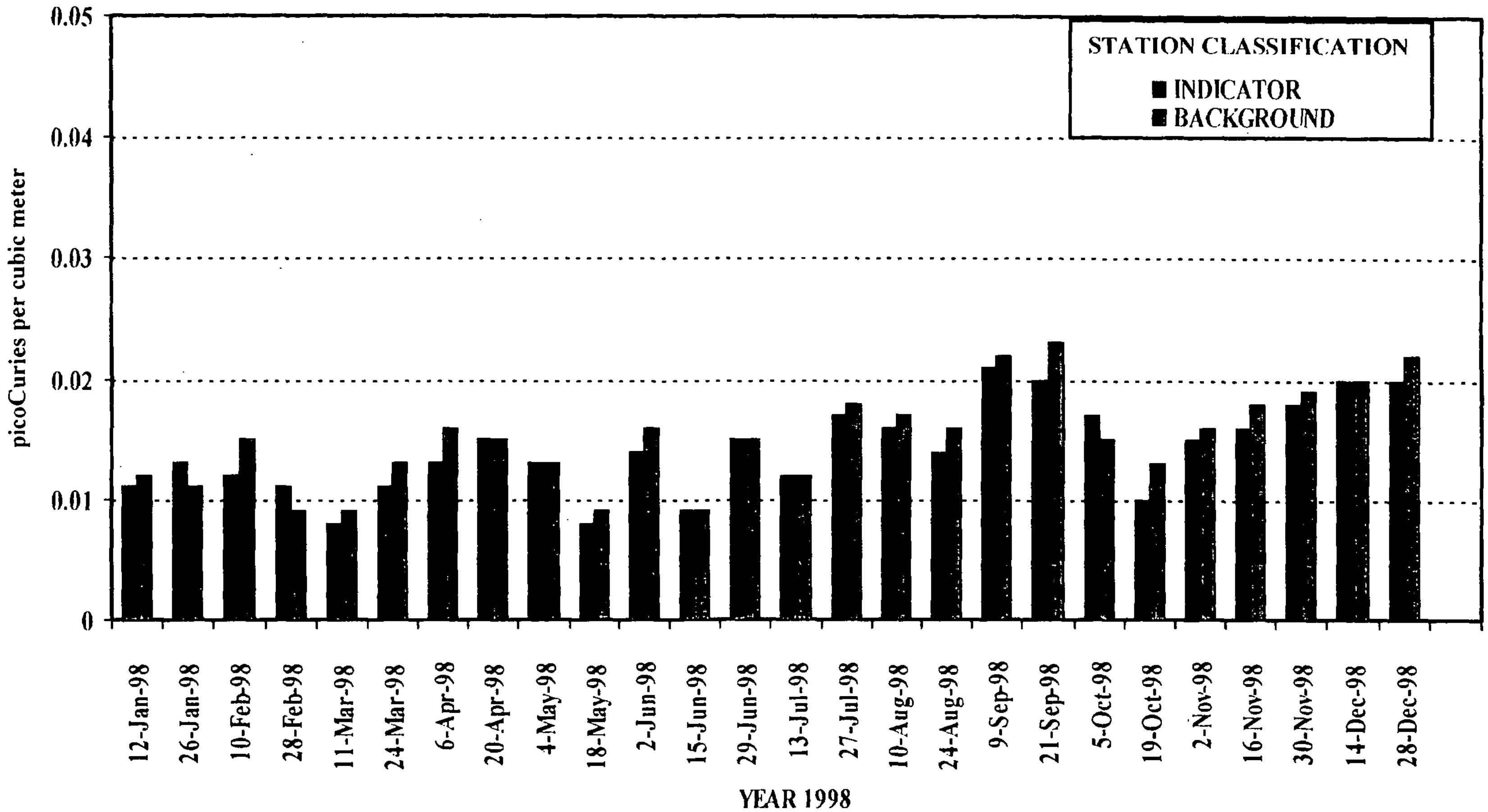
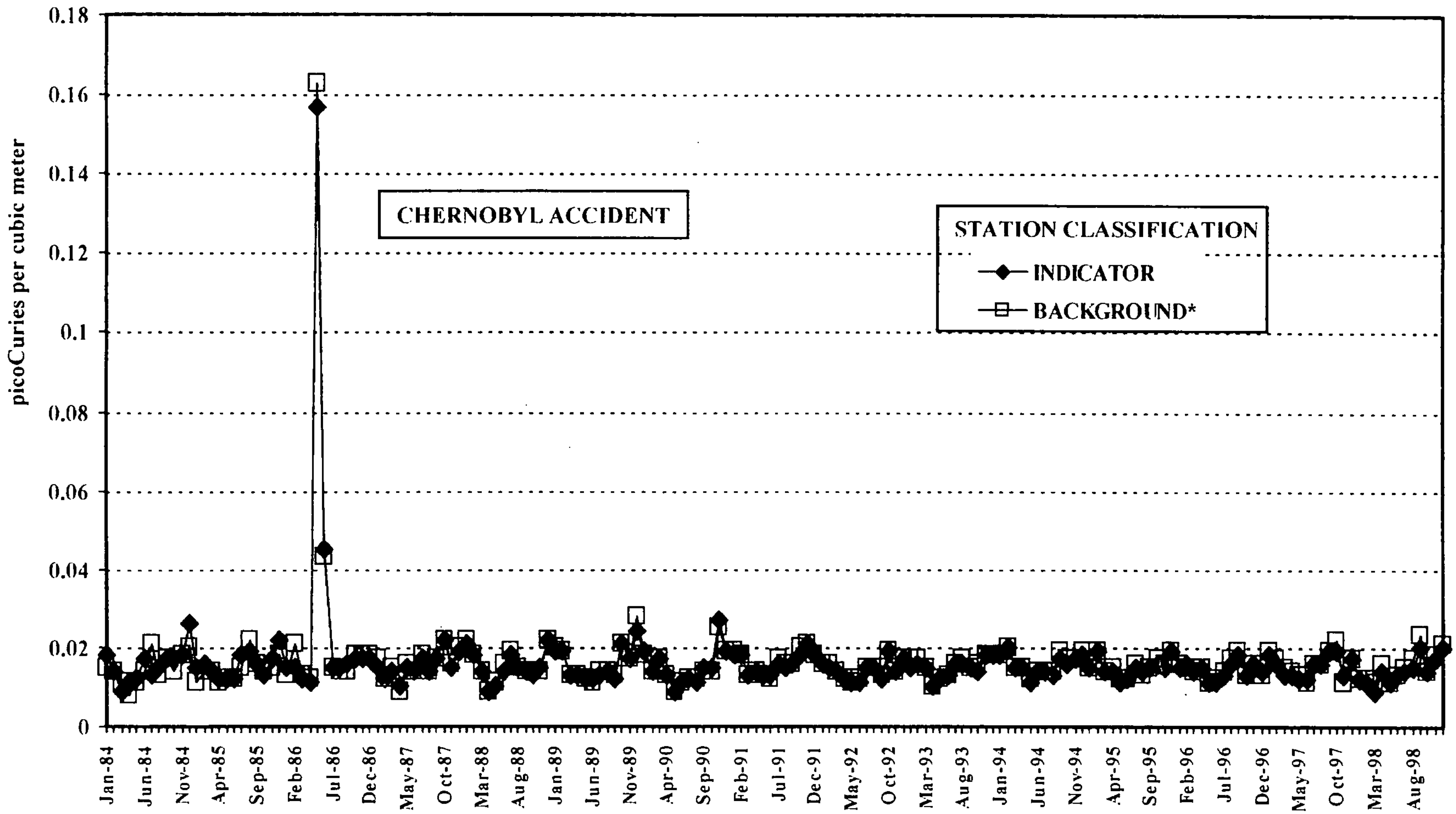


FIGURE 10

MONTHLY MEAN AIR PARTICULATE GROSS BETA CONCENTRATIONS 1984 THROUGH 1998



* Data from Cookstown station ONLY after December 1996

FIGURE 11

AQUATIC MONITORING

Brackish water from Barnegat Bay is drawn in through the South Branch of Forked River, pumped into the OCNGS cooling systems, and then discharged to Barnegat Bay via Oyster Creek. Normally, no radioactive material is introduced to this non-contact cooling water. On occasion, radioactive liquids may be released to the discharge canal in accordance with the limits established in the OCNGS Offsite Dose Calculation Manual (ODCM) Specifications, Technical Specifications, and 10CFR20. Highly purified water, containing traces of radioactivity, may be discharged into the OCNGS discharge canal, which routinely has a minimum flow rate of slightly under one-half million gallons per minute. Liquid effluents during 1998 resulted in the release of 0.011 curies of tritium.

Fish, clams, and crabs are harvested from the bay on a recreational and, to a limited extent, commercial basis. The ingestion pathway is addressed because of fish, clam, and crab consumption by man. Samples of surface water, sediment, fish, blue crab, and hard clams were routinely collected from locations in the OCNGS discharge canal, Barnegat Bay, and Great Bay/Little Egg Harbor in order to monitor any environmental impact that may be associated with liquid effluents from the OCNGS.

Sample Collection and Analysis

Surface water samples from two stations were collected monthly while an additional two stations were sampled on a semiannual basis. Sediment and clam samples were also collected semiannually. Grab samples of surface water and sediment were collected from three indicator stations and one background station. Grab samples of clams were collected from two indicator stations and one background station. An indicator station (Station 33) is located in the OCNGS discharge canal where surface water and sediment are collected, but no clams are available for collection. Two additional indicator stations for surface water, sediment, and clams are located in Barnegat Bay in close proximity to the mouth of Oyster Creek. One background station is located approximately 22 miles south of the OCNGS in Great Bay/Little Egg Harbor.

Fish samples were collected semiannually (when available) from two indicator stations and one background station. One crab sample was collected annually from an indicator station. Indicator stations for fish and crabs are located in the OCNGS discharge canal and the background station for fish is located in Great Bay/Little Egg Harbor. Crab pots were used to catch blue crab. Traps, as well as the hook and line technique, were used to catch fish.

Sediment, clam, fish, and crab samples were analyzed for gamma-emitting nuclides and surface water was analyzed for tritium as well as gamma-emitting nuclides.

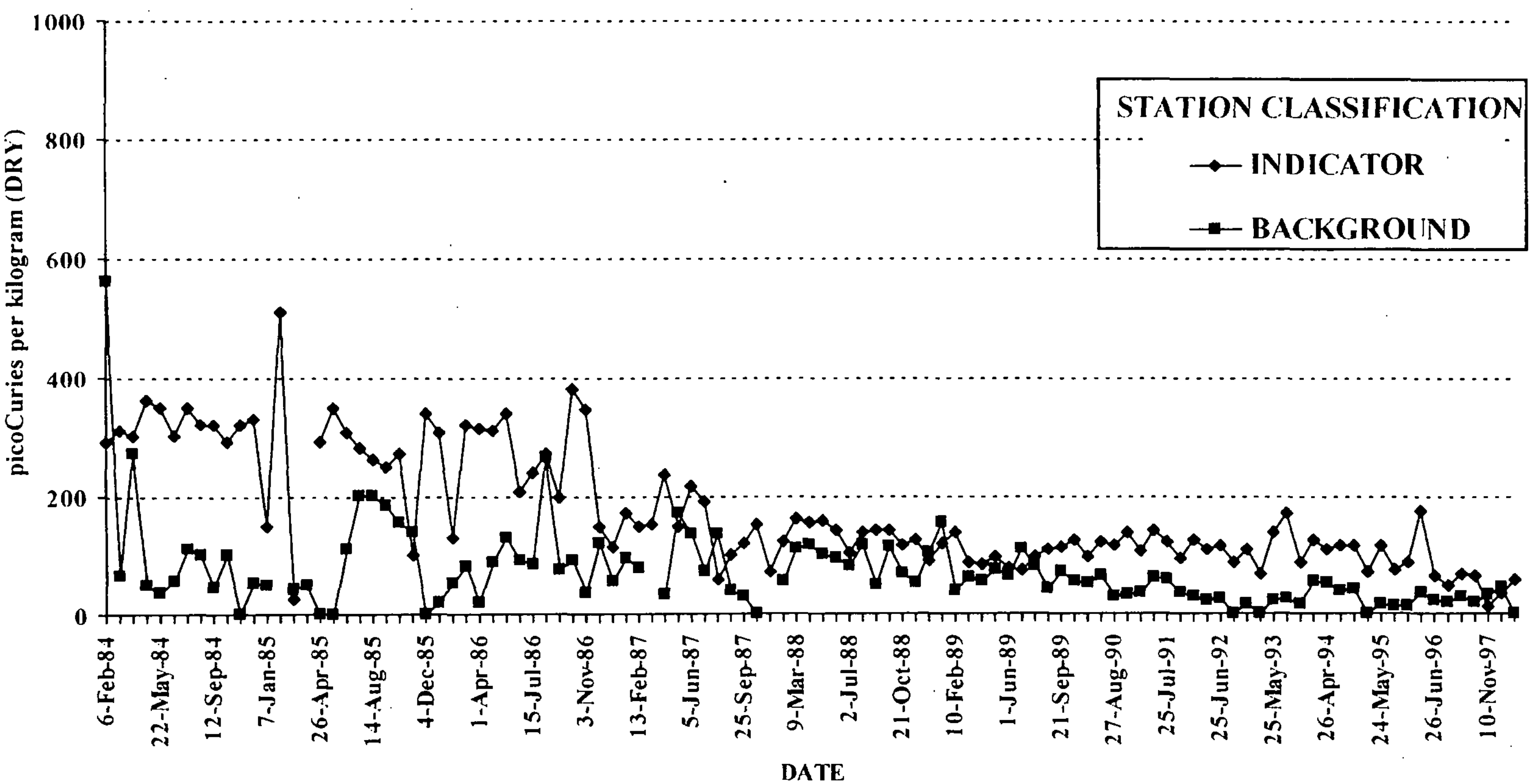
Results

Operation of the OCNGS had no detectable effect upon the local surface water which was sampled 40 times at four different locations during 1998. One gamma-emitting nuclide, potassium-40 (K-40) was detected in 27 of 28 analysis performed (Table D-1). Tritium (H-3) activity was also detected in one sample (Table D-1). Both of these nuclides are naturally occurring and commonly found in salt water at or above the observed concentrations. No other radionuclides were detected in surface water samples.

Five gamma-emitting nuclides were detected in the 8 sediment samples collected during 1998 (Table D-1). Four of these radionuclides, beryllium-7 (Be-7), potassium-40, radium-226 (Ra-226), and thorium-232 (Th-232), are naturally occurring and not attributable to OCNGS effluents. Cesium-137 (Cs-137), which is a fission product, was also detected in both background and indicator samples. Cesium-137 was widely distributed and detected in considerable abundance as a result of fallout following atmospheric weapons tests and the 1986 Chernobyl accident. Cesium-137 was also released in small quantities from the OCNGS in liquid effluents in past years. The results of the sediment sampling program indicate that the presence of cesium-137 in the sediments of the OCNGS discharge canal and nearby portions of Barnegat Bay may be attributable in part to past liquid discharges from the facility. A review of sediment sample analysis results for the 1994 – 1998 period shows cesium-137 was detected in 82 percent of background and only 60 percent of indicator samples (Table 4). However, cesium-137 concentrations detected at the two indicator stations (Stations 33 and 93), which are closest to the OCNGS liquid discharge point, show concentrations consistently higher than those found at background stations (Fig. 12). During the previous five years, the mean concentration of cesium-137 at background stations was 32 pCi/kg-dry, while the average concentration at indicator Stations 33 and 93 was 93 pCi/kg-dry. In addition, during this five year period, the highest concentration of Cs-137 at an indicator station was 240 pCi/kg-dry, which was detected at Station 33 during March 1996. The highest concentration at a background station during the same five year period was 67 pCi/kg-dry.

It is important to note that even the highest concentration of Cs-137 observed in sediments (240 pCi/Kg-dry) was only slightly above the 180 pCi/kg-dry Lower Limit of Detection specified by the Nuclear Regulatory

MEAN CESIUM-137 CONCENTRATION IN AQUATIC SEDIMENT - 1984 THROUGH 1998



45

FIGURE 12

Table 4

Cesium-137 Concentration in Aquatic Sediment

1994 - 1998

(pCi/Kg-dry)

Date	Station 23	Station 24	Station 25	Station 31	Station 32	Station 33	Station 93	Station 94
Jan 94	26	22	< LLD	40	54	140	110	67
Apr 94	< LLD	21	< LLD	49	45	150	67	48
Jul 94	< LLD	< LLD	< LLD	24	29	160	70	46
Nov 94	24	37	< LLD	22	44	140	95	61
Mar 95	< LLD	< LLD	< LLD	< LLD	72	46	94	< LLD
May 95	56	< LLD	< LLD	< LLD	< LLD	130	100	32
Aug 95	< LLD	< LLD	9	13	32	60	91	15
Oct 95	47	31	< LLD	< LLD	< LLD	51	120	27
Mar 96	< LLD	< LLD	< LLD	37	20	240	110	26
Jun 96	32	21	11	23	< LLD	56	71	22
Aug 96	16	< LLD	< LLD	17	< LLD	< LLD	100	24
Sep 96	< LLD	< LLD	15	39	23	33	100	17
May 97	45	< LLD				64		20
Oct 97	< LLD	< LLD				12		31
Jun 98	< LLD	< LLD				34		45
Nov 98	< LLD	< LLD				58		< LLD
Maximum	56	37	15	49	72	240	120	67
Average	35	26	12	29	40	92	94	34
Minimum	16	21	9	13	20	12	67	15

- Shaded areas indicate no data
- Stations 23, 24, 25, 32, 33, and 93 are indicator stations
- Stations 31 and 94 are background stations

Commission (Ref. 13) and only 12 percent of their Reporting Level for Cs-137 in fish and broad leaf vegetation (2,000 pCi/kg-wet).

Over the years, there has been a dramatic reduction in liquid discharges from the OCNGS and there have been no routine discharges of liquid radioactive wastes since 1989. As a result of this reduction in liquid effluents, as well as the ongoing natural radioactive decay process, the level of Cs-137 in sediments continues to decrease (Fig. 12).

Cobalt-60 was not detected in either indicator or background station sediment samples during 1998 (Table D-1; Fig. 13). The presence of cobalt-60 in sediment samples in previous years has been attributed to past OCNGS liquid effluents (Ref 19). During the years 1994 through 1996, cobalt-60 was detected in 58 percent of sediment samples collected from indicator stations 33 and 93, located in the OCNGS Discharge Canal (Table 5). During the same time period, no Co-60 was detected at either of the background stations, Stations 31 and 94, nor was it detected at any other indicator station. As documented in previous reports, OCNGS-related cobalt-60 activity had been found in sediment and clams from Barnegat Bay since the mid-1970's. The amount of radioactivity in liquid effluents has been significantly reduced since that time and this decrease in the rate of input of cobalt-60 to the environment, combined with radioactive decay of the existing inventory, has resulted in a gradual decline in the cobalt-60 concentration in sediment and clams (Figs. 13 and 14). The last detectable concentrations of this radionuclide in sediment were found during the third quarter of 1996 (Fig. 13), and in clams, during the third quarter of 1987 (Fig. 14).

No radionuclides attributable to effluents from the OCNGS were found in samples of clams, crabs and fish collected during 1998 (Table D-1).

Six clam samples were collected from three different locations during 1998. Gamma isotopic analyses indicated that the only gamma-emitting nuclide present was potassium-40, which is naturally occurring and commonly found in salt water (Table D-1).

One blue crab sample was collected from the OCNGS discharge canal during 1998. A gamma isotopic analysis was performed on this sample and naturally occurring potassium-40 and thorium-232 were the only radionuclides identified (Table D-1). The close association of this species with sediments could make it susceptible to cesium-137 and cobalt-60 uptake. However, no detectable Cs-137 or Co-60 activity has been observed in blue crab samples since routine collection began in 1985.

MEAN COBALT-60 CONCENTRATION IN AQUATIC SEDIMENT - 1983 THROUGH 1998

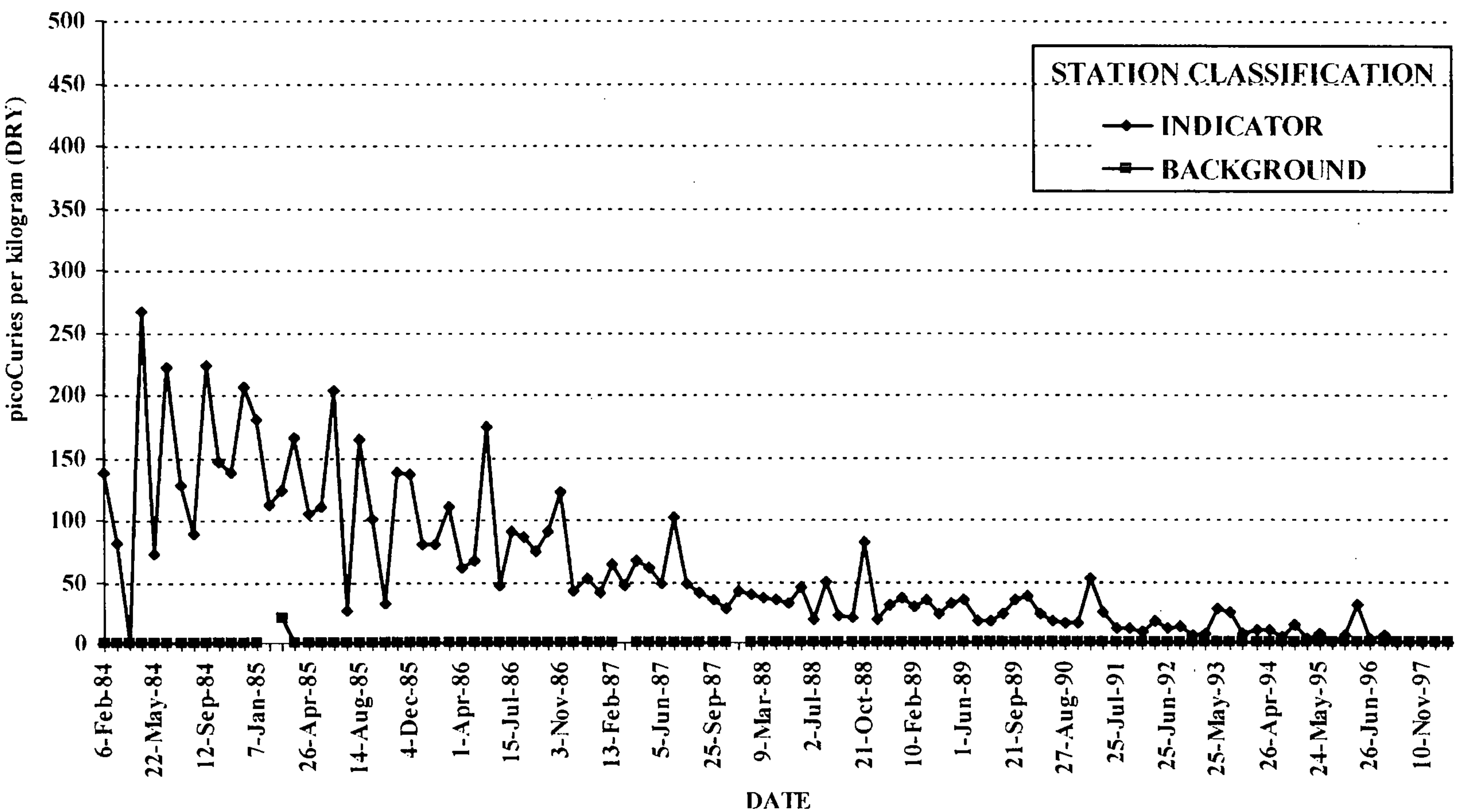
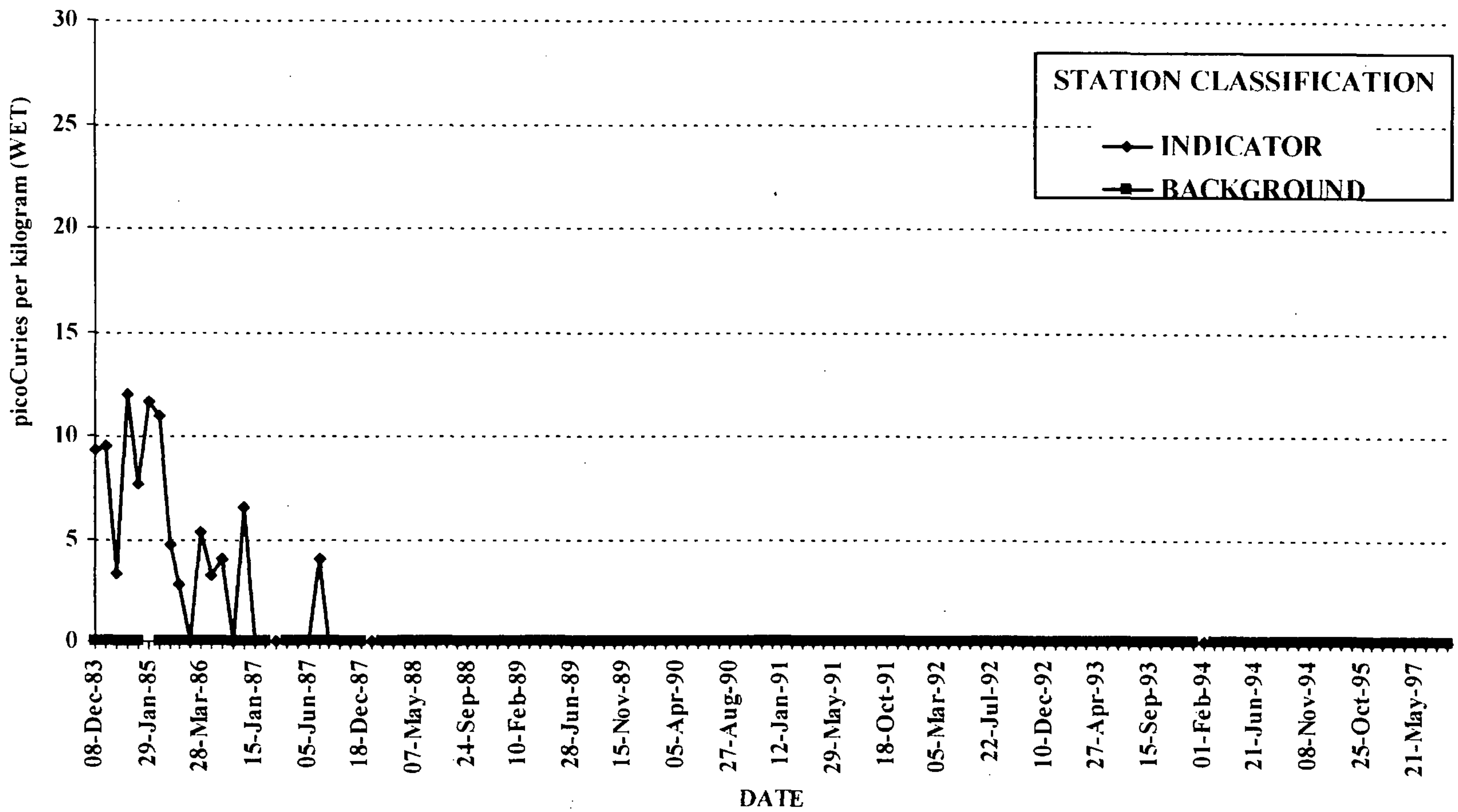


FIGURE 13

MEAN COBALT-60 CONCENTRATION IN CLAMS - 1983 THROUGH 1998



49

FIGURE 14

Table 5

Cobalt-60 Concentration in Aquatic Sediment

1994 - 1998

(pCi/Kg-dry)

Date	Station 23	Station 24	Station 25	Station 31	Station 32	Station 33	Station 93	Station 94
Jan 94	< LLD	< LLD	< LLD	< LLD	< LLD	26	37	< LLD
Apr 94	< LLD	< LLD	< LLD	< LLD	< LLD	38	26	< LLD
Jul 94	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	22	< LLD
Nov 94	< LLD	< LLD	< LLD	< LLD	< LLD	44	27	< LLD
Mar 95	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	18	< LLD
May 95	< LLD	< LLD	< LLD	< LLD	< LLD	41	< LLD	< LLD
Aug 95	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD
Oct 95	< LLD	< LLD	< LLD	< LLD	< LLD	14	20	< LLD
Mar 96	< LLD	< LLD	< LLD	< LLD	< LLD	180	< LLD	< LLD
Jun 96	< LLD	< LLD	< LLD	< LLD	< LLD	15	< LLD	< LLD
Aug 96	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	33	< LLD
Sep 96	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD	< LLD
May 97	< LLD	< LLD				< LLD		< LLD
Oct 97	< LLD	< LLD				< LLD		< LLD
Jun 98	< LLD	< LLD				< LLD		< LLD
Nov 98	< LLD	< LLD				< LLD		< LLD
Maximum	< LLD	< LLD	< LLD	< LLD	< LLD	180	37	< LLD
Average	< LLD	< LLD	< LLD	< LLD	< LLD	51	26	< LLD
Minimum	< LLD	< LLD	< LLD	< LLD	< LLD	14	18	< LLD

- Shaded areas indicate no data
- Stations 23, 24, 25, 32, 33, and 93 are indicator stations
- Stations 31 and 94 are background stations

Eighteen fish samples, yielding nine species, were collected from 3 sampling locations during 1998. The species and number of samples collected are listed in Table 6.

TABLE 6

SPECIES OF FISH CAUGHT AS PART OF THE OCNGS REMP IN 1998

Fish	Number of Samples
bluefish	3
striped bass	3
white perch	3
winter flounder	3
tautog	2
blowfish	1
sea bass	1
summer flounder	1
weakfish	1

Naturally occurring potassium-40 was the only radionuclide detected in fish samples collected during 1998 (Table D-1).

TERRESTRIAL MONITORING

Radionuclides released to the atmosphere may be deposited on soil and vegetation and may be incorporated into milk, vegetation, vegetables, and other food products. To assess the impact of dose to humans from this ingestion pathway, samples of green leafy vegetables were collected and analyzed during 1998.

The contribution of radionuclides from OCNGS effluents to this ingestion pathway was assessed by comparing the results of samples collected at indicator stations in prevalent downwind locations, primarily to the southeast of the site, with background samples collected from distant and generally upwind directions. Indicator samples are collected at the two locations with the highest D/Q (deposition factor). These locations were identified using site-specific meteorological data. This technique is utilized in lieu of performing any garden census, because it ensures that representative measurements of radioactivity in the highest potential exposure pathways are obtained as required by Technical Specification 6.8.4.b.

In addition, a dairy census was conducted to determine the locations of commercial dairy operations and milk producing animals in each of the 16 meteorological sectors out to a distance of five miles from the OCNGS. The census showed that there were no commercial dairy operations and no dairy animals producing milk for human consumption within a 5 mile radius of the plant (Appendix G).

Two gardens were maintained near the site boundary of the OCNGS in the two sectors with the highest potential for radioactive deposition in accordance with the Offsite Dose Calculation Manual (Ref 2). Both of these indicator gardens are greater than 50 square meters (500 square feet) in size and produced green leafy vegetables. A commercial farm located approximately 24 miles northwest of the site was used as a background station.

Sample Collection and Analysis

Broadleaf vegetables, specifically cabbage and collards, were collected on a monthly basis beginning in August and ending in November 1998. A gamma isotopic analysis was performed on each sample.

Results

The results of the terrestrial monitoring during 1998 demonstrated that the radioactive effluents associated with the OCNGS did not have any measurable effects on vegetation.

A gamma isotopic analysis was performed on twelve collard samples and six cabbage samples (Table D-1). Naturally occurring potassium-40 (K-40) was detected in all of the samples collected from both indicator and background stations. Beryllium-7 (Be-7), which is also naturally occurring, was identified in 3 of 8 collard samples and detected in 2 of 4 cabbage samples collected from the indicator garden. No other radionuclides were detected in vegetable samples. Of the radionuclides detected, all are naturally occurring, and none are associated with OCNGS operation.

GROUNDWATER MONITORING

The Oyster Creek Nuclear Generating Station is located on the Atlantic Coastal Plain Physiographic Province. This Province extends southeastward from the Fall Zone, a topographic break that marks the boundary between the Atlantic Coastal Plain and the more rugged topography of the Piedmont Province. The Fall Zone is also where the crystalline and sedimentary rocks of the Piedmont and the unconsolidated Coastal Plain sediments meet.

At least five distinct bodies of fresh groundwater or aquifers exist in the vicinity of the OCNGS. From the surface downward, they are:

1. Recent and Upper Cape May Formation
2. Lower Cape May Formation
3. Cohansey Sand
4. Upper Zone in the Kirkwood Formation
5. Lower Zone in the Kirkwood Formation

The Recent and Cape May Formations are replenished directly by local precipitation. The recharge to the underlying aquifers occurs primarily from direct rainfall penetration on the outcrop areas, which are generally to the west of the site at higher elevations.

Sample Collection and Analysis

As part of the routine REMP, three groundwater wells were sampled on a quarterly basis. Grab samples were obtained from two local Municipal Utility Authority wells and an on-site drinking water well. The Lacey Municipal Utility Authority combines water from three wells which are drilled to depths of 239', 248', and 267'. This sampling location is 2.2 miles north-northeast of the OCNGS. A second sampling location is the Ocean Township Municipal Utility Authority well which is approximately 360' deep and located 1.6 miles from the OCNGS in a south-southwest direction. The third sampling location is the 400' deep on-site well that supplies drinking water to the OCNGS. Each sample was subjected to a tritium and gamma isotopic analysis.

In addition, a groundwater monitoring network installed around the OCNGS in 1983 to serve as an early detection and monitoring system for spills, was sampled in March and October 1998. This network is comprised of fifteen wells which are located in the Cape May, Cohansey, and Kirkwood Aquifers. Grab sample methodology was used and the samples were also analyzed for tritium and gamma emitting nuclides.

Results

The results of the REMP groundwater monitoring during 1998 demonstrated that, as in previous years, the radioactive effluents associated with the OCNGS did not have any measurable effects on offsite drinking water.

Twelve routine REMP well water samples were collected during 1998. No radioactivity was detected in any of these samples (Table D-1).

The results of the analyses of 28 samples collected from the onsite groundwater monitoring well network were similar to results seen in past years except for tritium concentrations (Table I-1). Tritium, potassium-40, and thorium-232 were the only nuclides detected in these wells and each is naturally occurring. Tritium, however, is also produced as a byproduct in the OCNGS reactor and it was detected in these monitoring wells more frequently than in prior years (Table 7). Tritium was detected in 15 of the 28 samples collected in 1998. Tritium concentrations ranged from 150 to 840 pCi/liter with an average concentration of 299 pCi/liter. Prior to 1998, the highest frequency of occurrence was seven positive tritium results out of 25 samples in 1991. Only two positive tritium results, 170 pCi/liter in each, were observed during 1997, and only one positive result (180 pCi/liter) was observed during 1996.

TABLE 7		
FREQUENCY OF OCCURRENCE OF TRITIUM IN THE ONSITE GROUNDWATER MONITORING NETWORK (1989 through 1998)		
Year	Number of Samples Collected	Number of Tritium Results That Were Above the Lower Limit of Detection
1998	28	15
1997	30	2
1996	15	1
1995	30	3
1994	29	1
1993	30	1
1992	25	2
1991	25	7
1990	30	5
1989	28	2

The increase in the frequency of occurrence and concentration of tritium in the onsite groundwater monitoring wells can be attributed to the increase in the amount of tritium in airborne effluents from the OCNGS during 1997 and 1998. Increases in reactor coolant tritium concentrations, thought to be related to control rod blade leakage, have resulted in an increase in the amount of tritium released in gaseous effluents. Remedial efforts during the 17R outage in the autumn of 1998, including the replacement and shuffling of control rods, were implemented in order to reduce or eliminate this source of tritium.

The highest tritium concentration detected in onsite monitoring wells during 1998 (840 pCi/liter) was only 42 percent of the analytical Lower Limit of Detection of 2,000 pCi/liter specified by the Nuclear Regulatory Commission (Ref. 13) and only 4.2 percent of the USEPA drinking water limit of 20,000 pCi/liter. In addition, as discussed above, no tritium was detected in samples collected from offsite drinking water wells.

RADIOLOGICAL IMPACT OF OCNGS OPERATIONS

An assessment of potential radiological impact indicated that radiation doses to the public from 1998 operations at the OCNGS were well below all applicable regulatory limits and were significantly less than doses received from common sources of radiation. The 1998 total body dose, potentially received by a hypothetical maximum exposed individual, from OCNGS liquid and airborne effluents, was conservatively calculated to be 1.7E-2 millirem total or only 6.8E-2 percent of the regulatory limit. The 1998 total body dose to the surrounding population from OCNGS liquid and airborne effluents was calculated to be 1.0E-1 person-rem. This is approximately 12.3 million times lower than the doses to the total population within a 50-mile radius of the OCNGS resulting from natural background sources.

Determination of Radiation Doses to the Public

To the extent possible, doses to the public are based on direct measurement of dose rates from external sources and measurements of radionuclide concentrations in the environment which may contribute to an internal dose of radiation. Thermoluminescent dosimeters (TLDs) positioned in the environment around the OCNGS provide measurements to determine external radiation doses to humans. Samples of air, water, food products, etc. can be used to determine internal doses.

During normal plant operations the quantities of radionuclides released are typically too small to be measured once released to the offsite environment. As a result, the potential offsite doses are calculated using a computerized model that predicts concentrations of radioactive materials in the environment and subsequent radiation doses on the basis of radionuclides released to the environment. OCNGS doses were calculated using a computer program called SEEDS (Simplified Effluent Environmental Dosimetry System). This program is based upon the OCNGS Offsite Dose Calculation Manual (ODCM) and incorporates the guidelines and methodologies set forth by the USNRC in Regulatory Guide 1.109 (Ref. 17). Due to the conservative assumptions that are used in SEEDS, the calculated doses are considerably higher than the actual doses to people.

The type and amount of radioactivity released from the OCNGS is calculated using measurements from effluent radiation monitoring instruments and effluent sample analysis. Once released, the dispersion of radionuclides in the environment is readily estimated by computer modeling. Airborne releases are diluted and carried away from the site by atmospheric diffusion which continuously acts to disperse radioactivity. Variables which affect atmospheric dispersion include wind speed and direction, atmospheric stability, and terrain. A meteorological monitoring station northwest of the OCNGS permanently records and telemeters all necessary meteorological data. A computer program is also used to predict the downstream dilution and travel times for liquid releases into the Barnegat Bay estuary and Atlantic Ocean.

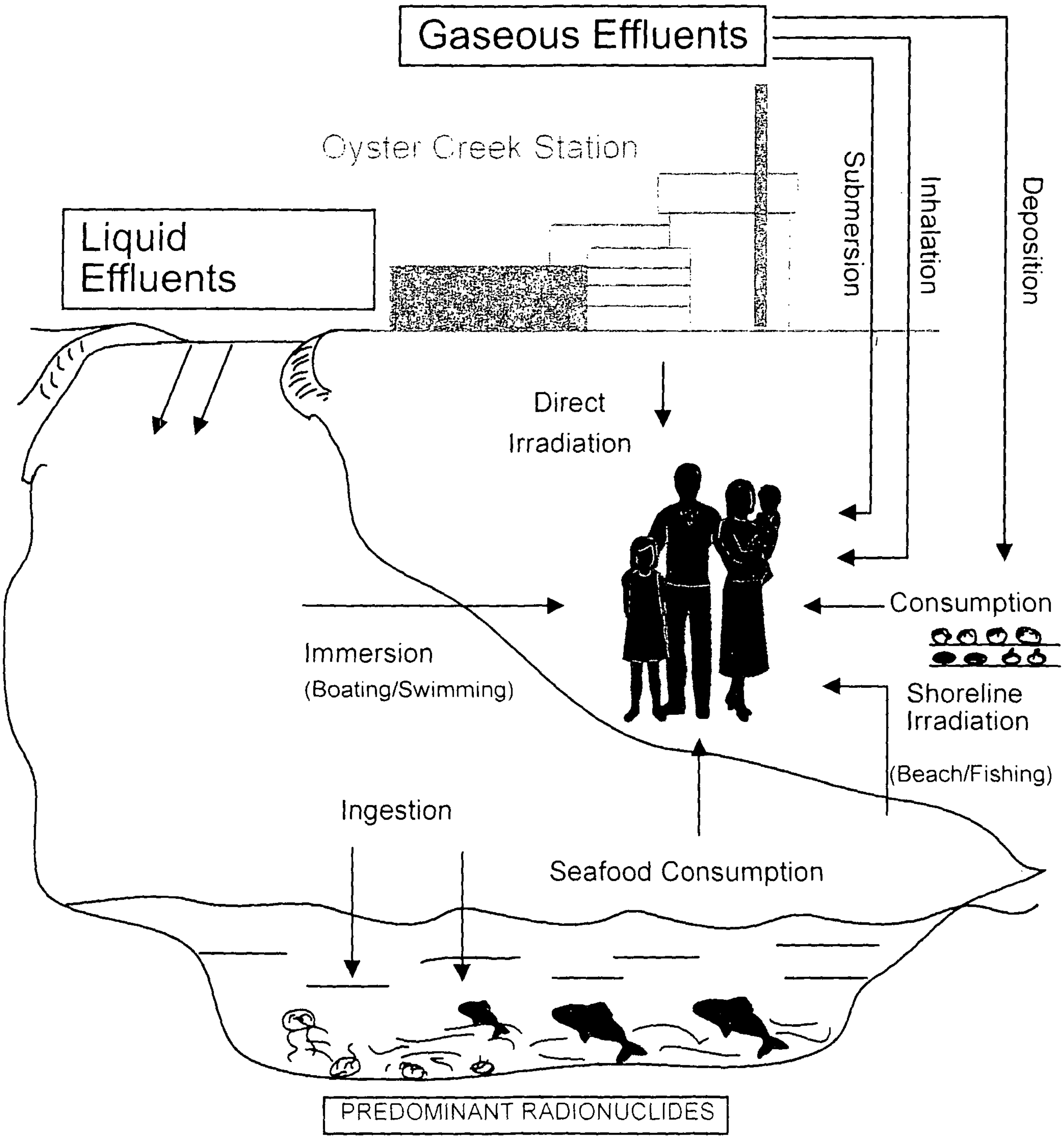
The pathways to human exposure are also included in the model. These pathways are depicted in Figure 15. The exposure pathways considered for the discharge of the station's liquid effluent are fish and shellfish consumption and shoreline exposure. The exposure pathways considered for airborne effluents include plume exposure, inhalation, vegetable consumption (during growing season), and land deposition.

SEEDS employs numerous data files which describe the area around the OCNGS in terms of demography and foodstuffs production. Data files include such information as the distance from the plant stack to the site boundary in each of the sixteen compass sectors, the population groupings, meat animals, and crop yields.

When determining the dose to humans, it is necessary to consider all pathways and all exposed tissues (summing the dose from each) to provide the total dose for each organ as well as the total body from a given radionuclide in the environment. Dose calculations involve determining the energy absorbed per unit mass in the various tissues. Thus, for radionuclides taken into the body, the metabolism of the radionuclide in the body must be known along with the physical characteristics of the nuclide such as energies, types of radiations emitted, and half-life. SEEDS also contains dose conversion factors for over 75 radionuclides for each of four age groups (adult, teen, child, and infant) and eight organs (total body, thyroid, liver, skin, kidney, lung, bone, and gastro-intestinal tract).

Doses are calculated for what is termed the "maximum hypothetical individual". This individual is assumed to be affected by the combined maximum environmental concentrations wherever they occur. For liquid releases at the OCNGS, the maximum hypothetical individual would be one who stands at the U.S. Route 9-discharge canal shoreline for 67 hours per year while eating

FIGURE 15
EXPOSURE PATHWAYS FOR RADIONUCLIDES POTENTIALLY RELEASED FROM THE OCNGS



NOBLE GASES (Xe, Kr)
Plume Exposure

ACTIVATION PRODUCTS (Co-60, Mn-54)
Shoreline Exposure and Consumption of Seafood

TRITIUM (H-3)
Inhalation and Consumption of Vegetables

RADIOIODINES (I-131, I-133)
Inhalation and Consumption of Vegetables

RADIOCESIUMS (Cs-134, Cs-137)
Shoreline Exposure and Consumption of Seafood and Vegetables

43 pounds of fish and shellfish. For airborne releases, the maximum hypothetical individual would live at the location of highest radionuclide concentration for inhalation and direct plume exposure while eating 1,389 pounds of vegetables per year. This location is 2,616 meters to the south-southwest based on meteorological air dispersion analysis. The usage factors and other assumptions used in the model result in a conservative overestimation of dose. Doses are calculated for the population within 50 miles of the OCNGS for airborne effluents and the entire population using the Barnegat Bay estuary and Atlantic Ocean for liquid effluents. Appendix H contains a more detailed discussion of the dose calculation methodology.

Results of Dose Calculations

Doses from natural background radiation provide a baseline for assessing the potential public health significance of radioactive effluents. The average person in the United States receives about 300 millirem (mrem) per year from natural background radiation sources. Natural background radiation from cosmic, terrestrial, and natural radionuclides in the human body (not including radon), averages about 100 mrem/yr. The natural background radiation from cosmic and terrestrial sources varies with geographic location, ranging from a low of about 65 mrem/yr on the Atlantic and Gulf coastal plains to as much as 350 mrem/yr on the Colorado plateau (Ref. 5). The National Council on Radiation Protection and Measurements (NCRP) now estimates that the average individual in the United States receives an annual dose of about 2,400 millirems to the lung from natural radon gas. This lung dose is considered to be equivalent to a whole body dose of 200 millirems (Ref. 4). Effluent releases from the OCNGS and other nuclear power plants contribute a very small percentage to the natural radioactivity which has always been present in the air, water, soil, and even in our bodies.

In general, the annual population doses from natural background radiation (excluding radon) are 1,000 to 1,000,000 times larger than the doses to the same population resulting from nuclear power plant operations (Ref. 18).

Results of the dose calculations are summarized in Tables 8 and 9. Table 8 compares the calculated maximum dose to an individual of the public with the OCNGS ODCM Specifications, Technical Specifications, 10CFR20.1301, and 10CFR50 Appendix I dose limits. Table 9 presents the maximum total body radiation doses to the population within 50 miles of the plant from airborne releases, and to the entire population using Barnegat Bay and the Atlantic Ocean, for liquid releases.

These conservative calculations of the doses to members of the public from the OCNGS resulted in a maximum dose of only 0.15 percent of the applicable regulatory limits. They are also considerably lower than the doses from natural background and fallout from prior nuclear weapon tests.

TABLE 8

CALCULATED MAXIMUM HYPOTHETICAL DOSES TO AN INDIVIDUAL FROM LIQUID AND AIRBORNE EFFLUENT RELEASES FROM THE OCNGS FOR 1998

EFFLUENT RELEASED	REGULATORY LIMITS mrem/YEAR	REGULATORY LIMITS SOURCE	CALCULATED DOSE mrem/YEAR	PERCENT OF REGULATORY LIMIT
LIQUID	3 - TOTAL BODY	ODCM SPEC 4.6.1.1.4	8.6E-8	2.9E-6
LIQUID	10 - ANY ORGAN	ODCM SPEC 4.6.1.1.4	8.6E-8	8.6E-7
AIRBORNE (NOBLE GAS)	100 - TOTAL BODY	10CFR20.1301	4.3E-5	4.3E-5
AIRBORNE (NOBLE GAS)	3000 - SKIN	ODCM SPEC 4.6.1.1.5	6.6E-5	2.2E-6
AIRBORNE (IODINE AND PARTICULATE)	15 - ANY ORGAN	ODCM SPEC 4.6.1.1.7	2.2E-2	1.5E-1
TOTAL-LIQUID AND AIRBORNE	25 - TOTAL BODY	ODCM SPEC 4.6.1.1.8	1.7E-2	6.8E-2
TOTAL - LIQUID AND AIRBORNE	75 - THYROID	ODCM SPEC 4.6.1.1.8	2.2E-2	2.9E-2
TOTAL - LIQUID AND AIRBORNE	25 - ANY OTHER ORGAN	ODCM SPEC 4.6.1.1.8	6.6E-5	2.6E-4

TABLE 9

CALCULATED MAXIMUM TOTAL RADIATION DOSES TO THE POPULATION[1] FROM LIQUID AND AIRBORNE EFFLUENT RELEASES FROM THE OCNGS FOR 1998

	Calculated Population Total Body Dose Person-rem/Year
From Radionuclides in Liquid Releases (Barnegat Bay and Atlantic Ocean Users)	1.0E-3
From Radionuclides in Airborne Releases (Within 50-Mile Radius of OCNGS)	1.0E-1

DOSE DUE TO NATURAL BACKGROUND RADIATION

Approximately 1,230,000 Person-rem Per Year

[1] Based upon 1990 Census Data

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APPENDIX A

1998 REMP Sampling Locations and Descriptions, Synopsis of REMP, and Sampling and Analysis Exceptions

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLING LOCATIONS

Sample Medium	Station Code	Distance (miles)	Azimuth (degrees)	Description
TLD	1	0.3	227	SW of site, at OCNGS Fire Pond, Forked River, NJ
WWA	1	0.1 0.2	208 359	On-site wells at OCNGS, Forked River, NJ
APT, AIO, TLD	3	6.1	94	E of site, near old Coast Guard Station, Island Beach State Park
TLD	6	2.2	14	NNE of site, Lane Place, behind St. Pius Church, Forked River, NJ
TLD	8	2.3	180	S of site, Route 9 at the Waretown Substation, Waretown, NJ
TLD	9	2.0	230	SW of site, where Route 532 and the Garden State Parkway meet, Waretown, NJ
APT, AIO, TLD	C	25	309	NW of site, GPU Energy office rear parking lot, Cookstown, NJ
TLD	11	8.3	156	SSE of site, 80th and Anchor Streets at Water Tower, Harvey Cedars, NJ
TLD	14	21.7	1	N of site, Larrabee Substation on Randolph Road, Lakewood, NJ
APT, AIO	20	0.7	93	E of site, on Finninger Farm on south side of access road, Forked River, NJ
TLD	22	1.6	146	SE of site, at 27 Long Silver Way, Skippers Cove, Waretown, NJ
SWA, CLAM, AQS	23	4.0	63	ENE of site, Barnegat Bay off Stouts Creek, 400 yards SE of Flashing Light "1"
SWA, CLAM, AQS	24	2.0	104	ESE of site, Barnegat Bay, 250 yards SE of Flashing Light "3"
SWA, AQS, FISH, CRAB	33	0.4 to 0.5	112 to 130	E to SE of site, east of Route 9 Bridge in OCNGS Discharge Canal
VEG	35	0.4	110	ESE of site, east of Route 9 and north of the OCNGS Discharge Canal, Forked River, NJ
VEG	36	24	315	NW of site, at "U-Pick" Farm, New Egypt, NJ

TABLE A-1(Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLING LOCATIONS

Sample Medium	Station Code	Distance (miles)	Azimuth (degrees)	Description
WWA	37	2.2	19	NNE of Site, off Boox Road at Lacey MUA Pumping Station, Forked River, NJ
WWA	38	1.6	193	SSW of Site, on Route 532, at Ocean Township MUA Pumping Station, Waretown, NJ
TLD	51	0.4	358	N of site, on the access road to Forked River site, Forked River, NJ
TLD	52	0.4	340	NNW of site, on the access road to Forked River site, Forked River, NJ
TLD	53	0.3	310	NW of site, at sewage lift station on the access road to the Forked River site, Forked River, NJ
TLD	54	0.3	294	WNW of site, on the access road to Forked River site, Forked River, NJ
TLD	55	0.3	265	W of site, on Southern Area Stores security fence, west of OCNGS Switchyard, Forked River, NJ
TLD	56	0.3	250	WSW of site, on utility pole east of Southern Area Stores, west of the OCNGS Switchyard, Forked River, NJ
TLD	57	0.2	203	SSW of site, on Southern Area Stores access road, Forked River, NJ
TLD	58	0.4	180	S of site, on Southern Area Stores access road, Forked River, NJ
TLD	59	0.3	163	SSE of site, on Southern Area Stores access road, Waretown, NJ
TLD	61	0.3	116	ESE of site, on Route 9 south of OCNGS Main Entrance, Forked River, NJ
TLD	62	0.2	99	E of site, on Route 9 at access road to OCNGS Main Gate, Forked River, NJ
TLD	63	0.2	70	ENE of site, on Route 9 at access road to OCNGS North Gate, Forked River, NJ
TLD	64	0.3	48	NE of site, on Route 9 north of OCNGS North Gate access road, Forked River, NJ
TLD	65	0.4	22	NNE of site, on Route 9 at Intake Canal Bridge, Forked River, NJ

TABLE A-1(Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLING LOCATIONS

Sample Medium	Station Code	Distance (miles)	Azimuth (degrees)	Description
APT, AIO, TLD, VEG	66	0.5	127	SE of site, east of Route 9 and south of the Discharge Canal, Waretown, NJ
TLD	68	1.2	271	W of site, on Garden State Parkway at mile marker 71.7
APT, AIO, TLD	71	1.7	165	SSE of site, on Route 532 at the Waretown Municipal Building, Waretown, NJ
APT, AIO, TLD	72	1.9	26	NNE of site, on Lacey Road at Knights of Columbus Hall, Forked River, NJ
APT, AIO, TLD	73	1.8	111	ESE of site, on Bay Parkway, Sands Point Harbor, Waretown, NJ
TLD	74	2.0	90	E of site, Orlando Drive and Penguin Court, Forked River, NJ
TLD	75	2.0	69	ENE of site, Beach Blvd. and Maui Drive, Forked River, NJ
TLD	78	1.8	2	N of site, 1514 Arient Road, Forked River, NJ
TLD	79	2.9	162	SSE of site, Hightide Drive and Bonita Drive, Waretown, NJ
TLD	81	4.6	192	SSW of site, east of Route 9 at Brook and School Streets, Barnegat, NJ
TLD	82	4.4	38	NE of site, Bay Way and Clairmore Avenue, Lanoka Harbor, NJ
TLD	84	4.8	339	NNW of site, on Lacey Road, 1.3 miles west of the Garden State Parkway on siren pole, Forked River, NJ
TLD	85	3.8	254	WSW of site, on Route 532, just east of Wells Mills Park, Waretown, NJ
TLD	86	4.8	226	SW of site, on Route 554, 1 mile west of the Garden State Parkway, Barnegat, NJ
TLD	88	6.6	127	SE of site, eastern end of 3rd Street, Barnegat Light, NJ
TLD	89	6.2	110	ESE of site, Job Francis residence, Island Beach State Park
TLD	90	6.6	74	ENE of site, parking lot A-5, Island Beach State Park

TABLE A-1(Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLING LOCATIONS

Sample Medium	Station Code	Distance (miles)	Azimuth (degrees)	Description
TLD	92	9.2	48	NE of site, at Guard Shack/Toll Booth, Island Beach State Park
FISH	93	0.1 to 0.3	128 to 250	SE to WSW of site, OCNGS Discharge Canal between Pump Discharges and Route 9, Forked River, NJ
SWA, AQS, CLAM, FISH	94	21.8	201	SSW of site, in Great Bay/Little Egg Harbor
TLD	98	1.3	297	WNW of site, on Garden State Parkway at mile marker 72.3
TLD	99	1.5	318	NW of site, on Garden State Parkway at mile marker 72.8
TLD	T1	0.3	227	SW of site, at OCNGS Fire Pond, Forked River, NJ

SAMPLE MEDIUM IDENTIFICATION KEY

APT	=	Air Particulate	SWA	=	Surface Water	TLD	=	Thermoluminescent Dosimeter
AIO	=	Air Iodine	AQS	=	Aquatic Sediment	FISH	=	Fish
WWA	=	Well Water	CLAM	=	Clams	CRAB	=	Crab
VEG	=	Vegetables						

TABLE A-2

SYNOPSIS OF THE OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM FOR THE OYSTER CREEK NUCLEAR GENERATING STATION 1998 (1)

SAMPLE TYPE	NUMBER OF SAMPLING LOCATIONS	COLLECTION FREQUENCY	NUMBER OF SAMPLES COLLECTED	TYPE OF ANALYSIS	ANALYSIS FREQUENCY	NUMBER OF SAMPLES ANALYZED (2)
Air Particulate	7	Bi-weekly	183	Gross Beta Gamma	Bi-weekly Quarterly composite	183(3) 28
Air Iodine	7	Weekly	364	I-131	Weekly	364
Well Water	3	Quarterly	12	Gamma H-3	Quarterly Quarterly	12 12
Surface Water	4	2 locations-Monthly 4 locations – Semi-Annually	28	Gamma H-3	Monthly (2 Stations) Semiannually (4 Stations)	28 28
Clam	3	Semiannually	6	Gamma	Semiannually	6
Sediment	4	Semiannually	8	Gamma	Semiannually	8
Vegetables	2	Monthly(4)	18	Gamma	Monthly(4)	18
Fish	3	Semiannually	18	Gamma	Semiannually	18
Crab	1	Annually	1	Gamma	Annually	1
TLD-Teledyne Brown Engineering	4	Quarterly	16	Immersion Dose	Quarterly	16
TLD-Panasonic	44	Quarterly	170	Immersion Dose	Quarterly	170

(1) This table does not include Quality Assurance (QA) samples.

(2) The number of samples analyzed does not include duplicate analyses, recounts, or reanalyses.

(3) See Table A-3.

(4) Collected during harvest season only.

TABLE A-3

1998 SAMPLING AND ANALYSIS EXCEPTIONS

During 1998, 638 samples were collected from aquatic, atmospheric, and terrestrial environments around the OCNGS. This is far more than the minimum number of samples required by the Offsite Dose Calculation Manual (ODCM) Specifications. There were sampling and analysis exceptions that occurred in 1998 that resulted in minor deviations from the requirements of the ODCM. These deviations did not compromise GPUN's ability to assess the impact of the OCNGS on public health or the environment because the scope of the monitoring program exceeds the ODCM requirements. The circumstances surrounding these events are described below.

On September 3, 1998, Instrument and Control Technicians were calibrating the air sampler at Station 66. Because there was a higher than usual loading on the particulate filter, the technicians replaced the particulate filter. Because of this, two filters were used to collect the sample during the two week collection period, as opposed to a single filter being used. Both filters were analyzed separately and the activity detected on each filter was within the normal range.

During the year, 170 out of a possible 176 Panasonic TLDs were collected and analyzed. Six TLD's, which were lost due to vandalism, are listed below:

STATION LOCATION	COLLECTION DATE	ODCM REQUIRED STATION
75	16 Apr 98	NO
6	22 Jul 98	YES
85	14 Oct 98	YES
6	14 Oct 98	YES
68	15 Oct 98	YES
51	13 Jan 99	YES

APPENDIX B

1998 Lower Limits of Detection (LLD) Exceptions

1998 LOWER LIMITS OF DETECTION (LLD) EXCEPTIONS

During 1998, there were no Lower Limit of Detection (LLD) violations on any analyzed REMP sample.

APPENDIX C

Changes to the REMP During 1998

Table C-1

Changes to the REMP during 1998

January, 1998	The background TLD station at Allenhurst, NJ (Station A) was eliminated and reestablished in Lakewood, NJ (Station 14). Station 14 is located 21.7 miles from OCNGS at an azimuth of 1 degree. The Lakewood station is in a more practical location in regard to the TLD replacement tour.
May, 1998	A vegetable garden was reestablished at Station 66. The vegetable garden at this location had been eliminated in 1997 in lieu of collecting broadleaf vegetation from this location. This change allows for easier and quicker access to broadleaf vegetation.

APPENDIX D

Radionuclide Concentrations

in 1998 Environmental Samples

TABLE D-1
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY 1998 THROUGH DECEMBER 1998
ANNUAL SUMMARY

THE FOLLOWING PAGES ARE A SUMMARY OF REMP DATA FOR THE SCHEDULED COLLECTION PERIOD JANUARY, 1998 THROUGH DECEMBER, 1998. DATA* ARE SUMMARIZED ON AN ANNUAL BASIS, WHERE:

SAMPLE TYPE: Media being analyzed

ANALYSIS: Type of analysis being performed on the particular media

 # OF ANALYSES PERFORMED: The total number of analyses performed for a particular sample type

LLD: The mean lower limit of detection. Note that this value is based on samples whose results showed no detectable activity

INDICATOR STATIONS: The mean, minimum, and maximum radioactive concentrations detected at all indicator stations

HIGHEST ANNUAL MEAN: The mean, minimum, and maximum radioactive concentrations detected at the station with the highest annual mean concentration

STATION: The station designation with the highest annual mean concentration

BACKGROUND STATION: The mean, minimum, and maximum radioactive concentrations detected at all background stations

(N/TOT): The fraction of detectable concentrations versus the total number of analyses performed

* An asterisk (*) indicates no data

BACKGROUND STATIONS AT OCNGS

STATION(S):	C	94	37	36
SAMPLE TYPE(S):	AIR PARTICULATE AIR IODINE	SURFACE WATER CLAMS SEDIMENT FISH	WELL WATER	VEGETABLES

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
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SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL PERF.	LLD	INDICATOR STATIONS MIN	INDICATOR STATIONS MEAN	INDICATOR STATIONS MAX	INDICATOR STATIONS (N/TOT)	HIGHEST ANNUAL MEAN MIN	HIGHEST ANNUAL MEAN MEAN	HIGHEST ANNUAL MEAN MAX Station-#	HIGHEST ANNUAL MEAN (N/TOT)	BACKGROUND STATIONS MIN	BACKGROUND STATIONS MEAN	BACKGROUND STATIONS MAX	BACKGROUND STATIONS (N/TOT)
AIR PARTICULATE (pCi/m3)	Gross Beta		183	No LLD Reported	6.20E-03	1.42E-02	2.40E-02	(157/157)	7.70E-03	1.52E-02	2.30E-02 Station-#	(26/26) 20	8.60E-03	1.51E-02	2.30E-02	(26/26)
AIR PARTICULATE (pCi/m3)	Gamma Scan	Ag-110m	28	6.11E-04	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	Ba-140	28	5.75E-03	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	Be-7	28	No LLD Reported	4.60E-02	6.63E-02	8.60E-02	(24/24)	5.70E-02	7.15E-02	8.60E-02 Station-#	(4/4) 20	5.50E-02	6.93E-02	8.00E-02	(4/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	Co-58	28	8.00E-04	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	Co-60	28	8.68E-04	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	Cs-134	28	6.57E-04	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	Cs-137	28	7.00E-04	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	Fe-59	28	1.98E-04	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	I-131	28	2.72E-03	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	K-40	28	1.17E-02	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
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SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS MIN	MEAN	MAX	(N/TOT)	HIGHEST ANNUAL MEAN MIN	MEAN	MAX Station #	(N/TOT)	BACKGROUND STATIONS MIN	MEAN	MAX	(N/TOT)
AIR PARTICULATE (pCi/m3)	Gamma Scan	La-140	28	2.71E-03	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	Mn-54	28	7.36E-04	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	Nb-95	28	1.11E-03	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	Ra-226	28	1.09E-02	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	Sb-125	28	2.16E-03	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	Th-232	28	2.73E-03	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	U-235	28	2.66E-03	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	Zn-65	28	1.79E-03	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR PARTICULATE (pCi/m3)	Gamma Scan	Zr-95	28	1.38E-03	<LLD	<LLD	<LLD	(0/24)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
AIR IODINE (pCi/m3)	Iodine-131	I-131	364	1.78E-02	<LLD	<LLD	<LLD	(0/312)	<LLD	<LLD	<LLD	(0/52)	<LLD	<LLD	<LLD	(0/52)
SURFACE WATER (pCi/L)	Tritium	H-3	28	1.31E+02	1.60E+02	1.60E+02	1.60E+02	(1/16)	1.60E+02	1.60E+02	1.60E+02 Station #	(1/12) 33	<LLD	<LLD	<LLD	(0/12)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
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SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS				HIGHEST ANNUAL MEAN				BACKGROUND STATIONS			
					MIN	MEAN	MAX	(N/TOT)	MIN	MEAN	MAX Station-#	(N/TOT)	MIN	MEAN	MAX	(N/TOT)
SURFACE WATER (pCi/L)	Gamma Scan	Ag-110m	28	2.29E+00	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
SURFACE WATER (pCi/L)	Gamma Scan	Ba-140	28	1.30E+01	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
SURFACE WATER (pCi/L)	Gamma Scan	Be-7	28	1.99E+01	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
SURFACE WATER (pCi/L)	Gamma Scan	Co-58	28	2.45E+00	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
SURFACE WATER (pCi/L)	Gamma Scan	Co-60	28	2.64E+00	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
SURFACE WATER (pCi/L)	Gamma Scan	Cs-134	28	2.11E+00	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
SURFACE WATER (pCi/L)	Gamma Scan	Cs-137	28	2.43E+00	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
SURFACE WATER (pCi/L)	Gamma Scan	Fe-59	28	5.82E+00	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
SURFACE WATER (pCi/L)	Gamma Scan	I-131	28	5.25E+00	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
SURFACE WATER (pCi/L)	Gamma Scan	K-40	28	5.00E+01	1.80E+02	2.41E+02	3.30E+02	(15/16)	2.10E+02	2.70E+02	3.30E+02 Station-# 23	(2/2)	2.10E+02	2.89E+02	3.30E+02	(12/12)
SURFACE WATER (pCi/L)	Gamma Scan	La-140	28	5.24E+00	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
SURFACE WATER (pCi/L)	Gamma Scan	Mn-54	28	2.51E+00	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
SURFACE WATER (pCi/L)	Gamma Scan	Nb-95	28	2.79E+00	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
SURFACE WATER (pCi/L)	Gamma Scan	Ra-226	28	5.25E+01	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)

TABLE D-1 (Cont.)
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SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS MIN	INDICATOR STATIONS MEAN	INDICATOR STATIONS MAX	INDICATOR STATIONS (N/TOT)	HIGHEST ANNUAL MEAN MIN	HIGHEST ANNUAL MEAN MEAN	HIGHEST ANNUAL MEAN MAX Station-#	HIGHEST ANNUAL MEAN (N/TOT)	BACKGROUND STATIONS MIN	BACKGROUND STATIONS MEAN	BACKGROUND STATIONS MAX	BACKGROUND STATIONS (N/TOT)
SURFACE WATER (pCi/L)	Gamma Scan	Sb-125	28	7.79E+00	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
SURFACE WATER (pCi/L)	Gamma Scan	Th-232	28	9.36E+00	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
SURFACE WATER (pCi/L)	Gamma Scan	U-235	28	1.41E+01	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
SURFACE WATER (pCi/L)	Gamma Scan	Zn-65	28	5.50E+00	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
SURFACE WATER (pCi/L)	Gamma Scan	Zr-95	28	4.32E+00	<LLD	<LLD	<LLD	(0/16)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/12)
WELL WATER (pCi/L)	Tritium	H-3	12	1.33E+02	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	Ag-110m	12	2.17E+00	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	Ba-140	12	1.91E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	Be-7	12	1.89E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	Co-58	12	2.20E+00	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	Co-60	12	2.44E+00	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	Cs-134	12	2.17E+00	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	Cs-137	12	2.23E+00	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	Fe-59	12	5.17E+00	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)

TABLE D-1 (Cont.)
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SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS MIN	MEAN	MAX	(N/TOT)	HIGHEST ANNUAL MEAN MIN	MEAN	MAX Station-#	(N/TOT)	BACKGROUND STATIONS MIN	MEAN	MAX	(N/TOT)
WELL WATER (pCi/L)	Gamma Scan	I-131	12	4.17E+00	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	K-40	12	2.97E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	La-140	12	4.50E+00	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	Mn-54	12	2.18E+00	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	Nb-95	12	2.68E+00	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	Ra-226	12	5.08E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	Sb-125	12	7.42E+00	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	Th-232	12	8.67E+00	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	U-235	12	1.34E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	Zn-65	12	4.83E+00	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
WELL WATER (pCi/L)	Gamma Scan	Zr-95	12	3.92E+00	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
CABBAGE (pCi/kg(WET))	Gamma Scan	Ag-110m	6	1.30E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CABBAGE (pCi/kg(WET))	Gamma Scan	Ba-140	6	6.67E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CABBAGE (pCi/kg(WET))	Gamma Scan	Be-7	6	1.18E+02	1.30E+02	1.50E+02	1.70E+02	(2/4)	1.30E+02	1.50E+02	1.70E+02 Station-# 66	(2/2)	<LLD	<LLD	<LLD	(0/2)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
ANNUAL SUMMARY

SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS				HIGHEST ANNUAL MEAN				BACKGROUND STATIONS			
					MIN	MEAN	MAX	(N/TOT)	MIN	MEAN	MAX Station-#	(N/TOT)	MIN	MEAN	MAX	(N/TOT)
CABBAGE (pCi/kg(WET))	Gamma Scan	Co-58	6	1.57E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CABBAGE (pCi/kg(WET))	Gamma Scan	Co-60	6	1.53E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CABBAGE (pCi/kg(WET))	Gamma Scan	Cs-134	6	1.28E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CABBAGE (pCi/kg(WET))	Gamma Scan	Cs-137	6	1.65E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CABBAGE (pCi/kg(WET))	Gamma Scan	Fe-59	6	3.67E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CABBAGE (pCi/kg(WET))	Gamma Scan	I-131	6	2.47E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CABBAGE (pCi/kg(WET))	Gamma Scan	K-40	6	No LLD Reported	2.00E+03	2.90E+03	3.30E+03	(4/4)	3.10E+03	3.20E+03	3.30E+03 Station-#	(2/2) 66	2.20E+03	2.35E+03	2.50E+03	(2/2)
CABBAGE (pCi/kg(WET))	Gamma Scan	La-140	6	2.93E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CABBAGE (pCi/kg(WET))	Gamma Scan	Mn-54	6	1.62E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CABBAGE (pCi/kg(WET))	Gamma Scan	Nb-95	6	1.62E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CABBAGE (pCi/kg(WET))	Gamma Scan	Ra-226	6	2.83E+02	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CABBAGE (pCi/kg(WET))	Gamma Scan	Sb-125	6	4.50E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CABBAGE (pCi/kg(WET))	Gamma Scan	Th-232	6	5.50E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CABBAGE (pCi/kg(WET))	Gamma Scan	U-235	6	6.83E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
ANNUAL SUMMARY

SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS MIN	INDICATOR STATIONS MEAN	INDICATOR STATIONS MAX	INDICATOR STATIONS (N/TOT)	HIGHEST ANNUAL MEAN MIN	HIGHEST ANNUAL MEAN MEAN	HIGHEST ANNUAL MEAN MAX Station-#	HIGHEST ANNUAL MEAN (N/TOT)	BACKGROUND STATIONS MIN	BACKGROUND STATIONS MEAN	BACKGROUND STATIONS MAX	BACKGROUND STATIONS (N/TOT)
CABBAGE (pCi/kg(WET))	Gamma Scan	Zn-65	6	3.67E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CABBAGE (pCi/kg(WET))	Gamma Scan	Zr-95	6	2.48E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
COLLARD (pCi/kg(WET))	Gamma Scan	Ag-110m	12	1.11E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
COLLARD (pCi/kg(WET))	Gamma Scan	Ba-140	12	7.08E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
COLLARD (pCi/kg(WET))	Gamma Scan	Be-7	12	1.11E+02	1.80E+02	1.80E+02	1.80E+02	(3/8)	1.80E+02	1.80E+02	1.80E+02 Station-# 35	(1/1)	<LLD	<LLD	<LLD	(0/4)
COLLARD (pCi/kg(WET))	Gamma Scan	Co-58	12	1.34E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
COLLARD (pCi/kg(WET))	Gamma Scan	Co-60	12	1.41E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
COLLARD (pCi/kg(WET))	Gamma Scan	Cs-134	12	1.12E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
COLLARD (pCi/kg(WET))	Gamma Scan	Cs-137	12	1.34E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
COLLARD (pCi/kg(WET))	Gamma Scan	Fe-59	12	3.41E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
COLLARD (pCi/kg(WET))	Gamma Scan	I-131	12	3.09E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
COLLARD (pCi/kg(WET))	Gamma Scan	K-40	12	No LLD Reported	2.60E+03	3.06E+03	3.80E+03	(8/8)	3.20E+03	3.45E+03	3.80E+03 Station-# 66	(4/4)	3.00E+03	4.48E+03	5.60E+03	(4/4)
COLLARD (pCi/kg(WET))	Gamma Scan	La-140	12	2.43E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
COLLARD (pCi/kg(WET))	Gamma Scan	Mn-54	12	1.33E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
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SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS MIN	MEAN	MAX	(N/TOT)	HIGHEST ANNUAL MEAN MIN	MEAN	MAX Station-#	(N/TOT)	BACKGROUND STATIONS MIN	MEAN	MAX	(N/TOT)
COLLARD (pCi/kg(WET))	Gamma Scan	Nb-95	12	1.51E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
COLLARD (pCi/kg(WET))	Gamma Scan	Ra-226	12	2.34E+02	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
COLLARD (pCi/kg(WET))	Gamma Scan	Sb-125	12	3.83E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
COLLARD (pCi/kg(WET))	Gamma Scan	Th-232	12	4.92E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
COLLARD (pCi/kg(WET))	Gamma Scan	U-235	12	6.08E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
COLLARD (pCi/kg(WET))	Gamma Scan	Zn-65	12	3.25E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
COLLARD (pCi/kg(WET))	Gamma Scan	Zr-95	12	2.24E+01	<LLD	<LLD	<LLD	(0/8)	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/4)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	Ag-110m	1	3.00E+00	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	Ba-140	1	5.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	Be-7	1	4.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	Co-58	1	4.00E+00	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	Co-60	1	4.00E+00	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	Cs-134	1	4.00E+00	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	Cs-137	1	4.00E+00	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
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SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS MIN	MEAN	MAX	(N/TOT)	HIGHEST ANNUAL MEAN MIN	MEAN	MAX Station-#	(N/TOT)	BACKGROUND STATIONS MIN	MEAN	MAX	(N/TOT)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	Fe-59	1	1.10E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	I-131	1	4.00E+00	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	K-40	1	No LLD Reported	2.00E+03	2.00E+03	2.00E+03	(1/1)	2.00E+03	2.00E+03	2.00E+03 Station-#	(1/1) 93	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	La-140	1	1.90E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	Mn-54	1	4.00E+00	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	Nb-95	1	7.00E+00	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	Ra-226	1	8.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	Sb-125	1	1.20E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	Th-232	1	No LLD Reported	6.50E+01	6.50E+01	6.50E+01	(1/1)	6.50E+01	6.50E+01	6.50E+01 Station-#	(1/1) 93	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	U-235	1	9.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	Zn-65	1	9.00E+00	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLUE CRAB (pCi/kg(WET))	Gamma Scan	Zr-95	1	8.00E+00	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	Ag-110m	3	1.77E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	Ba-140	3	1.23E+02	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
ANNUAL SUMMARY

SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS MIN	MEAN	MAX	(N/TOT)	HIGHEST ANNUAL MEAN MIN	MEAN	MAX Station-#	(N/TOT)	BACKGROUND STATIONS MIN	MEAN	MAX	(N/TOT)
BLUEFISH (pCi/kg(WET))	Gamma Scan	Be-7	3	1.80E+02	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	Co-58	3	2.40E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	Co-60	3	2.43E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	Cs-134	3	2.20E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	Cs-137	3	2.43E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	Fe-59	3	5.33E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	I-131	3	5.00E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	K-40	3	No LLD Reported	3.20E+03	3.27E+03	3.40E+03	(3/3)	3.20E+03	3.27E+03	3.40E+03 Station-# 93	(3/3)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	La-140	3	4.00E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	Mn-54	3	1.90E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	Nb-95	3	3.23E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	Ra-226	3	5.00E+02	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	Sb-125	3	7.67E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	Th-232	3	7.33E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
ANNUAL SUMMARY

SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS MIN	MEAN	MAX	(N/TOT)	HIGHEST ANNUAL MEAN MIN	MEAN	MAX Station-#	(N/TOT)	BACKGROUND STATIONS MIN	MEAN	MAX	(N/TOT)
BLUEFISH (pCi/kg(WET))	Gamma Scan	U-235	3	1.13E+02	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	Zn-65	3	5.67E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)
BLUEFISH (pCi/kg(WET))	Gamma Scan	Zr-95	3	3.67E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/3)	*	*	*	(*/*)
CLAMS (pCi/kg(WET))	Gamma Scan	Ag-110m	6	1.25E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CLAMS (pCi/kg(WET))	Gamma Scan	Ba-140	6	1.00E+02	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CLAMS (pCi/kg(WET))	Gamma Scan	Be-7	6	1.23E+02	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CLAMS (pCi/kg(WET))	Gamma Scan	Co-58	6	1.55E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CLAMS (pCi/kg(WET))	Gamma Scan	Co-60	6	1.78E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CLAMS (pCi/kg(WET))	Gamma Scan	Cs-134	6	1.25E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CLAMS (pCi/kg(WET))	Gamma Scan	Cs-137	6	1.30E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CLAMS (pCi/kg(WET))	Gamma Scan	Fe-59	6	3.83E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CLAMS (pCi/kg(WET))	Gamma Scan	I-131	6	5.00E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CLAMS (pCi/kg(WET))	Gamma Scan	K-40	6	No LLD Reported	1.40E+03	1.45E+03	1.50E+03	(4/4)	1.50E+03	1.50E+03	1.50E+03 Station-# 24	(2/2)	1.00E+03	1.20E+03	1.40E+03	(2/2)
CLAMS (pCi/kg(WET))	Gamma Scan	La-140	6	3.67E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
ANNUAL SUMMARY

SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS				HIGHEST ANNUAL MEAN				BACKGROUND STATIONS			
					MIN	MEAN	MAX	(N/TOT)	MIN	MEAN	MAX Station-#	(N/TOT)	MIN	MEAN	MAX	(N/TOT)
CLAMS (pCi/kg(WET))	Gamma Scan	Mn-54	6	1.35E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CLAMS (pCi/kg(WET))	Gamma Scan	Nb-95	6	1.75E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CLAMS (pCi/kg(WET))	Gamma Scan	Ra-226	6	2.82E+02	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CLAMS (pCi/kg(WET))	Gamma Scan	Sb-125	6	4.50E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CLAMS (pCi/kg(WET))	Gamma Scan	Th-232	6	6.00E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CLAMS (pCi/kg(WET))	Gamma Scan	U-235	6	6.67E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CLAMS (pCi/kg(WET))	Gamma Scan	Zn-65	6	3.50E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
CLAMS (pCi/kg(WET))	Gamma Scan	Zr-95	6	2.67E+01	<LLD	<LLD	<LLD	(0/4)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	Ag-110m	3	1.70E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	Ba-140	3	1.27E+02	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	Be-7	3	1.50E+02	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	Co-58	3	2.33E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	Co-60	3	2.33E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	Cs-134	3	1.57E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
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SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS				HIGHEST ANNUAL MEAN				BACKGROUND STATIONS			
					MIN	MEAN	MAX	(N/TOT)	MIN	MEAN	MAX Station-#	(N/TOT)	MIN	MEAN	MAX	(N/TOT)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	Cs-137	3	2.13E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	Fe-59	3	5.33E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	I-131	3	5.20E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	K-40	3	No LLD Reported	4.00E+03	4.07E+03	4.20E+03	(3/3)	4.00E+03	4.10E+03	4.20E+03 Station-# 93	(2/2)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	La-140	3	5.53E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	Mn-54	3	1.97E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	Nb-95	3	2.37E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	Ra-226	3	3.30E+02	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	Sb-125	3	5.67E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	Th-232	3	7.33E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	U-235	3	9.00E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	Zn-65	3	5.00E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
STRIPED BASS (pCi/kg(WET))	Gamma Scan	Zr-95	3	3.33E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	Ag-110m	1	7.00E+00	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
ANNUAL SUMMARY

SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS MIN	MEAN	MAX	(N/TOT)	HIGHEST ANNUAL MEAN MIN	MEAN	MAX Station-#	(N/TOT)	BACKGROUND STATIONS MIN	MEAN	MAX	(N/TOT)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	Ba-140	1	4.00E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	Be-7	1	6.00E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	Co-58	1	7.00E+00	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	Co-60	1	1.00E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	Cs-134	1	7.00E+00	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	Cs-137	1	7.00E+00	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	Fe-59	1	2.00E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	I-131	1	1.80E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	K-40	1	No LLD Reported	*	*	*	(*/*)	*	*	*	(*/*)	4.40E+03	4.40E+03	4.40E+03	(1/1)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	La-140	1	1.30E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	Mn-54	1	7.00E+00	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
ANNUAL SUMMARY

SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS MIN	MEAN	MAX	(N/TOT)	HIGHEST ANNUAL MEAN MIN	MEAN	MAX Station-#	(N/TOT)	BACKGROUND STATIONS MIN	MEAN	MAX	(N/TOT)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	Nb-95	1	9.00E+00	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	Ra-226	1	1.50E+02	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	Sb-125	1	2.00E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	Th-232	1	3.00E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	U-235	1	5.00E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	Zn-65	1	2.00E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
SUMMER FLOUNDER (pCi/kg(WET))	Gamma Scan	Zr-95	1	1.60E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
TAUTOG (pCi/kg(WET))	Gamma Scan	Ag-110m	2	1.60E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	Ba-140	2	9.00E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	Be-7	2	1.35E+02	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	Co-58	2	1.80E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	Co-60	2	2.00E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
ANNUAL SUMMARY

SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS MIN	MEAN	MAX	(N/TOT)	HIGHEST ANNUAL MEAN MIN	MEAN	MAX Station-#	(N/TOT)	BACKGROUND STATIONS MIN	MEAN	MAX	(N/TOT)
TAUTOG (pCi/kg(WET))	Gamma Scan	Cs-134	2	1.75E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	Cs-137	2	1.80E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	Fe-59	2	5.00E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	I-131	2	3.40E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	K-40	2	No LLD Reported	4.70E+03	5.20E+03	5.70E+03	(2/2)	4.70E+03	5.20E+03	5.70E+03 Station-# 93	(2/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	La-140	2	3.00E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	Mn-54	2	1.65E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	Nb-95	2	2.00E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	Ra-226	2	4.00E+02	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	Sb-125	2	5.50E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	Th-232	2	6.50E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	U-235	2	9.00E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	Zn-65	2	4.50E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
TAUTOG (pCi/kg(WET))	Gamma Scan	Zr-95	2	3.00E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
ANNUAL SUMMARY

SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS MIN	MEAN	MAX	(N/TOT)	HIGHEST ANNUAL MEAN MIN	MEAN	MAX Station-#	(N/TOT)	BACKGROUND STATIONS MIN	MEAN	MAX	(N/TOT)
WEAKFISH (pCi/kg(WET))	Gamma Scan	Ag-110m	1	1.40E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	Ba-140	1	1.00E+02	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	Be-7	1	1.10E+02	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	Co-58	1	1.60E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	Co-60	1	1.70E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	Cs-134	1	1.30E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	Cs-137	1	1.60E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	Fe-59	1	4.00E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	I-131	1	3.00E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	K-40	1	No LLD Reported	*	*	*	(*/*)	*	*	*	(*/*)	4.10E+03	4.10E+03	4.10E+03	(1/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	La-140	1	4.00E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	Mn-54	1	1.40E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	Nb-95	1	1.70E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	Ra-226	1	2.00E+02	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
ANNUAL SUMMARY

SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS				HIGHEST ANNUAL MEAN				BACKGROUND STATIONS			
					MIN	MEAN	MAX	(N/TOT)	MIN	MEAN	MAX Station-#	(N/TOT)	MIN	MEAN	MAX	(N/TOT)
WEAKFISH (pCi/kg(WET))	Gamma Scan	Sb-125	1	4.00E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	Ra-226	1	2.00E+02	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	Th-232	1	6.00E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	U-235	1	6.00E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	Zn-65	1	4.00E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WEAKFISH (pCi/kg(WET))	Gamma Scan	Zr-95	1	3.00E+01	*	*	*	(*/*)	*	*	*	(*/*)	<LLD	<LLD	<LLD	(0/1)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	Ag-110m	3	1.60E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	Ba-140	3	1.17E+02	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	Be-7	3	1.40E+02	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	Co-58	3	1.90E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	Co-60	3	2.00E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	Cs-134	3	1.70E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
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SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS MIN	MEAN	MAX	(N/TOT)	HIGHEST ANNUAL MEAN MIN	MEAN	MAX Station-#	(N/TOT)	BACKGROUND STATIONS MIN	MEAN	MAX	(N/TOT)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	Cs-137	3	1.90E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	Fe-59	3	5.00E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	I-131	3	4.67E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	K-40	3	No LLD Reported	3.80E+03	4.20E+03	4.80E+03	(3/3)	4.80E+03	4.80E+03	4.80E+03 Station-# 93	(1/1)	*	*	*	(*/*)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	La-140	3	4.00E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	Mn-54	3	1.90E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	Nb-95	3	2.33E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	Ra-226	3	3.00E+02	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	Sb-125	3	5.33E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	Th-232	3	7.67E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	U-235	3	7.67E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
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SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS				HIGHEST ANNUAL MEAN				BACKGROUND STATIONS			
					MIN	MEAN	MAX	(N/TOT)	MIN	MEAN	MAX Station-#	(N/TOT)	MIN	MEAN	MAX	(N/TOT)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	Zn-65	3	4.67E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
WINTER FLOUNDER (pCi/kg(WET))	Gamma Scan	Zr-95	3	3.67E+01	<LLD	<LLD	<LLD	(0/3)	<LLD	<LLD	<LLD	(0/2)	*	*	*	(*/*)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	Ag-110m	3	2.23E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	Ba-140	3	9.67E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	Be-7	3	1.73E+02	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	Co-58	3	2.27E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	Co-60	3	2.43E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	Cs-134	3	1.97E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	Cs-137	3	2.43E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	Fe-59	3	5.00E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	I-131	3	2.93E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	K-40	3	No LLD Reported	3.80E+03	5.15E+03	6.50E+03	(2/2)	3.80E+03	5.15E+03	6.50E+03 Station-# 33	(2/2)	3.30E+03	3.30E+03	3.30E+03	(1/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	La-140	3	3.53E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	Mn-54	3	2.27E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)

TABLE D-1 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

OYSTER CREEK NUCLEAR GENERATING STATION

JANUARY, 1998 THROUGH DECEMBER, 1998

ANNUAL SUMMARY

SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS MIN	INDICATOR STATIONS MEAN	INDICATOR STATIONS MAX	INDICATOR STATIONS (N/TOT)	HIGHEST ANNUAL MEAN MIN	HIGHEST ANNUAL MEAN MEAN	HIGHEST ANNUAL MEAN MAX Station-#	HIGHEST ANNUAL MEAN (N/TOT)	BACKGROUND STATIONS MIN	BACKGROUND STATIONS MEAN	BACKGROUND STATIONS MAX	BACKGROUND STATIONS (N/TOT)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	Nb-95	3	2.77E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	Ra-226	3	4.67E+02	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	Sb-125	3	8.00E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	Th-232	3	9.33E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	U-235	3	1.20E+02	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	Zn-65	3	5.33E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
WHITE PERCH (pCi/kg(WET))	Gamma Scan	Zr-95	3	3.93E+01	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/1)
BLOWFISH (pCi/kg(WET))	Gamma Scan	Ag-110m	1	1.60E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLOWFISH (pCi/kg(WET))	Gamma Scan	Ba-140	1	1.20E+02	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLOWFISH (pCi/kg(WET))	Gamma Scan	Be-7	1	1.40E+02	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLOWFISH (pCi/kg(WET))	Gamma Scan	Co-58	1	2.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLOWFISH (pCi/kg(WET))	Gamma Scan	Co-60	1	2.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLOWFISH (pCi/kg(WET))	Gamma Scan	Cs-134	1	1.50E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLOWFISH (pCi/kg(WET))	Gamma Scan	Cs-137	1	1.90E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)

Figure I-1
Locations of On-Site Wells

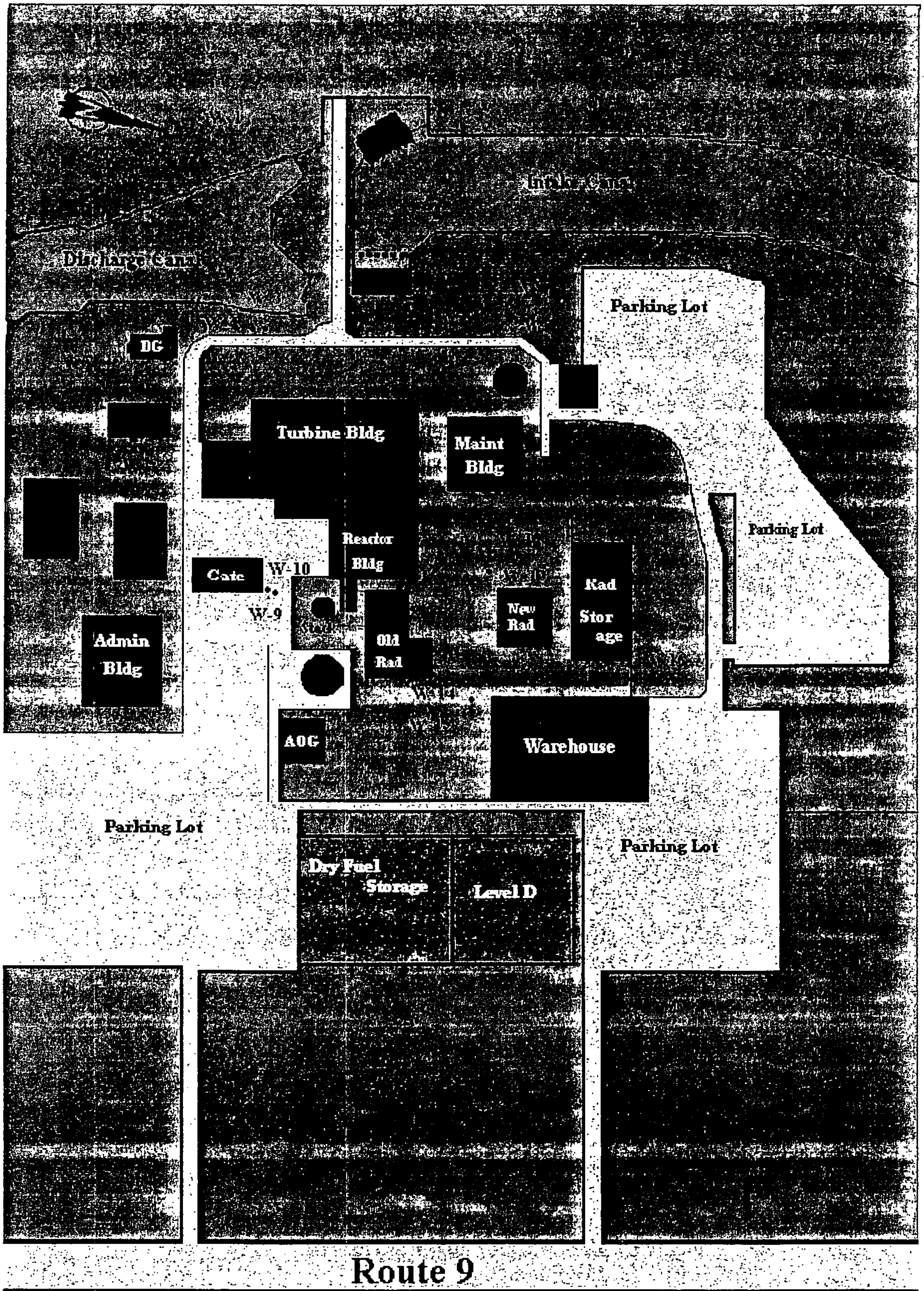

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
ANNUAL SUMMARY

SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS MIN	MEAN	MAX	(N/TOT)	HIGHEST ANNUAL MEAN MIN	MEAN	MAX Station-#	(N/TOT)	BACKGROUND STATIONS MIN	MEAN	MAX	(N/TOT)
BLOWFISH (pCi/kg(WET))	Gamma Scan	Fe-59	1	4.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	
BLOWFISH (pCi/kg(WET))	Gamma Scan	I-131	1	5.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLOWFISH (pCi/kg(WET))	Gamma Scan	K-40	1	No LLD Reported	3.60E+03	3.60E+03	3.60E+03	(1/1)	3.60E+03	3.60E+03	3.60E+03 Station-#	(1/1) 93	*	*	*	(*/*)
BLOWFISH (pCi/kg(WET))	Gamma Scan	La-140	1	3.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLOWFISH (pCi/kg(WET))	Gamma Scan	Mn-54	1	2.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLOWFISH (pCi/kg(WET))	Gamma Scan	Nb-95	1	2.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLOWFISH (pCi/kg(WET))	Gamma Scan	Ra-226	1	3.00E+02	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLOWFISH (pCi/kg(WET))	Gamma Scan	Sb-125	1	6.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLOWFISH (pCi/kg(WET))	Gamma Scan	Th-232	1	7.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLOWFISH (pCi/kg(WET))	Gamma Scan	U-235	1	8.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLOWFISH (pCi/kg(WET))	Gamma Scan	Zn-65	1	5.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
BLOWFISH (pCi/kg(WET))	Gamma Scan	Zr-95	1	3.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	Ag-110m	1	2.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	Ba-140	1	1.40E+02	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
ANNUAL SUMMARY

SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS MIN	INDICATOR STATIONS MEAN	INDICATOR STATIONS MAX	INDICATOR STATIONS (N/TOT)	HIGHEST ANNUAL MEAN MIN	HIGHEST ANNUAL MEAN MEAN	HIGHEST ANNUAL MEAN MAX Station-#	HIGHEST ANNUAL MEAN (N/TOT)	BACKGROUND STATIONS MIN	BACKGROUND STATIONS MEAN	BACKGROUND STATIONS MAX	BACKGROUND STATIONS (N/TOT)
SEABASS (pCi/kg(WET))	Gamma Scan	Be-7	1	2.00E+02	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	Co-58	1	3.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	Co-60	1	3.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	Cs-134	1	2.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	Cs-137	1	3.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	Fe-59	1	5.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	I-131	1	6.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	K-40	1	No LLD Reported	1.90E+03	1.90E+03	1.90E+03	(1/1)	1.90E+03	1.90E+03	1.90E+03 Station-# 93	(1/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	La-140	1	6.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	Mn-54	1	3.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	Nb-95	1	4.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	Ra-226	1	5.00E+02	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	Sb-125	1	8.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	Th-232	1	1.10E+02	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
ANNUAL SUMMARY

SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL. PERF.	LLD	INDICATOR STATIONS				HIGHEST ANNUAL MEAN				BACKGROUND STATIONS			
					MIN	MEAN	MAX	(N/TOT)	MIN	MEAN	MAX Station-#	(N/TOT)	MIN	MEAN	MAX	(N/TOT)
SEABASS (pCi/kg(WET))	Gamma Scan	U-235	1	1.10E+02	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	Zn-65	1	5.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
SEABASS (pCi/kg(WET))	Gamma Scan	Zr-95	1	4.00E+01	<LLD	<LLD	<LLD	(0/1)	<LLD	<LLD	<LLD	(0/1)	*	*	*	(*/*)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	Ag-110m	8	1.73E+01	<LLD	<LLD	<LLD	(0/6)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	Ba-140	8	1.53E+02	<LLD	<LLD	<LLD	(0/6)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	Be-7	8	1.93E+02	1.70E+02	2.70E+02	3.70E+02	(4/6)	3.20E+02	3.45E+02	3.70E+02 Station-#	(2/2) 23	<LLD	<LLD	<LLD	(0/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	Co-58	8	2.00E+01	<LLD	<LLD	<LLD	(0/6)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	Co-60	8	2.10E+01	<LLD	<LLD	<LLD	(0/6)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	Cs-134	8	1.59E+01	<LLD	<LLD	<LLD	(0/6)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	Cs-137	8	1.54E+01	3.40E+01	4.60E+01	5.80E+01	(2/6)	3.40E+01	4.60E+01	5.80E+01 Station-#	(2/2) 33	4.50E+01	4.50E+01	4.50E+01	(1/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	Fe-59	8	5.25E+01	<LLD	<LLD	<LLD	(0/6)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)

TABLE D-1 (Cont.)
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OYSTER CREEK NUCLEAR GENERATING STATION
JANUARY, 1998 THROUGH DECEMBER, 1998
ANNUAL SUMMARY

SAMPLE TYPE	ANALYSIS	NUCLIDE	# OF ANAL PERF	LLD	INDICATOR STATIONS				HIGHEST ANNUAL MEAN				BACKGROUND STATIONS			
					MIN	MEAN	MAX	(N/TOT)	MIN	MEAN	MAX Station-#	(N/TOT)	MIN	MEAN	MAX	(N/TOT)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	I-131	8	7.50E+01	<LLD	<LLD	<LLD	(0/6)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	K-40	8	No LLD Reported	8.20E+02	4.67E+03	9.10E+03	(6/6)	2.10E+03	5.60E+03	9.10E+03 Station-# 23	(2/2)	1.50E+04	1.65E+04	1.80E+04	(2/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	La-140	8	5.50E+01	<LLD	<LLD	<LLD	(0/6)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	Mn-54	8	1.95E+01	<LLD	<LLD	<LLD	(0/6)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	Nb-95	8	2.75E+01	<LLD	<LLD	<LLD	(0/6)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	Ra-226	8	No LLD Reported	5.90E+02	9.52E+02	1.20E+03	(6/6)	1.00E+03	1.00E+03	1.00E+03 Station-# 33	(2/2)	1.60E+03	1.95E+03	2.30E+03	(2/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	Sb-125	8	6.00E+01	<LLD	<LLD	<LLD	(0/6)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	Th-232	8	No LLD Reported	1.80E+02	3.63E+02	4.60E+02	(6/6)	4.30E+02	4.45E+02	4.60E+02 Station-# 33	(2/2)	7.70E+02	9.35E+02	1.10E+03	(2/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	U-235	8	1.09E+02	<LLD	<LLD	<LLD	(0/6)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	Zn-65	8	5.00E+01	<LLD	<LLD	<LLD	(0/6)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)
AQUATIC SEDIMENT (pCi/kg(DRY))	Gamma Scan	Zr-95	8	4.00E+01	<LLD	<LLD	<LLD	(0/6)	<LLD	<LLD	<LLD	(0/2)	<LLD	<LLD	<LLD	(0/2)

APPENDIX E

1998 Quality Assurance Results

The OCNGS REMP Quality Assurance (QA) Program is comprised of three phases. Phase I requires samples collected at designated stations be split and analyzed by separate (independent) laboratories. Analysis results from the quality assurance (QA) laboratory are compared to those from the primary laboratory as set forth in OC Environmental Affairs procedure 6530-ADM-4500.07. Agreement criteria are established in this procedure. If non-agreement of the data occurs, an investigation begins which may include recounting or reanalyzing the sample(s) in question. Table E-2 outlines the split sample portion (Phase I) of the QA program for the media collected during 1998. Of the 10 samples that were split, all resulted in an initial agreement (Table E-3) except for one case of possible initial agreement which was subsequently resolved by performing a recount.

Phase II requires laboratories analyzing REMP samples for the OCNGS to participate in a program involving analysis and reporting of single-blind radiological samples, such as the USEPA Cross-Check Program. This serves as independent verification of each laboratory's ability to correctly perform analyses on various kinds of samples containing unknown quantities of specific radionuclides. The Phase II program during 1998 included participation in cross-check programs with the USEPA, the Department of Energy Environmental Measurements Laboratory (DOE EML), and an independent contractor, Analytics, Inc. of Atlanta, Georgia. The results of these interlaboratory comparison programs are presented in Appendix F.

Phase III requires that the REMP analytical laboratories perform duplicate analyses on every twentieth sample. The number of duplicate analyses performed during 1998 is outlined in Table E-1. Results of the duplicate analyses were reviewed in accordance with procedure 6530-ADM-4500.07. No non-agreements occurred during 1998 regarding duplicate analyses of OCNGS REMP samples.

TABLE E-1

1998 QA SAMPLE PROGRAM
NUMBER OF DUPLICATE ANALYSES PERFORMED

	ANALYSES			
SAMPLE MEDIUM	GROSS BETA	H-3	I-131	GAMMA ISOTOPIC
AIR PARTICULATE	7			2
AIR IODINE			25	
WELL WATER		0		0
SURFACE WATER		3*		3*
AQUATIC SEDIMENT				0
CLAMS				1
FISH				0
CRABS				0
VEGETABLES				2

Notes: 1. Asterisks identify duplicate analyses performed on QC (split) samples.
2. Shaded areas identify analyses that are not performed.

TABLE E-2

1998 QA SAMPLE PROGRAM

SPLIT SAMPLES

SAMPLE MEDIUM	NUMBER OF REGULAR STATIONS	COLLECTION FREQUENCY	NUMBER OF QA STATIONS	QA SAMPLE COLLECTION FREQUENCY
WELL WATER	3	QUARTERLY	1	QUARTERLY
SURFACE WATER	2	MONTHLY	0	MONTHLY
	2	SEMI-ANNUALLY	1	SEMI-ANNUALLY
SEDIMENT	4	SEMI-ANNUALLY	1	ANNUALLY
CLAMS	3	SEMI-ANNUALLY (WHEN AVAILABLE)	1	ANNUALLY (WHEN AVAILABLE)
VEGETABLES	3	MONTHLY (WHEN AVAILABLE)	1	QUARTERLY (WHEN AVAILABLE)
TLD	44	QUARTERLY	1	QUARTERLY

TABLE E-3

INTERLABORATORY COMPARISON RESULTS

Two independent laboratories (ERL and Teledyne Brown Engineering) analyzed selected split samples that were collected during 1998 by the OCNGS Environmental Affairs department. This practice gives further assurance that the measurements reported by both labs are meaningful and valid.

A total of 10 gamma isotopic analyses on samples of six different types of environmental media were analyzed concurrently by both laboratories (ERL and Teledyne Brown Engineering) during the period of January 1998 through December 1998. The results reported by the ERL and the QC laboratory are listed in Table E-3.

Agreement between the ERL result and the QC laboratory result was achieved if it met the criteria similar to those listed in Gibson and Pagliaro, 1980 "Confirmatory Measurements of Radionuclide Concentrations in Power Reactor Effluents", ASTM STP 698.

During 1998, all of the paired results for nuclides reported by both laboratories to be present in detectable quantities were in agreement. One pair of clam sample results, which were initially found to be in possible agreement for K-40, were found to be in agreement when a reanalysis was performed using a slightly larger aliquot of clams than originally counted.

TABLE E-3 (Cont.)

INTERLABORATORY COMPARISON RESULTS

STATION ID	SAMPLE MEDIA	ANALYSIS	NUCLIDE	ERL RESULT (1)	QC LAB RESULT (2)	UNITS	RATIO	RESOLUTION	AGREEMENT
OC04QC19-98	SW	GAMMA	K-40	2.20e+02 +/- 2.00E+01	1.84E+02 +/- 3.10E+01	pCi/l	11.00	0.84	YES
OC05QC07-98	WW	GAMMA	ALL	LLD	LLD	pCi/l			YES
OC05QC20-98	WW	GAMMA	ALL	LLD	LLD	pCi/l			YES
OC06QC19-98	SE	GAMMA	K-40	1.10e+03 +/- 2.00E+02	1.66E+03 +/- 4.20E+02	pCi/kg(WET)	5.50	1.51	YES
OC08QC19-98	CL	GAMMA	K-40	1.60e+03 +/- 4.00E+02	6.96E+02 +/- 1.13E+02	pCi/kg(WET)	4.00	0.44	(3)
OC04QC45-98	SW	GAMMA	K-40	3.00e+02 +/- 3.00E+01	2.30E+02 +/- 2.90E+01	pCi/l	10.00	0.77	YES
OC05QC33-98	WW	GAMMA	ALL	LLD	LLD	pCi/l			YES
OC05QC46-98	WW	GAMMA	ALL	LLD	LLD	pCi/l			YES
OC12QC33-98	CA	GAMMA	K-40	2.60e+03 +/- 3.00E+02	1.80E+03 +/- 1.80E+02	pCi/kg(WET)	8.67	0.69	YES
OC38QC33-98	CO	GAMMA	K-40	3.20e+03 +/- 3.00E+02	3.30E+03 +/- 3.40E+02	pCi/kg(WET)	10.67	1.03	YES

KEY TO SAMPLE MEDIA

CA	CABBAGE
CL	CLAMS
CO	COLLARDS
SE	AQUATIC SEDIMENT
SW	SURFACE WATER
WW	WELL WATER

FOOTNOTES

(1) The ERL result is ± 2 sigma.

(2) The Teledyne Brown Engineering (TBE) result is ± 2 sigma.

(3) The initial result reported by TBE yielded an acceptance ratio of 0.44, which indicated possible agreement. A reanalysis performed by TBE on a slightly larger aliquot of clams yielded an acceptance ratio of 0.64,which is in agreement with the ERL result.

APPENDIX F

1998 Environmental Radioactivity Interlaboratory Comparison Results

TABLE F-1

1998 USEPA Cross Check Program Results

Collection Date	Media	Nuclide	EPA Control Limits (A)			GPUN-ERL Results (B)			TBE Results (B)		
01/16/98	Water	Sr-89	8.0	±	8.7	8.33	±	0.58	5.00	±	1.73
		Sr-90	32.0	±	8.7	34.33	±	1.15	31.67	±	0.58
01/30/98	Water	Alpha	30.5	±	13.2	21.00	±	2.65	33.00	±	2.65
		Beta	3.9	±	8.7	7.23	±	0.32	5.60	±	0.90
02/06/98	Water	I-131	104.9	±	18.2	103.33	± (C)	5.77	110.00	±	0.00
			104.9	±	18.2	106.67	± (D)	5.77			
03/13/98	Water	H-3	2155.0	±	603.8	2166.67	±	57.74	1833.33	±	57.74
04/21/98	Water	Alpha	54.4	±	23.6	46.67	±	2.08	50.00	±	1.73
		Beta	94.7	±	17.3	87.33	±	11.02	102.00	±	6.56
		Co-60	50.0	±	8.7	50.00	±	1.00	52.33	±	1.53
		Sr-89	6.0	±	8.7	4.67	±	0.58	4.67	±	1.15
		Sr-90	18.0	±	8.7	17.33	±	2.31	21.67	±	1.15
		Cs-134	22.0	±	8.7	20.00	±	1.00	21.00	±	1.00
		Cs-137	10.0	±	8.7	11.00	±	1.00	11.67	±	0.58
06/05/98	Water	Co-60	12.0	±	8.7	13.00	±	0.00	13.00	±	1.00
		Zn-65	104.0	±	17.3	105.67	±	7.51	111.67	±	2.52
		Ba-133	40.0	±	8.7	40.00	±	2.00	35.00	±	2.65
		Cs-134	31.0	±	8.7	29.00	±	1.73	32.33	±	0.58
		Cs-137	35.0	±	8.7	34.33	±	1.15	37.67	±	2.08
07/17/98	Water	Sr-89	21.0	±	8.7	21.67	±	2.31	21.00	±	1.00
		Sr-90	7.0	±	8.7	6.67	±	0.58	6.33	±	0.58
07/24/98	Water	Alpha	7.2	±	8.7	6.43	±	0.12	5.43	±	0.64
		Beta	12.8	±	8.7	14.00	±	0.00	14.67	±	2.08
08/07/98	Water	H-3	17996.0	±	3122.9	19000.00	±	0.00	16000.00	±	0.00
09/11/98	Water	I-131	6.1	±	3.5	7.00	± (C)	0.53	5.93	±	0.55
			6.1	±	3.5	6.60	± (D)	0.26			
10/20/98	Water	Alpha	30.1	±	13.0	25.33	±	1.53	21.67	±	2.31
		Beta	94.0	±	17.3	84.67	±	3.21	74.67	± (E)	7.64
		Co-60	21.0	±	8.7	22.67	±	2.52	22.33	±	1.15
		Sr-89	19.0	±	8.7	19.00	±	1.00	18.33	±	1.53
		Sr-90	8.0	±	8.7	5.00	±	0.00	8.33	±	1.15
		Cs-134	6.0	±	8.7	6.67	±	0.58	6.67	±	0.58
		Cs-137	50.0	±	8.7	53.67	±	2.52	56.33	±	3.79

TABLE F-1

1998 USEPA Cross Check Program Results

Collection Date	Media	Nuclide	EPA Control Limits (A)			GPUN-ERL Results (B)			TBE Results (B)		
11/13/98	Water	Alpha	47.2	±	20.4	29.33	±	3.21	23.67	± (E)	4.04
		Beta	3.5	±	8.7	8.67	±	1.53	5.50	±	0.87
11/6/98	Water	Co-60	38.0	±	8.7	38.00	±	1.00	39.67	±	2.52
		Zn-65	131.0	±	22.6	146.67	±	5.77	140.67	±	10.97
		Ba-133	56.0	±	10.4	59.67	±	1.53	46.33	±	2.52
		Cs-134	105.0	±	8.7	103.00	±	6.08	103.00	±	2.00
		Cs-137	111.0	±	10.4	116.67	±	5.77	115.33	±	1.53

A. The EPA Control Limit is the known concentration ± 3 sigma for three determinations. The units are pCi/L.

B. The GPUN-ERL and TBE results are the average of three determinations ± one standard deviation. The units are pCi/L.

C. The analysis was performed by first concentrating I-131 on a resin. The resin was then counted by gamma spectroscopy.

D. The analysis was performed by gamma spectroscopy. The I-131 in the sample was not concentrated prior to counting.

E. An investigation is underway. The results of the investigation will be available shortly.

Criteria are listed in EPA 600/4-81-004.

TABLE F-2

1998 DOE EML Cross Check Program Results

Collection Date	Media	Nuclide	GPU VALUE (A & D)	GPU UNCERTAINTY (B)	DOE EML VALUE (C&D)	DOE EML UNCERTAINTY (E)	RATIO	Min. RATIO	Max. RATIO	AGREEMENT
3/1/98	Air Filter	Am-241	0.076	0.008	0.069	0.003	1.106	0.71	2.12	YES
		Ce-144	7.7	0.9	8.21	0.796	0.938	0.6	1.3	YES
		Co-57	11	1	11.11	0.846	0.99	0.65	1.34	YES
		Co-60	10	1	9.09	0.732	1.1	0.75	1.3	YES
		Cs-134	18	2	19.74	1.38	0.912	0.74	1.23	YES
		Cs-137	27	3	11.86	0.957	2.277	0.73	1.33	NO (F)
		Alpha	1.3	0.1	1.4	0.1	0.929	0.49	1.56	YES
		Beta	1.9	0.2	1.96	0.3	0.969	0.71	1.71	YES
		Mn-54	5.3	0.6	5.44	0.485	0.974	0.76	1.37	YES
		Pu-238	0.06	0.006	0.07	0.003	0.863	0.72	1.39	YES
		Pu-239	0.063	0.006	0.062	0.002	1.01	0.72	1.42	YES
		Sb-125	10	1.1	12.16	1.151	0.822	0.61	1.41	YES
		Sr-90	2.2	0.3	1.758	0.042	1.251	0.65	1.95	YES
		U-234	0.032	0.004	0.031	0.003	1.039	0.8	2.02	YES
		U-238	0.033	0.004	0.03	0.001	1.083	0.8	2.55	YES
		U-Nat	0.066		0.063	0.004	1.046	0.8	3.35	YES
3/1/98	Soil	Am-241	11	5	2.678	0.212	4.108	0.57	2.26	NO (G)
		Cs-137	370	40	329.5	9.26	1.123	0.8	1.32	YES
		K-40	380	40	313.5	10.15	1.212	0.76	1.54	YES
		Pu-239	5.1	1.1	5.305	0.253	0.961	0.69	1.67	YES
		Sr-90	17	7	13.091	0.279	1.299	0.56	2.87	YES
		U-234	29	4	31.133	0.802	0.931	0.46	1.3	YES
		U-238	32	4	31.9	2.552	1.003	0.43	1.39	YES
		U-Nat	61.77		64.6	2.858	0.956	0.29	1.37	YES
3/1/98	Vegetation	Am-241	1.2	0.3	1.105	0.051	1.086	0.71	2.7	YES
		Cm-244	2.1	0.5	2.174	0.066	0.966	0.46	1.65	YES
		Co-60	11	2	10.575	0.206	1.04	0.65	1.46	YES
		Cs-137	195	20	181.5	7.141	1.074	0.8	1.39	YES
		K-40	785	80	707.5	24.987	1.11	0.76	1.31	YES
		Pu-238	0.18	0.08	0.116	0.035	1.552	0.34	6.95	YES
		Pu-239	1.7	0.3	1.77	0.154	0.96	0.59	1.72	YES
		Sr-90	300	30	359.005	6.021	0.836	0.43	1.31	YES

TABLE F-2(Cont.)

1998 DOE EML Cross Check Program Results

Collection Date	Media	Nuclide	GPU VALUE (A & D)	GPU UNCERTAINTY (B)	DOE EML VALUE (C&D)	DOE EML UNCERTAINTY (E)	RATIO	Min. RATIO	Max. RATIO	AGREEMENT
3/1/98	Water	Am-241	1.4	0.1	1.226	0.05	1.142	0.72	1.52	YES
		Co-60	17	2	13.6	1.3	1.25	0.8	1.2	NO (H)
		Cs-137	53	5	46	1.7	1.152	0.8	1.25	YES
		Fe-55	310	30	202.8	2.921	1.529	0.22	1.51	NO (I)
		Alpha	1500	100	1421	100	1.056	0.52	1.31	YES
		Beta	2200	200	2200	100	1	0.53	1.6	YES
		H-3	240	30	218.3	6.505	1.099	0.69	1.8	YES
		Mn-54	63	6	57	1.9	1.105	0.8	1.24	YES
		Pu-238	2.5	0.3	2.526	0.06	0.99	0.76	1.25	YES
		Pu-239	1.7	0.2	1.65	0.061	1.03	0.8	1.36	YES
		Sr-90	5.3	0.9	4.357	0.192	1.216	0.75	1.56	YES
		U-234	0.46	0.06	0.396	0.027	1.161	0.8	1.42	YES
		U-238	0.46	0.06	0.396	0.037	1.161	0.8	1.29	YES
		U-Nat	0.94		0.801	0.067	1.173	0.47	1.48	YES
9/1/98	Air Filter	Am-241	0.5	0.05	0.51	0.008	0.98	0.73	2.58	YES
		Co-60	9.3	1.6	9.16	0.58	1.015	0.75	1.32	YES
		Cs-137	22	3	22.47	1.03	0.979	0.73	1.37	YES
		Alpha	1.7	0.2	1.65	0.16	1.03	0.5	1.55	YES
		Beta	2	0.2	2.16	0.07	0.926	0.72	1.67	YES
		Mn-54	5	0.9	4.92	0.4	1.016	0.76	1.42	YES
		Pu-238	0.48	0.05	0.46	0.005	1.043	0.74	1.4	YES
		Pu-239	0.44	0.04	0.42	0.006	1.048	0.76	1.44	YES
		Sb-125	13	2	8.89	0.55	1.462	0.61	1.43	NO (J)
		Sr-90	1	0.3	1.12	0.05	0.893	0.61	1.93	YES
		U-234	0.2	0.02	0.26	0.01	0.769	0.83	1.92	NO (K)
		U-238	0.21	0.03	0.26	0.01	0.808	0.84	2.61	NO (K)
		U-Nat	0.42		0.53	0.02	0.792	0.8	3.35	NO (K)
9/1/98	Soil	Cs-137	1000	100	954	38	1.048	0.83	1.32	YES
		K-40	350	30	314	13	1.115	0.78	1.53	YES
		Sr-90	19	7	39.61	0.003	0.479	0.6	3.66	NO (L)

TABLE F-2(Cont.)
1998 DOE EML Cross Check Program Results

Collection Date	Media	Nuclide	GPU VALUE (A & D)	GPU UNCERTAINTY (B)	DOE EML VALUE (C&D)	DOE EML UNCERTAINTY (E)	RATIO	Min. RATIO	Max. RATIO	AGREEMENT
9/1/98	Vegetation	Am-241	2.8	0.8	2.33	0.06	1.202	0.68	2.7	YES
		Cm-244	1.5	0.6	1.76	0.07	0.852	0.44	1.62	YES
		Co-60	21	3	20	1	1.05	0.69	1.46	YES
		Cs-137	410	40	390	20	1.051	0.8	1.4	YES
		K-40	520	50	460	20	1.13	0.79	1.42	YES
		Pu-238	0.26	0.15	0.31	0.07	0.839	0.66	7.94	YES
		Pu-239	3.4	0.6	3.72	0.27	0.914	0.68	1.59	YES
		Sr-90	580	50	606	40	0.957	0.5	1.33	YES
9/1/98	Water	Am-241	1.4	0.3	1.25	0.08	1.12	0.75	1.49	YES
		Co-60	51	5	49.4	1.2	1.032	0.8	1.2	YES
		Cs-137	52	5	50	1.7	1.04	0.8	1.26	YES
		Fe-55	160	20	139	2	1.151	0.44	1.53	YES
		Alpha	980	100	1080	60	0.907	0.61	1.32	YES
		Beta	1300	100	1420	60	0.915	0.55	1.54	YES
		Mn-54	34	3	32.4	1.4	1.049	0.8	1.25	YES
		Pu-238	1.1	0.1	1.1	0.01	1	0.78	1.25	YES
		Pu-239	1.5	0.2	1.41	0.04	1.064	0.8	1.39	YES
		Sr-90	1.5	0.6	2.11	0.18	0.711	0.75	1.5	NO (M)
		U-234	0.47	0.11	0.51	0.03	0.922	0.8	1.4	YES
		U-238	0.5	0.12	0.52	0.05	0.962	0.8	1.26	YES
		U-Nat	0.97		1.05	0.08	0.924	0.67	1.42	YES

A. The DOE EML value is the mean of replicate determinations for each nuclide.

B. The DOE EML uncertainty is the standard error of the mean.

C. The GPU Value is an average of 1 to 4 determinations.

D. The units are Bq/L for water, Bq/kg (dry) for soil, Bq/kg (wet) for vegetation and total Bq for air filters.

E. The GPU uncertainty is the square root of the sum of the squares of the reported two sigma uncertainty of the individual determinations for each nuclide.

F. A reanalysis was requested. The reanalysis result agrees with the original analysis. The sample must have been contaminated during digestion. Beakers used for high activity samples will be gamma scanned and discarded if contaminated.

G. The Am-241 result (reported on 8-Jun-1998) was too late to be submitted to the EML (due date of 1-Jun-1998) for inclusion in the study. The reported value (11 ± 5 Bq/kg) is not acceptable with the EML value (2.678 ± 0.212 Bq/kg). The ratio is 4.108. A reanalysis was requested and the result (5.2 ± 1.6 Bq/kg) is similar to the original result and has a ratio with the EML of 1.942 and is acceptable with Warning. The EML sample consists of approximately 200 grams of an air-dried, pulverized and blended soil. Soil samples tested for homogeneity ranged in sample size from 2 to 600 grams. The sample sizes used for Am-241 analysis were 0.49 and 0.44 gram. Because both analysis results agree with each other no further action is necessary.

H. The Co-60 result (17.00 ± 2.00 Bq/L) reported to the EML is not within acceptable agreement with the EML value (13.60 ± 1.20 Bq/L). A reanalysis was requested. The reanalysis result (14.77 ± 1.282 Bq/L) has a ratio of 1.086, which is within acceptable agreement with the EML value. The original raw (non rounded) results were 16.01 ± 1.042 and 16.50 ± 1.047 Bq/L. If the mean of these values (16.255 Bq/L) was reported a ratio of 1.195 would have been acceptable with a warning. The mean of 90 reported values versus the EML value was 1.092 for this nuclide, which indicates a 9% bias.

TABLE F-2(Cont.)
1998 DOE EML Cross Check Program Results

I. This sample has been analyzed five times.
The results are:

8.6E-06 ± 0.9E-06 uCi/ml	319 Bq/L
8.0E-06 ± 0.8E-06 uCi/ml	296 Bq/L
7.8E-06 ± 0.9E-06 uCi/ml	289 Bq/L
8.0E-06 ± 0.9E-06 uCi/ml	296 Bq/L
9.8E-06 ± 0.1E-05 uCi/ml	363 Bq/L

All of the results are similar.
The nuclides contained in this water matrix is unlike any samples analyzed in the ERL for Fe-55 . These nuclides may have caused the high results.

18 laboratories reported Fe-55 results to the EML in QAP 48. 7 were Acceptable, 7 were Acceptable with Warning and 4 were Not Acceptable. Only 2 laboratories reported values below the EML value. Of the 14 "A" and "W" reported values the Mean ratio was 1.194 (242 Bq/L). This indicates that the EML value (202.8 Bq/L) may be low. The ERL results for Fe-55 in the previous QAP studies have been acceptable. Future Fe-55 in EML QAP studies will be monitored to identify continuing trends.

J. Previously the ERL value was not in agreement with the EML and was less than the minimum acceptable ratio. The library was analyzed and compared to the Kocher isotope table and the decay scheme. The decay scheme was incorrectly evaluated and a change was made to the library to reduce the apparent abundance result was greater than the maximum allowed ratio. This time the library was evaluated, and Gary Chevalier at TMI was consulted. We came to the agreement that the Kocher listing could be confusing and that the abundance should be used as stated in the Kocher listing. The library "EML" was edited and the values from Kocher were placed in the library for Sb-125. Re-analyzing the spectra resulted in an Average result of 10.5 Bq/un. This gives a ratio of 1.18 with the EML known value. The result is acceptable. All libraries will be checked to verify the correct abundance for Sb-125.

K. The EML air filter was processed for actinide analyses. During the precipitation step for uranium, titanium chloride (TiCl3) which is used to purify the precipitant appeared not to react as in the past. Notably the dark color of TiCl3 faded immediately after being added to the final solution. After counting the uranium source, a number of high-energy peaks interfered with the U-232 tracer peak. These peaks resulted in an abnormally high recovery (~ 140%) and consequently yielded low results for the radionuclides (U-234 and U-238) to be reported. A different cross check sample (EPA uranium in water) resulted in the same high energy peaks. This sample was reprocessed using extra TiCl3 and the interfering peaks were eliminated. The reported result was within 0.1 sigma of the known value. Also, the other two media from the EML were processed with extra TiCl3 and yielded acceptable results. It appears that the TiCl3 lost its strength and more was needed to purify the final precipitant solution. A new reagent has since been purchased for future analysis.

L. The Sr-90 in EML soil result (19 ± 7 Bq/kg) is not acceptable with the EML value (39.63 ± 0.003 Bq/kg). The ratio is 0.479. A reanalysis was performed using a larger aliquot and this result (39 ± 5 Bq/kg) has a ratio with the known value of 0.984 and is acceptable. For future processing of EML soils, a larger aliquot will be used in order to achieve the best result with the lowest error

M. The EML water for strontium analysis failed to achieve acceptable results because the spiked value was at the lower end of the sensitivity for the analysis. Three aliquots, 20ml, 25ml and 30ml, were used for the analysis. The average result was 1.5 ± 0.6 Bq/l. The EML value is 2.11 ± 0.18 Bq/l giving a ratio of 0.711. Due to the small volume of water submitted by EML, larger aliquots could not be taken for reprocessing. A reanalysis using a similar aliquot volume (25ml) was processed and yielded the same unacceptable result. To prevent this non-agreement from reoccurring, only one aliquot will be initially analyzed. The result will dictate what size aliquot should be used for additional analysis in order to achieve optimum statistical results.

The control limit concept was established from percentiles of historic data distributions (1982 - 1992). The evaluation of this historic data and the development of the control limits are presented in DOE report EML-564. The control limits for QAP XLVII were developed from percentiles of data distributions for the years 1991 - 1998

TABLE F-3

1998 ANALYTICS Cross Check Program Results

Collection Date	Media	Nuclide	GPU VALUE (B)	ANALYTICS VALUE (A)	ANALYTICS UNCERTAINTY (3 SIGMA)	ANALYTICS UNCERTAINTY (1 SIGMA)	RESOLUTION	RATIO	Min. RATIO	Max. RATIO	AGREEMENT
06/11/98	Air Filter	Alpha	30	34	2	0.7	51.0	0.88	0.8	1.25	YES
		Beta	170	200	10	3.3	60.0	0.85	0.8	1.25	YES
06/11/98	Air Filter	Ce-141	120	118	6	2.0	59.0	1.02	0.8	1.25	YES
		Cr-51	210	157	8	2.7	58.9	1.34	0.8	1.25	NO (C)
		Cs-134	110	113	6	2.0	56.5	0.97	0.8	1.25	YES
		Cs-137	89	84	4	1.3	63.0	1.06	0.8	1.25	YES
		Mn-54	140	126	6	2.0	63.0	1.11	0.8	1.25	YES
		Fe-59	52	54	3	1.0	54.0	0.96	0.8	1.25	YES
		Zn-65	170	145	7	2.3	62.1	1.17	0.8	1.25	YES
		Co-60	180	171	9	3.0	57.0	1.05	0.8	1.25	YES
06/11/98	Air Filter	Sr-89	170	168	8	2.7	63.0	1.01	0.8	1.25	YES
		Sr-90	43	49	2	0.7	73.5	0.88	0.8	1.25	YES
06/11/98	Cartridge	I-131	72	60	3	1.0	60.0	1.20	0.8	1.25	YES
06/11/98	Milk	I-131	73	67	3	1.0	67.0	1.09	0.8	1.25	YES
		Ce-141	96	99	5	1.7	59.4	0.97	0.8	1.25	YES
		Cr-51	140	132	7	2.3	56.6	1.06	0.8	1.25	YES
		Cs-134	86	95	5	1.7	57.0	0.91	0.8	1.25	YES
		Cs-137	74	70	4	1.3	52.5	1.06	0.8	1.25	YES
		Mn-54	110	106	5	1.7	63.6	1.04	0.8	1.25	YES
		Fe-59	63	45	2	0.7	67.5	1.40	0.8	1.25	NO (D)
		Zn-65	130	122	6	2.0	61.0	1.07	0.8	1.25	YES
		Co-60	140	143	7	2.3	61.3	0.98	0.8	1.25	YES
06/11/98	Milk	I-131	75	67	3	1.0	67.0	1.12	0.8	1.25	YES
06/11/98	Milk	Sr-89	80	77	4	1.3	57.8	1.04	0.8	1.25	YES
		Sr-90	51	60	3	1.0	60.0	0.85	0.8	1.25	YES
06/11/98	Soil	Ce-141	0.14	0.142	0.007	0.002	60.9	0.99	0.8	1.25	YES
		Cr-51	L.T.	0.188	0.009	0.003	62.7		0.8	1.25	
		Cs-134	0.13	0.135	0.007	0.002	57.9	0.96	0.8	1.25	YES
		Cs-137	0.11	0.1	0.005	0.002	60.0	1.10	0.8	1.25	YES
		Mn-54	0.15	0.151	0.008	0.003	56.6	0.99	0.8	1.25	YES
		Fe-59	0.071	0.065	0.003	0.001	65.0	1.09	0.8	1.25	YES
		Zn-65	0.18	0.174	0.009	0.003	58.0	1.03	0.8	1.25	YES
		Co-60	0.21	0.205	0.01	0.003	61.5	1.02	0.8	1.25	YES

TABLE F-3 (cont.)

1998 ANALYTICS Cross Check Program Results

Notes:

A. Units are pCi/L for Milk, pCi/g (dry) for Soil and total pCi for Filter and Cartridge.
B. GPU Value is an average of three or more determinations. Units are pCi/L for Milk, pCi/g (dry) for Soil and total pCi for Filter and Cartridge.
C. See Attached Laboratory Deviation Report
D. See Attached Laboratory Deviation Report

<u>To determine agreement or possible agreement:</u>

1. Divide each Analytics value by its associated one sigma uncertainty to obtain the resolution.
2. Divide each GPU value by the corresponding Analytics value to obtain the ratio.
3. The GPU measurement is in agreement if the value of the ratio falls within the limits shown in the following table for the corresponding resolution.

Resolution	Agreement	Agreement "A" Criteria	Agreement "B" Criteria
<4	0.4-2.5	no comparison	no comparison
>=3 and <4		0.3-3.0	no comparison
>=4 and <8	0.5-2.0	0.4-2.5	0.3-3.0
>=8 and <16	0.6-1.66	0.5-2.0	0.4-2.5
>=16 and <51	0.75-1.33	0.6-1.67	0.5-2.0
>=51 and <200	0.80-1.25	0.75-1.33	0.6-1.67
>200	0.85-1.18	0.8-1.25	0.75-1.33

"A" criteria are applied to the following analyses:
Gamma Spectrometry where the principal gamma energy used for identification is greater than 250 kev,
Tritium analyses of liquid samples and
Low-level I-131

"B" criteria are applied to the following analyses:
Gamma Spectrometry where the principal gamma energy used for identification is less than 250 kev,
Sr-89 and Sr-90 determinations and
Gross Alpha and Beta

Criteria are similar to those listed in USNRC Inspection Procedure 84750 with minor adjustments to account for activity concentrations with large uncertainties.

TABLE F-4

1998 ANALYTICS Cross Check Program Results

Collection Date	Media	Nuclide	TBE VALUE (A)	ANALYTICS VALUE (A)	UNCERTAINTY (3 SIGMA)	UNCERTAINTY (1 SIGMA)	RESOLUTION	RATIO (B)	Min. RATIO	Max. RATIO	AGREEMENT
031298	Milk	I-131	87	82	4	1.3	61.5	1.06	0.8	1.25	YES
		Ce-141	66	70	4	1.3	52.5	0.94	0.8	1.25	YES
		Cr-51	220	201	10	3.3	60.3	1.09	0.8	1.25	YES
		Cs-134	85	84	4	1.3	63.0	1.01	0.8	1.25	YES
		Cs-137	180	161	8	2.7	60.4	1.12	0.8	1.25	YES
		Mn-54	130	133	7	2.3	57.0	0.98	0.8	1.25	YES
		Fe-59	110	95	5	1.7	57.0	1.16	0.8	1.25	YES
		Zn-65	160	142	7	2.3	60.9	1.13	0.8	1.25	YES
		Co-60	82	85	4	1.3	63.8	0.96	0.8	1.25	YES
061198	Milk	I-131	68	67	3	1.0	67.0	1.01	0.8	1.25	YES
		Ce-141	94	99	5	1.7	59.4	0.95	0.8	1.25	YES
		Cr-51	97	132	7	2.3	56.6	0.73	0.8	1.25	NO (C)
		Cs-134	101	95	5	1.7	57.0	1.06	0.8	1.25	YES
		Cs-137	79	70	4	1.3	52.5	1.13	0.8	1.25	YES
		Mn-54	112	106	5	1.7	63.6	1.06	0.8	1.25	YES
		Fe-59	58	45	2	0.7	67.5	1.29	0.8	1.25	NO (D)
		Zn-65	143	122	6	2.0	61.0	1.17	0.8	1.25	YES
		Co-60	157	143	7	2.3	61.3	1.10	0.8	1.25	YES
121498	Milk	I-131	65	71	4	1.3	53.3	0.92	0.8	1.25	YES
		Ce-141	647	746	37	12.3	60.5	0.87	0.8	1.25	YES
		Cr-51	900	979	49	16.3	59.9	0.92	0.8	1.25	YES
		Cs-134	200	220	11	3.7	60.0	0.91	0.8	1.25	YES
		Cs-137	177	183	9	3.0	61.0	0.97	0.8	1.25	YES
		Mn-54	136	142	7	2.3	60.9	0.96	0.8	1.25	YES
		Fe-59	156	148	7	2.3	63.4	1.05	0.8	1.25	YES
		Zn-65	132	140	7	2.3	60.0	0.94	0.8	1.25	YES
		Co-60	169	178	9	3.0	59.3	0.95	0.8	1.25	YES
		Sr-89	20	69	3	1.0	69.0	0.29	0.8	1.25	NO (E)
		Sr-90	16	41	2	0.7	61.5	0.39	0.8	1.25	NO (E)

TABLE F-4 (cont.)

1998 ANALYTICS Cross Check Program Results

Collection Date	Media	Nuclide	TBE VALUE (A)	ANALYTICS VALUE (A)	ANALYTICS UNCERTAINTY (3 SIGMA)	ANALYTICS UNCERTAINTY (1 SIGMA)	RESOLUTION	RATIO (B)	Min. RATIO	Max. RATIO	AGREEMENT
121498	Air Filter	Ce-141	566	524	26	8.7	60.5	1.08	0.8	1.25	YES
		Cr-51	800	687	49	16.3	42.1	1.16	0.75	1.33	YES
		Cs-134	158	128	6	2.0	64.0	1.23	0.8	1.25	YES
		Cs-137	147	154	8	2.7	57.8	0.95	0.8	1.25	YES
		Mn-54	122	100	5	1.7	60.0	1.22	0.8	1.25	YES
		Fe-59	134	104	5	1.7	62.4	1.29	0.8	1.25	NO (D)
		Zn-65	129	98	5	1.7	58.8	1.32	0.8	1.25	NO (F)
		Co-60	134	125	6	2.0	62.5	1.07	0.8	1.25	YES
121498	Water	H-3	5500	5980	299	99.7	60.0	0.92	0.8	1.25	YES

Notes:

A. The Analytics Value is the known concentration. Units are pCi/L for Milk, pCi/g (dry) for Soil and total pCi for Filter and Cartridge.

B. Ratio of Teledyne Brown Engineering to Analytics results.

C. The Cr-51 result was slightly out of range. No follow up action was requested because other Cr-51 results were typically acceptable. Also, the result was acceptable if the resolution was based on the TBE result and its uncertainty.

D. The Fe-59 result was slightly out of range. No follow up action was requested because other Fe-59 results were typically acceptable. Also, the result was acceptable if the resolution was based on the TBE result and its uncertainty.

E. An investigation is being conducted. The results of the investigation will be available shortly.

F. The Zn-65 result was slightly out of range. No follow up action was requested because other Zn-65 results were typically acceptable. Also, the result was acceptable if the resolution was based on the TBE result and its uncertainty.

1. Divide each Analytics value by its associated one sigma uncertainty to obtain the resolution.
2. Divide each TBE value by the corresponding Analytics value to obtain the ratio.
3. The measurement is in agreement if the value of the ratio falls within the limits shown in the following table for the corresponding resolution.

Agreement	Agreement "A" Criteria	Agreement "B" Criteria
0.4-2.5	no comparison	no comparison
0.5-2.0	0.4-2.5	0.3-3.0
0.6-1.66	0.5-2.0	0.4-2.5
0.75-1.33	0.6-1.67	0.5-2.0
0.80-1.25	0.75-1.33	0.6-1.67
0.85-1.18	0.8-1.25	0.75-1.33

"A" criteria are applied to the following analyses:
Gamma Spectrometry where the principal gamma energy used for identification is greater than 250 kev, Tritium analyses of liquid samples and Low-level I-131.

"B" criteria are applied to the following analyses:
Gamma Spectrometry where the principal gamma energy used for identification is less than 250 kev, Sr-89 and Sr-90 determinations and Gross Alpha and Beta.

Criteria are similar to those in USNRC Inspection Procedure 84750 with minor adjustment to account for activity concentrations with large uncertainties

APPENDIX G

1998 Annual Dairy Census

Annual Dairy Census - 1998

An annual dairy census was conducted to determine the number of commercial dairy operations and/or lactating dairy animals providing milk for human consumption which were located within a five mile radius of the OCNGS. The results of the census demonstrated that no commercial dairy operations were located within 5 miles of the OCNGS.

Ocean County Agricultural Extension Service Agent, Ms. Debra Fiola, was contacted regarding the occurrence of dairy animals within a five mile radius of the OCNGS. Ms. Fiola indicated that no commercial dairy operations were active in the study area. The closest known dairy animals whose milk was being used for human consumption were goats owned by three families in Whiting, NJ, which is approximately 12 miles northwest of the OCNGS.

APPENDIX H

Dose Calculation Methodology

To the extent possible, radiological impacts were evaluated based on the direct measurement of dose rates or of radionuclide concentrations in the environment. However, the effluents associated with 1998 OCNGS routine operations were too small to be measured once dispersed in the offsite environment. As a result, the potential offsite doses could only be estimated using computerized models that predict concentrations of radioactive materials in the environment and subsequent radiation doses on the basis of radionuclides released to the environment. GPUN calculates doses using an advanced class "A" dispersion model called SEEDS (Simplified Effluent Environmental Dosimetry System). This model incorporates the guidelines and methodology set forth in USNRC Regulatory Guide 1.109 (Ref. 17). SEEDS uses real-time hourly meteorological information matched to the time of release to assess the dispersion of effluents in the discharge canal/estuary system and the atmosphere. Combining this assessment of dispersion and dilution with effluent data, postulated maximum hypothetical doses to the public from the OCNGS effluents are computed. The maximum individual dose is calculated as well as the dose to the total population within 50 miles of the OCNGS for gaseous effluents and the entire population downstream of the OCNGS around Barnegat Bay and the Atlantic Ocean for liquid effluents. Values of environmental parameters and radionuclide concentration factors have been chosen to provide conservative results. As a result, the doses calculated using this model are conservative estimates (i.e., overestimates) of the actual exposures.

The dose summary table, Table H-1, presents the maximum hypothetical doses to an individual, as well as the population dose, resulting from effluents from OCNGS during the 1998 reporting period.

Individual Doses From Liquid Effluents

As recommended in USNRC Regulatory Guide 1.109 (Ref. 17), calculations of doses resulting from OCNGS liquid effluents are performed on four age groups and eight organs. The pathways considered are consumption of fish, consumption of shellfish, and shoreline exposure. All pathways are considered to be primary recreational activities associated with Barnegat Bay and the Atlantic Ocean in the vicinity of the OCNGS. The "receptor" would be that individual who eats fish and shellfish that reside in the OCNGS discharge canal, and stands on the shoreline influenced by the station discharge. Table H-1 presents the maximum total body dose and critical organ dose for the age group most affected.

For the 1998 reporting period, the calculated maximum hypothetical total body dose received from liquid effluents would have been 8.6E-8 mrem. This represents 2.9E-6 percent of the OCNGS Offsite Dose Calculation Manual (ODCM) limit. Similarly, the maximum hypothetical organ dose from liquid effluents would have been 8.6E-8 mrem to the liver. This represents 8.6E-7 percent of the OCNGS ODCM annual dose limit.

Individual Doses From Gaseous Effluents

There are seven major pathways considered in the dose calculation for gaseous effluents. These are: (1) plume exposure, (2) inhalation, (3) consumption of cow milk, (4) goat milk, (5) vegetables, (6) meat, and (7) standing on contaminated ground.

The maximum plume exposure reported in lines 3 and 4 of Table H-1 generally occurs at, or near, the site boundary. These "air doses" are not to an individual but are considered to be the maximum dose at a location. The location is not necessarily a receptor.

With respect to airborne noble gas releases for the 1998 reporting period, the maximum plume exposure (air dose) would have been 8.7E-5 and 4.0E-5 mRad for OCNGS gamma and beta radiation, respectively. These doses are equal to only 8.7E-4 percent and 2.0E-4 percent of the OCNGS ODCM annual dose limits, respectively.

The calculated airborne dose to the closest individual in the maximally affected sector (SSW) for total body dose and skin dose was at a distance of 2616 meters. These data are presented in lines 5 and 6 of Table H-1. Maximum calculated plume exposures to an individual from gaseous effluents during the 1998 reporting period were 4.3E-5 mrem to the total body and 6.6E-5 mrem to the skin. These doses are equivalent to only 4.3E-5 percent and 2.2E-6 percent of the applicable annual dose limits, respectively.

The dose to the maximum exposed organ due to radioactive airborne iodine and particulates is presented in line 7, Table H-1. This does not include the total body plume exposure, which was separated out on line 5. The dose presented in this section reflects the maximum exposure to an organ for the appropriate age group. During 1998, gaseous iodines and particulates from OCNGS would have resulted in a maximum dose of 2.2E-2 mrem to any organ, which during

1998 was the thyroid gland. This dose is only 1.5E-1 percent of the OCNGS ODCM specified annual dose limit.

Population Doses From Liquid and Gaseous Effluents

The population doses resulting from liquid and gaseous effluents are summed over all pathways and the affected population (Table H-1, lines 8-11). Liquid population dose is based upon the population located within the region from the OCNGS outfall extending out to the Atlantic Ocean. The population dose due to gaseous effluents is based upon the 1990 census data and considers the population out to a distance of 50 miles around the OCNGS as well as the much larger total population which can be fed by foodstuffs grown in the 50-mile radius. Population doses are summed over all distances and sectors to give an aggregate dose. OCNGS liquid and gaseous effluents resulted in a population dose of 1.0E-1 person-rem total body for the 1998 reporting period. This is approximately 12.3 million times lower than the doses to the same population resulting from natural background sources.

TABLE H-1

SUMMARY OF MAXIMUM HYPOTHETICAL INDIVIDUAL AND POPULATION DOSES FROM LIQUID AND AIRBORNE EFFLUENT RELEASES FROM THE OCNGS FOR 1998

INDIVIDUAL DOSES

Effluent Released	ODCM Specification Limit	Calculated Dose	Age Group	Dist. (m)	Sector	Percent of Reg. Limit
LIQUID	3 mrem-Total Body	8.6E-8 mrem	Adult	Receptor 1*		2.9E-6 %
LIQUID	10 mrem-Liver	8.6E-8 mrem	Adult	Receptor 1*		8.6E-7 %
AIRBORNE	10 mRad-Gamma	8.7E-5 mRad	-	530	SSW	8.7E-4 %
AIRBORNE	20 mRad-Beta	4.0E-5 mRad	-	4000	SSW	2.0E-4 %
AIRBORNE	100 mrem-Total Body[1]	4.3E-5 mrem	All	2616	SSW	4.3E-5 %
AIRBORNE	3000 mrem-Skin	6.6E-5 mrem	All	2616	SSW	2.2E-6 %
AIRBORNE	15 mrem-Any Organ[2]	2.2E-2 mrem	All	966	SE	1.5E-1 %

POPULATION DOSES

Effluent Released		Calculated Dose (Person-rem)	
LIQUID	Total Body	1.0E-3	
LIQUID	All organs except bone which was 0 person-rem[3]	1.0E-3	
GASEOUS	Total Body	1.0E-1	
GASEOUS	Thyroid	1.3E-1	

* Receptor 1 is the Discharge Canal at the U.S. Route 9 bridge.

[1] This limit is from 10CFR20.1301. The ODCM limit is 500 mrem.

[2] During 1998, this dose was to the thyroid gland.

[3] The calculated dose for the liver, thyroid, kidney, lung, GI-Tract, and skin was 1.0E-3 person-rem. The calculated dose for bone was 0 person-rem.

APPENDIX I

1998 Groundwater Monitoring Results

TABLE I-1
RADIONUCLIDE CONCENTRATIONS IN SAMPLES FROM THE ON-SITE GROUNDWATER MONITORING NETWORK

March 1998 Results

WELL	DEPTH (Ft.)	TRITIUM (pCi/liter)	GAMMA ISOTOPIC K-40 (pCi/liter)	GAMMA ISOTOPIC Th-232 (pCi/liter)
WW-1	50.0	< 100	< 40	< 11
WW-2	55.0	< 100	< 40	< 11
WW-3	24.0	No Sample	No Sample	No Sample
WW-4	52.0	No Sample	No Sample	No Sample
WW-5	22.5	180 +/- 70	< 30	< 11
WW-6	52.5	< 100	< 80	< 20
WW-7	20.0	390 +/- 70	< 30	< 9
WW-9	20.0	240 +/- 70	< 30	< 8
WW-10	57.0	< 100	< 30	< 9
WW-12	20.0	< 100	< 50	< 19
WW-13	50.0	< 100	< 30	< 8
WW-14	53.0	< 100	< 90	< 20
WW-15	20.0	840 +/- 90	< 40	< 10
WW-16	20.0	240 +/- 70	< 40	< 12
WW-17	150.0	< 100	< 30	< 10

October 1998 Results

WELL	DEPTH (Ft.)	TRITIUM (pCi/liter)	GAMMA ISOTOPIC K-40 (pCi/liter)	GAMMA ISOTOPIC Th-232 (pCi/liter)
WW-1	50.0	< 120	48 +/- 43	< 14
WW-2	55.0	150 +/- 80	< 20	< 7
WW-3	24.0	220 +/- 80	< 30	< 8
WW-4	52.0	180 +/- 80	< 20	< 7
WW-5	22.5	280 +/- 90	< 40	16 +/- 10
WW-6	52.5	< 120	< 30	< 8
WW-7	20.0	670 +/- 90	< 20	< 6
WW-9	20.0	170 +/- 100	< 20	< 6
WW-10	57.0	< 110	< 40	< 12
WW-12	20.0	200 +/- 90	< 40	< 15
WW-13	50.0	< 120	< 40	< 12
WW-14	53.0	200 +/- 100	< 40	< 11
WW-15	20.0	240 +/- 80	< 50	< 14
WW-16	20.0	280 +/- 90	< 40	< 11
WW-17	150.0	< 120	< 50	< 13

APPENDIX J

1998 REMP Sample Collection and

Analysis Methods

TABLE J-1
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
SUMMARY OF SAMPLE COLLECTION AND ANALYSIS METHODS
1998

Analysis	Sample Medium	Sampling Method	Collection Procedure Number	Sample Size	Analysis Procedure Number	Procedure Abstract
Gross Beta	Air Particulate	Two week composite of continuous air sampling through filter paper	OCNGS Environmental Affairs Department Procedure 6530-IMP-4522.05	1 filter (approximately 1200 cubic meters bi-weekly)	TMI Environmental Affairs Department Procedure 6510-IMP-4592.05	Low background gas flow proportional counting
Gamma Spectroscopy	Air Particulate	Quarterly composite of each station	OCNGS Environmental Affairs Department Procedure 6530-IMP-4522.05	6 filters (approximately 7200 cubic meters)	TMI Environmental Affairs Department Procedure 6510-IMP-4592.05	Gamma Isotopic analysis
Gamma Spectroscopy	Air Iodine	Weekly composite of continuous air sampling through charcoal filter	OCNGS Environmental Affairs Department Procedure 6530-IMP-4522.05	1 cartridge (approximately 600 cubic meters weekly)	TMI Environmental Affairs Department Procedure 6510-OPS-4591.04	Gamma Isotopic analysis
Gamma Spectroscopy	Surface Water	Monthly grab sample at two stations and semiannual grab sample at an additional two stations	OCNGS Environmental Affairs Department Procedure 6530-IMP-4522.06	3.78 liters	TMI Environmental Affairs Department Procedure 6510-IMP-4592.06 6510-OPS-4591.04 Teledyne Brown Engineering PRO-042-5	Gamma Isotopic analysis Gamma Isotopic analysis
Gamma Spectroscopy	Well Water	Quarterly grab sample	OCNGS Environmental Affairs Department Procedure 2870-IMP-4522.10	3.78 liters	TMI Environmental Affairs Department Procedure 6510-IMP-4592.06 6510-OPS-4591.04 Teledyne Brown Engineering PRO-042-5	Gamma Isotopic analysis Gamma Isotopic analysis

TABLE J-1 continued
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
SUMMARY OF SAMPLE COLLECTION AND ANALYSIS METHODS
1998

Analysis	Sample Medium	Sampling Method	Collection Procedure Number	Sample Size	Analysis Procedure Number	Procedure Abstract
Gamma Spectroscopy	Clams Fish Crabs	Semiannual grab sample Semiannual grab sample Annual grab sample	OCNGS Environmental Affairs Department Procedure 6530-IMP-4522.14 6530-IMP-4522.16	Approximately 250g	TMI Environmental Affairs Department Procedure 6510-IMP-4592.03 6510-OPS-4591.04 Teledyne Brown Engineering PRO-042-5	Gamma Isotopic analysis Gamma Isotopic analysis
Gamma Spectroscopy	Sediment	Semiannual grab sample	OCNGS Environmental Affairs Department Procedure 6530-IMP-4522.03	3.78 liters	TMI-EC 6510-IMP-4592.04 6510-OPS-4591.04 Teledyne Brown Engineering PRO-042-5	Gamma Isotopic analysis Gamma Isotopic analysis
Gamma Spectroscopy	Vegetables	Monthly grab sample during the harvest season	OCNGS Environmental Affairs Department Procedure 6530-IMP-4522.04	Approximately 1 kg	TMI-EC 6510-IMP-4592.03 6510-OPS-4591.04 Teledyne Brown Engineering PRO-042-5	Gamma Isotopic analysis Gamma Isotopic analysis
Tritium	Well Water Surface Water	Quarterly grab sample Monthly grab sample from two stations and semiannual grab sample from two additional stations	OCNGS Environmental Affairs Department Procedure 2870-IMP-4522.10 6530-IMP-4522.06	3.78 liters	TMI-EC 6510-IMP-4592.02 6510-OPS-4591.05 Teledyne Brown Engineering PRO-052-2 PRO-052-35	Sample is filtered and mixed with scintillation fluid for scintillation counting. Sample is filtered and mixed with scintillation fluid for scintillation counting.

TABLE J-1 continued
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
SUMMARY OF SAMPLE COLLECTION AND ANALYSIS METHODS
1998

Analysis	Sample Medium	Sampling Method	Collection Procedure Number	Sample Size	Analysis Procedure Number	Procedure Abstract
TLD (Panasonic)	Immersion Dose	Dosimeters exchanged quarterly	OCNGS Environmental Affairs Department Procedure 6530-IMP-4522.02	Two Badges	TMI-Dosimetry 6610-OPS-4243.01	Thermoluminescent dosimetry
TLD (Teledyne Brown Engineering)	Immersion Dose	Dosimeters exchanged quarterly	OCNGS Environmental Affairs Department Procedure 6530-IMP-4522.02	One Badge	Teledyne Brown Engineering PRO-342-17	Thermoluminescent dosimetry

APPENDIX K

1998 TLD

Quarterly Data

Table K-1
1998 TLD Quarterly Data - Panasonic TLD's
mrem per Standard Quarter +/- 2 Sigma

Station	First Period - 1998			Second Period - 1998			Third Period - 1998			Fourth Period - 1998		
C	9.2	+/-	0.5	9.9	+/-	0.6	10.5	+/-	0.2	11.4	+/-	0.4
14	10.4	+/-	0.3	10.9	+/-	0.4	12.4	+/-	0.3	11.9	+/-	0.8
1	9.7	+/-	0.4	12.0	+/-	0.6	11.1	+/-	0.7	9.9	+/-	0.5
3	7.4	+/-	0.6	8.6	+/-	1.1	9.3	+/-	0.2	9.9	+/-	0.7
6	8.4	+/-	0.7	TLD Lost			TLD Lost			9.1	+/-	0.6
8	8.0	+/-	0.5	9.3	+/-	0.7	9.7	+/-	0.4	8.9	+/-	0.8
9	8.8	+/-	0.2	9.4	+/-	0.5	10.5	+/-	0.5	10.3	+/-	0.6
11	7.9	+/-	1.1	9.2	+/-	0.8	9.7	+/-	0.3	8.6	+/-	0.8
22	8.0	+/-	0.6	8.7	+/-	0.7	9.2	+/-	0.4	9.0	+/-	0.4
51	11.7	+/-	0.9	12.3	+/-	1.0	12.9	+/-	0.4	TLD Lost		
52	12.3	+/-	0.4	14.4	+/-	0.8	12.8	+/-	0.4	13.7	+/-	0.8
53	11.2	+/-	0.6	14.2	+/-	0.5	13.5	+/-	0.5	13.1	+/-	1.1
54	8.4	+/-	0.2	9.8	+/-	0.3	10.1	+/-	0.7	10.1	+/-	0.5
55	14.7	+/-	0.7	17.2	+/-	1.1	17.5	+/-	0.7	16.6	+/-	1.0
56	13.2	+/-	0.6	16.0	+/-	0.9	14.9	+/-	0.9	14.8	+/-	0.9
57	11.0	+/-	1.1	12.8	+/-	0.7	12.1	+/-	0.4	12.2	+/-	0.4
58	10.0	+/-	0.6	10.9	+/-	0.5	12.7	+/-	0.4	11.2	+/-	0.6
59	9.9	+/-	0.5	11.9	+/-	0.5	12.0	+/-	0.6	11.5	+/-	0.4
61	8.3	+/-	1.2	8.8	+/-	0.7	8.8	+/-	0.5	10.0	+/-	0.5
62	8.5	+/-	0.6	9.7	+/-	0.9	9.8	+/-	0.5	10.5	+/-	0.7
63	7.9	+/-	0.7	9.5	+/-	0.7	9.4	+/-	0.5	11.0	+/-	0.7
64	7.4	+/-	0.6	8.7	+/-	0.8	9.0	+/-	0.5	10.5	+/-	0.8
65	8.2	+/-	0.4	9.3	+/-	0.8	9.5	+/-	0.5	10.8	+/-	0.8
66	8.0	+/-	0.8	8.9	+/-	0.3	9.8	+/-	0.6	10.4	+/-	0.7
68	7.9	+/-	0.5	9.2	+/-	0.2	TLD Lost			9.9	+/-	0.5
71	8.3	+/-	0.5	9.2	+/-	0.5	10.1	+/-	0.3	9.8	+/-	0.7
72	8.9	+/-	0.5	9.5	+/-	0.7	10.1	+/-	0.7	10.8	+/-	0.6
73	7.7	+/-	0.4	8.2	+/-	0.6	9.3	+/-	0.5	9.6	+/-	1.0
74	8.1	+/-	0.4	9.2	+/-	0.7	9.9	+/-	0.4	9.2	+/-	0.5
75	TLD Lost			10.3	+/-	0.7	10.9	+/-	0.7	10.6	+/-	0.9
78	7.7	+/-	0.2	8.4	+/-	0.7	10.0	+/-	0.3	8.5	+/-	0.8

Table K-1 (cont.)
1998 TLD Quarterly Data - Panasonic TLD's
mrem per Standard Quarter +/- 2 Sigma

Station	First Period - 1998			Second Period - 1998			Third Period - 1998			Fourth Period - 1998		
79	7.1	+/-	0.3	8.2	+/-	0.6	8.5	+/-	0.6	8.4	+/-	0.7
81	8.6	+/-	0.6	9.3	+/-	0.7	9.4	+/-	0.5	10.0	+/-	1.0
82	8.6	+/-	0.3	9.2	+/-	0.6	9.7	+/-	0.5	9.9	+/-	0.6
84	9.5	+/-	0.3	10.1	+/-	0.6	10.6	+/-	0.8	10.3	+/-	0.9
85	7.9	+/-	0.5	8.6	+/-	0.9		TLD Lost		8.6	+/-	0.9
86	8.7	+/-	0.5	8.9	+/-	0.7	9.7	+/-	0.6	10.0	+/-	1.2
88	6.9	+/-	0.3	8.2	+/-	0.4	8.2	+/-	0.5	7.8	+/-	0.8
89	7.1	+/-	0.4	8.1	+/-	0.6	8.4	+/-	0.5	9.0	+/-	0.5
90	7.5	+/-	0.5	7.7	+/-	0.5	8.4	+/-	0.4	9.3	+/-	0.9
92	8.9	+/-	0.2	9.5	+/-	0.4	9.8	+/-	0.5	11.0	+/-	1.1
98	8.6	+/-	0.6	9.0	+/-	0.8	9.9	+/-	0.6	10.3	+/-	0.6
99	8.2	+/-	0.7	9.0	+/-	0.6	9.2	+/-	0.7	9.9	+/-	1.0
T1	10.0	+/-	0.4	11.2	+/-	0.9	11.3	+/-	0.6	10.6	+/-	0.7

Table K-2
1998 TLD Ouarterly Data - Teledyne Browne Engineering TLD's
mrem per Standard Quarter +/- 2 Sigma

Station	First Period - 1998			Second Period - 1998			Third Period - 1998			Fourth Period - 1998		
C	10.6	+/-	1.3	9.5	+/-	0.6	10.3	+/-	1.2	10.9	+/-	0.5
8	10.0	+/-	0.7	8.9	+/-	0.6	9.6	+/-	0.2	9.6	+/-	0.3
66	9.5	+/-	0.4	8.7	+/-	0.3	9.8	+/-	0.7	9.9	+/-	0.5
79	8.9	+/-	0.7	7.9	+/-	0.4	9.1	+/-	0.5	8.5	+/-	0.4