DIC 2601.1

Contamination Event Report No. 92-001

Storm Drain Pond
1984 - 1992
Columbia Generating Station

November 14, 2007

A-3

S-1

Contamination Event Report
No. 92-001

Summary

From 1984 through 1992, discharges from the Turbine Building "clean" sumps, in part, resulted in low level radioactive material being identified in the Storm Drain Pond (SDP). The design of the Turbine Building sump drainage system allowed for process water that was anticipated to contain radioactive materials to be discharged to the SDP. Sources of this liquid inventory included water discharges from the plant air wash system, condenser water box drainage, fire protection system water, waste service water, and other non-radioactive system liquid discharges. Seasonal rains have also been identified as an additional source of very low level radioactive material reaching the storm drain pond from gaseous effluent washout and rainout. The seasonal rains may also wash particles that have settled on the roofs of buildings and grounds surrounding Columbia Generating Station to the SDP.

Elevated levels of tritium at the environmental sampling station located at the SDP outfall were also detected. The primary source of the tritium was concluded to be from the plant gaseous effluents that were condensing on the building roofs and draining into the SDP through the roof drain system.

Event Description & Location

The storm drain pond could receive water from several sources including roof drains, the Turbine building non-radioactive floor drains, the Service Building floor drains, Diesel Generator Building floor drains, and air handling unit drains. The pond was designed to allow for evaporation of released water into the air or for percolation into the soil.

Drains in the Turbine Building flow to five sumps. Sumps T-1, T-2, and T-3 were designed to be non-radioactive. Sumps T-4 and T-5 are radioactive sumps by design. Discharge from the radioactive sumps is routed to radwaste. Discharge from the non-radioactive drains was routed to the Storm Drain Pond, but was diverted to the radwaste system automatically if the discharge radiation monitor (FD-RIS-1, 2, 3) setpoint of 80 percent of the 10 CFR 20, Appendix B Table II value for Cs-137 was reached.

Small amounts of radioactivity were released to the storm drain pond since the plant startup. In November 1984, NCR 284-0729 was issued when low levels of radioactivity were reported in the Storm Drain Pond. An isolation valve in the line between the radioactive and non-radioactive systems failed resulting in contaminated water being input into the clean sump and discharged to the storm drain pond. Two check valves (FDR-V-34 & 35) were installed to resolve this issue.

NRC Information Notice No. 88-22 led to the initiation of Operational Experience Report (OER) 83022F on May 12, 1988. Several evaluations of the radioactive material identified in the storm drain pond, cooling tower sludge, and sanitary sewage sludge were performed. A Technical Evaluation Request (TER No. 88-0157-0) was initiated on April 23, 1988 indicating water containing low levels of radioactivity continued to be released to the storm drain pond. A Problem Evaluation Request (PER No. 289-0731) was initiated on September 5, 1989 indicating the August soil sample from the roof drain leach pond contained radioactivity. The PER was dispositioned to the TER that had recommended actions to thoroughly investigate the cause of the radioactivity in the Storm Drain Pond. However, no approved actions are documented.

PER 292-0531 was originated on January 29, 1992 indicating there was a potential unmonitored potential for radiological release point from the radiological controlled area by unmarked drains in the Diesel Generator Building and from the plant roof. Actions included labeling of drains and change in Operations practice of recirculating air back to the Radwaste HVAC system.

On November 11, 1992, an analysis of soil sample results taken in the vicinity of the storm drain pond showed levels of radioactivity that exceeded ten times the values of 10 CFR 20, resulting in the initiation of Licensee Event Report No. 92-042-01 and Plant Problem Nonconformance Report (NCR) 292-1228.

The storm drain pond is located within the controlled area boundary (a 1.2 mile radius surrounding the plant). Storm water was released at a point approximately 1500 feet northeast of the plant. The water is released through an eighteen inch diameter pipe at a concrete outfall into an earthen channel approximately 300 feet in length. The channel empties into a circular unlined pond area that is approximately 100 feet in diameter. The SDP is fenced and controlled as a Radioactive Materials Area.

Radiological Information

Radiological information for the SDP prior to 1993 can be found in the following documents:

1. Final Report – An Assessment of the Quantity of Residual Licensed Radioactive Material in the WNP-2 Storm Drain Pond. J. Stewart Bland Associates, Inc., September 20, 1994.
2. Final Report – Management of the Residual Radioactive Material in the Washington Nuclear Plant 2 Storm Drain Pond. J. Stewart Bland Associates, Inc., September 20, 1994.
3. Licensee Event Report No. 92-042-01.
4. IOM V. E. Shockley to J. W. Baker, "Response to ST-101 Sampling Requirement of Licensee Event Report No. 92-04-01, May 21, 1993.
5. IOM J.E. McDonald to A.I. Davis, "Results for ST101 through March 4, 1992, dated April 24, 1992.
6. Radiological Environmental Monitoring Program Special Report, July 30, 1992.
7. Radiological Environmental Monitoring Program 1992 Annual Report for Nuclear Plant 2, April 28, 1993.
8. Radiological Environmental Monitoring Program 1993 Annual Report for Nuclear Plant 2.

Dose Analysis

Dose analysis for the SDP prior to 1993 is provided in the report:
Final Report – Management of the Residual Radioactive Material in the Washington Nuclear Plant 2 Storm Drain Pond. J. Stewart Bland Associates, Inc., September 20, 1994

Contamination Event Report
No. 92-001

References
1. Final Report – An Assessment of the Quantity of Residual Licensed Radioactive Material in the WNP-2 Storm Drain Pond. J. Stewart Bland Associates, Inc., September 20, 1994.
2. Final Report – Management of the Residual Radioactive Material in the Washington Nuclear Plant 2 Storm Drain Pond. J. Stewart Bland Associates, Inc., September 20, 1994.
3. Licensee Event Report No. 92-042-01.
4. IOM V. E. Shockley to J. W. Baker, "Response to ST-101 Sampling Requirement of Licensee Event Report No. 92-04-01, May 21, 1993.
5. IOM J.E. McDonald to A.I. Davis, "Results for ST101 through March 4, 1992, dated April 24, 1992.
6. Radiological Environmental Monitoring Program Special Report, July 30, 1992.
7. PER 289-0731, Soil sample from roof drain leach pond contained radioactivity, September 6, 1989.
8. NRC Information Notice No. 88-22, "Disposal of Sludge from Onsite Sewage Treatment Facilities at Nuclear Power Stations", May 12, 1988.
9. PER 292-0531, Environmental samples of the ST101 Storm Drain Pond, obtained 5/13/92 have significant levels of radioactivity in the drain pond water.
10. NCR 284-0739, Install Check Valves.
11. TER 88-0157-0, "Non-Radioactive Drains/Storm Drain System", April 29, 1988.
12. Radiological Environmental Monitoring Program 1992 Annual Report for Nuclear Plant 2, April 28, 1993.
13. Radiological Environmental Monitoring Program 1993 Annual Report for Nuclear Plant 2.
14. NCR 292-1228, Increased Tritium Levels in Storm Drain.

Records
(Provide list of records generated specific to the event. Attach copies of these records.)
1. Final Report – An Assessment of the Quantity of Residual Licensed Radioactive Material in the WNP-2 Storm Drain Pond. J. Stewart Bland Associates, Inc., September 20, 1994.
2. Final Report – Management of the Residual Radioactive Material in the Washington Nuclear Plant 2 Storm Drain Pond. J. Stewart Bland Associates, Inc., September 20, 1994.
3. Licensee Event Report No. 92-042-01.
4. IOM V. E. Shockley to J. W. Baker, "Response to ST-101 Sampling Requirement of Licensee Event Report No. 92-04-01, May 21, 1993.
5. IOM J.E. McDonald to A.I. Davis, "Results for ST101 through March 4, 1992, dated April 24, 1992.
6. Radiological Environmental Monitoring Program Special Report, July 30, 1992.
7. PER 289-0731, Soil sample from roof drain leach pond contained radioactivity, September 6, 1989.
8. IOM J.E. McDonald to D.E. Larson, "ST101 Sample Results for June", July 6, 1989.
9. IOM T.S. Gray to K.D. Cowan, "OER 83022F Status", September 29, 1989
10. TER 88-0157-0, "Non-Radioactive Drains/Storm Drain System", April 29, 1988.

Prepared by: [signature] Date: 11/14/07

Approved by: [signature] Date: 11/14/07

FINAL REPORT

AN ASSESSMENT OF THE QUANTITY OF RESIDUAL LICENSED RADIOACTIVE MATERIAL IN THE WNP-2 STORM DRAIN POND

Prepared for:

Washington Public Power Supply System
Washington Nuclear Plant 2

By:

J. Stewart Bland Associates, Inc.

September 20, 1994

FINAL REPORT

AN ASSESSMENT OF THE QUANTITY OF RESIDUAL LICENSED RADIOACTIVE MATERIAL IN THE WNP-2 STORM DRAIN POND

A. Evaluation of Existing Sample Data

Extensive sampling of the soils and sediments underlying the WNP-2 Storm Drain Pond (SDP) was conducted on April 19th and 20th, 1993 by Burlington Environmental. The samples consisted of twelve core borings taken at the outfall, along the 300 foot run to the Pond and at six locations in the pond (See Attachment A). The borings were taken with a three inch diameter (OD) split-barrel sampler driven by 350 foot-pound hammer blows until 50 consecutive blows drove the sampler no more than six inches. In most cases, this first refusal of the sampling rig occurred at a depth range between 12 and 14 feet. A detailed description of the sampling process including USC classified soil horizons may be found in the Burlington Environmental project report listed in the reference section. These samples were composited and catalogued by the WNP-2 staff for the characterization of the quantity and distribution of radioactive material in the area.

The samples were analyzed by Teledyne at the Westwood Laboratory in New Jersey. Teledyne has provided copies of the software output of the Teledyne counting system for each individual sample. This software, programmed by Nuclear Data, provides the result of a peak search and matches peaks found to a designated radionuclide library for each sample analyzed. This software also provides an evaluation of the fractional error associated with each identified photopeak. Any photopeaks with a fractional error of greater than 30% were determined to be not present by Teledyne based on an empirical study based on the assumption that activity below the system "Lower Limit of Detection" (LLD) is not detectable. This type of decision is more appropriately based on a "Critical level" than on the LLD as recommended in NUREG/CR 4007[1]. The "critical level" for a measurement can be shown to be equivalent to a fractional error of 66% for low level measurements. J. Stewart Bland Associates, Inc. evaluated these photopeak error statements directly from the Nuclear Data software output for each individual sample. "Critical level" decision criteria were applied to this data to determine the presence or absence of licensed radionuclides in the sample. When a photopeak was identified with a fractional error of 66% or less the radionuclide was considered to be present at the detected concentration rather than at the derived minimum detectable as recorded by Teledyne. The specific decision criteria used for determining the presence of licensed radionuclides in concentrations that may be statistically distinguished from background at

[1]NUREG/CR 4007 is the basis for the NRC's current definition of LLD and related concepts such as the Critical or Decision Level, L_C.

the 95% confidence level is presented in Attachment B. The presence or absence of the radionuclides identified in each sample was assessed based on the decision level criterion and a characterization of the spacial distribution of licensed radioactive material in the SDP. The results of these evaluations have been tabulated in Attachment C in units of pCi/kg.

The utility of the decision level criterion is qualitative and the reliability of measurements of concentrations of radionuclides below the Lower Limit of Detection (LLD) should be considered as estimates based on the best information available. For the purpose of this study, the identification of the presence or absence of radionuclides within the defined sectors of the SDP was considered to be of greater value than attaining exceptional accuracy of measurements in the very low-level concentration range. All of the measurements contributing significantly to the total activity present in the SDP were above the specified LLD's for the measurement process and were therefore accurate measurements of the concentrations within those samples.

B. <u>Determination of the Quantity of Residual Activity in the SDP</u>

In order to determine the quantity (μCi's) of activity in the SDP, the mass concentrations listed in Attachment B were converted into volume concentrations having units of μCi/ml. For this conversion, the density of the substrate lying below the SDP has been estimated to be 1.5 gm/ml based on the dry mass and volume of samples prepared for counting.

The SDP is modeled in twelve distinct sectors each having a core sample assumed to be representative of the activity concentrations in the sector (see Attachment A). For the purpose of this assessment, it is assumed that the first refusal barrier to sampling is effectively impermeable and that no activity has penetrated beneath this level.

The head of the pond consists of a 300 foot long stream which begins at the station outfall and empties into the pond. This region of the SDP was divided into six sectors/boring locations. It is assumed that the contaminated area along the head of the pond extends 10 feet on either side of the stream bed. Although no samples were taken off the centerline of the stream bed, the existence of a significant lateral transport component for radionuclide dispersal in the soil is not anticipated due to the surface run-off nature of water movement in this region of the SDP. For this reason, the assumption of the twenty foot width in this region of the SDP is felt to be conservative. The total surface area of this contaminated region is 6000 ft^2 (20' x 300'). The outfall, Sector A, and at the point where the stream enters the pond, Sector C, were assigned a nominal length of thirty feet due to the proximity of the borings to the extreme ends of the stream. The remaining sectors in the head of the pond, L, K, B and J were evenly divided into lengths of 60' each.

The second region encompasses the roughly circular pond having a surface area of about 6000 ft^2. The pond was segmented into six "pie slice" sectors each with a surface area of 1000 ft^2. Each of these sectors are characterized by the activity concentrations in borings D through I.

The quantity of each radionuclide in each sector at one foot depth intervals was determined using the measured volume concentration at each depth interval and the volume of that increment of the sector. This step was necessary since the sectors vary in volume. These quantities were then summed to obtain the total activity of each radionuclide in the SDP.

Two types of samples were prepared for analysis from the borings allowing two semi-independent methods to be utilized for the characterization of the radionuclide distribution in the SDP. The first population of samples were composites of material taken along two foot depth intervals from each of the borings. The second population consisted of composites of material taken along five foot intervals of each boring. The general method of determining the quantity of activity described above was applied to each of these sample populations independently. The application of this process to the first population of samples is referred to as "Method I" and the use of the second population of samples is referred to as "Method II". The results obtained by each of these two methods are presented in Attachment D.

For many of the radionuclides identified in the SDP, the majority of the activity was located at or near the surface of the affected area. The results obtained using the two foot depth interval samples (Method I) therefore provided a more accurate characterization of the radionuclide distribution. The results obtained using the five foot depth interval samples (Method II) were consistently lower in evaluated concentrations. This is believed to be the result of the dilution effect of the inclusion of lower depth uncontaminated soils into the composite samples submitted for analysis. From this point forward in this discussion, any reference to results of evaluations refer strictly to those obtained using the two foot depth interval sample population (Method I).

The total quantity of each radionuclide measured in the SDP as a whole and only the quantity measured in the first three feet is presented in Table 1 below.

Table 1 - Total Activity in the SDP vs the Quantity Located in the First Three Feet (μCi)			
Radionuclide	Total in SDP	Total in 1^{st} 3'	% in 1^{st} 3'
Cs-137	66	53	80
Cs-134	180	45	25
Co-60	570	420	74
Zn-65	20	18	90
Mn-54	26	10	38
Zr-95	29	6.8	23
Nb-95	63	15	24
Ce-141	4.6	0.61	13

The majority of the activity in the SDP was found to be located in sectors A, C and I. These sectors correspond to the outfall and the area where the run-off stream enters the pond (see Attachment A). It is logical that these areas should contain a majority of the activity. The outfall location should accumulate heavy suspended solids as sediment and is also subject to mechanical agitation/mixing of the sediments and soils. The area of the pond where the run-off stream intersects the pond should accumulate sediment containing adsorbed activity since this is the area where the stream velocity decreases dramatically thereby reducing the ability of the water to retain suspended solids.

Table 2 below presents the total quantity of each radionuclide measured in the SDP as a whole and only the quantity measured in sectors A, C and I.

Table 2 - Total Activity in the SDP vs the Quantity Located in Sectors A, C and I (μCi)			
Radionuclide	Total in SDP	Total in Sectors A, C & I	% in Sectors A, C & I
Cs-137	66	47	71
Cs-134	180	43	24
Co-60	580	370	64
Zn-65	20	17	85
Mn-54	26	7.2	28
Zr-95	29	4.0	14
Nb-95	63	8.7	14
Ce-141	4.6	0.46	10

The quantities of Co-60, Cs-137 and Zn-65 located within the first three feet of depth and in sectors A, C and I are a large percentage of the total quantity of these radionuclides found in the SDP. This distribution would be expected for radionuclides adsorbed onto particulates. The distribution of Cs-134, Zr-95/Nb-95, and Ce-141 follow a distribution pattern that would be expected for radionuclides in a soluble chemical form. The case of cesium-137 appears anomalous since this radionuclide would be expected to be more evenly distributed throughout the soil matrix similar to the distribution of cesium-134. This anomaly may be due to the very low concentrations of these radionuclides being detected and the conservative method used for the evaluation of the presence of Cs-134 (see Attachment B).

C. Determination of Averaged Radionuclide Concentrations for Radiological Assessment

It is appropriate to use volume concentrations derived from the quantity of activity located in the first three feet when estimating the direct exposure to individuals in the vicinity of the SDP. This depth profile was selected since the contribution of radionuclides below this depth to the exposure rates at the surface will be minimal primarily due to the shielding afforded by the soil in the first three feet of depth. If all the activity of all the radionuclides detected were present within the first three feet, the Co-60 activity would still be the largest contributor to the external exposure of the receptor since it constitutes around 60% of the total activity. In addition, Co-60 emits two high energy gamma photons for each decay while the remainder of the radionuclides emit only one or two lower energy photons. This will result in Co-60 being the limiting case for subsurface penetration. Only a small fraction of the total exposure rate at the surface will originate from activity below three feet in depth even if all of this activity were Co-60.

Table 3 below lists the averaged concentrations for each radionuclide in the first three feet at the head and in the body of the pond. This determination used only the measured activity contained in the first three feet of soil depth averaged over the volume contained in the first three feet of the contaminated area depth.

Table 3 - Averaged Concentrations Contained in the First Three feet of the Head and the Pond (μCi/ml)

Radionuclide	Head of the Pond	Pond
Cs-137	7.9 E-08	2.6 E-08
Cs-134	6.3 E-08	2.4 E-08
Co-60	6.1 E-07	2.0 E-07
Zn-65	3.0 E-08	5.2 E-09
Mn-54	1.6 E-08	4.3 E-09
Zr-95	6.3 E-09	6.9 E-09
Nb-95	1.4 E-08	1.5 E-08
Ce-141	1.2 E-09	None

Table 4 below lists the concentrations averaged over the entire volume of the SDP for each radionuclide detected in the head and the pond.

Table 4 - Averaged Concentrations in the Head and Pond (μCi/ml)		
Radionuclide	Head	Pond
Cs-137	2.3 E-08	9.3 E-09
Cs-134	5.4 E-08	4.1 E-08
Co-60	2.0 E-07	1.0 E-07
Zn-65	8.6 E-09	1.6 E-09
Mn-54	1.0 E-08	3.5 E-09
Zr-95	5.7 E-09	7.7 E-09
Nb-95	1.2 E-08	1.7 E-08
Ce-141	2.4 E-09	None

These types of exposure assessments are very dependent on the relative geometry of the source to the receptor. The averaged volume concentrations are calculated separately for the head and the main pond because the different shapes of these two contaminated regions of the SDP require them to be modeled separately.

These derived volume concentrations may be used for comparison to the Station clean-up guidelines as presented in the "Low Level Radioactive Material Control Program" document for decisions on any further remediation activities that may be necessary until the area is re-evaluated at the time of facility decommissioning.

D. References

1. "Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements," NUREG/CR-4007, Currie, L. A., September 1984

2. "Hope Creek Chemistry Counting System Detection Limits and the Use of Post Analysis Peak Rejection Criteria," prepared for PSE&G by J. W. Moon and J. S. Bland, J. Stewart Bland Associates, Inc., February 1992

3. "Poisson's Exponential Binomial Limit"; Molina, E.C.; Robert E. Krieger Publishing Co., Huntington, N.Y.;(1973)

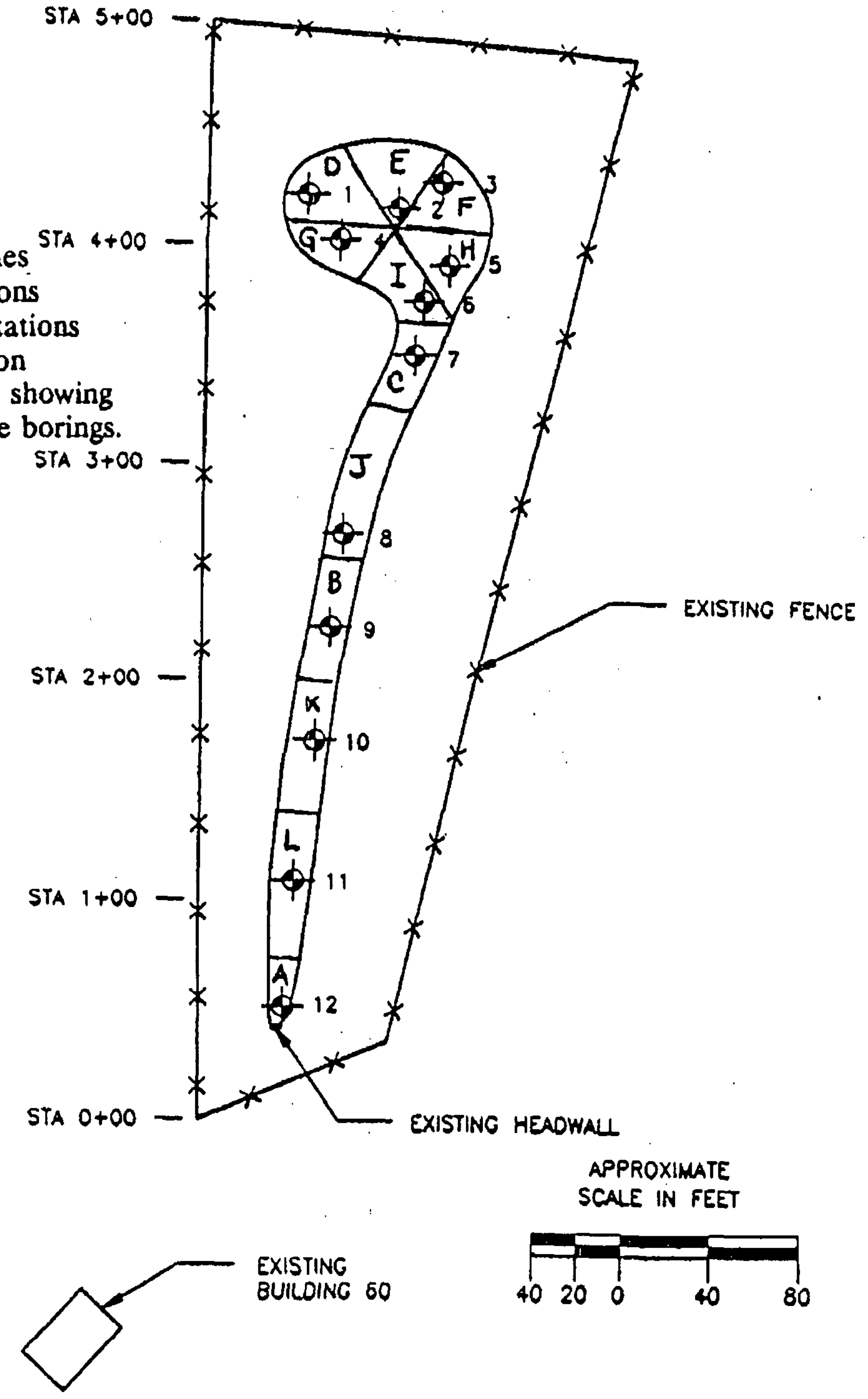
4. "Pond Soil Sampling, Hanford Reservation, Richland, Washington"; Report Dated May 13, 1994 by Burlington Environmental Inc., 2203 Airport Way South, Suite 400 Seattle, WA 98134

5. Presentation at the Health Physics Society meeting in Atlanta, GA in July 1993. This presentation prepared by J. Stewart Bland Associates, Inc. was titled "A Peak Rejection Criterion Based on Counting Error for Low Level Gamma Spectroscopy Measurements".

6. "Statistically Based Detection Criteria for Peak Identification in Gamma Spectrometry," prepared for PSE&G by Halliburton NUS Environmental Corporation, July 2, 1992

7. "Report of Analysis (12 May 1993)" Revised 5/14/93; Teledyne Isotopes, 50 Van Buren Ave., Westwood, N.J. 07675.

NOTE: The division lines and the letter designations of the sectors are annotations to the original Burlington Environmental diagram showing the locations of the core borings.



LEGEND

1 APPROXIMATE BORING LOCATION AND IDENTIFYING NUMBER

Burlington Environmental Inc.

SUPPLY SYSTEM POND SOIL SAMPLING
BORING LOCATION PLAN

W.P.P.S.S.
RICHLAND, WA.
625557

FIGURE 1

DOCUMENT MANAGER

CHECKED BY

DRAWN BY

Attachment B

Criteria for Determination of the Presence of Radionuclides

The criteria utilized by Teledyne for identification of radionuclides in concentrations above background levels was based on the assumption that activity below the *a priori* Lower Limit of Detection (LLD) is not detectable. While this process used by Teledyne for the rejection of data is by no means unusual, the characterization of the residual activity in the SDP calls for the application of discrete decision level criteria (e.g., a "Critical" Level, L_C) to the sample data. As described by Currie in NUREG/CR 4007, the decision level is an *a posteriori* determination of the net count in a photopeak that can be statistically distinguished from the background radiation level. This method of positive identification criterion is fundamentally different than the method used by Teledyne based on the LLD. Considerations for the probabilities of both false positive and false negative detection are included in the concept of the LLD, whereas the concept of the Critical Level only includes the probability of false positive detection. As a result of the application of this discrete detection criterion many of the sample analyses gave positive indication of the presence of individual radionuclides where they were previously reported as not detectable using the Teledyne criteria. This decision level is 2.33 standard deviations above the *a posteriori* background level.

For low level counting, where the number of counts is below the threshold of applicability of Gaussian or normal statistics, the decision level may be established using Poisson statistics. This "critical level" has been directly related to a 66% fractional error at one standard deviation under counting conditions similar to those encountered in the evaluation of these samples.[2] This criteria for distinguishing concentrations of radionuclides above background levels is appropriate for comparisons of concentrations in a group of related samples for the purpose of characterizing the distribution of individual radionuclides in a contaminated area. Therefore, any identified peak with a 1σ fractional error statement below 66% was considered to have been detected above the background level at the 95% confidence level.

There was one positive indication of the presence of cobalt-58 in the sample data. This occurred in sector K at a depth of 11 to 12 feet below the surface. This indication was rejected as a probable false positive due to the absence of this radionuclide at locations near the surface and the anticipated insoluble chemical form. It is quite unlikely that cobalt-58 would appear only at this depth and in this location.

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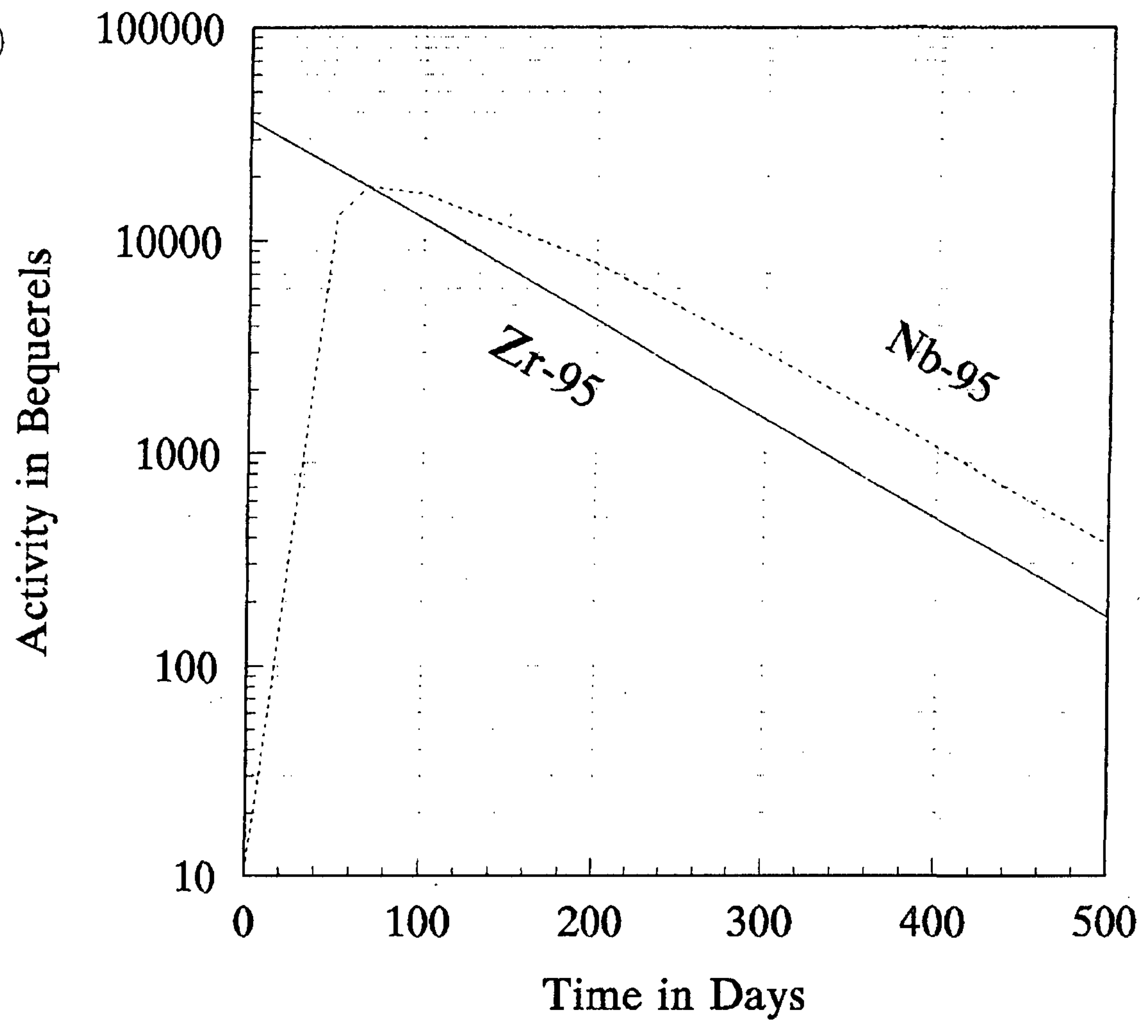
[2] Presentation at the Health Physics Society meeting in Atlanta, GA in July 1993. This presentation prepared by J. Stewart Bland Associates, Inc. was titled "A Peak Rejection Criterion Based on Counting Error for Low Level Gamma Spectroscopy Measurements".

In the cases of Cs-134 and Zr-95, derived concentrations based on indirect detection criteria were used. Teledyne did not use a blank sample for eliminating the photopeak interference of naturally occurring radionuclides in the samples. The comparative levels of natural activity are two to three orders of magnitude above the levels of the fission and activation products detected in the samples. In the case of cesium-134, interference with detection of the 604 kev photopeak by the substantially larger 609 kev peak of bismuth 214, a progeny of radium-226 was significant. In most cases, the 795 kev peak was positively identified with less than 18% uncertainty but the 604 kev photopeak was not detected. Teledyne has rejected the presence of cesium-134 based on the absence of the 604 kev photopeak. In consideration of the significant interference present at the 604 kev energy region, cesium-134 was re-evaluated to be present when the 795 kev peak was identified. Cesium-134 was recorded as not present when neither of the two photopeaks were identified. Although this method may result in an overstatement of the presence of Cs-134 due to the probability of false positives, the basis for identification of this radionuclide is felt to be conservative.

In the case of Zr-95, the level of activity indirectly determined by the presence of the daughter Nb-95 would be below the LLD based criterion used by Teledyne. With some probable interference with detection of one of the two primary peaks, it was not surprising that only one of the Zr-95 photopeaks was detected on a sporadic basis. Although Nb-95 was detected consistently at levels even above Teledyne's peak rejection criterion of 30% fractional error (typical Nb-95 peaks had 12 to 15% fractional error), the presence of the Nb-95 was rejected because Zr-95 was rejected. Our re-evaluation of the data credits the positive identification of Nb-95 and infers the presence of the parent based on an assumed transient equilibrium relationship. This transient equilibrium condition has been evaluated to result in a Nb-95/Zr-95 ratio of between 2.18 at 500 days to 2.2 after stabilization of the equilibrium. We used the inverse of the 2.18 ratio (0.459) as a multiplier to the Nb-95 measured concentrations to obtain our indirect evaluation of the quantity of Zr-95 present. This method assumes that any original complement of Nb-95 had decayed and that there were no chromatographic effects that would separate the parent from its progeny. The chromatographic effect is principally observed in separations of radionuclide progeny from the parent by taking advantage in the difference in their chemical form (solubility). The best example is the elution of Tc-99^{m} with saline from a column containing the parent radionuclide Mo-99 in a sand-like medium. The Tc-99^{3} is washed from the column thereby achieving the separation. The situation in the storm drain pond may be similar with large quantities of water washing over deposits of Zr-95. The graph below shows the transient equilibrium relationship established by the ingrowth of Nb-95 in a medium containing Zr-95.

The application of these criteria and assumptions provide an accurate and, in general, a conservative evaluation of the distribution of residual licensed radioactive material in the SDP.


100000
10000
1000
100
10
Activity in Bequerels
Zr-95
Nb-95
0
100
200
300
400
500
Time in Days

Attachment C - Storm Drain Pond (SDP) Results-Picocuries per Kilogram - Analyzed by Teledyne (April 1993), Evaluated by JSB Associates (May 1994)

DATE	DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228
	ST101A											
DATE	DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228
22-Apr-93	0'-1'	3.00E+02	1.26E+02	1.26E+03	6.84E+01	4.14E+01				1.08E+04	1.12E+03	5.08E+02
22-Apr-93	1'-2'	4.05E+02	1.42E+02	3.05E+03	1.92E+02	3.78E+01				1.14E+04	2.06E+03	9.07E+02
22-Apr-93	2'-3'	1.23E+02	6.00E+01	7.67E+02	7.03E+01					1.85E+04	1.33E+03	7.39E+02
22-Apr-93	3'-5'	9.83E+01	4.91E+01	5.11E+02	4.07E+01					1.31E+04	9.97E+02	5.05E+02
22-Apr-93	5'-7'	9.59E+00	2.85E+01	1.04E+02						1.52E+04	7.40E+02	5.34E+02
22-Apr-93	7'-9'		3.20E+01				5.78E+00	1.26E+01		1.31E+04	8.56E+02	4.97E+02
22-Apr-93	9'-10.5'		4.16E+01				1.50E+01	3.26E+01		1.59E+04	8.80E+02	5.73E+02
22-Apr-93	11'-13'		3.33E+01			9.19E+00				1.37E+04	8.91E+02	5.36E+02
22-Apr-93	13'-14.4'		4.80E+01							1.04E+04	1.03E+03	4.33E+02
22-Apr-93	0'-5'	9.80E+01	4.59E+01	1.20E+03	6.08E+01	2.65E+01	1.39E+01	3.04E+01	1.96E+01	1.47E+04	9.93E+02	5.43E+02
22-Apr-93	5'-10'	1.67E+01	3.51E+01	1.55E+02		1.39E+01	1.14E+01	2.49E+01		1.34E+04	7.67E+02	4.79E+02
	ST101B											
DATE	DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228
21-Apr-93	0'-2'		4.27E+01	5.30E+01		1.63E+01	1.40E+01	3.05E+01		1.58E+04	1.13E+03	5.97E+02
21-Apr-93	2'-3'	9.18E+00	3.70E+01	5.70E+01		1.48E+01			1.21E+01	1.69E+04	1.05E+03	6.44E+02
21-Apr-93	3'-5'		3.30E+01	2.16E+01						1.24E+04	6.99E+02	4.51E+02
21-Apr-93	5'-7'		4.12E+01			8.69E+00	1.04E+01	2.26E+01		1.29E+04	7.21E+02	4.89E+02
21-Apr-93	7'-9'									1.29E+04	7.18E+02	4.49E+02
21-Apr-93	9'-11'		4.07E+01							1.64E+04	1.06E+03	6.07E+02
21-Apr-93	11'-12'		2.55E+01							1.21E+04	5.82E+02	4.39E+02
21-Apr-93	0'-5'		3.39E+01	9.94E+01			8.03E+00	1.75E+01		1.32E+04	9.01E+02	4.83E+02
21-Apr-93	5'-10'		2.95E+01	5.99E+01			9.95E+00	2.17E+01		1.26E+04	8.53E+02	4.57E+02
21-Apr-93	10'-12'		2.15E+01							1.34E+04	8.35E+02	4.87E+02
	ST101C											
DATE	DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228
21-Apr-93	0'-2'	3.72E+01	3.36E+01	3.23E+02		8.33E+00				1.21E+04	7.63E+02	4.45E+02
21-Apr-93	2'-3'	3.26E+02	1.28E+02	3.35E+03	2.46E+02	4.33E+01				1.58E+04	1.63E+03	7.15E+02
21-Apr-93	3'-5'		3.11E+01	4.11E+02						1.45E+04	8.60E+02	5.21E+02
21-Apr-93	5'-7'		2.27E+01	2.25E+01		1.17E+01				1.02E+04	6.08E+02	3.92E+02
21-Apr-93	7'-9'		3.17E+01			1.30E+01	1.53E+01	3.33E+01		1.48E+04	9.21E+02	6.44E+02
21-Apr-93	9'-11'	1.73E+01	3.98E+01	5.66E+02						1.38E+04	9.10E+02	4.52E+02
21-Apr-93	11'-12'		4.19E+01	1.11E+01		1.59E+01			1.76E+01	1.84E+04	1.32E+03	7.57E+02

Attachment C - Storm Drain Pond (SDP) Results-Picocuries per Kilogram - Analyzed by Teledyne (April 1993), Evaluated by JSB Associates (May 1994)

DATE	DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228
21-Apr-93	0'-5'	3.82E+01	3.49E+01	3.81E+02			8.44E+00	1.84E+01		1.04E+04	7.73E+02	4.26E+02
21-Apr-93	5'-10'	1.70E+01	2.89E+01	1.19E+02						1.16E+04	7.38E+02	4.45E+02
21-Apr-93	10'-12.5.'		4.83E+01	1.39E+02			2.61E+01	5.68E+01		1.87E+04	8.81E+02	7.87E+02

DATE	ST101D DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228
19-Apr-93	0'-2'			7.70E+01			5.00E+00	1.09E+01		1.18E+04	7.86E+02	4.61E+02
19-Apr-93	2'-3'		4.29E+01	4.42E+01						1.56E+04	1.09E+03	7.22E+02
19-Apr-93	3'-5'		2.96E+01			3.70E-01	9.86E+00	2.15E+01		1.33E+04	7.65E+02	4.81E+02
19-Apr-93	5'-7'						1.95E+01	4.25E+01		1.69E+04	1.20E+03	7.22E+02
19-Apr-93	7'-9'		3.15E+01				6.97E+00	1.52E+01		1.29E+04	5.22E+02	4.57E+02
19-Apr-93	9'-11'		4.45E+01							1.55E+04	1.21E+03	5.30E+02
19-Apr-93	11'-13'		2.93E+01							1.25E+04	6.84E+02	4.69E+02
19-Apr-93	5'-10'		2.19E+01			6.23E+00				1.16E+04	7.80E+02	5.32E+02

DATE	ST101E DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228
20-Apr-93	0'-2'	1.30E+01	2.81E+01	1.95E+02	3.13E+01	1.55E+01	1.13E+01	2.47E+01		1.50E+04	1.09E+03	6.23E+02
20-Apr-93	2'-3'		2.63E+01	3.25E+01			8.12E+00	1.77E+01		1.34E+04	7.98E+02	6.42E+02
20-Apr-93	3'-5'		2.69E+01	1.99E+01			5.00E+00	1.09E+01		1.14E+04	6.74E+02	3.89E+02
20-Apr-93	5'-6.5'			8.37E+01						1.60E+04	1.11E+03	6.52E+02
20-Apr-93	7'-10'		3.03E+01	4.73E+01		1.02E+01	9.72E+00	2.12E+01		1.32E+04	8.66E+02	5.14E+02
20-Apr-93	11'-13'		1.30E+02				3.58E+01	7.80E+01		1.89E+04	3.41E+03	9.91E+02
20-Apr-93	0'-5'			1.79E+01			7.38E+00	1.61E+01		1.13E+04	6.93E+02	3.79E+02
20-Apr-93	5'-10'		2.11E+01							1.07E+04	8.34E+02	4.02E+02

DATE	ST101F DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228
20-Apr-93	0'-2'	1.48E+01		1.06E+02		6.93E+00	4.54E+01	9.88E+00		1.23E+04	8.43E+02	4.73E+02
20-Apr-93	2'-3'		2.81E+01	6.23E+01			1.38E+01	3.00E+01		1.51E+04	9.06E+02	6.63E+02
20-Apr-93	3'-5'		2.68E+01	2.85E+01			5.36E+00	1.17E+01		1.16E+04	6.48E+02	4.62E+02
20-Apr-93	5'-7'					7.53E+00	7.25E+00	1.58E+01		1.03E+03	5.83E+02	3.96E+02
20-Apr-93	7'-8'									1.11E+04	4.16E+02	4.62E+02
20-Apr-93	11'-11.5'		4.62E+01							1.42E+04	4.90E+02	4.82E+02
20-Apr-93	0'-5'		2.63E+01	2.84E+01						1.05E+04	7.66E+02	4.10E+02
20-Apr-93	5'-10'		2.21E+01	2.19E+01						1.15E+04	6.38E+02	4.59E+02

Attachment C - Storm Drain Pond (SDP) Results-Picocuries per Kilogram - Analyzed by Teledyne (April 1993), Evaluated by JSB Associates (May 1994)

DATE	DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228

ST101G

DATE	DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228
20-Apr-93	0'-2'			9.09E+01						1.27E+04	8.06E+02	5.11E+02
20-Apr-93	2'-4.5'		2.52E+01	5.10E+01		7.00E+00				1.08E+04	6.23E+02	4.97E+02
20-Apr-93	3'-5'			6.99E+01			1.35E+01	2.94E+01		1.65E+04	1.06E+03	7.53E+02
20-Apr-93	5'-7'		3.35E+01	2.93E+01						1.78E+04	1.25E+03	7.41E+02
20-Apr-93	7'-8'	1.09E+01		9.84E+00			9.90E+00	2.16E+01		1.31E+04	1.02E+03	5.13E+02
20-Apr-93	9'-11.8'									1.49E+04	1.24E+03	6.00E+02
20-Apr-93	0'-4'		2.62E+01	5.85E+01						1.19E+04	7.42E+02	4.39E+02
20-Apr-93	5'-9'		2.28E+01	1.68E+01			8.30E+00	1.81E+01		1.11E+04	6.15E+02	4.52E+02
20-Apr-93	10'-12'		2.22E+01	2.95E+01						1.12E+04	7.10E+02	4.77E+02

ST101H

DATE	DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228
20-Apr-93	0'-2'	3.02E+01	4.08E+01	2.03E+02						1.30E+04	9.03E+01	5.38E+02
20-Apr-93	2'-3'	7.76E+01		4.42E+02						1.58E+04	1.48E+03	7.08E+02
20-Apr-93	3'-5'		2.38E+01				7.43E+00	1.62E+01		1.12E+04	7.66E+02	5.01E+02
20-Apr-93	5'-7'		2.84E+01	1.60E+01			7.38E+00	1.61E+01		1.69E+04	9.23E+02	6.01E+02
20-Apr-93	7'-7.8'		3.21E+01	7.23E+01						1.07E+04	1.17E+03	5.74E+02
20-Apr-93	9'-11'		2.57E+01				1.64E+01	3.57E+01		1.47E+04	7.29E+02	4.55E+02
20-Apr-93	11'-11.9'	2.02E+01					1.08E+01	2.35E+01		1.66E+04	9.50E+02	6.56E+02
20-Apr-93	13'-13.5'		2.94E+01							1.27E+04	8.03E+02	5.38E+02
20-Apr-93	0'-5'		2.50E+01	2.63E+01			5.87E+00	1.28E+01		1.14E+04	7.81E+02	4.61E+02
20-Apr-93	6'-12'	4.90E+00	2.68E+01	2.67E+01		6.97E+00				1.11E+04	7.11E+02	4.36E+02

ST101I

DATE	DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228
21-Apr-93	0'-2'	5.52E+01		1.76E+02			9.49E+00	2.07E+01		1.35E+04	9.29E+00	5.66E+02
21-Apr-93	2'-4.2'	6.38E+00	2.89E+01	1.26E+02						1.23E+04	8.53E+02	4.78E+02
21-Apr-93	5'-7.8'	2.76E+01	3.69E+01	1.82E+02		1.18E+01				1.57E+04	1.22E+03	6.26E+02
21-Apr-93	9'-11.7'		2.95E+01				1.06E+01	2.31E+01		1.07E+04	1.08E+03	4.78E+02
21-Apr-93	0'-5'	3.06E+01	2.61E+01	1.85E+02						1.16E+04	7.90E+02	4.41E+02
21-Apr-93	5'-10'		2.48E+01	7.34E+01			1.40E+01	3.06E+01		1.23E+04	7.94E+02	4.79E+02
21-Apr-93	10'-12'		3.23E+01			9.38E+00			1.62E+01	1.15E+04	7.83E+02	4.66E+02

Attachment C - Storm Drain Pond (SDP) Results-Picocuries per Kilogram - Analyzed by Teledyne (April 1993), Evaluated by JSB Associates (May 1994)

DATE	DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228
	ST101J											
DATE	DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228
21-Apr-93	0'-2'		2.93E+01	9.02E+01						1.29E+04	9.82E+02	4.64E+02
21-Apr-93	2'-3'		3.33E+01	3.97E+01		8.55E+00	1.08E+01	2.36E+01		1.67E+04	9.56E+02	6.71E+02
21-Apr-93	3'-5'		3.30E+01				4.72E+00	1.03E+01		1.20E+04	7.20E+02	4.45E+02
21-Apr-93	5'-7'		2.39E+01	3.67E+01		8.34E+00			1.70E+01	1.31E+04	8.04E+02	4.90E+02
21-Apr-93	7'-9'		2.45E+01			9.04E+00	1.08E+01	2.35E+01		1.20E+04	7.65E+02	4.57E+02
21-Apr-93	9'-11'		2.28E+01			1.14E+01				1.26E+04	8.21E+02	5.04E+02
21-Apr-93	11'-13'		2.56E+01			8.13E+00				1.19E+04	6.48E+02	4.59E+02
21-Apr-93	13'-14'		3.63E+01				1.15E+01	2.50E+01		1.52E+04	1.06E+03	6.31E+02
21-Apr-93	0'-5'		2.98E+01	1.68E+01			7.98E+00	1.74E+01		1.20E+04	6.83E+02	5.54E+02
21-Apr-93	5'-11'		2.26E+01							1.15E+04	6.99E+02	4.08E+02

	ST101K											
DATE	DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228
22-Apr-93	0'-2'	3.80E+01	4.07E+01	1.12E+02		1.04E+01				1.48E+04	9.85E+02	6.08E+02
22-Apr-93	2'-3'	1.40E+01	3.46E+01	6.51E+01						1.34E+04	1.02E+03	6.31E+02
22-Apr-93	3'-5'									4.23E+04	2.08E+03	1.59E+03
22-Apr-93	5'-7'		2.06E+01							1.21E+04	6.83E+02	4.14E+02
22-Apr-93	7'-9'		1.40E+01			5.26E+00				1.14E+04	6.72E+02	4.03E+02
22-Apr-93	9'-10.5'		2.95E+01							1.49E+04	9.02E+02	6.05E+02
22-Apr-93	11'-12.4'		4.17E+01			8.90E+00	2.06E+01	4.50E+01		1.52E+04	1.18E+03	6.72E+02
22-Apr-93	13'-13.8'		1.73E+01							9.73E+03	5.44E+02	3.72E+02
22-Apr-93	0'-5'	2.16E+01	3.51E+01	6.84E+01		9.81E+00				1.31E+04	8.76E+02	4.69E+02
22-Apr-93	5'-10'	2.02E+01	3.44E+01	4.01E+01		1.36E+01				1.33E+04	8.06E+02	4.45E+02
22-Apr-93	10'-13'	3.59E+01	3.76E+01	6.46E+01						1.37E+04	8.89E+02	5.11E+02

	ST101L											
DATE	DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228
22-Apr-93	0'-2'	2.17E+01		1.13E+02			1.23E+01	2.69E+01		1.45E+04	8.65E+02	5.45E+02
22-Apr-93	2'-3'	3.35E+01	4.19E+01	6.91E+02	1.71E+01	1.39E+01				1.77E+04	1.14E+03	7.17E+02
22-Apr-93	3'-5'		3.13E+01	1.02E+01		7.30E+00				1.49E+04	8.61E+02	5.44E+02
22-Apr-93	5'-7'		3.34E+01							1.60E+04	9.46E+02	6.19E+02
22-Apr-93	7'-9'		2.57E+01			9.38E+00				1.37E+04	6.85E+02	4.68E+02
22-Apr-93	9'-10'		3.39E+01			1.40E+01				1.72E+04	1.04E+03	6.82E+02
22-Apr-93	11'-14.5'		3.62E+01			1.09E+01	1.48E+01	3.23E+01	1.18E+01	1.92E+04	1.26E+03	7.34E+02

Attachment C - Storm Drain Pond (SDP) Results-Picocuries per Kilogram - Analyzed by Teledyne (April 1993), Evaluated by JSB Associates (May 1994)

DATE	DEPTH	CS-137	CS-134	CO-60	ZN-65	MN-54	ZR-95	NB-95	CE-141	K-40	RA-226	TH-228
22-Apr-93	0'-5'	2.04E+01	3.06E+01	5.56E+01			6.19E+00	1.35E+01		1.25E+04	6.51E+02	4.41E+02
22-Apr-93	5'-10'		2.62E+01	1.58E+01		1.02E+01	5.00E+00	1.09E+01		1.29E+04	6.73E+02	4.24E+02
22-Apr-93	10'-14'	5.48E+00								1.16E+04	7.18E+02	4.42E+02

RESULT - Denotes detectable result.

Attachment D

Two distinct populations of samples were prepared. The first population represents approximately two foot depth intervals at each boring. The second population represents composites of five foot depth intervals at each boring. This sample protocol allows estimation of activity concentrations by two separate methods. These are designated Method I and Method II respectively. The results of the two methods should be in general agreement. Method I is considered to be inherently more accurate since the depth intervals were smaller allowing a better resolution of radionuclide distributions. For the purpose of this comparison the total quantity of activity of each radionuclide detected in the SDP is expressed in microcuries. Table D-1 below shows the difference in the total quantity of each radionuclide measured in the SDP as a whole and only the quantity measured in the first three feet using each of the two sample populations.

Table D-1 - Total Activity in the SDP vs the Quantity Located in the First Three feet (μCi)

Radionuclide	Method I			Method II		
	Total in SDP	Quantity in 1st 3'	% in 1st 3'	Total in SDP	Quantity in 1st 3'	% in 1st 3'
Cs-137	66	53	80	56	21	37
Cs-134	180	45	25	150	39	26
Co-60	570	420	74	450	200	44
Zn-65	20	18	90	8.0	4.6	56
Mn-54	26	10	38	18	5.8	32
Zr-95	29	6.8	23	23	4.1	18
Nb-95	63	15	24	49	9	18
Ce-141	4.6	0.61	13	5.9	3.6	60

Table D-2 below lists the concentrations averaged over the entire volume of the SDP for each radionuclide detected in the head of the pond for each of these methods.

Table D-2 - Averaged Concentrations in Head of Pond (μCi/ml)		
Radionuclide	Method I	Method II
Cs-137	2.3 E-08	2.3 E-08
Cs-134	5.4 E-08	4.5 E-08
Co-60	2.0 E-07	1.7 E-07
Zn-65	8.6 E-09	3.8 E-09
Mn-54	1.0 E-08	6.7 E-09
Zr-95	5.7 E-09	7.3 E-09
Nb-95	1.2 E-08	1.6 E-08
Ce-141	2.4 E-09	1.3 E-09

Table D-3 below lists the averaged concentrations for each radionuclide detected in the pond itself for each of the two quantification methods.

Table D-3 - Averaged Concentrations in Pond (μCi/ml)		
Radionuclide	Method I	Method II
Cs-137	9.3 E-09	3.9 E-09
Cs-134	4.1 E-08	2.9 E-08
Co-60	1.0 E-07	5.2 E-08
Zn-65	1.6 E-09	None
Mn-54	3.5 E-09	2.1 E-09
Zr-95	7.7 E-09	3.7 E-09
Nb-95	1.7 E-08	8.2 E-09
Ce-141	None	1.7 E-09

Table D-4 below lists the averaged concentrations for each radionuclide in the first three feet at the head of the pond showing the difference in using the two sample populations.

Table D-4 - Averaged Concentrations Contained in the First Three feet of the Head of Pond (μCi/ml)		
Radionuclide	Method I	Method II
Cs-137	7.9 E-08	3.3 E-08
Cs-134	6.3 E-08	5.1 E-08
Co-60	6.1 E-07	3.1 E-07
Zn-65	3.1 E-08	9.1 E-09
Mn-54	1.6 E-08	8.9 E-09
Zr-95	6.3 E-09	9.7 E-09
Nb-95	1.4 E-08	2.1 E-08
Ce-141	1.2 E-09	3.0 E-09

Table D-5 below lists the averaged concentrations for each radionuclide detected in the first three feet of depth of the pond itself using the two quantification methods.

Table D-5 - Averaged Concentrations in the First Three feet of the Pond (μCi/ml)		
Radionuclide	Method I	Method II
Cs-137	2.6 E-08	7.7 E-09
Cs-134	2.4 E-08	2.6 E-08
Co-60	2.0 E-07	7.9 E-08
Zn-65	5.2 E-09	None
Mn-54	4.3 E-09	2.6 E-09
Zr-95	6.9 E-09	6.9 E-10
Nb-95	1.5 E-08	1.5 E-09
Ce-141	None	4.0 E-09

For many of the radionuclides identified in the SDP, the majority of the activity was located at or near the surface of the affected area. The results obtained using the two foot depth interval samples (Method I) therefore provided a more accurate characterization of the radionuclide distribution. The results obtained using the five foot depth interval samples (Method II) were consistently lower in evaluated concentrations. This is believed to be the result of the dilution effect of the inclusion of lower depth uncontaminated soils into the composite samples submitted for analysis.

FINAL REPORT

MANAGEMENT OF THE RESIDUAL RADIOACTIVE MATERIAL IN THE WASHINGTON NUCLEAR PLANT 2 STORM DRAIN POND

Prepared for:

Washington Public Power Supply System
Washington Nuclear Plant 2

By:

J. Stewart Bland Associates, Inc.

September 20, 1994

MANAGEMENT OF THE RESIDUAL RADIOACTIVE MATERIAL IN THE WNP-2 STORM DRAIN POND

Executive Summary

In the past, discharges to the WNP-2 Storm Drain Pond (SDP) have inadvertently contained small quantities of licensed radioactive material from the turbine building sump. Design modifications or valve tag-outs of the turbine building sumps have been completed to prevent the recurrence of this type of event.

The discovery of detectable levels of tritium in liquid recondensed from gaseous effluents on external horizontal building surfaces has also presented a challenging on-site control issue since this liquid is channelled to the SDP via the roof drain system.

In response to these events and the identification of sources of non-licensed radioactive material being introduced to the site from upstream sources on the Columbia River, a comprehensive program for the management of residual low-level radioactive material on the WNP-2 site has been prepared. In this report, the management of discharges to the SDP is shown to be consistent with this comprehensive program.

Due to the complex radiological and environmental issues surrounding the current uses of the SDP, this report has been prepared to clarify the site policy regarding the discharge of liquids to the SDP. This report contains the following:

- a description of the discovery of the contaminating event,
- documentation of actions taken to prevent future releases of licensed radioactive material to the SDP and a comparison of these actions to the recommendations of the proposed "Low-Level Radioactive Material Control Program",
- an assessment of the concentrations of licensed radioactive material in the SDP in relation to the interim clean-up guidelines established by the proposed "Low-Level Radioactive Material Control Program", and
- an assessment of the physical and administrative controls established to prevent unauthorized removal or dispersal and the environmental stability of the residual activity in the SDP.

This report is intended to resolve the regulatory issues surrounding the continuing use of the storm drain pond and to provide key documentation necessary for managing this residual activity under the provisions of 10 CFR Part 50.75(g).

I. DESCRIPTION OF CONTAMINATING EVENT

Low level radioactive material has been identified in the WNP-2 Storm Drain Pond (SDP). This material is, in part, the result of past discharges to the pond from the Turbine Building "clean" sumps. The design of the Turbine Building drainage system allowed for large quantities of "clean" (not anticipated to contain radioactive materials) process water to be discharged directly to the SDP. Sources of this liquid inventory included water discharges from the plant air wash system, condenser water box drainage, fire protection system water, waste service water, and numerous other non-radioactive system liquid discharges. At some point radioactive materials originating inside the Radiologically Controlled Area of the plant were introduced to the sumps and therefore were discharged to the SDP.

Environmental sampling at station ST101 at the SDP outfall showed elevated levels of tritium as well. Water samples from puddles of standing water on the building roofs also showed elevated tritium levels. A preliminary investigation into the source of this tritium concluded that gaseous effluents were condensing on the building roofs and draining into the SDP via the roof drain system. The gaseous effluents contain tritium vapor originating from steam leaks in plant primary coolant systems. A review of the recent operational history of the plant confirmed that tritium levels in the primary coolant had risen to levels beyond those projected for this stage of the plant operational lifetime. While these elevated tritium levels were not problematic from an operational standpoint, the appearance of tritium in the SDP resulted in repeated notifications of the State of Washington of these discharges to the environment.

II. REVIEW OF THE RECOMMENDATIONS OF THE PROPOSED "LOW-LEVEL RADIOACTIVE MATERIAL CONTROL PROGRAM"[1]

II.1 Recommendations of the Program for Response to Spills of Radioactive Material

Section III.D of the proposed "Low-Level Radioactive Material Control Program" contains specific recommendations for response to spills of radioactive material in a pre-planned and organized manner. Since the program was developed after the occurrence of this event, the objective of this document is to show how the actions taken in response to the events are generally consistent with the recommendations of the program document. The following steps were cited as appropriate for a comprehensive response:

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[1]The referenced "Low-Level Radioactive Material Control Program" has been developed at the request of the Supply System by J. Stewart Bland Associates, Inc. and currently exists as a Final Report dated September 1994.

- initial sampling and assessment of the affected area,
- clean-up of the affected area to established guidelines,
- consideration of system modifications and/or corrective administrative actions to prevent future spills,
- characterization of the residual contamination,
- stabilization and controls over the affected area, and
- documentation of the event and quantity of residual activity for decommissioning.

A brief description of these steps is provided here for continuity. The Program document referenced above should be referred to for a more detailed description of these recommendations.

Initial Assessment - Initial sampling should assure that samples adequate to assess the radiological hazard associated with the material in question are obtained. The primary purpose of these samples is to gather the data needed to establish appropriate radiological controls over the conduct of the clean-up/recovery effort.

Clean-up - Radioactive material contamination should be removed from the affected area to the extent practical. If complete decontamination of the affected area is not practical, clean-up should continue until an acceptable level of residual contamination remains. This acceptable level of residual contamination, commonly referred to as a "Clean-up Guideline", has been proposed as the concentrations listed in 10 CFR Part 20, Appendix B, Table 3. Appendix A of the program document demonstrates that these levels of residual contamination assure that annual exposures to workers and members of the general public are a small fraction of the regulatory limits. After the completion of practical clean-up measures, any residual contamination will be controlled in place under the provisions of 10 CFR Part 50.75(g) pending approval of the site decommissioning plan.

System Modifications and Corrective Actions - A comprehensive review of the cause of the contaminating event should be conducted by management, operations and engineering personnel. Once the cause of the event is known, system modifications to prevent event recurrence should be considered.

If system modifications are not practical, corrective administrative actions may be appropriate to prevent recurrence. Corrective actions should not be limited to the specific event but should address the likelihood of similar events involving other plant systems to prevent future spills.

Characterization - If residual contamination remains following clean-up of site contamination, the location must be characterized to implement the interim disposition afforded by 10 CFR Part 50.75(g). This characterization is simply a description of the location, the amount and distribution of contamination within the affected area, and a narrative of the events leading to the residual contamination.

Area characterization should be accomplished using a sampling program of sufficient scope to assure that all residual contamination has been included. The analysis of these samples should be performed using gamma spectroscopy with sufficient sensitivity to provide detection of radioactive material contamination at environmental detection levels as defined in the plant Offsite Dose Calculation Manual (ODCM) under section 6.3.1 Radiological Environmental Monitoring Program (Table 6.3.1.1.1-1 "Detection Capabilities for Environmental Sample Analysis"). This section of the ODCM was previously associated with WNP-2 Technical Specifications section 3/4.12.1.

Stabilization and Controls - Residual contamination should be environmentally stabilized when necessary to prevent additional dispersal into human exposure pathways (i.e., inhalation or ingestion of wind blown dust). Residual activity should be considered to be stabilized if no environmental dispersion pathways are apparent. Control of residual activity implies that the location of such activity at the time of site decommissioning is known with a reasonable degree of certainty.

Residual contamination of plant origin, i.e., contamination remaining after completion of reasonable clean-up efforts, remains licensed material. Appropriate radiological controls are required to assure regulatory compliance and to minimize radiological safety concerns. Stabilization and controls are needed to prevent dispersal by human or environmental factors and to limit the potential radiation exposures from residual contamination.

The following are the minimum controls which should be imposed even when the guideline clean-up objectives established in this program have been achieved.

- The area should be stabilized to the extent necessary to prevent inadvertent dispersal of the contaminated material by wind or water erosion.

- The area should be clearly identified as containing low-level contamination and administrative procedures/controls should be imposed to prevent activities which could cause additional dispersal of the material. For example, a sign or other designator may provide appropriate notification to individuals that Health Physics should be contacted prior to any activities involving excavation or other disturbance of the affected area.

Documentation - The types of records and documents necessary for supporting the interim disposition of residual contamination under §50.75(g) are clearly specified in the regulation. During evaluation, clean-up, and stabilization efforts, records of all surveys, excavation volumes, sampling locations and methodologies, and the results of all sample analyses should be kept and maintained. The documentation of any clean-up activities and the basis for decisions made during the course of such projects should be clearly presented so that the residual hazard associated with the spill can be readily discerned.

The following specific information is required:

1) description of spill, clean-up activities, and location of remaining contaminants;
2) drawings marking the areas of contamination and points of measurement;
3) radionuclide quantities, form and concentrations (with $T\frac{1}{2} > 6$ months); and,
4) the basis for the above information or any special calculations or assessments performed for each affected area.

Records of interim dispositions of residual radioactive material must be maintained as a part of the formal plant records required for decommissioning as specified in §50.75(g). This information should be assembled at the conclusion of each event for retrieval at the time decommissioning activities are being planned.

The program items listed above comprise the recommendations of the "Low-Level Radioactive Material Control Program" applicable to events such as the inadvertent contamination of the SDP.

III COMPARISON OF ACTIONS TAKEN IN RESPONSE TO THE EVENT WITH THE RECOMMENDATIONS OF THE PROGRAM

III.1 Actions Taken to Terminate the Release of Radioactive Materials to the SDP

When the source of licensed radioactive material in the SDP was identified as discharges from Turbine Building sumps T-1, T-2 and T-3, restrictions on the types of liquid allowed to be placed in or routed to the sumps were reiterated to all plant personnel by the Plant Manager and a comprehensive review of inputs to these sumps was performed by the plant engineering staff. Sampling protocols for the sumps were instituted as a condition of release to the SDP under PPM 1.11.12 "Removal of Liquids from the RCA". Sump volumes found to be free of licensed radionuclides when analyzed at the environmental detection level LLD's specified in the WNP-2 ODCM Section 6.3.1 were allowed to be discharged to the SDP. Sump volumes containing detectable quantities of radionuclides were routed to the Turbine Building Floor Drain system for processing.

A comprehensive investigation of the cause of elevated tritium levels in the primary system was also conducted. Several possibilities including leakage from reactor control blades were evaluated. As a result of this investigation, a major source of the elevated levels of tritium in the primary coolant was traced to processed water contaminated with boron. The source of the boron was found to be coolant from the in-plant air compressors. The processed water containing low levels of boron was returned to the condensate storage tank where it entered the primary coolant volume. As this water passed through the reactor, nuclear reactions converted the boron to tritium. Corrective action was taken by the replacement of the air compressor coolant with a non-borated product. Control rod blades are routinely inspected and replaced when necessary as a part of the on-going plant maintenance program performed during scheduled refueling outages. As a result of these activities, concentrations of tritium in the primary coolant and discharges of tritium in liquid effluents to the Columbia River within the constraints of the ODCM release parameters have both been significantly reduced as shown by routine primary system chemistry and effluent sample analyses.

Discharges from the Auxiliary Boiler blowdown also contribute tritium to the SDP. The water used as make-up to this boiler comes from the plant demineralized water supply. This water volume was affected by the increase in primary coolant tritium levels due to system cross connects and recycling of processed water to the system.

Further investigations found that the Turbine Building airwash system was also a major contributor to the tritium being discharged to the SDP. A significant portion of the air handled by the Turbine Building HVAC system is recirculated. The recirculated volume contains tritium vapor from steam leaks in the turbine building. During the winter months, access doors were also routinely opened to de-ice the air intake screens. When tritium vapor in the recirculated air volume is in contact with the airwash system, an equilibrium concentration is established in the airwash system water. As the airwash system water becomes concentrated in biocides and dissolved salts (not tritium) through the effects of evaporation, it must be continually drained and replaced with make-up water. The discharge, containing equilibrium concentrations of tritium, was routed to Turbine Building sumps and from there to the SDP.

Several actions were taken by operations to mitigate this problem. The practice of propping open the access doors was discontinued, and the air flow dampers on the four outside air intake units were physically removed. A baffle plate was installed within the HVAC recirculation system to eliminate the recirculation flow from the Turbine Building and prevent cross-contamination of the Turbine Building airwash system. This plant modification (PMR 90-340) was completed in July of 1994.[2]

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[2]This information was obtained by teleconference with John Bekhazi on 9/19/93. PMR 90-340 was completed with the final administrative close-out on 9/1/94, all physical work has been completed and the system is operational without component tag-outs on July 1, 1994.

As a result of the operational change of processing Turbine Building sump water rather than releasing it to the SDP, large quantities of high conductivity water are being introduced to the radwaste processing system. The liquid waste processing systems were not designed to accommodate these large volume inputs. Demineralization beds designed for removal of radionuclides at low concentrations from relatively clean water are rapidly depleted when this poor quality water is introduced. This results in poor efficiency at removing radionuclides, and increased operating maintenance schedules for bed change-outs, and larger volumes of low-level radioactive waste to be managed.

In an effort to alleviate the operational burden of the large volumes of high conductivity water that must be processed, the airwash system sump discharge is to be re-routed directly to the SDP under PMR 93-138. The airwash system is a major source of this large volume of poor quality water contributing approximately 8.4 million gallons a year (16 gpm). This action is considered radiologically sound since the levels of tritium in the primary coolant system have been reduced and the recirculation of Turbine Building air into the airwash system was mitigated by completion of PMR 90-340. The discharge of the airwash system wastewater containing low concentrations of biocide and concentrated salts has also been evaluated for applicability of the Resource Conservation and Recovery Act (RCRA). The result of this evaluation is summarized along with the evaluation of all other known process water additives in Appendix A. Essentially, although the liquid discharges as allowed by the NPDES permit are exempt from consideration as "Solid Waste" subject to regulation under RCRA, the soils and sediments accumulated in the SDP as a result of these discharges could possibly be classified as "Solid Waste" at the time of site decommissioning and termination of the NPDES permit. If this situation should arise, and the material is not otherwise dispositioned due to its content of low-level radioactive byproduct material, the sediments would be required to be tested for hazardous waste characteristics prior to decision on the ultimate disposition of this material.

In response to the inadvertent discharge of low-level activity, the environmental sampling program at the SDP (ST101) was upgraded. Many more samples were taken and at a greater frequency than was required by section 6.3.1 of the ODCM. A composite sampler was installed at the outfall to obtain a more representative sample of the liquids being discharged than could be obtained by the previous grab sampling methods. Additionally, soil samples were taken from locations along the outfall runoff stream and the pond to determine the extent of the contamination and to monitor plant compliance with the new sump discharge policy.

A weir type flow monitoring flume has also been installed at the outfall of the SDP to monitor the volume of water flowing into the pond. Additional sampling protocols were implemented to allow accurate quantification of tritium activity or future inadvertent discharges of other licensed radioactive material to the SDP.

The actions detailed above have removed the source of contamination of the SDP with licensed radioactive material with the exception of the much diminished levels of tritium that still are introduced through the roof drain system and that will be unavoidably introduced by the Turbine Building airwash discharge. The results of the tritium monitoring conducted in 1993 and early 1994 indicate much lower concentrations of tritium being introduced to the SDP seldom triggering the reporting requirements of the State of Washington. The actions taken are consistent with those that would have been recommended by the "Low-Level Radioactive Material Control Program" had it been implemented at the time of the inadvertent discharges. Specifically, the source of the discharge was investigated, identified and terminated to the extent practical (tritium remains a vexing control problem), and corrective actions, both physical and administrative, were initiated to prevent recurrence of similar events in the future.

III.2 Sampling and Analysis of SDP Soils and Sediments

Once the inadvertent release of licensed radioactive materials to the SDP was curtailed, a comprehensive survey was performed by obtaining core borings of the soils and sediments at the outfall, along the runoff stream to the pond, and in the pond. The borings were taken by Burlington Environmental, Inc. during the period from April 19th to the 23rd, 1993. Records were made of the soil horizons encountered and the classifications of the soil types in each boring. Boring was terminated at the refusal of the drilling process[3]. This typically occurred around 12 to 14 feet in depth.

Supply System personnel prepared composite samples from each core allowing radionuclide distributions to be characterized at two foot depth intervals. The samples were sent to Teledyne's Environmental Laboratory in Westwood, NJ for evaluation by gamma spectroscopy at the environmental detection levels specified in section 6.3.1 of the WNP-2 ODCM. The original gamma spectroscopy peak search and analysis data for each of these samples were evaluated by J. Stewart Bland Associates, Inc. using the decision level criterion ("critical level") recommended in NUREG/CR 4007[4]. The presence or absence of the radionuclides identified in each sample was assessed based on this criterion and a characterization of the spacial distribution of licensed radioactive material in the SDP was compiled. The utility of the decision level criterion is qualitative and the reliability of measurements of concentrations of radionuclides below the Lower Limit of Detection (LLD) should be considered as estimates based on the

[3]The Standard Penetration Test (SPT) used by Burlington Environmental defined the refusal criterion as failure to advance the three inch outside-diameter split-barrel sampler a depth of six inches after 50 blows with a 140 pound hammer dropped 30 inches.

[4]NUREG/CR 4007 is the basis for the NRC's current definition of LLD and related concepts such as the Critical or Decision Level, L_C.

best information available. For the purpose of this study, the identification of the presence or absence of radionuclides within the defined sectors of the SDP was considered to be of greater value than attaining exceptional accuracy of measurements in the very low-level concentration range. All of the measurements contributing significantly to the total activity present in the SDP were above the specified LLD's for the measurement process and were therefore accurate measurements of the concentrations within those samples. The results of these evaluations and a more detailed description of the decision level criterion are contained in a separate document titled "An Assessment of the Quantity of Residual Low Level Licensed Radioactive Material in the WNP-2 Storm Drain Pond" by J. Stewart Bland Associates ,Inc. dated September 20, 1994.

III.3 Comparison of Soil Contamination Levels with Interim Clean-up Guidelines

The distributions of licensed radionuclides in the SDP were found to be non-homogeneous with much of the activity located near the surface at the outfall and at the point where the runoff stream enters the pond. These locations also represent the points of highest concentration of many of the radionuclides. For the purpose of comparison of the activity concentrations in the SDP to the interim clean-up guidelines specified in the "Low-Level Radioactive Material Control Program", the quantity of each radionuclide in the first three feet of depth was averaged over the volume of soil in both the pond and in the head of the pond (the section of the SDP between the outfall and the pond. In addition, the total quantity of each radionuclide in each of these sections of the SDP was averaged over the entire volume of the soil in those sections. Because the activity is not evenly distributed, the concentrations derived using the data from the first three feet of depth are higher and therefore present the limiting case for comparison with the interim clean-up guidelines. Table 1 below shows the averaged concentrations of each licensed radionuclide detected in the SDP and the corresponding concentration from 10 CFR Part 20, Appendix B, Table 3 (interim clean-up guidelines). The fraction of the Appendix B, Table 3 concentration is also shown.

Table 1 - Comparison of Averaged Concentrations Contained in the First Three feet of the Head and the Pond with 10 CFR Part 20, Appendix B, Table 3 concentrations (μCi/ml)					
Radionuclide	10 CFR 20 App. B, Table 3	Head of the Pond	Fraction	Pond	Fraction
Cs-137	1.0 E-05	7.9 E-08	7.9 E-03	2.6 E-08	2.6 E-03
Cs-134	9.0 E-06	6.3 E-08	7.0 E-03	2.4 E-08	2.7 E-03
Co-60	3.0 E-05	6.1 E-07	2.0 E-02	2.0 E-07	6.7 E-03
Zn-65	5.0 E-05	3.0 E-08	6.0 E-04	5.2 E-09	1.0 E-04
Mn-54	3.0 E-04	1.6 E-08	5.3 E-05	4.3 E-09	1.4 E-05
Zr-95	2.0 E-04	6.3 E-09	3.1 E-05	6.9 E-09	3.4 E-05
Nb-95	3.0 E-04	1.4 E-08	4.7 E-05	1.5 E-08	5.0 E-05
Ce-141	3.0 E-04	1.2 E-09	4.0 E-06	None	
Sum of Fractions	-	-	3.6 E-02	-	1.2 E-02

The sums of the fractions of the Appendix B, Table 3 concentrations are far below unity and therefore the interim clean-up guidelines have not been exceeded. The highest concentration of Co-60 for an individual sample was located at the outfall between 1 and 2 feet in depth. This concentration was 3050 pCi/kg or 4.6 E-06 μCi/ml. Even this extreme value is only 15% of the corresponding Appendix B, Table 3 concentration for Co-60.

Based on the results of this comparison with the clean-up guidelines no clean-up is warranted at this time. The concentrations of licensed radionuclides in the SDP present an acceptable level of residual contamination that will result in annual exposure to workers and members of the public at a small fraction of the regulatory limits. The radionuclide distribution of the SDP was used as a typical case for a spill at WNP-2 in Appendix A of the program document. When the distribution was scaled to 100% of the clean-up guideline (sum of the fractions of the 10 CFR Part 20, Appendix B, Table 3 concentrations were set at unity), the annual exposure was shown to be a small fraction of the applicable annual exposure limits for both occupationally exposed individuals and members of the public.

III.4 Radiological Controls over the Contaminated Area

A fence was erected around the SDP at the time of the inadvertant discharges to limit access of personnel to the pond and prior to full characterization of the quantity of activity in the pond. Administrative controls in the form of posted notifications on the fencing prevent unauthorized removal or dispersion of the residual activity by individuals. Since the concentration of licensed radioactive material in the SDP is far below the interim clean-up guidelines, no physical controls are necessary according to the guidelines of the "Low-Level Radioactive Material Control Program" to limit access to the area for exposure control. The fencing is to remain as an added precaution to alert personnel of the Health Physics controlled status of the area.

An assumption is made that the residual activity in the SDP will not be transported downward past the hardpan layer of soil encountered by the core drilling rig. This layer is assumed to be able to retain the radionuclides within the SDP until the time of site decommissioning. The primary methods by which liquid is known to leave the pond are evaporation and transpiration from the abundant plant life growing along the edge the SDP. As a part of the modeling process described in Appendix A of the program document, the RESRAD program (version 5.0), developed by the Department of Energy (DOE), was used to model the transport of the radionuclides through the ground and into the groundwater. Exposure pathways were then evaluated using conservative assumptions.

The usage characteristics of the pond basin are an effective barrier to resuspension of the residual activity by wind action and subsequent inhalation of airborne particulate activity. The quantity of water added to the SDP on a weekly basis as measured by the newly installed weir-type flow indicator for the first six months of 1994 was an average of 252,000 gallons (25 gpm). This flow rate is sufficient to keep any loose soils wet or completely covered by standing water thereby preventing the possibility of activity being transported out of the SDP by wind action. For these reasons, the location is interpreted as being relatively environmentally stable.

The monitoring program established at the outfall is capable of detecting any new sources of activity being added to the pond. With the exception of low level tritium additions, any new inadvertent additions of licensed radioactive material should be treated as a new spill.

The State of Washington has expressed a willingness to permit the nuisance additions of tritium to the SDP recognizing the difficulty in establishing complete control over this radionuclide in the present configuration of the plant. This will be limited to a minimal concentration that will be incorporated into the next revision of the site NPDES permit.

The controls that are already in place are more than sufficient to maintain exposures of any likely receptor as low as reasonably achievable. These controls are consistent with the recommendations of the proposed Low-Level Radioactive Material Control Program.

III.5 Documentation

This evaluation and the accompanying interim report "An Assessment of the Quantity of Residual Licensed Radioactive Material in the WNP-2 Storm Drain Pond" along with the reports from Burlington Environmental, Inc. and the analyses performed by Teledyne Isotopes, Inc. should satisfy the record keeping requirements of Part 50.75(g). At the time of decommissioning, these documents may be re-examined for comparison with the final site clean-up guidelines established by approval of the site decommissioning plan.

IV. SUMMARY AND CONCLUSIONS

The actions taken in response to the inadvertent discharge of licensed radioactive material to the Storm Drain Pond were appropriate and were consistent with the recommendations of the subsequently developed "Low-Level Radioactive Material Control Program" for the site.

The residual low-level licensed radioactive material in the SDP poses no radiological hazard to workers or members of the public in its current configuration. With the exception of the continuing nuisance tritium additions to the SDP, the location is reasonably environmentally stable and should retain the activity for the duration of the useful life of the plant. The residual licensed radioactive material may be controlled in its present location under the provisions of 10 CFR Part 50.75(g) as an interim control measure. The anticipated revision of the NPDES permit by the State of Washington to allow limited releases of tritium to the SDP will provide needed relief from a vexing control problem of very minor radiological significance.

V. REFERENCES

1. "Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements," NUREG/CR-4007, Currie, L. A., September 1984

2. Currie, L.A. "Limits for Qualitative detection and Quantitative Determination - Applications to Radiochemistry"; Analytical Chemistry; Vol. 40, pg. 586, 1968

3. "Pond Soil Sampling, Hanford Reservation, Richland, Washington"; Report Dated May 13, 1994 by Burlington Environmental Inc., 2203 Airport Way South, Suite 400 Seattle, WA 98134

4. "Report of Analysis (12 May 1993)" Revised 5/14/93; Teledyne Isotopes, 50 Van Buren Ave., Westwood, N.J. 07675.

5. "An Assessment of the Quantity of Residual Licensed Radioactive Material in the WNP-2 Storm Drain Pond", J. Stewart Bland Associates, Inc., August 1994

6. "Low-Level Radioactive Material Control Program", Prepared for Washington Public Power Supply by J. Stewart Bland Associates, Inc., August 1994

APPENDIX A

Applicability of the Resource Conservation Recovery Act (RCRA) to Sediments Deposited in or Carried into the SDP (Storage Tank 101) by the Site Storm Drain System

The question of applicability of RCRA to the sediments deposited in the SDP will no doubt be raised at the time of decommissioning when the SDP is no longer utilized, the standing water in the pond has evaporated and the NPDES permit governing discharges to the SDP has been terminated.

In general, the evaluation considers the definition of "Solid Waste" contained in 40 CFR Part 261.2(a)1 and the definition of "Hazardous Waste" contained in 40 CFR Part 261.3 and the exclusions from this classification contained in part 261.4. "Solid Waste" is defined as any discarded material (including liquids and semi-solid materials) that is not excluded by 40 CFR Part 261.4(a) or that is not excluded by variance under Part 260.30 and Part 260.31.

Two of the exclusions listed in Part 261.4 have direct applicability to the sediments in the SDP. 40 CFR Part 261.4(a)2 specifically excludes industrial wastewater discharges that are point source discharges subject to regulation under under section 402 of the Clean Water Act as amended. The comment section of this regulation points out that this "... exclusion applies only to the actual point source discharge and does not exclude industrial wastewaters while they are being collected, stored, or treated before discharge, nor does it exclude sludges that are generated by wastewater treatment." While the wastewaters discharged into the SDP are covered under a point source NPDES permit issued under Section 402 of the Clean Water Act, the particulate matter that accumulates in the numerous drain headers that comprise the wastewater collection system prior to the discharge point may possibly be considered to be sludges also flushed out into the SDP with the wastewater discharge. The definition of sludge in 40 CFR Part 260.10 is "... any solid, semi-solid, or liquid waste generated from a ... industrial wastewater treatment plant, (or) water supply treatment plant ..." As the suspended particulates flushed into the SDP and settling in the SDP as sediment may contain either of these materials, the possibility of RCRA applicability to the sediments must be considered. A second exclusion from the classification of the SDP sediments as solid waste is Part 261.4(a)4 which specifically excudes "... byproduct material as defined by the Atomic Energy Act of 1954 as amended, 42 U.S.C. 2011 *et seq.*". This exclusion prevents the sludges from being classified as solid waste (hence Hazardous Waste) subject to RCRA solely due to the content of low-level radionuclides produced by nuclear fission in the WNP-2 reactor.

Since there is a possibility that the SDP sediments may not be excluded from the definition of "Solid Waste", the next step is to determine whether the material may be considered to be "discarded". The definition of "discarded material" is clearly specified in Part 261.2(a)2.i as "Abandoned". This classification is further explained in Part 261.2(b)3 as "Accumulated ... before ... being abandoned by being disposed of, burned, or incinerated.". Although the intention of what is ultimately to be done with these sediments at the time of site decommissioning is not presently known, an assumption can be made that unless the material is to be excavated and disposed of, solely for its content of low-level concentrations of byproduct radionuclides, the material will be left in place or be graded into its former geological profile. Under this assumption, the material would then be "recycled" as described in Part 261.2(c)1 which is "Used in a manner constituting disposal. This material would then be a "Solid Waste" if it is listed in Column 1 of Table 1 (part 261.2) and is "... applied to or placed on the land in a manner that constitutes disposal.". Table 1 of Part 261.2 lists "Sludges (or Byproducts) exhibiting a characteristic of hazardous waste, Sludges (or Byproducts) listed in 40 CFR Part 261.31 or .32, and commercial chemical products listed in in 40 CFR Part 261.33. The sediments in the SDP may possibly be classified as "solid waste" subject to regulation under RCRA at the time of site decommissioning.

If the sediments in the SDP are not excluded they may possibly be further classified as "hazardous waste" at the time of decommissioning. The material would be considered as a hazardous waste if it exhibits any of the characteristics of hazardous waste identified in Subpart C, it is a listed as a hazardous waste in Subpart D, or is a mixture containing constituents listed in subpart D 261.33 but only if it exhibits hazardous waste characteristics as defined in subpart C (this last exclusion is contained in the commentary following Part 261.33(d)). A majority of the conditions that would result in the sediments being classified as a hazardous waste subject to RCRA can be eliminated by a comparison of the constituent products used at the plant and subsequently discarded into the SDP with those wastes listed in 40 CFR Part 261 subpart D (specifically Part 261.31 and 32). The remainder of the criteria under which the sediments could be classified as a hazardous waste cannot be determined until the time of site decommissioning when the testing specified in Part 261 subpart C to determine if the waste exhibit any of the characteristics of a hazardous waste (ignitability, corrosivity, reactivity, or toxicity).

In the interest of documenting the types of materials (water treatment compounds) discharged into the SDP for future consideration at the time of site decommissioning, the following complete inventory (as of 1994) has been prepared. A careful review of the status of these materials under the current (1994) EPA regulations, specifically 40 CFR subpart D listed hazardous wastes from non-specific sources (Part 261.31) and specific sources (Part 261.32), has been performed using the information contained in "Material Safety Data Sheets" (MSDS) supplied by the material manufacturers. In addition, the MSDS documents were examined to determine whether any of the commercial chemical compounds listed in Part 261.33 are a constituent of the general water treatment chemicals used at the facility. Copies of these MSDS documents are attached to this report so that the materials may be re-evaluated at the time of site decommissioning should there be a change in the status of any of the constituents of the materials.

Listing of Products that may Appear in Diluted Concentrations
in the Industrial Wastewaters Discharged into the SDP
or the Sediments Accumulated in the SDP

1. Calgon Corporation - Anionic Polymer Solution*
Principal Hazardous Components - Ethylene Glycol
Sodium Hydroxide

* Ingredients listed in the Toxic Substances Control Act Chemical Substances Inventory

2. Calgon Corporation - CL-361
Principle Hazardous Components - None

3. Calgon Corporation - Surfactant
Principle Hazardous Components - None

4. Calgon Corporation - PCL-8125*
(Alkaline aqueous sol'n of organic phosphonates and polymer)
Principle Hazardous Components - Ethylene Glycol
Sodium tolyltriazole
Sodium Hydroxide

* Undiluted Product has EPA Hazardous Waste Number of D002 for the Corrosivity Characteristic. When product used for water conditioning, this characteristic is not present in the treated mixture.

* Ingredients listed in the Toxic Substances Control Act Chemical Substances Inventory

5. Sodium Nitrite
Principle Hazardous Components - Sodium Nitrite*

* The undiluted substance is an oxidixer and has an EPA Hazardous Waste Number of D001 for the Ignitability Characteristic. When product is used to condition water the mixture loses this characteristic. The undiluted product is designated as a hazardous substance by the EPA under 40 CFR Part 116.

6. Buckman Laboratories, Inc. - Bulab 6003 (Alkaline Corrosive Liquid)
Principle Components - Potassium N- methyldithiocarbamate
Disodium cyanodithioimidocarbonate

Undiluted Product has EPA Hazardous Waste Number of D002 for the Corrosivity Characteristic and D003 for the Reactivity Characteristic. When product used for water conditioning, these characteristics are not present in the treated mixture.

7. Nalco 2100 Liquid (Formula 5073)
Principle Components - Borate-nitrite-nitrate-meta silicate blend
Undiluted Product (pH = 11.6) has EPA Hazardous Waste Number of D002 for the Corrosivity Characteristic. When product used for water conditioning, this characteristic is not present in the treated mixture.

8. Buckman Laboratories, Inc. - Bulab 6050
Proper Shipping Name: Poison B, Liquid (potassium Endothall), UN2810
Principle Hazardous Components - Endothall Mono (N,N, -dimethyl-alkylamine

* While endothall is listed in 40 CFR Part 261.33(e) as P088 and in 40 CFR Part 261 Appendix VIII as P088 hazardous constituent, this particular product has a different Chemical Abstract Number (CAS # 66330-88-9) than the chemical product listed in Part 261 Subpart D as P088 (CAS # 145-73-3) and is presumably not the same compound. A warning is given on the MSDS that the substance is extremely toxic to fish in concentrations as low as 0.3 ppm. This product is also noted to be capable of being considered a Hazardous Waste under the Toxicity Characteristic criteria. The product is a FIFRA registered pesticide (4581-174-1448) and is exempt from the requirements of the Toxic Substances Control Act (TSCA).

9. Aluminum Sulfate (Alum) Flocculant for removal of particulates in water supply treatment system
Principle Components - Aluminum Sulfate*

* Long term decomposition products include Sulfur Oxide gases (SO_2, and SO_3) under reducing conditions encountered in stagnant pond environments (assuming moderate population by thiobacillus). These gases would dissipate into the atmosphere.

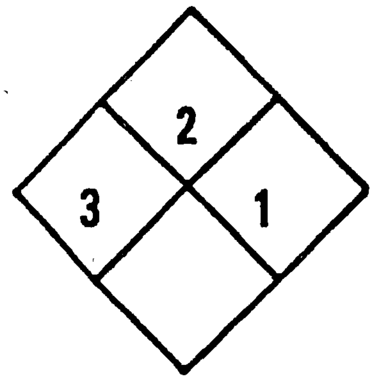
Conclusion: With the possible exception of item # 8, Bulab 6050 (Potassium Endothall), none of the chemical compounds are listed hazardous wastes in 40 CFR Part 261 subpart D. Although the undiluted products listed sometimes would be hazardous waste by one or more of the characteristics listed in 40 CFR Part 261 subpart C, the proper and common usage of these products in the treatment of the plant process waters would eliminate these characteristics from the mixture discharged to the storm drain pond. The requirement to test the SDP sediments for hazardous waste characteristics at the time of site decommissioning would resolve the questionable status of Bulab 6050.

BUCKMAN LABORATORIES, INC.

MATERIAL SAFETY DATA SHEET

BULAB 6050

Revision Date: 12/04/91



Phone 1-800-BUCKMAN

Buckman Laboratories, Inc.
1256 North McLean Boulevard
Memphis, TN 38108

24 Hour Emergency Phone
(901) 767-2722

SECTION 1	OSHA HAZARD CLASSIFICATIONS

Corrosive to eyes. Irritating to skin. Combustible. Highly toxic by inhalation of mist. Highly toxic by absorption through skin.

SECTION 2	HAZARDOUS COMPONENTS

Chemical Name	CAS Number	% by Weight	TLV
Endothall Mono(N,N,-dimethyl-alkylamine) salt	66330-88-9	53 %	N/A

Total listed: 53 %

The remainder of the components comprise proprietary information.

SECTION 3	PRECAUTIONARY LABEL INFORMATION

HAZARDS TO HUMAN AND DOMESTIC ANIMALS
FATAL IF ABSORBED THROUGH SKIN. MAY BE FATAL IF SWALLOWED. CORROSIVE, CAUSES IRREVERSIBLE EYE DAMAGE AND SKIN BURNS. HARMFUL IF INHALED. DO NOT GET IN EYES, ON SKIN, OR ON CLOTHING. WEAR PROTECTIVE CLOTHING, RUBBER GLOVES, AND GOGGLES OR FACE SHIELD WHEN HANDLING. Wash thoroughly with soap and water after handling and before eating or smoking. Remove contaminated clothing and wash before reuse. Avoid breathing spray mist.

STATEMENT OF PRACTICAL TREATMENT
IF SWALLOWED, drink promptly a large quantity of milk, egg whites, gelatin solution or if these are not available, drink large quantities of water. Avoid alcohol. Call a physician immediately.
IF ON SKIN, immediately flush with plenty of water for at least 15 minutes. Remove and wash contaminated clothing before reuse.
IF IN EYES, immediately flush with plenty of water for at least 15 minutes. Call a physician. NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory

depression, and convulsion may be needed.

ENVIRONMENTAL HAZARDS

Fish will be killed by dosages in excess of 0.3 ppm. Do not use where fish are important resources. Avoid contact with or drift to desirable plants or crops as injury may result. Clean out application equipment after each operation. Do not use fish from treated water for food or feed within three days after treatment. Do not use treated water for watering livestock or domestic purposes within the following periods: Up to 0.3 ppm - 7 days after application. Up to 3.0 ppm - 14 days after application. Up to 5.0 ppm - 25 days after application.

SECTION 4 FIRST AID INFORMATION

Eye exposure: Flush immediately with copious amounts of tap water or normal saline (minimum of 15 minutes). Take exposed individual to a health care professional, preferably an opthamologist, for further evaluation.
Skin exposure: Wash exposed area with plenty of soap and water. Repeat washing. Remove contaminated clothing and wash thoroughly before reuse. If irritation persists consult a health care professional.
Inhalation: If exposure by inhalation is suspected, immediately move exposed individual to fresh air. If individual experiences nausea, headache, dizziness, has difficulty in breathing or is cyanotic, seek a health care professional immediately.
Ingestion: DO NOT INDUCE VOMITING. Rinse with copious amounts of water or milk, first. Irrigate the esophagus and dilute stomach contents by slowly giving one (1) to two (2) glasses of water or milk. Avoid giving alcohol or alcohol related products. In cases where the individual is semi-comatose, comatose or convulsing, DO NOT GIVE FLUIDS BY MOUTH. In case of intentional ingestion of the product seek medical assistance immediately; take individual to nearest medical facility.
NOTE TO PHYSICIAN: No specific antidote is known. Probable mucosal damage may contraindicate the use of gastric lavage. Treat Symptoms. Medical Consultation is available 24 hours a day. Call the Buckman Center for Product Information at (901) 767-2722.

SECTION 5 PRIMARY ROUTES OF EXPOSURE

1. Effects from Acute Exposure:

Eye exposure: Corrosive to the eyes with possible permanent damage depending on the length of exposure, solution concentration and first aid measures.
Skin exposure: Irritant. Irritation will depend on solution strength, length of exposure and first aid measures.
Inhalation: May cause irritation or corrosion of mucous membranes and the lungs. Exposed individuals should be monitored for respiratory distress, bronchitis or pneumonia.
Ingestion: No data is available on human ingestion. May be harmful.

2. Effects from Chronic Exposure:

Chronic toxicity testing performed on the active ingredient indicates no significant chronic effects.

SECTION 6 TOXICOLOGICAL INFORMATION

Acute effects:
Acute Oral LD50: 221.0 mg/kg
Acute Dermal LD50: 50.0 mg/kg
Acute Inhalation LC50: 0.4 mg/L
Irritant effects: Corrosive to eyes. Irritating to skin.

Sensitization effects: Not a sensitizer.
Carcinogenic potential: Not listed in any of OSHA Standard, Section 1910.1200 sources as carcinogenic; not tested by Buckman Laboratories, Inc.
Other health effects: None known. Chronic toxicity testing performed on the active ingredient indicates no significant chronic effects.

SECTION 7 ENVIRONMENTAL TOXICOLOGICAL INFORMATION

Acute Aquatic LC50's
48 Hr. Daphnia Magna: 0.36 mg/L
96 Hr. Bluegill sunfish: 1.2 mg/L
96 Hr. Rainbow trout: 1.3 mg/L

Avian Acute Oral LD50's
Bobwhite quail: 736.0 mg/kg
Avian Dietary LC50's
Mallard ducks: > 10,000.0 ppm
Bobwhite quail: > 10,000.0 ppm

SECTION 8 PHYSICAL AND CHEMICAL PROPERTIES

Appearance	amber liquid
Odor	slight fatty, amine
Density @ 25°C	1.025 g/mL
Flash Point	136 °F
Freezing Point	N/T
Boiling Point	88°C to 98°C
Solubility	Miscible in water
pH	5.5 - 6.0
pH (100 ppm in water)	Not available
Vapor Pressure	N/T
o/w Partition Coefficient	N/T
Oxidizing/Reducing Properties	None

NOTE: N/A = Not Applicable, N/T = Not Tested

SECTION 9 FIRE AND EXPLOSION INFORMATION

Flammable limits: Not applicable.
Extinguishing media: Water fog, carbon dioxide, foam, dry chemical
Special firefighting procedures: Self contained breathing apparatus and protective clothing

SECTION 10 REACTIVITY INFORMATION

Stability: stable
Incompatibility: Materials which react with water.
Hazardous Decomposition Products: Elevated temperatures may convert Endothall to anhydride, a strong vesiccant on eyes, mucous membranes and skin.

SECTION 11 HANDLING PRECAUTIONS

Rubber gloves and safety glasses or goggles are required.
Body-protective clothing and rubber safety shoes are required.
Respiratory protection is required for work areas where misting may occur.
Eye wash fountains in the workplace strongly recommended.

SECTION 12 Reserved for SATISFACTORY MATERIALS OF CONSTRUCTION

SECTION 13 SPILL, LEAK, AND DISPOSAL PROCEDURES

SPILL AND LEAK RESPONSE GUIDELINES

Important: Before responding to a spill or leak of this product, review each section of this MSDS. Follow the recommendations given in the Handling Precautions sections. Check the Fire and Explosion Data section to determine if the use of non-sparking tools is merited. Insure that spilled or leaked product does not come into contact with materials listed as incompatible. If irritating fumes are present, consider evacuation of enclosed areas.

Emergency Response Assistance: Emergency technical assistance is available at any time from Buckman Laboratories, Inc., by calling (901) 767-2722.

Initially minimize area effected by the spill or leak. Block any potential routes to water systems (e.g., sewers, streams, lakes, etc.). Based on the product's toxicological and chemical properties, and on the size and location of the spill or leak, assess the impact on contaminated environments (e.g. water systems, ground, air equipment, etc.). There are no methods available to completely eliminate any toxicity this product may have on aquatic environments. Minimize adverse effects on these environments. Buckman Laboratories, Inc. can be contacted for technical assistance. Determine if federal, state, and/or local release notification is required (see Regulatory Classifications section of this MSDS). Recover as much of the pure product as possible into appropriate containers. Later, determine if this recovered product can be used for its intended purpose. Address clean-up of contaminated environments. Spill or leak residuals may have to be collected and disposed of. Clay, soil, or commercially available absorbents may be used to recover any material that can not readily be recovered as pure product. Flushing residual material to an industrial sewer, if present at the site of a spill or leak incident, may be acceptable if authorized approval is obtained. If product and/or spill/leak residuals are flushed to an industrial sewer, insure that they do not come into contact with incompatible materials. Contact the person(s) responsible for the operation of your facility's industrial sewer system prior to intentionally flushing or pumping spills or leaks of this product to the industrial sewer.

DISPOSAL GUIDELINES

Note: Follow federal, state, and local regulations governing the disposal of waste materials.

Neat Product: Contact your Buckman representative or Buckman Laboratories, Inc., at (901) 278-0330.

Contaminated Materials: Determine if waste containing this product can be handled by available industrial effluent system or other on-site waste management unit. If off-site management is required, contact a company experienced in industrial waste management. This product is not specifically listed in 40 CFR 261 as a Resource Conservation and Recovery Act (RCRA) hazardous waste. However, spill or leak residuals may meet the criteria of a characteristic hazardous waste under this Act. Check the characteristics of the material to be disposed of and/or the physical and reactivity data given in this MSDS for the neat product.

Container Disposal: Empty containers, as defined by appropriate sections of the RCRA, are not RCRA hazardous wastes. However, insure proper management of any residuals remaining in container.

SECTION 14	TRANSPORTATION AND SHIPPING INFORMATION

DOT Shipping Name: POISON B, LIQUID, N.O.S., (Potassium Endothall), UN 2810

The shipping name listed above applies only to a 55 gallon drum of the product. This product may have more than one proper shipping name, depending on packaging, product properties, and mode of shipment. All products shipped from Buckman locations have been properly packaged and labeled according to appropriate hazardous shipping regulations that apply for that particular shipment. If any alteration of packaging, product, or mode of transportation if further intended, different shipping names and labeling may apply. If there are any questions pertaining to hazardous shipping requirements, contact the Buckman transportation department for further details.

SECTION 15	REGULATORY INFORMATION

The following Regulations are known to apply to the use and disposal of this product. Additional Federal, State and Local regulations may also be applicable.

SARA (Superfund Amendments and Reauthorization Act):
SARA 302 Extremely Hazardous Substances List (40 CFR 300): No components of this product are listed.

SARA 312 Hazard Category: Immediate (Acute) Health Hazard and Fire Hazard.
SARA 313 Toxic Chemicals List: No Section 313 listed substances are present above de minimus levels.
CERCLA (Comprehensive Environmental Response, Compensation and Liability Act: No components of this product are listed.

RCRA (Resource Conservation and Reclaimation Act) Listed Hazardous Wastes: No components of this product are listed.
CWA (Clean Water Act, 40 CFR 401.15) Listed Substances: No components of this product are listed.
FDA (Food and Drug Administration): This product not approved for food contact uses.

TSCA (Toxic Substances Control Act) Applicability: Registered pesticides are exempt from the requirements of TSCA. All components may not be listed on TSCA Inventory.

FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act): This product is a registered pesticide.
EPA Reg. No. 4581-174-1448

HMIS/NPCA Ratings: Health 3; Flammability 2; Reactivity 1
NFPA Ratings: Health 3; Flammability 2; Reactivity 1

STATE REGULATIONS

Various State Right to Know Acts: Non-proprietary hazardous chemicals are listed in Section 2 of this MSDS. Should you require further information on specific proprietary chemicals or inerts please contact Buckman Laboratories' Regulatory Affairs Department.

The information on this Material Safety Data Sheet reflects the latest information and data that we have on hazards, properties, and handling of this product under the recommended conditions of use. Any use of this product or method of application which is not described in the Product Data Sheet is the responsibility of the user. This Material Safety Data Sheet was prepared to comply with the OSHA Hazard Communication regulations.

Buckman Laboratories, Inc. warrants that this product conforms to its chemical description and is reasonably fit for the purpose referred to in the directions for use when used in accordance with the directions under normal conditions. Buyer assumes the risk of any use contrary to such directions.

Seller makes no other warranty or representation of any kind, express or implied, concerning the product, including <u>NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS OF THE GOODS FOR ANY OTHER PARTICULAR PURPOSE.</u> No such warranties shall be implied by law and no agent of seller is authorized to alter this warranty in any way except in writing with a specific reference to this warranty.

The exclusive remedy against seller shall be a claim for damages not to exceed the purchase price of the product, without regard to whether such a claim is based upon breach of warranty or tort.

Any controversy or claim arising out of or relating to this contract, or breach thereof, shall be settled by arbitration in accordance with the commercial arbitration rules of the American Arbitration Association, and judgment upon the award rendered by the Arbitrator(s) may be entered in any court having jurisdiction thereof.

Product Nalco 2100 [illegible]id

Trade Name [illegible] Formula No. [illegible]

Synonyms Borate-nitrite-nitrate-meta silicate blend

Chemical Family inorganic/ organic

SECTION 2 -- HAZARDOUS INGREDIENTS

MATERIAL OR COMPONENT	%
Entire product is alkaline in nature.	

SECTION 3 – PHYSICAL PROPERTIES

Boiling Point, 760 MM HG --	Melting Point --
Specific Gravity (H_2O=1) 1.20 @ 60°F	Vapor Pressure --
Vapor Density (Air=1) --	Solubility in H_2O, % By Wt. Soluble in all proportions
% Volatiles By Vol. --	Evaporation Rate (Butyl Acetate=1) --

Appearance and Odor
Deep red liquid. odorless. pH - 11.6

SECTION 4 – FLAMMABILITY AND EXPLOSIVE PROPERTIES

Flash Point (Test Method)
None

Flammable Limits in Air, % By Vol.	Lower		Upper

Extinguishing Media
N/A

Special Fire Fighting Procedures
None

Unusual Fire and Explosion Hazard
None

SECTION 5 – HEALTH HAZARD DATA

Threshold Limit Value
None established for product.

Effects of Overexposure
Causes eye and skin irritation. May cause gastrointestinal disturbance if swallowed.

EMERGENCY AND FIRST AID PROCEDURES

Eyes
Flush with water for 15 minutes. Call a physician.

Skin
Wash with plenty of water.

Ingestion
Give water. Do not induce vomiting. Call a physician.

Inhalation

[illegible]

(Continued on Reverse Side)

Product Nalco 2100 [illegible] id

SECTION 6 – REACTIVITY DATA

Stability: Stable ☒ Unstable ☐ Conditions to Avoid

Materials to Avoid None

Hazardous Decomposition Products None

Hazardous Polymerization: Will Not Occur ☒ May Occur ☐ Conditions to Avoid

SECTION 7 – SPILL OR LEAK PROCEDURES

Steps to Take in Case Material Is Released or Spilled Flush with ample water or contain with absorbent material.

Waste Disposal Method No special method. Consult with local authorities on allowable discharge limits for borates, nitrates, nitrites.

SECTION 8 – SPECIAL PROTECTION INFORMATION

Type of Respiratory Protection Required None

Ventilation: Local Exhaust ☐; Mechanical (General) ☐; Special (Specify) Other (Specify)

Protective Gloves Rubber Eye Protection Goggles

Other Protective Equipment None

SECTION 9 SPECIAL PRECAUTIONS

Handling and Storage Precaution Will become "mushy" at 15°F. Satisfactory for use after complete thawing.

Other Precautions Handle as alkaline product. Avoid repeated or prolonged contact with skin. Avoid eye or nose contact. Do not take internally. Launder contaminated clothing before reuse.

Prepared By [signature] Title Toxicology and Industrial Hygiene Consultant Date 12/9/75

Nalco Form CSH-20 EMERGENCY TELEPHONE NUMBER -- (312) 920-1510

24 HOUR EMERGENCY NUMBER:
(901) 767-2722

MATERIAL SAFETY DATA SHEET

Buckman Laboratories, Inc.
1256 North McLean Boulevard
Memphis, TN 38108
(901) 278-0330

Product Name: Bulab 6003 Date: 3/29/89

Hazard(s) as defined by OSHA Hazard Communication Standard:
Corrosive to eyes and skin.
Toxic by ingestion or dermal absorption.

COMPONENTS

Chemical Name	% by wt	TLV
Potassium N-methyldithiocarbamate CAS Registry Number: 137-41-7	20.3	N/A
Disodium cyanodithioimidocarbonate CAS Registry Number: 138-93-2	14.7	N/A

PHYSICAL DATA

Appearance: Clear red-orange liquid
Odor: Sulfide
Boiling point: Above 212 °F
Solubility: Complete
Density (g/mL, 25°C): 1.22
pH (neat): 13
pH (100 ppm in water): 8 - 10

FIRE AND EXPLOSION DATA

Flash point: None below 212 °F Flammable limits: N/A
Extinguishing Media: Water fog, carbon dioxide, foam, dry chemical
Special Firefighting Procedures: None

REACTIVITY DATA

Stability: Stable Incompatibility: Strong acids
Hazardous Decomposition Products: Hydrogen sulfide

HEALTH HAZARD DATA

Acute Effects: Oral LD50=192 mg/kg; Dermal LD50= 884 mg/kg; Inhalation at high levels of mist can cause irritation to lung tissue due to corrosive characteristics.
Irritant Effects: Corrosive to eyes and skin.
Sensitization Effects: Not tested. Product is not expected to cause allergic reactions.
Carcinogenic Potential: Not listed in any of OSHA Standard, Section 1910.1200 sources as carcinogenic; not tested by Buckman Laboratories, Inc.
Other Health Effects: None known.

HANDLING PRECAUTIONS

Rubber gloves and safety glasses or goggles required. Body-protective clothing and shoes are recommended. Eye-wash fountains in the work area are recommended.

EMERGENCY AND FIRST AID INSTRUCTIONS

Eye exposure: Flush with clean, cool water for 15 minutes. See a physician.
Skin exposure: Wash with soap and water and apply glycerin. See a physician if irritation occurs. Remove and wash contaminated clothing.
Inhalation: Remove to fresh air.

SPILL, LEAK, AND DISPOSAL PROCEDURES

Large spills: Dam area to prevent spill from entering fish-bearing waters. Pump into appropriate containers. Dispose of as below.
Small spills: Flush liquid to sewer with copious amounts of water.
Product disposal: Product is hazardous waste, EPA Hazard Code (C,R), EPA Hazardous Waste Numbers D002, D003, due to pH.
Container disposal: Offer for recycling or triple rinse and dispose of in an approved landfill.

REGULATORY CLASSIFICATIONS

DOT Shipping: Corrosive, Shipping name: Alkaline Corrosive Liquid, n.o.s., UN 1719
EPA Registration: EPA Reg. No. 1448-54.
TSCA Inventory: Not applicable.
FDA Regulation(s): 21 CFR 176.300, 173.320
SARA 302 Extremely Hazardous Substances List: No components of this product are listed.
SARA 312 Hazard Classifications: Immediate (Acute) Health Hazard.
SARA 313 Toxic Chemicals: No components of this product are listed.

The information on this Material Safety Data Sheet reflects the latest information and data that we have on hazards, properties, and handling of this product under the recommended conditions of use. Any use of this product or method of application which is not described in the Product Data Sheet is the responsibility of the user.

This Material Safety Data Sheet was prepared to comply with the OSHA Hazard Communication regulations.

HMIS/NPCA Ratings: Health 3; Flammability 1; Reactivity 2.
NFPA Ratings: Health 3; Flammability 1; Reactivity 2.

Bulab 6003
3/29/89

Material Safety Data Sheet

From Genium's Reference Collection

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP.

No. 116
SODIUM NITRITE
(Revision A)

Issued: July 1983
Revised: February 1987

SECTION 1. MATERIAL IDENTIFICATION

22

MATERIAL NAME: SODIUM NITRITE

DESCRIPTION/USES: An inorganic salt. Used in rubber as a color fixative; as an antidote for cyanide poisoning; used in food preservatives, pharmaceuticals, reagents, and dyes.

OTHER DESIGNATIONS: Nitrous Acid, Sodium Salt; $NaNO_2$; CAS #7632-00-0.

MANUFACTURER/SUPPLIER:
Allied Corp., PO Box 2064R, Morristown, NJ 07960;
Telephone: (201) 455-4157

HMIS
H 0
F 0
R 0
PPE*
*See Sect. 8

Not Found
R 1
I –
S 1
K 0

SECTION 2. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Sodium Nitrite, CAS #7632-00-0		No TLV Established. Human, Oral, TDLo: 14 mg/kg Rat, Oral, LD_{50}: 85 mg/kg; TDLo: 40 g/kg/54 weeks, Continuous (Tumorigenic) Rabbit, Eye: 500 mg/24 hrs: Severe Irritation

SECTION 3. PHYSICAL DATA

Boiling Point, 1 atm ... Decomposes >608°F (>320°C)
Solubility in Water, 15°C, g/100 cc ... 82
Specific Gravity (H_2O = 1) ... 2.16

Melting Point ... 520°F (271°C)
pH (Aqueous Solution) ... 9.0
Molecular Weight ... 69.0

Appearance and odor: White-to-pale yellow sticks, granules, or powder. Odorless.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
Not Flammable	Not Found	Not Found	--	--

EXTINGUISHING MEDIA: Use flooding amounts of water during early stages of fire. Large quantities of sodium nitrite involved in a fire will melt; a water stream directed at molten material can scatter it, increasing the flammability of any combustible material it contacts (see sect. 5).
This material is an oxidizing agent. It can present a dangerous fire and explosion hazard at elevated temperatures.

SPECIAL FIRE-FIGHTING PROCEDURES: Use water spray to cool containers that have been exposed to fire. Fire fighters should use self-contained breathing apparatus and wear fully protective clothing.

SECTION 5. REACTIVITY DATA

Sodium nitrite is stable. Hazardous polymerization cannot occur.
This is a stable material in closed containers at room temperature under normal storage and handling conditions. It is slowly oxidized to sodium nitrate when exposed to air. It can explode when heated to 999°F (537°C) or on severe impact. It is a strong oxidizing agent that increases the flammability of all combustibles with which it comes into contact.
It is incompatible at elevated temperatures with ammonium salts, sodium thiosulfate, cyanides, cellulose, and organic matter.
Potassium or sodium nitrite is explosive when mixed with hydrazine or liquid ammonia.
Avoid heating this material to temperatures above 608°F (320°C) because it will yield oxides of nitrogen, which are toxic as well as oxidizers.
Products of hazardous decomposition can include toxic nitrogen oxides (NO_x).

SECTION 6. HEALTH HAZARD INFORMATION | TLV

Sodium nitrite is not listed as a carcinogen by the NTP, IARC, or OSHA (see sect. 9).

SUMMARY OF RISKS: Inhalation of sodium nitrite dust or solution mist may cause local irritation to the upper respiratory .. Its contact with eyes or skin may cause local irritation. Sodium nitrite may enter the body by inhalation, ingestion, and through the skin. It is used as a food additive (<100 ppm in cured meats or fish), but ingestion of excessive amounts can result in acute poisoning with headache, abdominal pains, vomiting, muscular weakness, cyanosis, a marked reduction in blood pressure, and collapse. One gram has been reported to be an adult fatal dose (mean) when administered at one time.

TARGET ORGANS: Eyes, skin, upper respiratory tract. PRIMARY ENTRY: Inhalation. ACUTE EFFECTS: Irritation to eyes, skin, respiratory tract. CHRONIC EFFECTS: Unknown.

FIRST AID: EYE CONTACT: Flush eyes thoroughly, including under the eyelids, with running water for 15 minutes. Get medical help.* SKIN CONTACT: Remove contaminated clothing. Flush affected area with water; wash with soap and water. Get medical help.* INHALATION: Remove victim to fresh air. Restore and/or support his breathing as required. Get medical help.* INGESTION: Rinse victim's mouth with water. Give him 2 to 3 glasses of water to drink to dilute material. Induce vomiting. Never give anything by mouth to someone who is unconscious or convulsing. Get medical help.*

* GET MEDICAL ASSISTANCE = In plant, paramedic, community. Get medical help for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety personnel of significant sodium nitrite spills. Remove sources of heat, acids, and combustibles. If flammable or combustible materials are present, have a CO_2 fire extinguisher available during cleanup. Cleanup personnel may need protection against contact or inhalation of material. Pick up spills promptly. When feasible, recover uncontaminated salt for reuse. Cover the spill with soda ash; moisten it with a water spray; collect the slurry for disposal. Flush trace residues with a lot of water to dilute them.

DISPOSAL: Follow Federal, state, and local regulations. Mix slurry with wet sand and dispose of it suitably in an approved landfill. Or, if required, small amounts can be carefully oxidized to nitrate with calcium hypochlorite; the neutralized nitrate solution can be placed in a landfill or flushed with a lot of water to dilute it.

EPA Ignitable Waste: D001 (40 CFR 261.21).

EPA, Clean Water Act, Reportable Spill Quantity: 100 lbs. (40 CFR 117).

SECTION 8. SPECIAL PROTECTION INFORMATION

Avoid eye contact with sodium nitrite by wearing safety goggles where dusty or misty conditions occur. Wear protective clothing, hat, rubber gloves, long-sleeved shirt, and trousers, etc., as needed to prevent repeated or prolonged skin exposures.

. a NIOSH-approved respirator where dusty conditions or solution mists or nitrogen oxide gases can occur.

Provide general ventilation in storage and use areas. Use local exhaust where dusty or misty conditions occur.

An eyewash station and washing facilities should be near the use or handling area. Clothing soiled with the dust or solution of this oxidizing agent can increase in flammability. Launder soiled clothing thoroughly before wearing it again. (Use water, *not* a fire blanket or a smothering technique, to extinguish a fire of nitrite-contaminated clothing.)

Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Particles may adhere to contact lenses and cause corneal damage.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store sodium nitrite in closed containers in a cool, dry, ventilated, low-fire risk area away from sources of heat and ignition and separated from combustibles or readily oxidizable material (NFPA manual 43A, *Code for storage of liquid solid oxidizing materials*). Protect containers from physical damage.

This is a hygroscopic material. Store it separately from ammonium compounds and cyanides. Do not store it on wood floors. Practice good housekeeping techniques. Avoid dust generation. Prevent dust accumulation. Do not take this material out of your work area or to your home on your clothing or equipment.

Minimize sodium nitrite's contact with skin. Avoid inhaling its dust or mist. Do not eat this material. Nitrite can react with certain amines to form nitrosamines, which are animal carcinogens.

Sodium nitrite is designated as a hazardous substance by EPA (40 CFR 116).

DOT Classification: Oxidizer DOT ID No. UN1500 Label: Oxidizer

Data Source(s) Code: 4-11, 14, 25, 49, 54, 58, 63, 82, 84. CK

Approvals	Accrocco 5/87
Indust. Hygiene/Safety	JW 4/87
Medical Review	5/11/87

MATERIAL SAFETY DATA SHEET

6819-09-23-82-578

DATE: SEPTEMBER 17, 1987

------SECTION I------

MANUFACTURER'S NAME: CALGON CORPORATION

EMERGENCY TELEPHONE NO. 412-777-8000

ADDRESS: BOX 1346
PITTSBURGH, PA 15230

CHEMICAL NAME AND SYNONYMS: SURFACTANT

FORMULA: MULTICOMPONENT LIQUID

PRODUCT NAME: CL-361

------SECTION II - HAZARDOUS INGREDIENTS------

PRINCIPAL HAZARDOUS COMPONENT(S)	% BY WT.	ORAL LD50	DERMAL LD50	TLV UNITS

THIS PRODUCT WOULD NOT BE REGARDED TO CONTAIN ANY HAZARDOUS INGREDIENTS ACCORDING TO OSHA HAZARD COMMUNICATION STANDARD (29 CFR 1910.1200).

------SECTION III - PHYSICAL DATA------

BOILING POINT (DEG. F): >212

SPECIFIC GRAVITY (H2O=1): 1.01 - 1.03

VAPOR PRESSURE (MM HG): SIMILAR TO WATER

PERCENT VOLATILE BY VOLUME (%): 95

VAPOR DENSITY (AIR=1): SIMILAR TO WATER

PH: 5.0 - 5.5

SOLUBILITY IN WATER: COMPLETE

APPEARANCE AND ODOR: CLEAR COLORLESS LIQUID WITH MILD ORGANIC ODOR.

------SECTION IV - FIRE AND EXPLOSION HAZARD DATA------

FLASHPOINT (METHOD USED): NOT FLAMMABLE

FLAMMABLE LIMITS: NOT APPLICABLE

EXTINGUISHING MEDIA: PRODUCT IS NOT FLAMMABLE.

SPECIAL FIRE FIGHTING PROCEDURES: NONE

UNUSUAL FIRE AND EXPLOSION HAZARDS: NONE

------SECTION V - HEALTH HAZARD DATA------

EFFECTS OF OVEREXPOSURE: THE PRODUCT IS PRACTICALLY NON-TOXIC THROUGH INGESTION AND DERMAL ABSORPTION. THE ACUTE ORAL LD50 (RATS) IS >3.0 G/KG. THE ACUTE DERMAL LD50 (RABBITS) IS >2 ML/KG. IT IS NOT A PRIMARY SKIN IRRITANT. THE PRIMARY IRRITATION INDEX IS 2.04/8 (RABBITS). THE PRODUCT PRODUCED SLIGHT CONJUNCTIVAL IRRITATION IN RABBIT EYES (SCORE AFTER 24 HR. - 2, SCORE AFTER 48 HR. - 0).

EMERGENCY AND FIRST AID PROCEDURES:
GOOD FIRST AID SHOULD ALWAYS BE FOLLOWED IN ALL CASES OF EXPOSURE.

IN CASE OF EYE CONTACT, FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. IF IRRITATION DEVELOPS, CALL A PHYSICIAN.

------SECTION VI - REACTIVITY DATA------

STABILITY
UNSTABLE ( )
STABLE (X)

CONDITIONS TO AVOID: UNKNOWN

COMPATIBILITY: STRONG BASES

HAZARDOUS DECOMPOSITION PRODUCTS: UNKNOWN

HAZARDOUS POLYMERIZATION:
MAY OCCUR ( )
NO (X)

CONDITIONS TO AVOID: UNKNOWN

------SECTION VII - SPILL OR LEAK PROCEDURES------

REPORTABLE QUANTITIES (RQ) IN LBS. OF EPA HAZARDOUS SUBSTANCES IN PRODUCT:

1. N/A

NOTIFY EPA OR PRODUCT SPILLS EQUAL TO OR EXCEEDING N/A LBS.

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS. DIKE AREA TO CONTAIN AS MUCH SPILLED MATERIAL AS POSSIBLE. REMOVE ANY REMAINING MATERIAL BY ABSORBING ON VERMICULITE OR OTHER SUITABLE ABSORBING MATERIAL AND PLACE IN A SEALED METAL CONTAINER FOR DISPOSAL.

WASTE DISPOSAL METHOD: FLUSH WITH PLENTY OF WATER AND DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS.

------SECTION VIII - SPECIAL PROTECTION INFORMATION------

RESPIRATORY PROTECTION: NOT REQUIRED

VENTILATION: NORMAL
LOCAL EXHAUST (NOT REQUIRED)
MECHANICAL (NOT REQUIRED)
SPECIAL ( )
OTHER ( )

PROTECTION GLOVES: NOT REQUIRED

EYE PROTECTION: NOT REQUIRED

OTHER PROTECTIVE EQUIPMENT: NOT REQUIRED

------SECTION IX - SPECIAL PRECAUTIONS------

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: WASH THOROUGHLY AFTER HANDLING. KEEP CONTAINER CLOSED. EXERCISE CAUTION IN THE STORAGE AND HANDLING OF ALL CHEMICAL SUBSTANCES.

OTHER PRECAUTIONS: NONE

PREPARED BY: JANET MOSTOWY

WHILE THIS INFORMATION AND RECOMMENDATIONS SET FORTH HEREIN ARE BELIEVED TO BE ACCURATE AS OF THE DATE HEREOF, CALGON CORPORATION MAKES NO WARRANTY WITH RESPECT HERETO AND DISCLAIMS ALL LIABILITY FROM RELIANCE THEREON.

MATERIAL SAFETY DATA SHEET
DATE: MAY 13, 1993
1179 1/85
6A79-08-07-86-523
PRODUCT NAME: PCL-8125
GON CORPORATION
IDIARY OF MERCK & CO. INC.

------SECTION I------

MANUFACTURER'S NAME: CALGON CORPORATION

EMERGENCY TELEPHONE NO. 412-777-8000

ADDRESS: BOX 1346
PITTSBURGH, PA 15230

CHEMICAL NAME AND SYNONYMS: ANIONIC POLYMER SOLUTION

FORMULA: MULTICOMPONENT LIQUID

------SECTION II - HAZARDOUS INGREDIENTS------

PRINCIPAL HAZARDOUS COMPONENT (S)	CAS#	% BY WEIGHT	ORAL LD50	DERMAL LD50	TLV UNITS ACGIH	OSHA	OTHER
ETHYLENE GLYCOL	107-21-1	APPROX. 2	4700MG/KG	19.53G/KG	50PPM CEILING	NOT LISTED	N/A
DIUM HYDROXIDE AUSTIC SODA)	1310-73-2	APPROX. 4	140-340 MG/KG	1350MG/KG	2MG/M3 CEILING	2MG/M3	N/A

------SECTION III - PHYSICAL DATA------

BOILING POINT (DEG. F): >212
SPECIFIC GRAVITY (H2O=1): 1.35-1.38
VAPOR PRESSURE (MM HG): SIMILAR TO WATER
PERCENT VOLATILE BY VOLUME (%): APPROX. 60
VAPOR DENSITY (AIR=1): SIMILAR TO WATER
PH: 12.0-13.5
OTHER: N/A
SOLUBILITY IN WATER: COMPLETE
APPEARANCE AND ODOR: CLEAR, AMBER LIQUID

N/A = NOT APPLICABLE

------SECTION IV - FIRE AND EXPLOSION HAZARD DATA------

FLASHPOINT (METHOD USED): >200 F; THIS PRODUCT IS NOT FLAMMABLE OR COMBUSTIBLE.

EXTINGUISHING MEDIA: THIS PRODUCT IS NOT FLAMMABLE OR COMBUSTIBLE.

SPECIAL FIRE FIGHTING PROCEDURES: EXERCISE CAUTION WHEN FIGHTING ANY CHEMICAL FIRE. A SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING ARE ESSENTIAL.

UNUSUAL FIRE AND EXPLOSION HAZARDS: NONE

------SECTION V - HEALTH HAZARD DATA------

TS OF OVEREXPOSURE:

A. ACUTE

1. INGESTION: BECAUSE OF THE HIGH PH, THIS PRODUCT MAY BE EXPECTED TO CAUSE SEVERE IRRITATION OR BURNS TO THE MOUTH, THROAT AND GASTROINTESTINAL TRACT. THIS PRODUCT CONTAINS ETHYLENE GLYCOL WHICH HAS BEEN REPORTED TO CAUSE INTOXICATION, CENTRAL NERVOUS SYSTEM DEPRESSION (INCOORDINATION, DIZZINESS), RESPIRATORY FAILURE, AND LIVER AND KIDNEY DAMAGE.

2. INHALATION: THIS PRODUCT MAY BE EXPECTED TO PRESENT A LOW POTENTIAL INHALATION HAZARD. IF MISTED OR SPRAYED, THIS PRODUCT MAY PRODUCE RESPIRATORY TRACT IRRITATION.

3. DERMAL EXPOSURE.

A. TOXIC: THIS PRODUCT IS NOT EXPECTED TO PRODUCE SYSTEMIC TOXICITY IF IT MAY BE ABSORBED THROUGH THE SKIN.

B. IRRITATION: BASED ON TOXICITY TESTING FOR THE PRODUCT, IT MAY BE EXPECTED TO PRODUCE SEVERE DAMAGE (BURNS) TO THE SKIN UPON CONTACT. THE SEVERITY OF THE BURN IS GENERALLY DETERMINED BY THE CONCENTRATION OF THE PRODUCT AND THE DURATION OF THE EXPOSURE.

C. SENSITIZATION: NO INFORMATION WAS AVAILABLE TO SUGGEST THAT THIS PRODUCT MAY PRODUCE AN ALLERGIC SKIN REACTION.

4. EYE IRRITATION: BASED ON ANIMAL TOXICITY TESTING FOR THIS PRODUCT, THIS PRODUCT MAY BE EXPECTED TO PRODUCE SEVERE EYE DAMAGE (BURNS) UPON CONTACT WITH THE EYES.

SUBCHRONIC, CHRONIC, OTHER: NO APPLICABLE INFORMATION WAS FOUND CONCERNING ADVERSE TH EFFECTS RESULTING FROM SUBCHRONIC OR CHRONIC EXPOSURE TO THIS PRODUCT.

------FIRST AID------

A. EYE: IN CASE OF CONTACT, IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. SEEK MEDICAL AID.

B. SKIN: IN CASE OF CONTACT, WASH WITH SOAP AND PLENTY OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING. SEEK MEDICAL AID.

C. INGESTION: IF SWALLOWED, DO NOT INDUCE VOMITING. GIVE LARGE QUANTITIES OF WATER. SEEK MEDICAL AID. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

D. INHALATION: NOT APPLICABLE.

------SECTION VI - REACTIVITY DATA------

STABILITY

UNSTABLE ( )

STABLE (X)

CONDITIONS TO AVOID: UNKNOWN

COMPATIBILITY: STRONG OXIDIZERS

HAZARDOUS DECOMPOSITION PRODUCTS: OXIDES OF NITROGEN.

------SECTION VII - SPILL OR LEAK PROCEDURES------

REPORTABLE QUANTITIES (RQ) IN LBS OF EPA HAZARDOUS SUBSTANCES IN PRODUCT:

SODIUM HYDROXIDE 1,000

NOTIFY EPA OR PRODUCT SPILLS EQUAL TO OR EXCEEDING 25,000 LBS.

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS. DIKE AREA TO CONTAIN AS MUCH SPILLED MATERIAL AS POSSIBLE. REMOVE ANY REMAINING MATERIAL BY ABSORBING ON VERMICULITE OR OTHER SUITABLE ABSORBING MATERIAL AND PLACE IN A SEALED METAL CONTAINER FOR DISPOSAL.

WASTE DISPOSAL METHOD: BURY IN AN APPROVED LAND FILL IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS. THIS PRODUCT AS SOLD WOULD BE CONSIDERED A RCRA HAZARDOUS WASTE, AS DEFINED IN 40 CFR PART 261.22, FOR CORROSIVITY. THE RCRA HAZARDOUS WASTE NUMBER IS D002.

------SECTION VIII - HANDLING/STORAGE------

PROTECTION GLOVES: RUBBER
EYE PROTECTION: CHEMICAL SPLASH GOGGLES AND FACE SHIELD.
OTHER PROTECTIVE CLOTHING: RUBBER APRON.
RESPIRATORY PROTECTION: NOT REQUIRED, HOWEVER IF THE RECOMMENDED ACGIH-TLV OR OSHA-PEL FOR SODIUM HYDROXIDE OR ETHYLENE GLYCOL ARE EXCEEDED, THEN AN APPROVED NIOSH/MSHA RESPIRATOR SHOULD BE USED.

ILATION:
..AL EXHAUST: RECOMMENDED MECHANICAL (GENERAL): RECOMMENDED
OTHER: USE ONLY IN WELL-VENTILATED AREAS THAT WILL MAINTAIN AIR LEVELS BELOW LIMITS ESTABLISHED BY LOCAL, STATE AND FEDERAL REGULATIONS.

STORAGE AND HANDLING:

!DANGER!

MAY CAUSE SEVERE EYE AND SKIN DAMAGE.
MAY BE HARMFUL IF SWALLOWED.
DO NOT GET IN EYES, ON SKIN OR CLOTHING.
AVOID BREATHING MIST AND VAPORS.
WEAR CHEMICAL SPLASH GOGGLES OR FULL FACE SHIELD, RUBBER GLOVES AND PROTECTIVE CLOTHING WHEN HANDLING.
WASH THOROUGHLY AFTER HANDLING.
KEEP CONTAINER CLOSED WHEN NOT IN USE.
USE ONLY IN WELL-VENTILATED AREAS THAT WILL MAINTAIN AIR LEVELS BELOW LIMITS ESTABLISHED BY LOCAL, STATE AND FEDERAL REGULATIONS.

OTHER PRECAUTIONS: NONE

PREPARED: PATRICIA A. PACELLA

IMP-0523
13/93

WHILE THIS INFORMATION AND RECOMMENDATIONS SET FORTH HEREIN ARE BELIEVED TO BE ACCURATE AS OF THE DATE HEREOF, ICALGON CORPORATION MAKES NO WARRANTY WITH RESPECT HERETO AND DISCLAIMS

1179 10/79

MATERIAL SAFETY DATA SHEET

DATE [illegible]

6819-06-25-86-578

CALGON CORPORATION
SUBSIDIARY OF MERCK & CO., INC.

PRODUCT NAME CL-361

SECTION I

MANUFACTURER'S NAME: Calgon Corporation	EMERGENCY TELEPHONE NO. (412) 777-8000
ADDRESS: P. O. Box 1346, Pittsburgh, Pennsylvania 15230	
CHEMICAL NAME AND SYNONYMS: Surfactant	FORMULA: Multicomponent Liquid

SECTION II HAZARDOUS INGREDIENTS

PRINCIPAL HAZARDOUS COMPONENT (S)	%	ORAL LD_{50}	DERMAL LD_{50}	TLV (Units)
This product would not be regarded to contain any hazardous				
ingredients according to OSHA Hazard Communication				
Standard (29 CFR 1910.1200).				

SECTION III PHYSICAL DATA

BOILING POINT (°F)	> 212	SPECIFIC GRAVITY (H_2O=1)	1.01 - 1.03
VAPOR PRESSURE (mmHg.)	Similar to Water	PERCENT VOLATILE BY VOLUME (%)	95
VAPOR DENSITY (AIR=1)	Similar to Water	pH	5.0 - 5.5
SOLUBILITY IN WATER	Complete		
APPEARANCE AND ODOR	Clear colorless liquid with mild organic odor		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method Used)	Not flammable	FLAMMABLE LIMITS: Not Applicable	Lel	Uel
EXTINGUISHING MEDIA	Product is not flammable.			
SPECIAL FIRE FIGHTING PROCEDURES	Exercise caution when fighting any chemical fire. A self-contained breathing apparatus and protective clothing are essential.			
UNUSUAL FIRE AND EXPLOSION HAZARDS	None			

CTS OF OVEREXPOSURE — The product is practically non-toxic through ingestion and dermal absorption. The acute LD_{50} (rats) is > 3.0 g/kg. The acute dermal LD_{50} (rabbits) is > 2 ml/kg. It is not a primary skin irritant. The Primary Irritation x is 2.04/8 (rabbits). The product produced slight conjunctival irritation in rabbit eyes (Score after 24 hr - 2, Score after 48 hr - 0).

ENCY AND FIRST AID DURES

Good First Aid should be followed in all cases of exposure.

In case of eye contact, flush with plenty of water for at least 15 minutes. If irritation develops, call a physician.

SECTION VI - REACTIVITY DATA

STABILITY	STABLE	X	CONDITIONS TO AVOID	Unknown
	UNSTABLE			

INCOMPATABILITY (Materials to Avoid) — Strong bases

HAZARDOUS DECOMPOSITION PRODUCTS — Unknown

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID	Unknown
MAY OCCUR	NO	X		

SECTION VII - SPILL OR LEAK PROCEDURES

REPORTABLE QUANTITIES (RQ) IN LBS. OF EPA HAZARDOUS SUBSTANCES IN PRODUCT

1 N/A

2

3

NOTIFY EPA OF PRODUCT SPILLS EQUAL TO OR EXCEEDING N/A LBS.

S TO BE TAKEN IN CASE ERIAL IS RELEASED OR SPILLED — Dispose of in accordance with local, state and federal regulations. Dike area to contain as much spilled material as possible. Remove any remaining material by absorbing on vermiculite or other suitable absorbing material and place in a sealed metal container for disposal.

WASTE DISPOSAL METHOD — Flush with plenty of water and dispose of in accordance with local, state and federal regulations.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify Type) — Not Required

VENTILATION	LOCAL EXHAUST — Not Required	SPECIAL	
Normal	MECHANICAL (General) — Not Required	OTHER	

PROTECTIVE GLOVES	Not Required	EYE PROTECTION	Not Required

OTHER PROTECTIVE EQUIPMENT — Not Required

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HA ING AND STORING — Wash thoroughly after handling. Keep container closed. Exercise caution in the storage and handling of all chemical substances.

HER PRECAUTIONS — None

PREPARED BY Janet Mostowy

MATERIAL SAFETY DATA SHEET

Calgon Corporation
P.O. Box 1346
Pittsburgh, PA 15230-1346

24 Hour Emergency Telephone--(412)777-8000

CALGON CORPORATION
SUBSIDIARY OF MERCK & CO., INC.

Section 1. PRODUCT IDENTIFICATION

PRODUCT NAME: PCL-8125

CHEMICAL DESCRIPTION: Alkaline aqueous solution of organic phosphonates and polymer
PRODUCT CLASS: Water treatment
MSDS CODE: 0523-03-10-93

Section 2. HAZARDOUS INGREDIENTS AND EXPOSURE LIMITS

Chemical Name	CAS Number	% by Weight	OSHA PEL	ACGIH TLV
Ethylene glycol	107-21-1	~ 2	Ceiling 50 ppm, 125 mg/m^3	Ceiling 50 ppm, 127 mg/m^3
Sodium tolyltriazole	64665-57-2	~ 2	None established	None established
Sodium hydroxide	1310-73-2	~ 1	Ceiling 2 mg/m^3	Ceiling 2 mg/m^3

Section 3. HAZARDS IDENTIFICATION

********************** EMERGENCY OVERVIEW **********************

DANGER! May cause severe eye and skin damage. May be harmful if swallowed. May cause respiratory tract irritation.

****

PRIMARY ROUTES OF ENTRY: Eye and skin contact, ingestion, inhalation

TARGET ORGANS: Eye, skin, mucous membranes, kidney, central nervous system

Continued on Page 2

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing kidney disease may be aggravated by exposure to ethylene glycol.

POTENTIAL HEALTH EFFECTS:

EYE CONTACT: This product may cause severe irritation and damage upon contact with the eye.

SKIN CONTACT: Exposure to this product may cause severe irritation of the skin. If not removed promptly, burns may result. The extent of injury depends on the duration of contact. This product is not expected to be absorbed through the skin in harmful amounts or to produce skin sensitization. Repeated skin contact with ethylene glycol may, in a very small proportion of cases, cause sensitization with the development of allergic contact dermatitis.

INGESTION: Ingestion of this product may cause severe irritation or burns of the mucous membranes of the mouth, throat, esophagus and stomach. Ingestion of large volumes of ethylene glycol may result in central nervous system depression and kidney damage. Cardiac failure and pulmonary edema may develop. Early to moderate CNS depression may be evidenced by giddiness, headache, dizziness, and nausea. Kidney damage may be evidenced by changes in urine output, urine appearance or edema (swelling from fluid retention).

INHALATION: This product is not expected to present an inhalation hazard unless mists or vapors are generated. Significant air concentrations are not achieved unless the product is heated or sprayed as a mist. Inhalation of low concentrations of mists or vapors may cause mucous membrane irritation with sore throat, coughing and shortness of breath. Intense exposure may result in destruction of mucous membranes and delayed pulmonary edema or pneumonitis. High vapor concentrations of ethylene glycol caused, for example, by heating the product in an enclosed and poorly ventilated workplace, may produce irritation of the upper respiratory tract, nausea, vomiting, headache, dizziness, and irregular eye movements.

SUBCHRONIC, CHRONIC:
No applicable information was found concerning any potential health effects resulting from subchronic or chronic exposure to the product.

Repeated inhalation of ethylene glycol mist may produce signs of central nervous system involvement, particularly dizziness and nystagmus (rhythmical oscillation of the eyeballs, either horizontal, rotary, or vertical).

Prolonged exposure to high concentrations of mists of sodium hydroxide may cause discomfort and ulceration of nasal passages. Chronic inhalation of mist may result in varying degrees of irritation or damage to respiratory tract tissues and an increased susceptibility to respiratory illness. The effects of chronic exposure to eyes and skin are dependent upon concentration and duration of exposure. Dermatitis, conjunctivitis or effects similar to those for acute exposure may occur.

CARCINOGENICITY:
NTP:
No ingredients listed in this section
IARC:
No ingredients listed in this section
OSHA:
No ingredients listed in this section

Continued on Page 3

MATERIAL SAFETY DATA SHEET

Section 4. FIRST AID MEASURES

EYE CONTACT: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Seek medical aid immediately.

SKIN CONTACT: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Seek medical aid immediately. Wash clothing before reuse.

INGESTION: If swallowed, do NOT induce vomiting. Give large quantities of water. Seek medical aid immediately. Never give anything by mouth to an unconscious person.

INHALATION: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Seek medical aid.

Section 5. FIRE-FIGHTING MEASURES

FLASH POINT: > 200°F (TCC) This product is not flammable or combustible.

LOWER FLAMMABLE LIMIT: Not available UPPER FLAMMABLE LIMIT: Not available

AUTO-IGNITION TEMPERATURE: Not available

EXTINGUISHING MEDIA: Use extinguishing media appropriate for the surrounding fire.

FIRE-FIGHTING INSTRUCTIONS: Exercise caution when fighting any chemical fire. A self-contained breathing apparatus and protective clothing are essential.

FIRE & EXPLOSION HAZARDS: Product emits toxic gases under fire conditions.

DECOMPOSITION PRODUCTS: Thermal decomposition or combustion may produce carbon monoxide, carbon dioxide, nitrogen oxides, phosphorus oxides, and sulfur oxides.

NFPA RATINGS: Health = 3 Flammability = 1 Reactivity = 0 Special Hazard = None

Hazard rating scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

Section 6. ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Wearing appropriate personal protective equipment, contain spill, collect onto inert absorbent and place into suitable container.

Continued on Page 4

MATERIAL SAFETY DATA SHEET

Section 7. HANDLING AND STORAGE

HANDLING: Do not get in eyes, on skin or clothing.
Avoid breathing vapor or mist.
Use with adequate ventilation.
Wash thoroughly after handling.
Keep container closed when not in use.

STORAGE: Store in a cool, well-ventilated area away from incompatible materials.

Section 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

PERSONAL PROTECTIVE EQUIPMENT:

EYE/FACE PROTECTION: Chemical splash goggles and face shield
SKIN PROTECTION: Chemical resistant gloves and protective clothing
RESPIRATORY PROTECTION: If airborne concentrations exceed published exposure limits, use a NIOSH approved respirator in accordance with OSHA respiratory protection requirements (29 CFR 1910.134).

ENGINEERING CONTROLS: Use local and/or general exhaust ventilation to maintain airborne concentrations below exposure limits.

WORK PRACTICES: Eye wash station and safety shower should be accessible in the immediate area of use.

Section 9. PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT: Not available

SOLUBILITY IN WATER: Complete

VAPOR PRESSURE: Similar to water

SPECIFIC GRAVITY: 1.34 - 1.38 @ 25°C

VAPOR DENSITY (air = 1): Similar to water

pH: > 12

% VOLATILE BY WEIGHT: ~ 60

FREEZING POINT: Not available

APPEARANCE AND ODOR: Clear, golden liquid.

Section 10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable

HAZARDOUS POLYMERIZATION: Will not occur

CONDITIONS TO AVOID: No specific information.

INCOMPATIBILITY: Strong oxidizers and acids

Continued on Page 5

DECOMPOSITION PRODUCTS: Thermal decomposition or combustion may produce carbon monoxide, carbon dioxide, nitrogen oxides, phosphorus oxides, and sulfur oxides.

Section 11. TOXICOLOGICAL INFORMATION

ON PRODUCT:
No information entered at this time.

ON INGREDIENTS:

Chemical Name	Oral LD_{50} (rat)	Dermal LD_{50} (rabbit)	Inhalation LC_{50} (rat)
Ethylene glycol	4700 mg/kg	9530 mg/kg	Human TCLO: 10,000 mg/m^3
Sodium tolyltriazole	640-920 mg/kg (50% soln)	> 2 g/kg	Not available
Sodium hydroxide	140-340 mg/kg	1350 mg/kg	Not available

Section 12. ECOLOGICAL INFORMATION

ON PRODUCT:

Aquatic toxicity data:
48 hr LC_{50} (Ceriodaphnia dubia): 188 ppm
96 hr LC_{50} (rainbow trout): 471 ppm
96 hr LC_{50} (fathead minnow): 1310 ppm

Environmental data:
COD: 250,000 mg/l
BOD: 37,000 mg/l

Section 13. DISPOSAL CONSIDERATIONS

RCRA STATUS: Discarded product, as sold, would be considered a RCRA Hazardous Waste based on the characteristic of corrosivity. The EPA Hazardous Waste Number is D002.

DISPOSAL: Dispose of in accordance with local, state and federal regulations.

Section 14. TRANSPORT INFORMATION

DOT CLASSIFICATION:
Hazard Class: Corrosive material
Proper Shipping Name: Corrosive liquid, n.o.s. (contains Sodium hydroxide)
ID Number: UN 1760
Label: Corrosive

Section 15. REGULATORY INFORMATION

OSHA Hazard Communication Status: Hazardous

Continued on Page 6

MATERIAL SAFETY DATA SHEET

TSCA: The ingredients of this product are listed on the Toxic Substances Control Act (TSCA) Chemical Substances Inventory.

CERCLA reportable quantity of EPA hazardous substances in product:

Chemical Name	RQ
Ethylene glycol	5000 lb
Sodium hydroxide	1000 lb

Product RQ: 100,000 lb (Notify EPA of product spills exceeding this amount.)

SARA TITLE III:

Section 302 Extremely Hazardous Substances:

Chemical Name	CAS #	RQ	TPQ
No ingredients listed in this section			

Section 311 and 312 Health and Physical Hazards:

Immediate	Delayed	Fire	Pressure	Reactivity
[yes]	[yes]	[no]	[no]	[no]

Section 313 Toxic Chemicals:

Chemical Name	CAS #	% by Weight
Ethylene glycol	107-21-1	~ 2

Section 16. OTHER INFORMATION

HMIS RATINGS: Health = 3* Flammability = 1 Reactivity = 0
Personal Protective Equipment = X (to be specified by user depending on use conditions)

*There are potential chronic health effects to consider.

Hazard rating scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

MSDS REVISION SUMMARY: Reason for reissue: Update to new format.

PREPARED BY: P.J. Maloney

Material Safety Data Sheet

ALUMINUM SULFATE, DRY
Identity (Trade Name As Used On Label)

Delta Chemical Corporation
Manufacturer

2601 Cannery Avenue
Address

Baltimore, Maryland 21226

410-354-0100
Phone Number (For Information)

410-354-0100
Emergency Phone Number

N/A
MSDS Number*

10043-01-3
CAS Number*

January 1993
Date Prepared

N/A
Prepared By*

Distributed By:
Manley-Regan Chemicals
Div. Of E+E (US) Inc.,
Middletown, PA

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

SECTION 1 - MATERIAL IDENTIFICATION AND INFORMATION

COMPONENTS — Chemical Name & Common Names (Hazardous Components 1% or greater; Carcinogens 0.1% or greater)	%*	OSHA PEL	ACGIH TLV	OTHER LIMITS RECOMMENDED
Aluminum Sulphate (Alum)	57.0	N/A	N/A	TWA
				2 mg/m³ as Al
				as Air Contaminar
Non-Hazardous Ingredients	43.0			
TOTAL	100			

SECTION 2 - PHYSICAL / CHEMICAL CHARACTERISTICS

Boiling Point	N/A	Specific Gravity (H_2O = 1)	1.61
Vapor Pressure (mm Hg and Temperature)	Negligible	Melting Point	105°C
Vapor Density (Air = 1)	N/A	Evaporation Rate (____ = 1)	N/A
Solubility in Water	50% @ 32°F	Water Reactive	No
Appearance and Odor	White or Brownish Crystals With No Odor.		

SECTION 3 - FIRE AND EXPLOSION HAZARD DATA

Flash Point and Method Used	Auto-Ignition Temperature	Flammability Limits in Air % by Volume	LEL	UEL
Non-Flammable	N/A	N/A	N/A	N/A

Extinguisher Media: Water

Special Fire Fighting Procedures: Wear NIOSH Approved Self-Contained Breathing Apparatus.

RECEIVED
APR 22 1994
MANLEY REGAN CHEM.

Unusual Fire and Explosion Hazards: See Hazardous Decomposition Products in Section IV.

*Optional

SECTION 4 · REACTIVITY HAZARD DATA

STABILITY
☒ Stable
☐ Unstable

Conditions To Avoid: Temperatures above 760°C - would release toxic & corrosive gases.

Incompatability (Materials to Avoid): Alkalies and water reactive materials like oleum cause exothermic reactions.

Hazardous Decomposition Products: Sulfur oxide gases (toxic & oxidizers & corrosive). Trioxide is a fire hazard

HAZARDOUS POLYMERIZATION
☐ May Occur
☒ Will Not Occur

Conditions To Avoid: N/A

SECTION 5 · HEALTH HAZARD DATA

PRIMARY ROUTES OF ENTRY: ☒ Inhalation ☒ Ingestion ☐ Skin Absorption ☐ Not Hazardous

CARCINOGEN LISTED IN: ☐ NTP ☐ OSHA ☐ IARC Monograph ☒ Not Listed

HEALTH HAZARDS
Acute: Ingestion may irritate gastrointestinal tract. May cause nausea,
Chronic: vomiting and purging. Skin irritation on repeated or prolonged contact or when moisture is present.

Signs and Symptoms of Exposure: May reach TLV without visible indication.

Medical Conditions Generally Aggravated by Exposure: Resperatory problems.

EMERGENCY FIRST AID PROCEDURES - Seek medical assistance for further treatment, observation and support if necessary.

Eye Contact: Flush with water for 15 minutes and seek medical attention if needed.

Skin Contact: Flush with water and remove contaminated clothing.

Inhalation: Remove to well ventilated area.

Ingestion: Induce vomiting and seek medical advice.

SECTION 6 · CONTROL AND PROTECTIVE MEASURES

Respiratory Protection (Specify Type): NIOSH approved dust & mist respirator when required for nuisance dust.

Protective Gloves: Rubber or Vinyl

Eye Protection: Chemical Goggles

VENTILATION TO BE USED: ☒ Local Exhaust ☐ Mechanical (general) ☐ Special ☐ Other (specify)

Other Protective Clothing and Equipment: Long sleeved shirt and trousers, hard hat or other head covering and boots.

Hygienic Work Practices: Eye wash and shower in work area.

SECTION 7 · PRECAUTIONS FOR SAFE HANDLING AND USE / LEAK PROCEDURES

Steps to be Taken if Material is Spilled Or Released: Shovel up dry chemical & place in covered container. Spray residue with large amounts of water & neutralize with soda ash or lime. Adequate ventilation required due to release of carbon dioxide gas.

Waste Disposal Methods: Disolve in water, neutralize with alkali; then flush to sewer with large quantities of water, if permitted by applicable disposal regulations.

Precautions to be Taken in Handling and Storage: Store in cool dry area. Avoid contact with eyes, skin or clothing. Avoid breathing dust.

Other Precautions and/or Special Hazards:

NFPA Rating* Health 1 Flammability 0 Reactivity 1 Special 0 | **HMIS Rating*** Health ___ Flammability ___ Reactivity ___

INTERNAL DISTRIBUTION: **FILE COPY**

JD Arbuckle	PE20	DE Larson	1020	WD Shaeffer	9270
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CL Fies	PE18	RK Nissen	944A	GC Sorensen	PE20
JC Gearhart	1023	AL Oxsen	387	CM Stroh	1022
GH Godfrey	1023	JV Parrish	1023	SL Washington	PE21
LL Grumme	PE21	DJ Pisarcik	927K	Docket File	PE20
CJ Halbfoster	927C	KE Pisarcik	PE18	LER File	PE18
AG Hosler	PE20	JE Powers	927S	WNP-2 Files	964Y
WA Kiel	PE20	JE Rhoads	PE21	JWB/lb	927M
DL Larkin	PE23				

NCR 292-1228
NCR 292-0531

March 19, 1993
G02-93-064

Docket No. 50-397

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: **NUCLEAR PLANT WNP-2, OPERATING LICENSE NPF-21 LICENSEE EVENT REPORT NO. 92-042-01**

Transmitted herewith is Licensee Event Report No. 92-042-01 for the WNP-2 Plant. This report is submitted in response to the report requirements of 10CFR 50.73 and provides an update of the root cause analysis that was not available with the initial LER.

Sincerely,

J. W. Baker
WNP-2 Plant Manager (Mail Drop 927M)

JWB/CLF/cgeh
Enclosure

cc: Mr. J. B. Martin, NRC - Region V
Mr. R. Barr, NRC Resident Inspector (Mail Drop 901A, 2 Copies)
INPO Records Center - Atlanta, GA
Mr. D. L. Williams, BPA (Mail Drop 399)

Author: CL Fies 3-17-93				For Signature of: JW Baker		
Section:						
For Approval of:	AG Hosler	DJ Pisarcik				
Approved:						
Date:	3-17-93	3-17-93				

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

P.O. Box 968 • 3000 George Washington Way • Richland, Washington 99352

March 19, 1993
G02-93-064

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Mr. D. L. Williams, BPA (Mail Drop 399)

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Washington Nuclear Plant - Unit 2	0 5 0 0 0 3 9 7	1 OF 7

TITLE (4)
NONRADIOACTIVE STORM DRAIN POND FOUND TO CONTAIN RADIOACTIVITY ABOVE EXPECTED LEVELS

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBERS(S)
										0 5 0 0 0
1 1	1 1	9 2	9 2	0 4 2	0 1	0 3	1 9	9 3		0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	1 0 0	20.402(b)	20.405(C)	50.73(a)(2)(iv)	77.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.73(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		X 20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
C. L. Fies, Licensing Engineer	AREA CODE 5 0 9 3 7 7 - 4 1 4 7

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE) X NO				

ABSTRACT (16)

On November 11, 1992, a limited assessment of soil sample results taken in the vicinity of the storm drain pond showed levels of radioactivity that exceeded ten times the values of 10CFR 20 Appendix C when conservatively averaged over the impacted area. This condition is a 30 day reportable event under 10CFR 20.203(e), 20.405(a)(1)(iii) and 20.405(d).

The area was promptly posted in accordance with the requirements of 10CFR 20.203. Additional sampling will be performed to characterize the extent of the radioactive material in the soil. Further corrective action has been taken to prevent a greater buildup of radioactive isotopes in the soil associated with the storm drain pond. In-plant corrective actions include suspension of all discharge from Turbine Building Sumps T-1, T-2, and T-3 to the Storm Drain Pond, additional sampling of potential sources, verification of drain piping configurations, and reviews of policy and procedures governing release of liquids.

The root cause of this event was less than adequate knowledge, communications, directives, and implementation.

The event posed no threat to the health and safety of either the public or plant personnel.

Plant Conditions

Power Level - 100%
Plant Mode - 1

Event Description

On November 11, 1992, an analysis of soil sample results taken in the vicinity of the storm drain pond showed levels of radioactivity that exceeded ten times the values of 10CFR 20 Appendix C (see Attachment 1). The analysis was based on data from four soil core samples. The concentration of Co-60 measured in the vicinity of the storm drain pond area, when conservatively averaged over the impacted area, was calculated to result in a quantity greater than 10 times the 10CFR 20 Appendix C value. This condition is a 30 day reportable event under 10CFR 20.203(e), 20.405(a)(1)(iii) and 10CFR 20.405(d).

The storm drain pond is located within the restricted area (a one square mile area surrounding the plant) as defined in FSAR Section 2.1.1.3 and within the site boundary (a 1.2 mile radius surrounding the plant) defined in the Offsite Dose Calculation Manual (ODCM). Storm drain water is released at a point approximately 1500 feet northeast of the plant. The water is released through a eighteen inch diameter pipe at a concrete outfall into a earthen channel approximately 300 feet in length. The channel empties into a circular pond area that is approximately 100 feet in diameter.

The WNP-2 Storm Drain Pond can receive water from several sources, including building roof drains, the Turbine Building nonradioactive floor drains, the Service Building floor drains, Diesel Generator Building floor drains, and air handling unit drains. The design flow capacity of the system is approximately 5000 gallons per minute. The capacity of the system is based on the maximum expected rainfall, a sump pump discharge of 300 gpm and an equipment drain flow of 150 gpm. The pond is designed to allow for evaporation of released water into the air or for percolation into the soil.

Drains in the Turbine Building flow to five sumps. Sumps T-1, T-2, and T-3 were designed to be nonradioactive. Sumps T-4 and T-5 are radioactive sumps by design. Discharge from the radioactive sumps is routed to radwaste. Discharge from the nonradioactive sumps was routed to the Storm Drain Pond but was diverted to radwaste systems automatically by design if the discharge radiation monitor (FD-RIS-1,2,3) setpoint was exceeded. This setpoint was established by design at 80 percent of the 10CFR 20, Appendix B, Table II value for Cs-137.

Very small amounts of radioactivity have been released with the water in the storm drain effluent over the years since plant startup. In addition to Co-60, Zn-65, Cs-137, tritium, Co-58, I-131, Mn-54, Cs-134 and Ce-141 have been detected in the pond area as previously reported in a Radiological Environmental Monitoring Program Special Report dated July 30, 1992.

Immediate Corrective Action

The area was promptly posted on November 13, 1992, in accordance with the requirements of 10CFR 20.203. In addition, on an interim basis, hourly tours were initiated by plant security to assure no unauthorized personnel are in the storm drain pond area until a fence can be constructed. Previously, on November 4, 1992, action was taken to stop all discharge from Turbine Building Sumps T-1, T-2, and T-3.

Further Evaluation, Root Cause and Corrective Action

A. Further Evaluation

1. Further evaluation showed that an analysis of WNP-2 systems was performed in response to IEB 80-010, Contamination of Nonradioactive Systems and Resulting Potential for Unmonitored Uncontrolled release of Radioactivity to the Environment dated May 6, 1980. Although the plant was not operated until 1983, this engineering review of the flow diagrams for WNP-2 was performed which identified approximately 100 areas where potential cross-connections existed between contaminated and noncontaminated systems. The clean turbine building Sumps T-1, T-2, and T-3 were identified as one of the more likely sources to the release of radioactivity because of their interface with the radioactive Sumps T-4 and T-5. In 1984, as a corrective action shortly after plant startup, composite samplers were installed on the pump discharge from Sumps T-1, T-2, and T-3 to monitor the release from these collection points. Sample analysis taken since 1984 typically showed the isotopic contamination at or below the Lower Limits of Detection (LLD).

2. In November 1984, NCR 284-0739 was issued when low levels of activity were reported in the Storm Drain Pond. The reported cause was the operation of the sump pumps associated with the turbine building radioactive Sumps T-4 and T-5. An isolation valve, FDR-V-18, in the line connecting the nonradioactive and radioactive systems was found to be failed in the mid position. To provide an additional design barrier, a design change (Plant Modification Request 84-1554) was implemented in 1985 to install check valves (FDR-V-34 and FDR-V-35) to prevent contamination of the nonradioactive sumps and inadvertent release to the Storm Drain Pond.

3. Sampling done by the Radiological Environmental Monitoring Program (REMP) in late 1986 and 1987 identified small amounts of radioactivity in the Storm Drain area. In April 1988, Technical Evaluation Request (TER) 88-0157 was written requesting an investigation and evaluation of radioactivity in the Storm Drain Pond. Investigation of this problem was not accomplished since it was believed that the radioactivity released was insignificant when compared to the discharge monitor (FD-RIS-1,2,3) setpoints. The fact that the sumps had radiation monitors that did not divert the effluent to the radwaste system seemed to confirm this belief. Corrective actions associated with this LER will resolve the concerns expressed in TER 88-0157.

4. The Radiological Environmental Monitoring Program continued to monitor the storm drain pond area and in July 1992, liquid radioactivity levels in the storm drain pond were discovered to be above Washington State reporting requirements as reported in the REMP Special Report dated July 30, 1992. A root cause analysis was performed (NCR 92-0531) at that time. This root cause identified nine possible sources of radioactivity to the storm drain pond. The most significant source was identified as water that was transferred (after sampling) from contaminated turbine building Sump T-5, to the storm drain system via the nonradioactive turbine building Sump T-2. Corrective actions identified in this root cause analysis are in progress and are listed below under further corrective actions.

5. Between July and November of this year, environmental sampling continued in the Storm Pond area in an attempt to characterize the nature of the release at the same time the root cause was being evaluated. On November 4, 1992, direction was issued to stop all flow from Turbine Buildings Sumps T-1, T-2, and T-3. This action was taken in response to the root cause investigation and additional REMP sample results. In the future, Sumps T-1, T-2, and T-3 will only be used after they have been verified radioactively clean and controls are in place to prevent contamination while in use.

B. Root Cause

A root cause analysis (NCR 92-0531) was performed on events associated with the storm drain pond during and immediately following the plant refueling outage (May-July 1992). A second root cause analysis and supporting Management Oversight and Risk Tree (MORT) analysis was performed to support this LER and Supply System's response to the violations contained in Inspection Report 92-035. The MORT analysis identified four root causes. The first root cause was determined to be less than adequate knowledge since qualified personnel did not know that the discharge of low level radiation at less than 80 percent of 10CFR 20, Appendix B, Table II limits to the storm drain pond was in violation of the plant's licensing agreement. Second, internal communications was less than adequate in that information known at various levels of plant and corporate organization did not get communicated to management so definitive action could be taken. Third, standards, directives and policy were found to be less than adequate since upper level management did not provide the guidance needed at lower organization levels so action could be taken to prevent further releases. Fourth, implementation was less than adequate since the methods, criteria, analyses and directives used for assessing the impact of the low level releases did not prevent the buildup of radioactivity in the pond.

C. Further Corrective Action

1. An independent consultant has been retained to provide additional staff advise on environmental radioactivity issues.

2. A memorandum was issued to the Plant Staff by the Plant Manager on November 4, 1992, on the subject of free release of liquids from the Radiologically Controlled Area (RCA).

3. A continuous sampler has been installed at the concrete outfall that is the entrance to the Storm drain pond. This sampler collects water every hour providing more specific data on water being released to the pond.

4. Additional soil core samples in the area of the storm drain pond will be taken and analyzed for radioactivity to better characterize the material in the pond area. Results from these samples will be available by May 21, 1993.

5. A fence was constructed around the storm drain pond area to further restrict any access.

6. A walkdown was completed for accessible areas of the inputs to all clean plant floor drains associated with the storm drain system to confirm that there are no inputs from any contaminated system. Any inaccessible areas will be inspected during the 1993 refueling outage.

7. A detailed radiological survey was performed of all clean drains and sumps associated with the Storm Drain System.

8. A review was performed of the in-plant sampling program and process controls to assure it prevents further radioactive releases to the storm drain pond.

9. A revision will be made of the current policy (Nuclear Operating Standard, NOS-38, Radiation Protection) with regard to the release of potentially contaminated material. Changes in this policy will be communicated to the Plant Staff. This will be completed by April 16, 1993.

Safety Significance

There is no safety significance associated with this event. Preliminary whole body dose calculations have been performed to estimate the dose an individual would receive from the storm drain sediment using the methods of Regulatory Guide 1.109. The dose was calculated using the first 2.5 centimeters of soil which contained 300 picocuries/kilogram of Co-60, 86 picocuries/kilogram of ZN-65 and 83 picocuries/kilogram of Cs-137. For an eight hour per year exposure, the calculated dose from the soil is 0.012 mrem/year. Even if it were postulated that an individual could be exposed to the soil for eight hours per week, the whole body dose would still be less than one mrem/year.

Similar Events

A Radiological Environmental Monitoring Program Special Report was submitted to the NRC on July 30, 1992, when measured I-131 and tritium concentrations exceeded the ODCM reporting levels. This special report contains detailed information on conditions associated with the storm drain pond prior to that date.

EIIS Information

Text Reference	EIIS Reference System	EIIS Reference Component
Turbine Building Sumps T-1, T-2, and T-3	NM	--
Isolation Valve, FDR-V-18	WH	V
Check Valves FDR-V-34 and FDR-V-35	WH	V
Sump Discharge Radiation Monitors (FD-RIS-1,2,3)	WH	RIS

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (8) Year	Number	Rev. No.	PAGE (3)
Washington Nuclear Plant - Unit 2	0 5 0 0 0 3 9 7	9 2	0 4 2	0 0	7 OF 7

TITLE (4) NONRADIOACTIVE STORM DRAIN POND FOUND TO CONTAIN RADIOACTIVITY ABOVE EXPECTED LEVELS

Attachment 1

COBALT-60 AND ZINC-65 TOTAL ACTIVITY AT THE STORM DRAIN

BASED ON THE JULY 1992 CORE SAMPLES

SAMPLE PARAMETERS	SAMPLE	SAMPLE 7-1-1	SAMPLE 7-1-1	SAMPLE 7-2-1	SAMPLE 7-2-1
Location		edge pond neck	edge pond neck	outfall	outfall
Sample Depth(ft)		0-1.5	1.5-3.0	0-1.0	1.0-2.0
S.A. Affected(sq ft)		6000 (50'X120')	6000 (50'X120')	1000(100'X10')	1000(100'X10')
Volume (cubic ft)		9000	9000	1000	1000
Wet Volume (cubic cm)		2.5E+08	2.5E+08	2.8E+07	2.8E+07
Dry Volume (cubic cm)		1.5E+08	1.5E+08	1.7E+07	1.7E+07
Weight (kg)		290000.0	290000.0	32000.0	32000.0
Co-60 Activity (pCi/kg)		920.0	100.0	290.0	2400.0
Zn-65 Activity (pCi/kg)		81.0	40.0	62.0	72.0
Total Co-60 (microcuries)		270.0	29.0	9.3	78.0
Total Zn-65 (microcuries)		23.0	12.0	2.0	2.3

Note: Appendix C limits=10 and 100 microcuries for Co-60 and Zn-65, respectively.

Assumptions

- Sample 7-2-2 (mid-channel) was not included since the results were very low.
- The sample depths included were the only ones containing significant activity.
- A volume reduction factor of 30 percent was applied to the wet sediment volumes to obtain dry sediment volumes.
- A dry sediment density of 1.9 grams per cubic centimeter was assumed.

WASHINGTON PUBLIC POWER
SUPPLY SYSTEM

INTEROFFICE MEMORANDUM

DATE: May 21, 1993

TO: J. W. Baker, WNP-2 Plant Manage (927M)

V. E. Shockley

FROM: V. E. Shockley, Manager, Health Physics (1020)

SUBJECT: **RESPONSE TO ST-101 SAMPLING REQUIREMENT OF LICENSEE EVENT REPORT NO. 92-042-01**

REFERENCE:

This IOM is to inform you that the storm drain core sampling requirements identified by LER 92-042-01 (Item C.2, "Further Corrective Action", page 5 of 7) has been completed.

One hundred twelve (112) samples were taken at depths down to 14 feet at the pond during the week of April 19, 1993 and then sent to the offsite analytical lab at Teledyne for analysis. The results of these analyses are attached to this memo along with an explanation of the process followed to collect the samples.

There were two sample locations having levels of Co-60 greater than State investigation levels and the State was notified of these results. It should be noted that these results were lower than previous samples collected at the same locations.

Attachments

Distribution:

Chasse

JP Albers	(1021)
DW Coleman	(PE20)
TE Chrisler	(1020)
JC Gearhart	(1023)
WA Kiel	(PE20)
PJ Macbeth	(927K)
MM Monopoli	(185)
AL Oxsen	(387)
JV Parrish	(1023)
DJ Pisarcik	(927K)
KE Pisarcik	(PE18)
JE Rhoads	(PE21)
GC Sorensen	(PE20)
GO Smith	(927)
DIC File 502.2.1	(1020)
VES/lb	

ST-101 CORE SAMPLING

The Storm Drain (ST-101) was selected for additional core sampling to better characterize the material in the pond area as specified by Licensee Event Report 92-042-01. The area had been fenced off and posted as a result of previous samples taken at the pond.

In January of this year core sampling was attempted, but finally abandoned due to adverse weather conditions and also as a result of rock and dense sands located below the surface that resulted in refusal.

The Supply System decided to wait until April 1993 to continue the effort to obtain core samples. April was selected for several reasons. We thought that the weather would be better for sampling in April. Also, waiting until May could have possibly impacted the Plant outage and might adversely impact the songbirds that use the pond for nesting.

Burlington Environmental was contracted to perform the sampling. During the period of April 19-23, 1993 twelve borings were drilled at locations selected which were considered representative for the pond. Six of the bores were taken at approximately equal distance along the drainage path to the pond, and six samples were taken around and across the pond.

The boring were to be made to 15 feet or where refusal was encountered with the boring tool. The sampler was a three inch outside diameter split-barrel driven by a 140-pound hammer dropped 30 inches. The Standard Penetration Test (SPT) results recorded each six inches. Where the hammer blow exceeded fifty blows per six inch interval, it was considered refusal and the SPT was terminated.

All soil borings were sampled in one foot increments down to three feet and thereafter in two foot increments down to the desired depth or when refusal was encountered. When refusal from subsurface conditions indicated, Supply System personnel would provide alternate instructions as required. Additionally, a composite sample was collected from the tailings for each five foot penetration. This sample was taken after the tailing were brought to the surface by the drilling tool and treated as the other samples. The core sampling equipment was rinsed to remove contaminates prior to collection of subsequent samples. Effort to minimize cross contamination of samples was maximized and the drilling tools were decontaminated prior to moving to the next boring location.

The samples collected were checked for contamination, bagged and delivered to Teledyne Isotopes for analysis for activity to be reported in picoCuries per kilogram (dry). Upon completion of the drilling, Burlington measured the approximate locations of the boring by using existing features for reference points.

All contractor equipment was checked for contamination prior to being released for departure from the site.

ST-101 CORE SAMPLE RESULTS

The analysis of the samples (112 in all) provides a good indication of the depth of penetration by each identified nuclide. This is shown on the attached graphs. It must be noted that the lettering of the locations was done to maintain the numbering sequence of previous sampling locations which were lettered from A through G. The actual sequence of samples taken was from the pond to the outfall, trying to minimized man caused disturbance effects between locations.

The letter sequence followed in order of sampling sequence is:

D, E, F, G, H, I, C, J, B, K, L, A

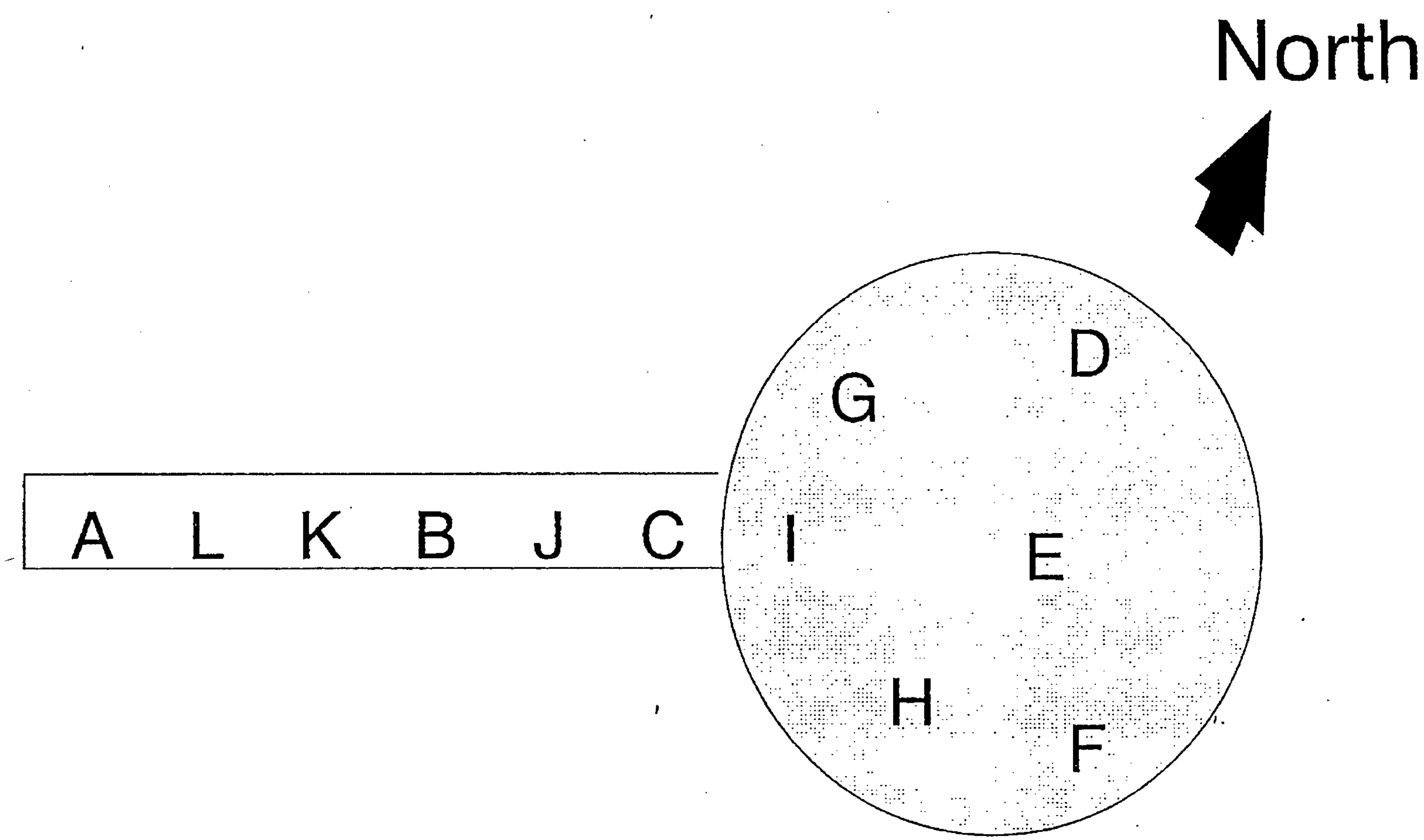
This also, is the order the graphs must be read in order to correctly interpret the data.

For each sample location the sample at a depth of approximately 14 feet is the last normal sample, and there will be 2-3 samples listed as having increments of 5 feet. These are the "composite" sample results taken from the mixture of tailings for each specified location at the indicated depth.

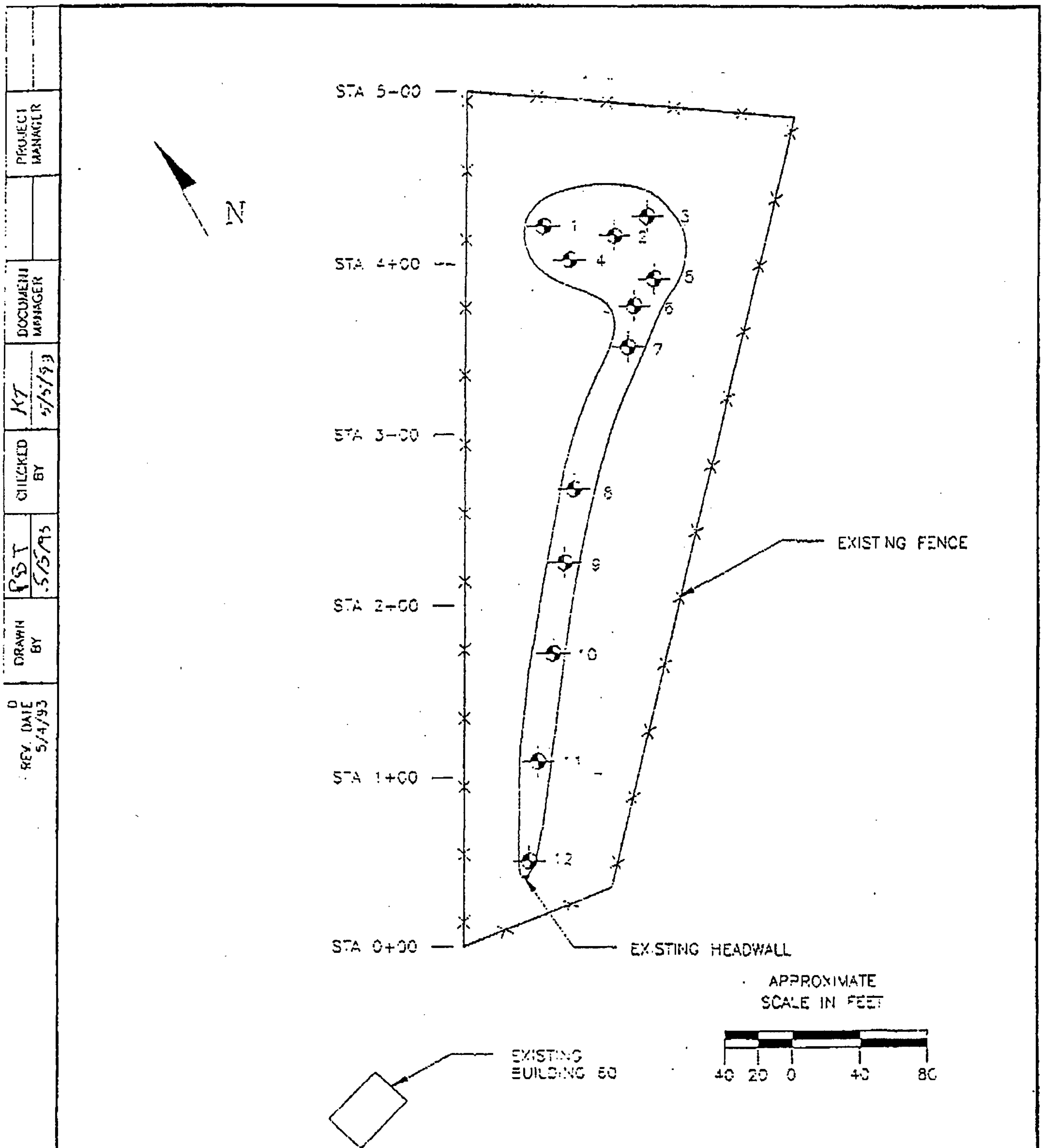
Following a preliminary review of the data, the results indicate that two areas indicate a slightly higher level of Co-60 than the balance of the pond. These two areas are at the storm drain outfall into the drainage ditch (Sample "A"), and a sample taken at the inlet to the major volume of the pond at the neck (Sample "C"). Sample "A" had 3.05E+03 pCi/kg (dry) Co-60 at the 1'-2' foot level, and Sample "C" had 3.35E+03 pCi/kg (dry) at the 2'-3' foot level. These were the highest values noted for any isotope other than natural occurring normal background activities and lower than Co-60 analysis previously taken at these locations. No other isotopes other than naturally occurring K-40, Ra-226, Th-230 exceeded a value of 1.0E+03 pCi/kg. It is again noted the values detected are less than the highest levels previously reported in the pond.

Additional analyses will be performed to further quantify the activities in the drainage path and in the pond with respect to the isotopic concentration by depth.

As part of the ongoing efforts to minimize and measure the effects on the pond, new equipment is being installed that can measure flow, pH, conductivity, and temperature. This complements the proportional sampler presently at this location. This solution will help provide more detailed information regarding the inputs into the pond.



STORM DRAIN (ST101)
CORE SAMPLE LOCATIONS



LEGEND

APPROXIMATE BORING LOCATION AND IDENTIFYING NUMBER

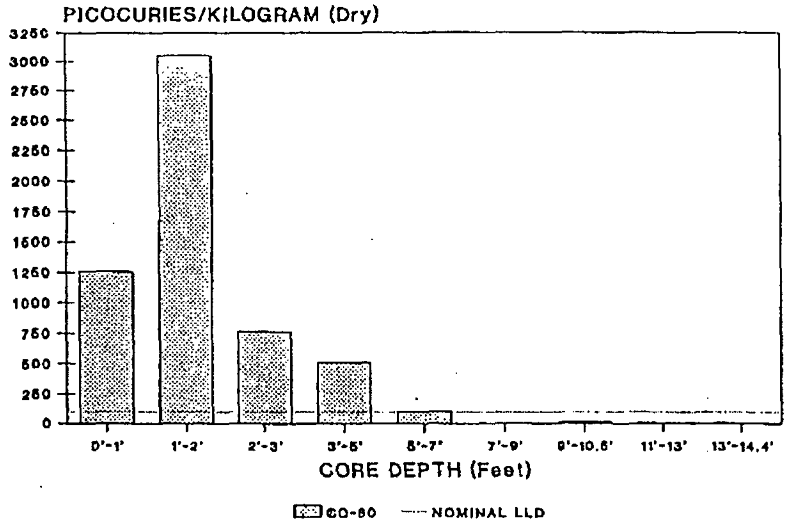
Burlington Environmental Inc.

SUPPLY SYSTEM POND SOIL SAMPLING
BORING LOCATION PLAN

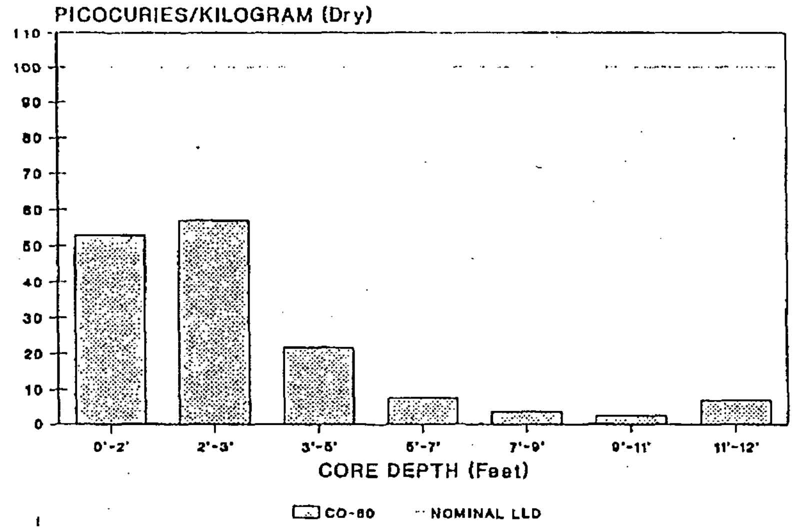
W.P.P.S.S.
RICHLAND, WA.
625557

FIGURE 1

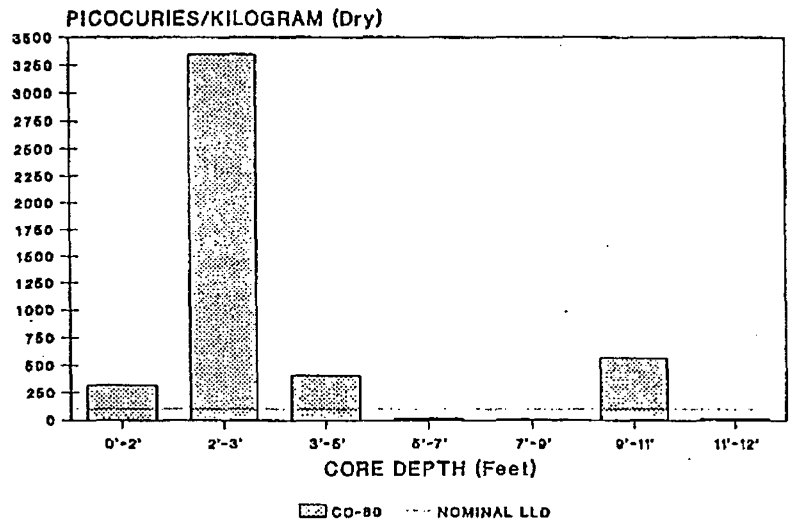
ST101 CORE SAMPLE RESULTS
STATION 101A



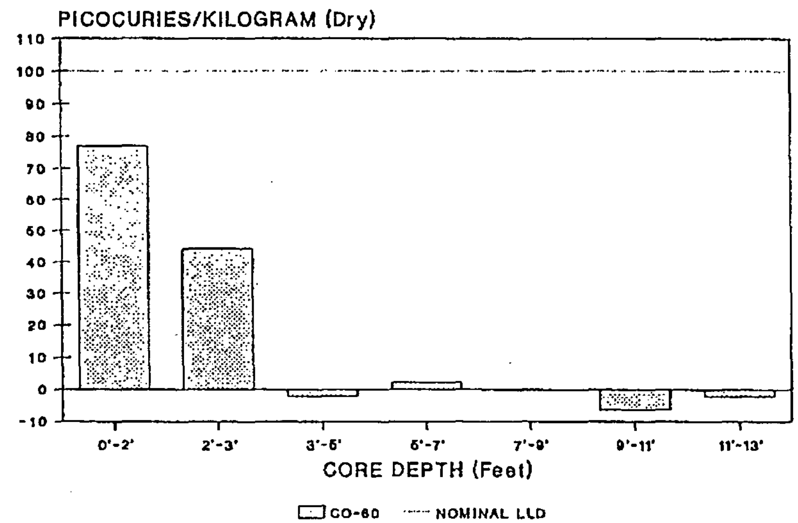
ST101 CORE SAMPLE RESULTS
STATION 101B



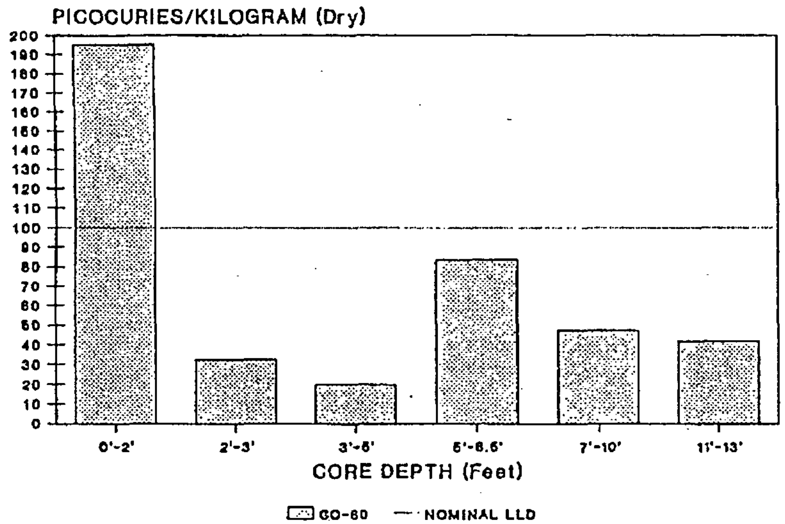
ST101 CORE SAMPLE RESULTS
STATION 101C



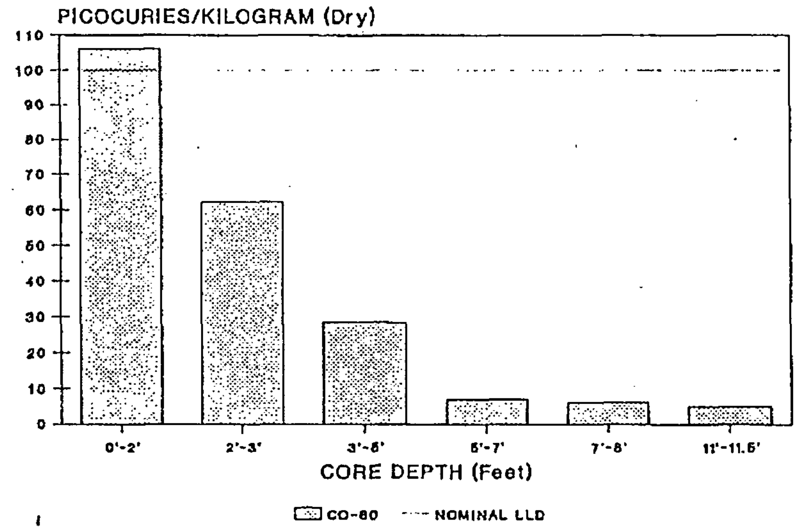
ST101 CORE SAMPLE RESULTS
STATION 101D



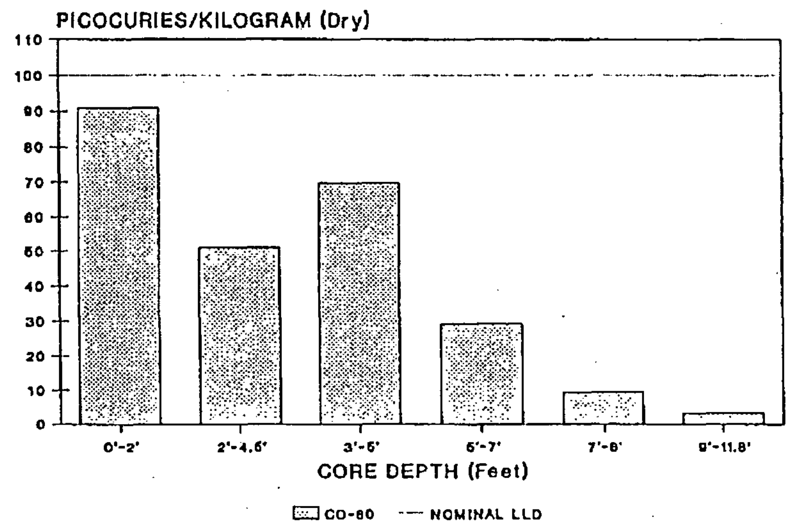
ST101 CORE SAMPLE RESULTS
STATION 101E



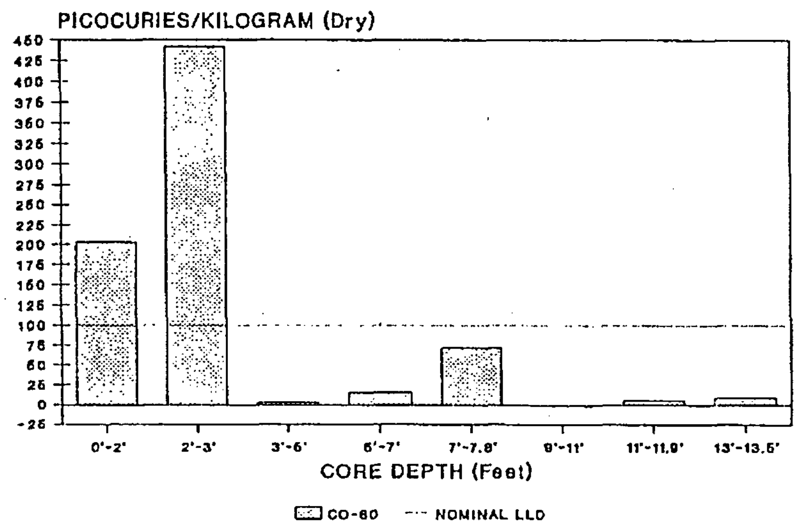
ST101 CORE SAMPLE RESULTS
STATION 101F



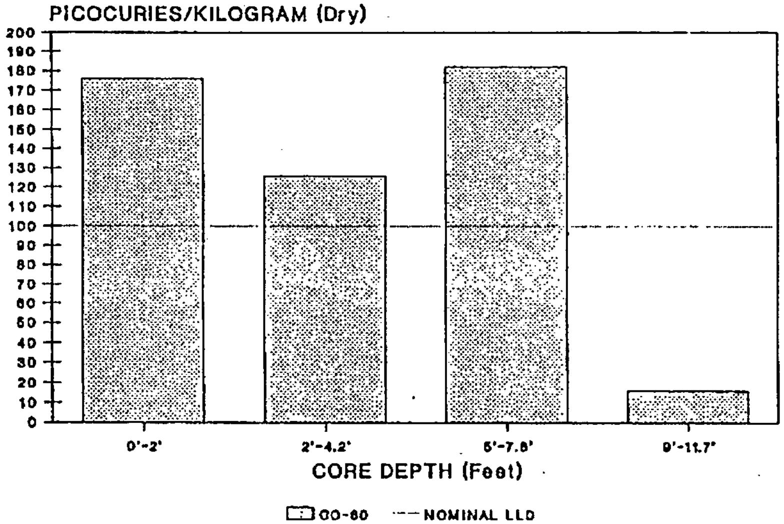
ST101 CORE SAMPLE RESULTS
STATION 101G



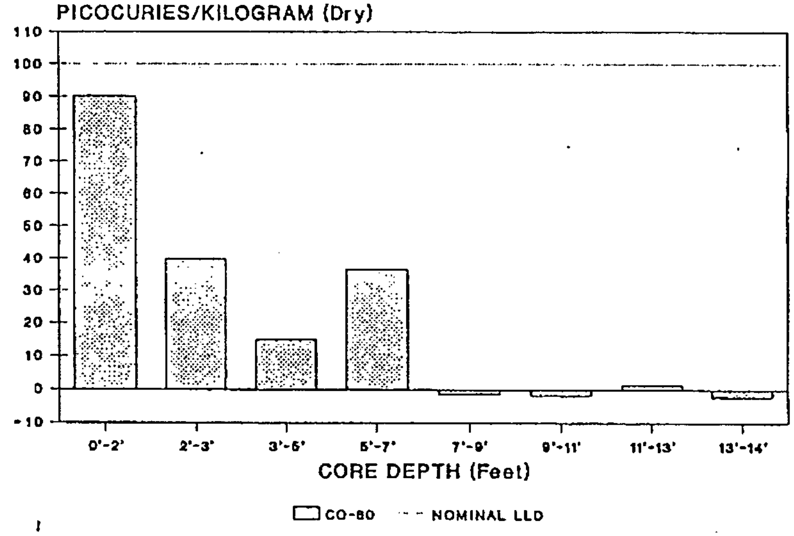
ST101 CORE SAMPLE RESULTS
STATION 101H



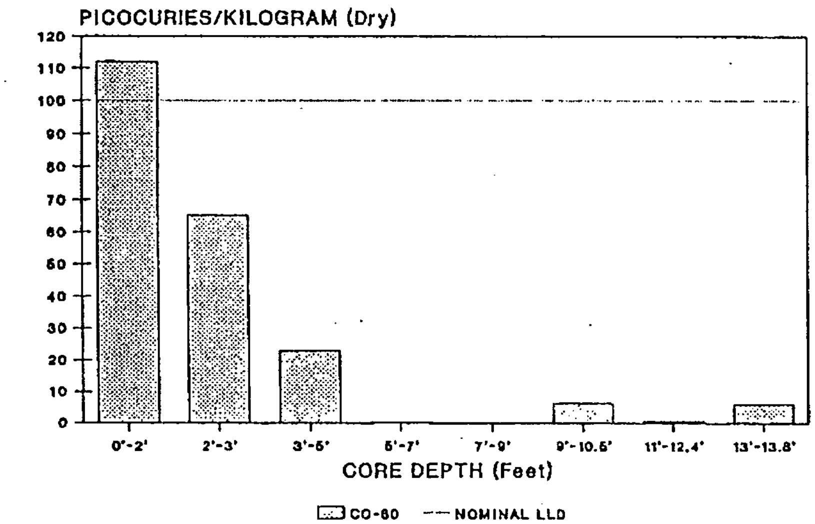
ST101 CORE SAMPLE RESULTS
STATION 101I



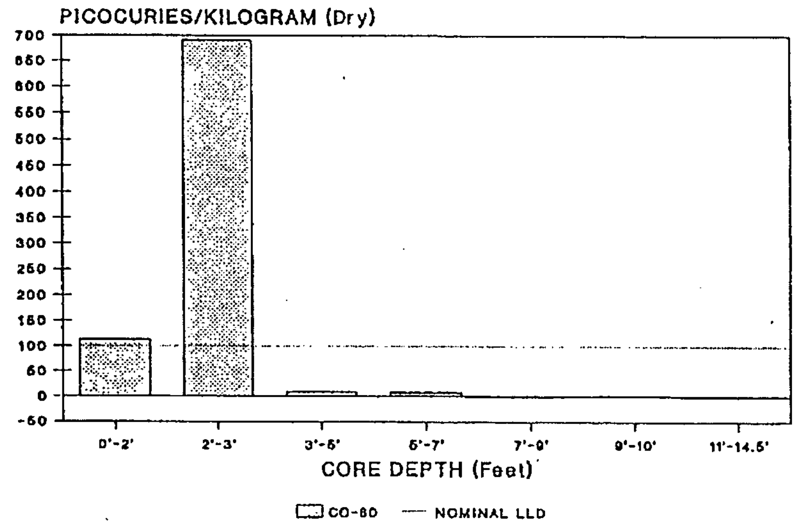
ST101 CORE SAMPLE RESULTS
STATION 101J



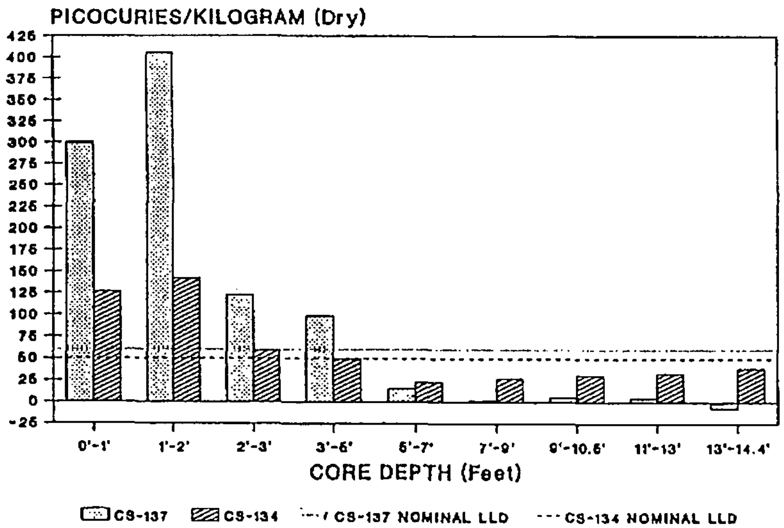
ST101 CORE SAMPLE RESULTS
STATION 101K



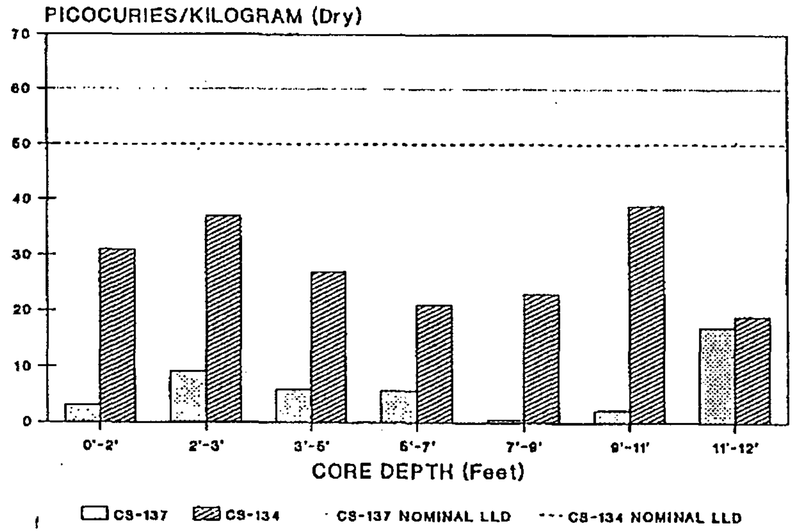
ST101 CORE SAMPLE RESULTS
STATION 101L



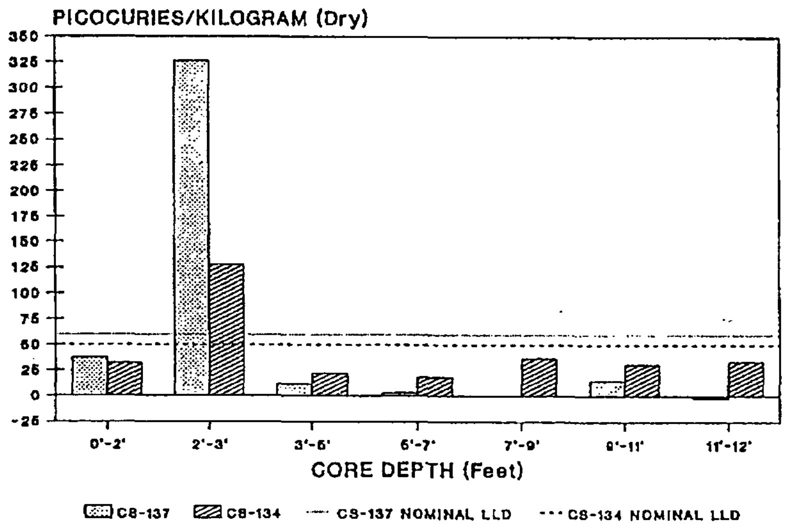
ST101 CORE SAMPLE RESULTS
STATION 101A



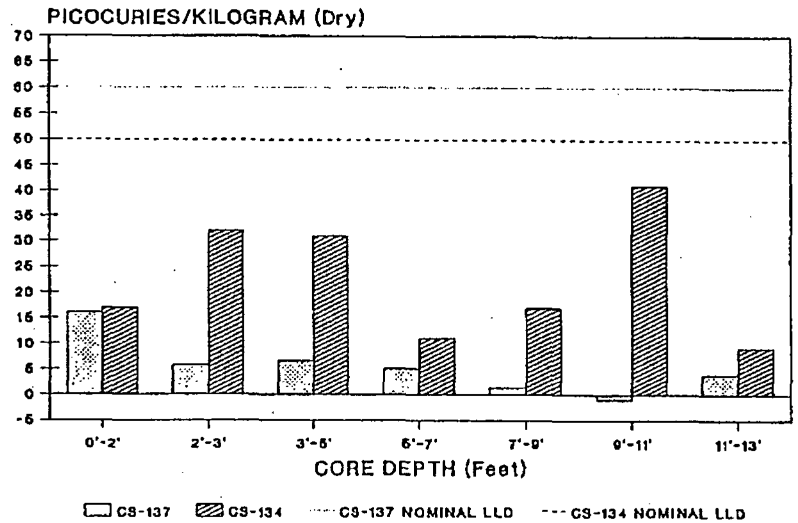
ST101 CORE SAMPLE RESULTS
STATION 101B

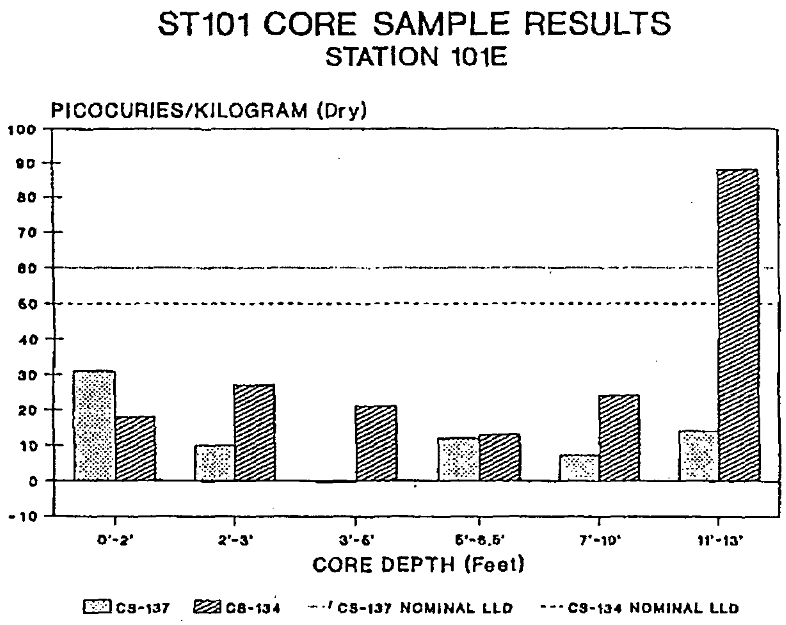


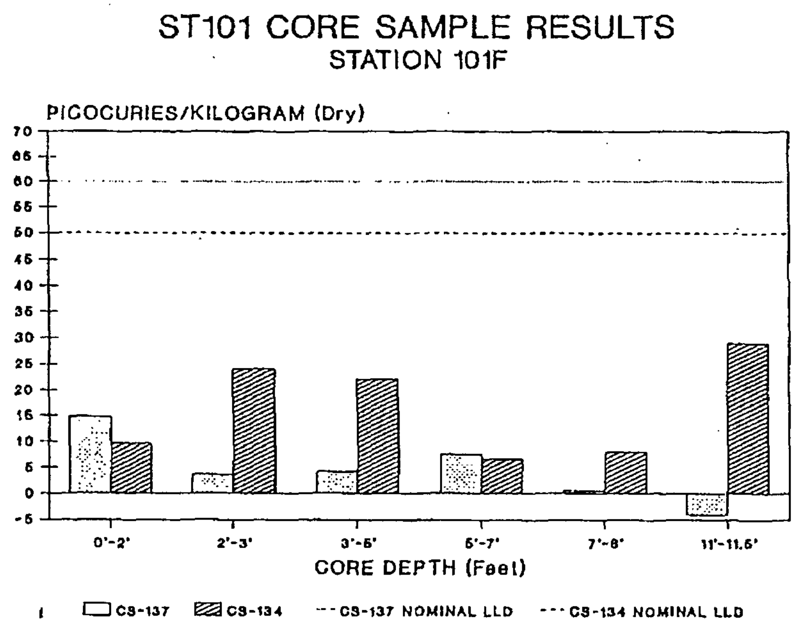
ST101 CORE SAMPLE RESULTS
STATION 101C

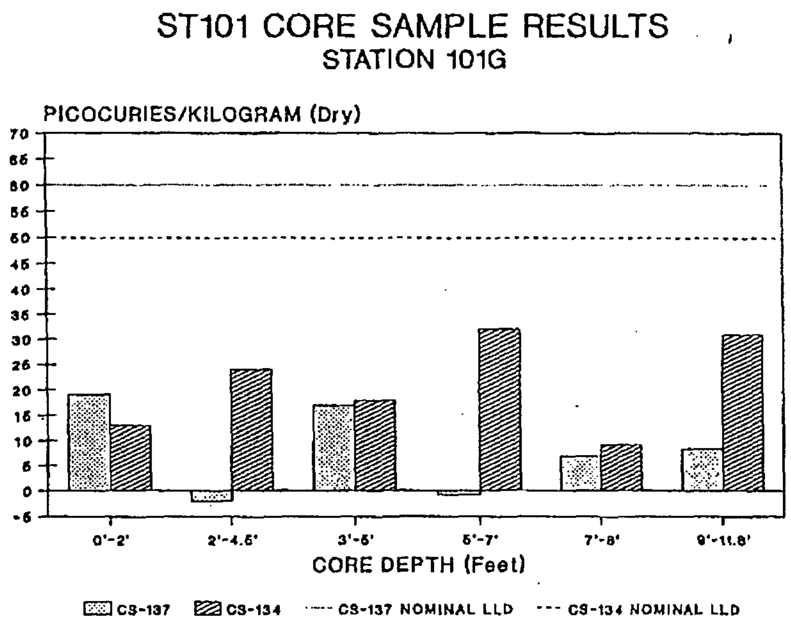


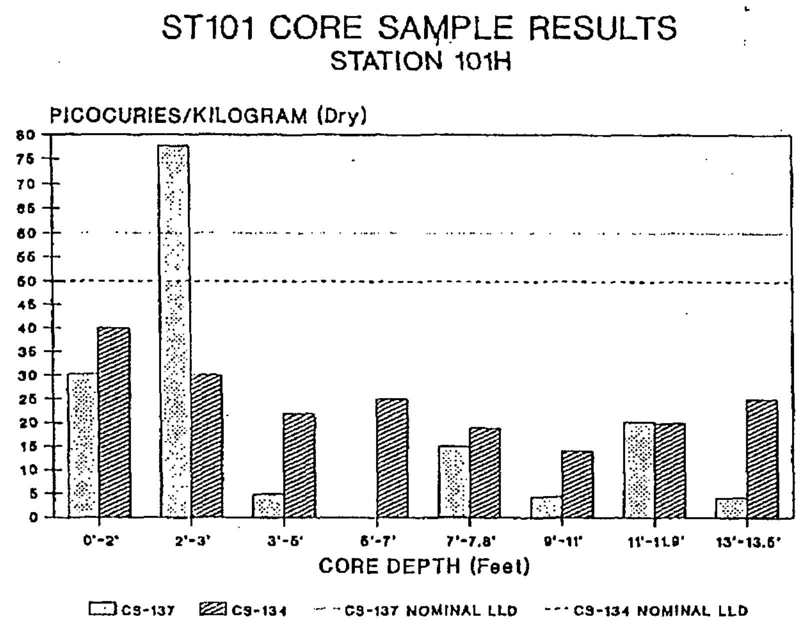
ST101 CORE SAMPLE RESULTS
STATION 101D



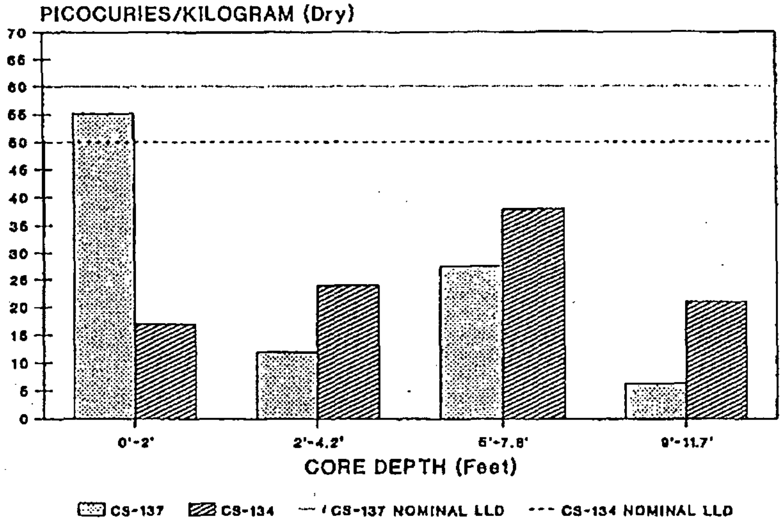

ST101 CORE SAMPLE RESULTS
STATION 101E
PICOCURIES/KILOGRAM (Dry)
CORE DEPTH (Feet)
0'-2'
2'-3'
3'-5'
5'-6.5'
7'-10'
11'-13'
CS-137
CS-134
CS-137 NOMINAL LLD
CS-134 NOMINAL LLD


ST101 CORE SAMPLE RESULTS
STATION 101F
PICOCURIES/KILOGRAM (Dry)
CORE DEPTH (Feet)
0'-2'
2'-3'
3'-5'
5'-7'
7'-8'
11'-11.5'
CS-137
CS-134
CS-137 NOMINAL LLD
CS-134 NOMINAL LLD

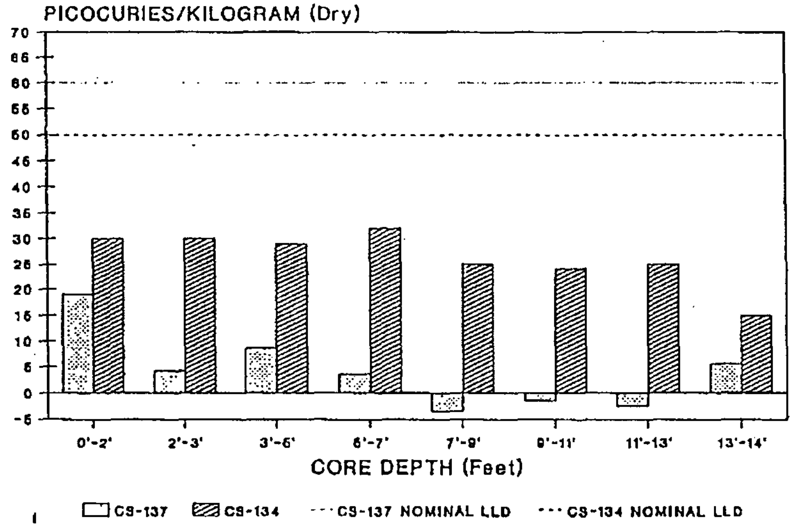

ST101 CORE SAMPLE RESULTS
STATION 101G
PICOCURIES/KILOGRAM (Dry)
CORE DEPTH (Feet)
0'-2'
2'-4.5'
3'-5'
5'-7'
7'-8'
9'-11.8'
CS-137
CS-134
CS-137 NOMINAL LLD
CS-134 NOMINAL LLD


ST101 CORE SAMPLE RESULTS
STATION 101H
PICOCURIES/KILOGRAM (Dry)
CORE DEPTH (Feet)
0'-2'
2'-3'
3'-5'
5'-7'
7'-7.8'
9'-11'
11'-11.9'
13'-13.5'
CS-137
CS-134
CS-137 NOMINAL LLD
CS-134 NOMINAL LLD

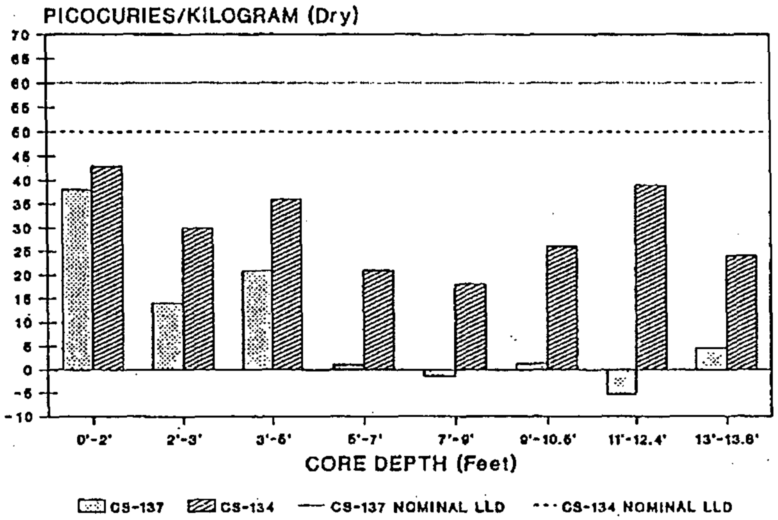
ST101 CORE SAMPLE RESULTS
STATION 101I



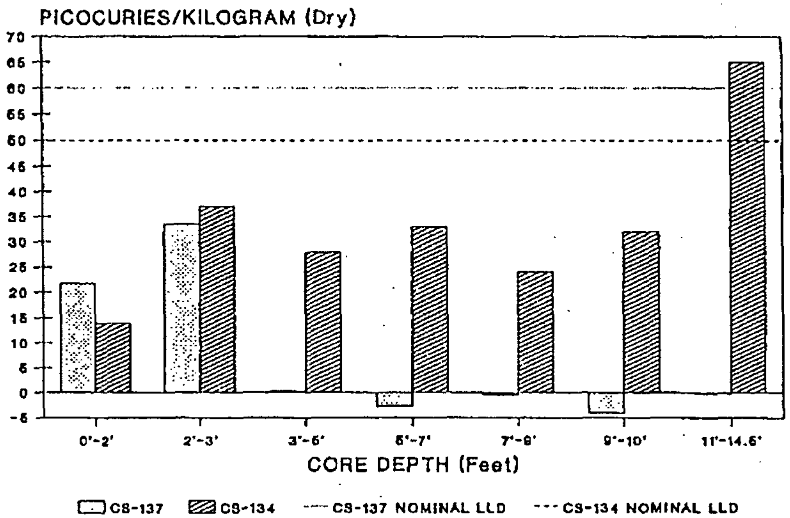
ST101 CORE SAMPLE RESULTS
STATION 101J

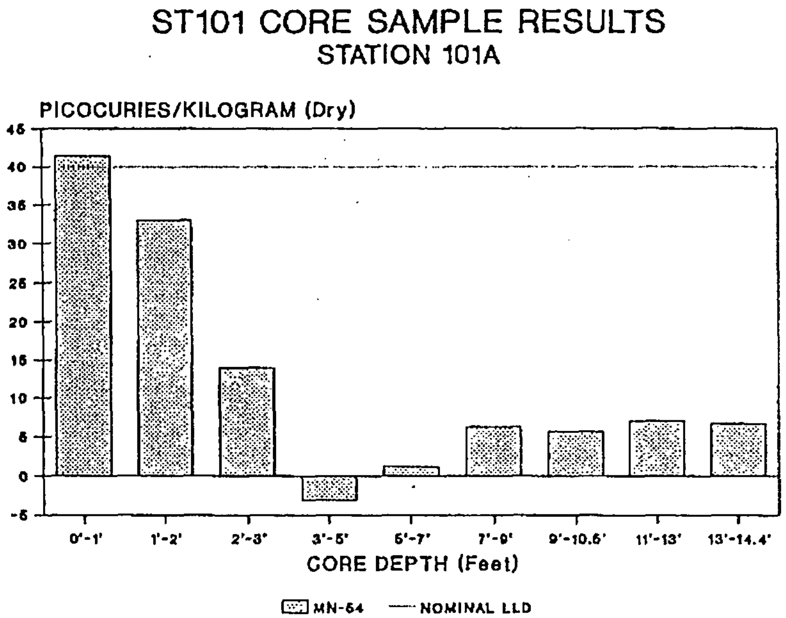


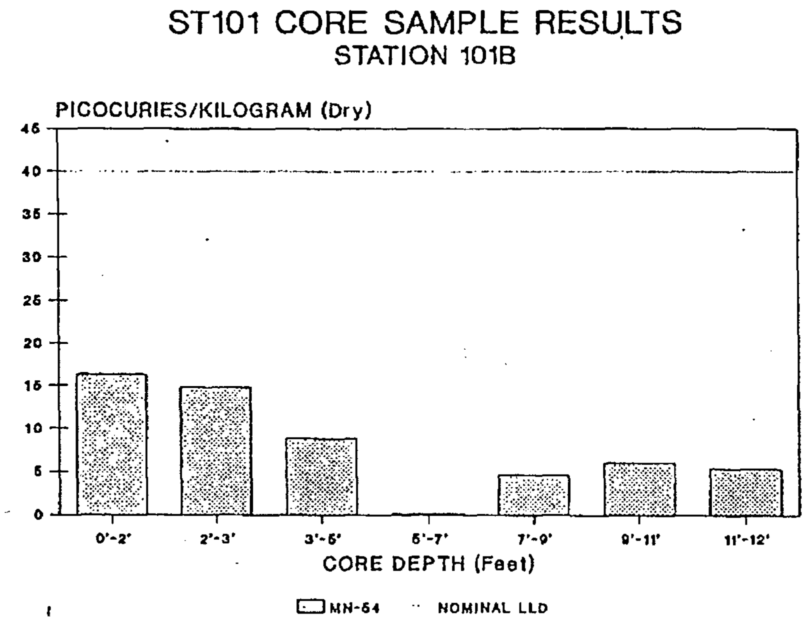
ST101 CORE SAMPLE RESULTS
STATION 101K

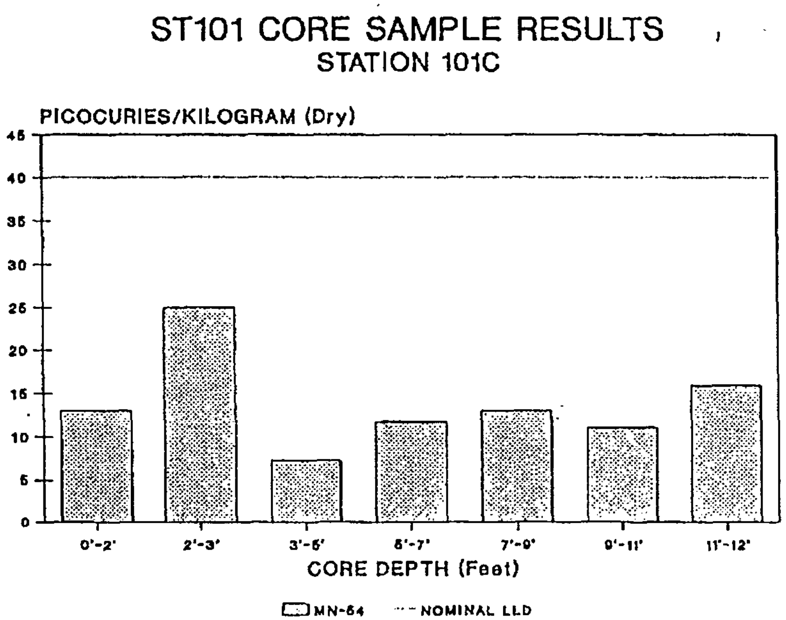


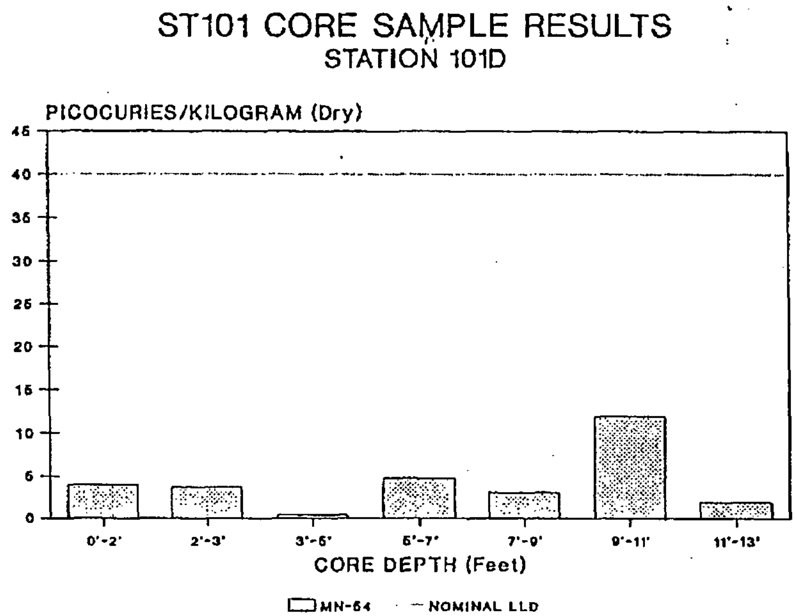
ST101 CORE SAMPLE RESULTS
STATION 101L

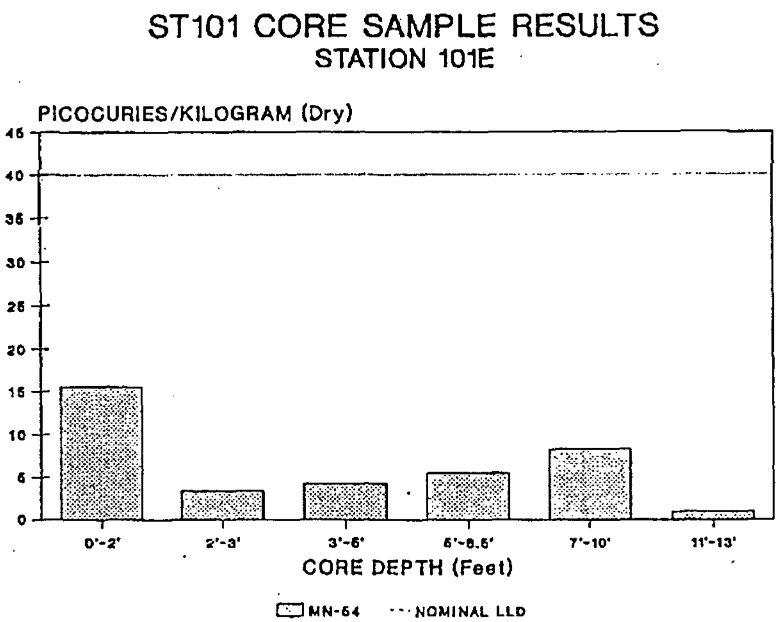


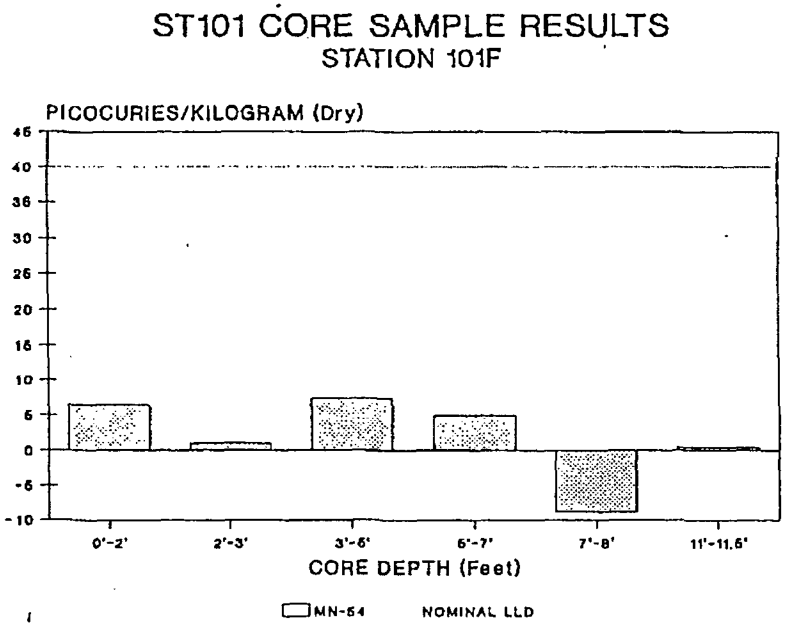

ST101 CORE SAMPLE RESULTS
STATION 101A
PICOCURIES/KILOGRAM (Dry)
45
40
35
30
25
20
15
10
5
0
-5
0'-1'
1'-2'
2'-3'
3'-5'
5'-7'
7'-9'
9'-10.5'
11'-13'
13'-14.4'
CORE DEPTH (Feet)
MN-54
NOMINAL LLD

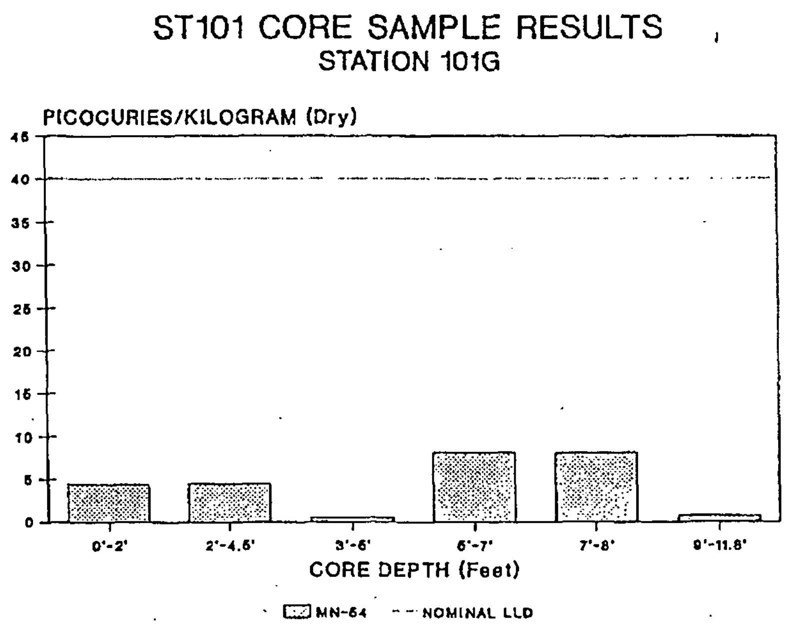

ST101 CORE SAMPLE RESULTS
STATION 101B
PICOCURIES/KILOGRAM (Dry)
45
40
35
30
25
20
15
10
5
0
0'-2'
2'-3'
3'-5'
5'-7'
7'-9'
9'-11'
11'-12'
CORE DEPTH (Feet)
MN-54
NOMINAL LLD

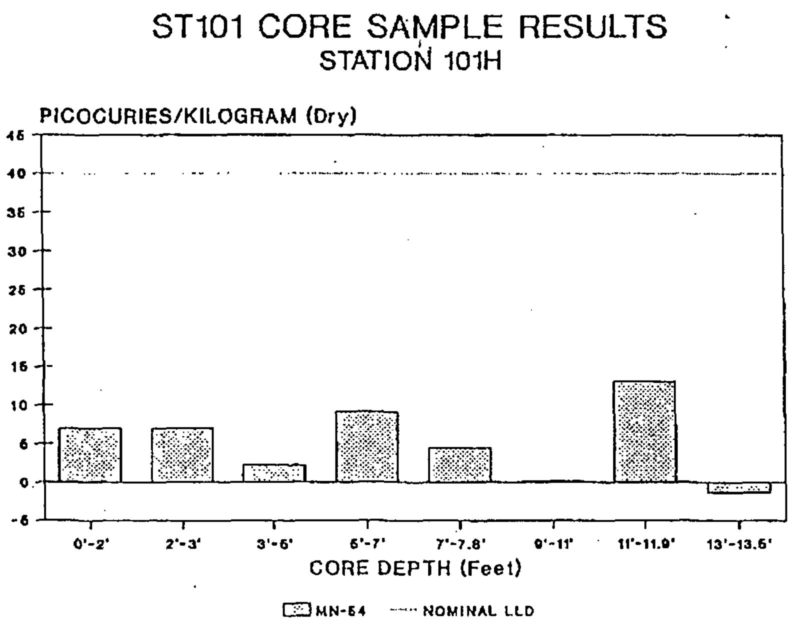

ST101 CORE SAMPLE RESULTS
STATION 101C
PICOCURIES/KILOGRAM (Dry)
45
40
35
30
25
20
15
10
5
0
0'-2'
2'-3'
3'-5'
5'-7'
7'-9'
9'-11'
11'-12'
CORE DEPTH (Feet)
MN-54
NOMINAL LLD


ST101 CORE SAMPLE RESULTS
STATION 101D
PICOCURIES/KILOGRAM (Dry)
45
40
35
30
25
20
15
10
5
0
0'-2'
2'-3'
3'-5'
5'-7'
7'-9'
9'-11'
11'-13'
CORE DEPTH (Feet)
MN-54
NOMINAL LLD

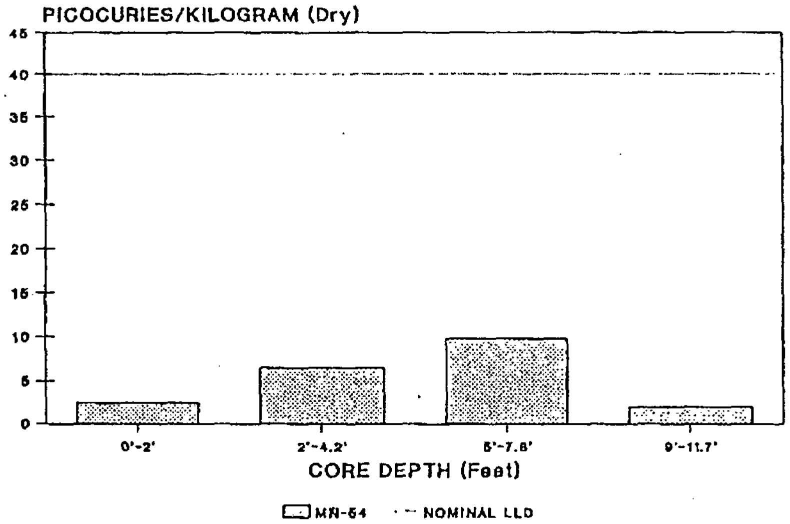

ST101 CORE SAMPLE RESULTS
STATION 101E
PICOCURIES/KILOGRAM (Dry)
45
40
35
30
25
20
15
10
5
0
0'-2'
2'-3'
3'-5'
5'-6.5'
7'-10'
11'-13'
CORE DEPTH (Feet)
MN-54
NOMINAL LLD


ST101 CORE SAMPLE RESULTS
STATION 101F
PICOCURIES/KILOGRAM (Dry)
45
40
35
30
25
20
15
10
5
0
-5
-10
0'-2'
2'-3'
3'-5'
5'-7'
7'-8'
11'-11.5'
CORE DEPTH (Feet)
MN-54
NOMINAL LLD

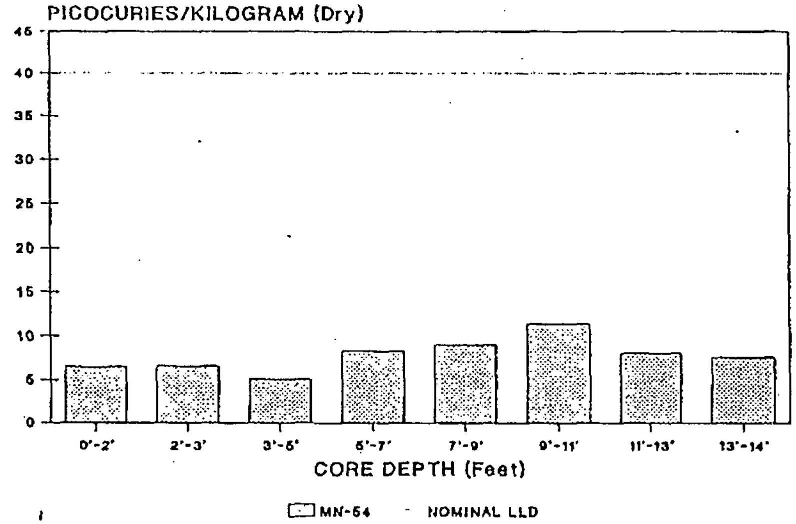

ST101 CORE SAMPLE RESULTS
STATION 101G
PICOCURIES/KILOGRAM (Dry)
45
40
35
30
25
20
15
10
5
0
0'-2'
2'-4.5'
3'-5'
5'-7'
7'-8'
9'-11.8'
CORE DEPTH (Feet)
MN-54
NOMINAL LLD


ST101 CORE SAMPLE RESULTS
STATION 101H
PICOCURIES/KILOGRAM (Dry)
45
40
35
30
25
20
15
10
5
0
-5
0'-2'
2'-3'
3'-5'
5'-7'
7'-7.8'
9'-11'
11'-11.9'
13'-13.5'
CORE DEPTH (Feet)
MN-54
NOMINAL LLD

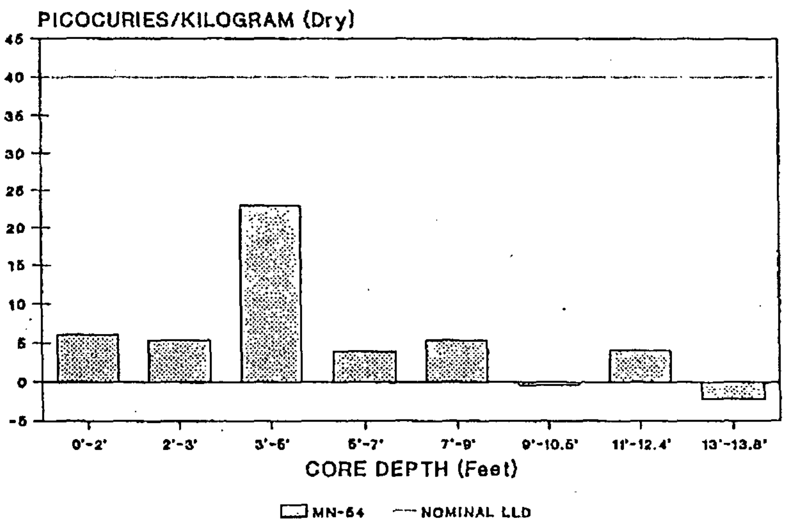
ST101 CORE SAMPLE RESULTS
STATION 101I



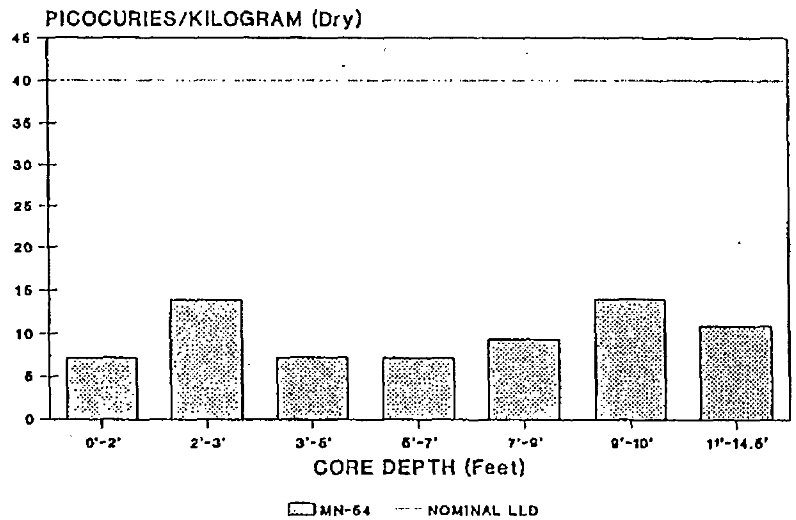
ST101 CORE SAMPLE RESULTS
STATION 101J



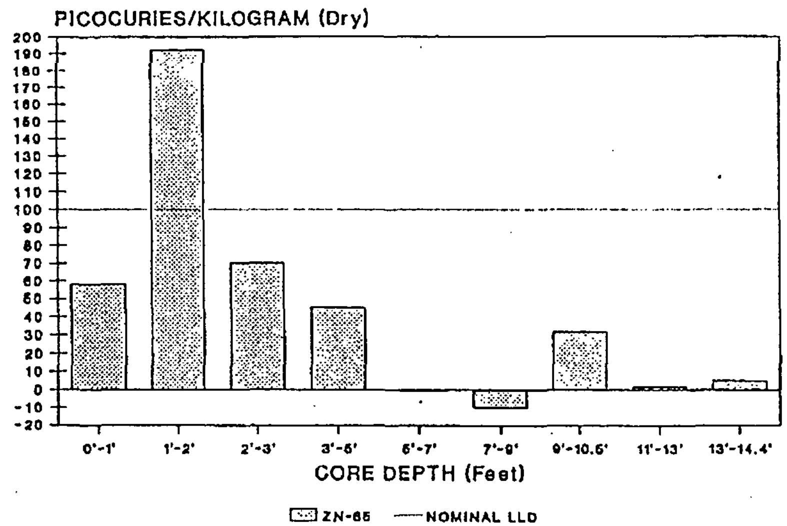
ST101 CORE SAMPLE RESULTS
STATION 101K



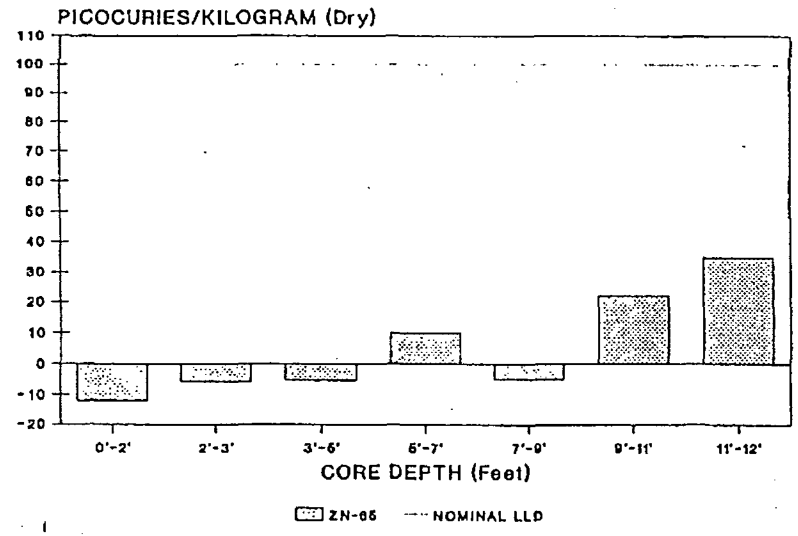
ST101 CORE SAMPLE RESULTS
STATION 101L



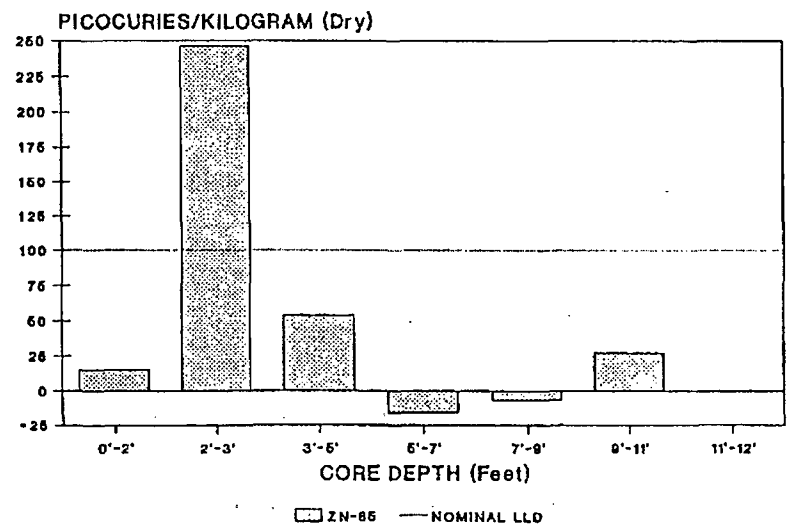
ST101 CORE SAMPLE RESULTS
STATION 101A



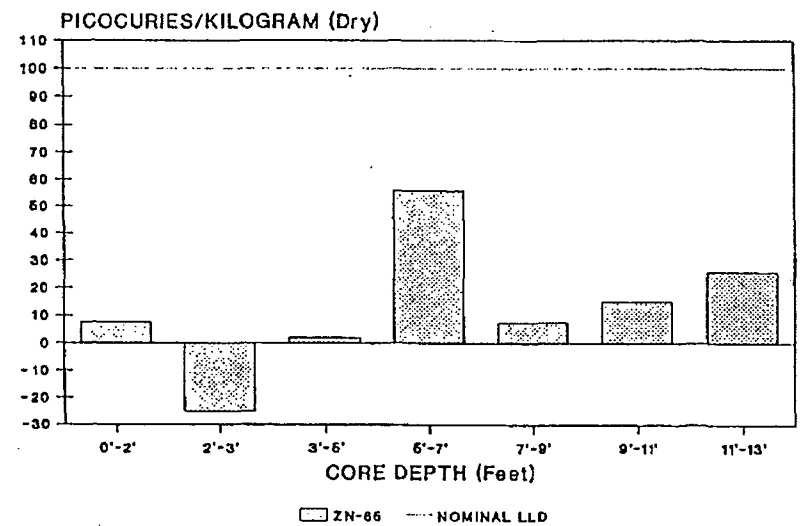
ST101 CORE SAMPLE RESULTS
STATION 101B

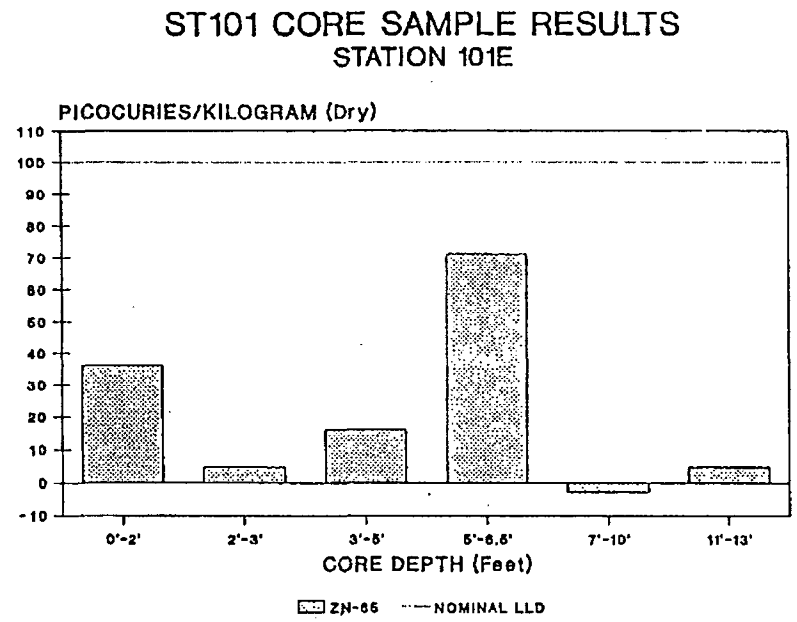


ST101 CORE SAMPLE RESULTS
STATION 101C

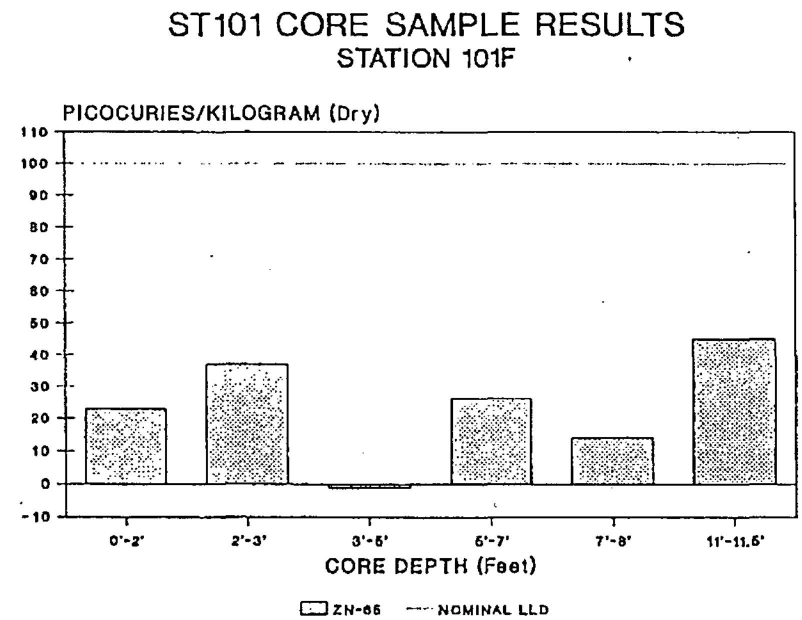


ST101 CORE SAMPLE RESULTS
STATION 101D

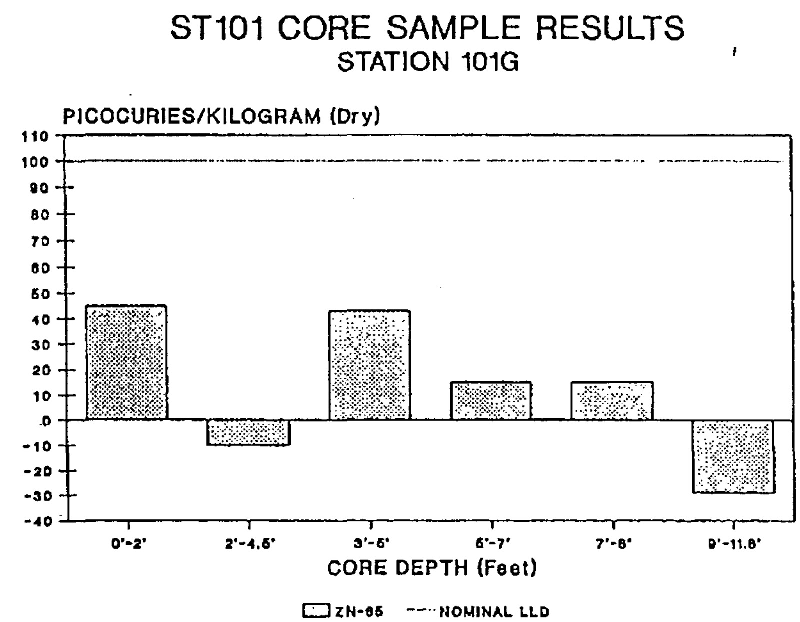




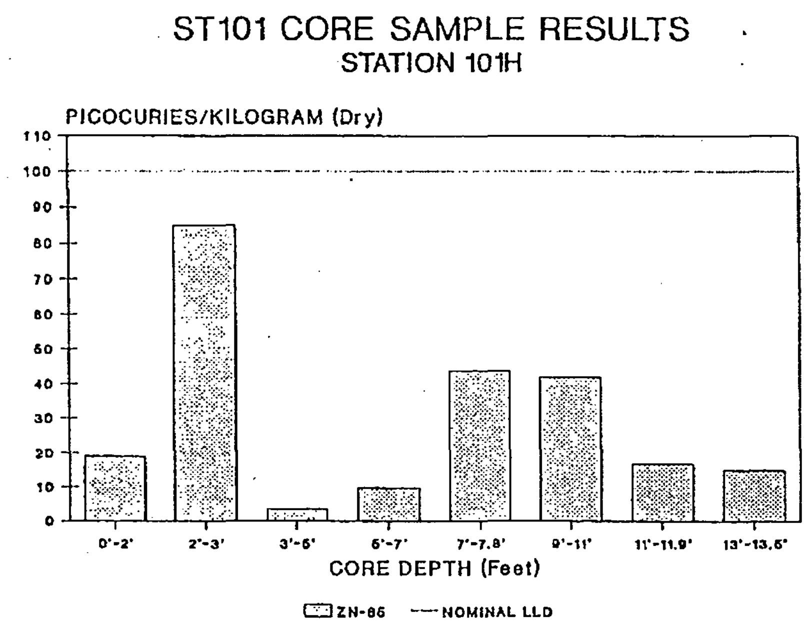
ST101 CORE SAMPLE RESULTS
STATION 101E
PICOCURIES/KILOGRAM (Dry)
CORE DEPTH (Feet)
ZN-65
NOMINAL LLD



ST101 CORE SAMPLE RESULTS
STATION 101F
PICOCURIES/KILOGRAM (Dry)
CORE DEPTH (Feet)
ZN-65
NOMINAL LLD

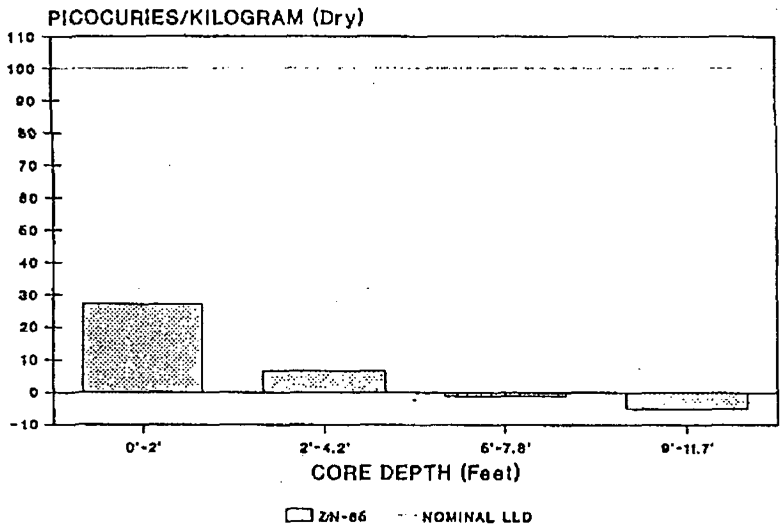


ST101 CORE SAMPLE RESULTS
STATION 101G
PICOCURIES/KILOGRAM (Dry)
CORE DEPTH (Feet)
ZN-65
NOMINAL LLD

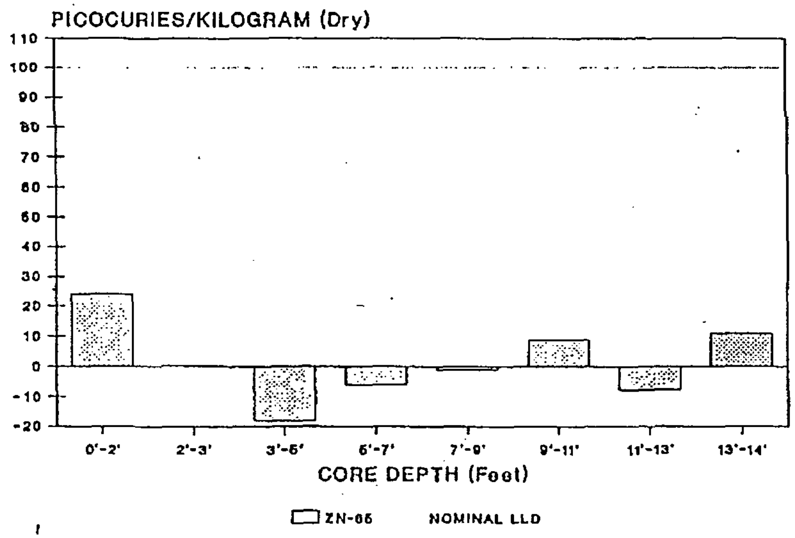


ST101 CORE SAMPLE RESULTS
STATION 101H
PICOCURIES/KILOGRAM (Dry)
CORE DEPTH (Feet)
ZN-65
NOMINAL LLD

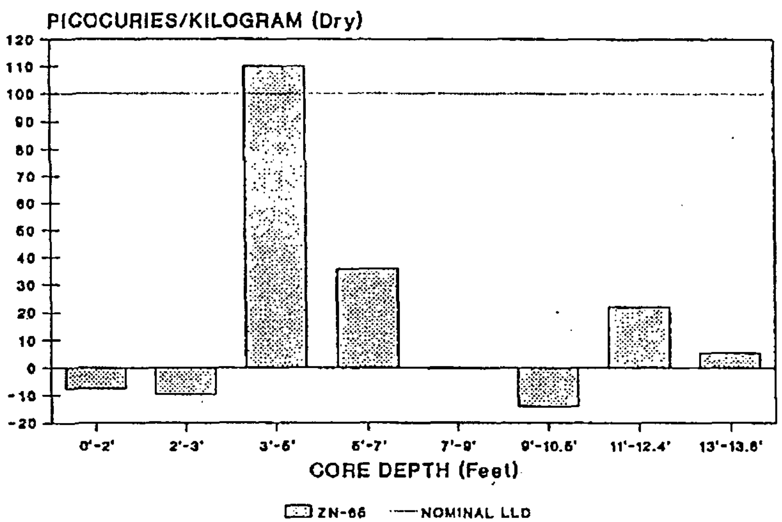
ST101 CORE SAMPLE RESULTS
STATION 101I



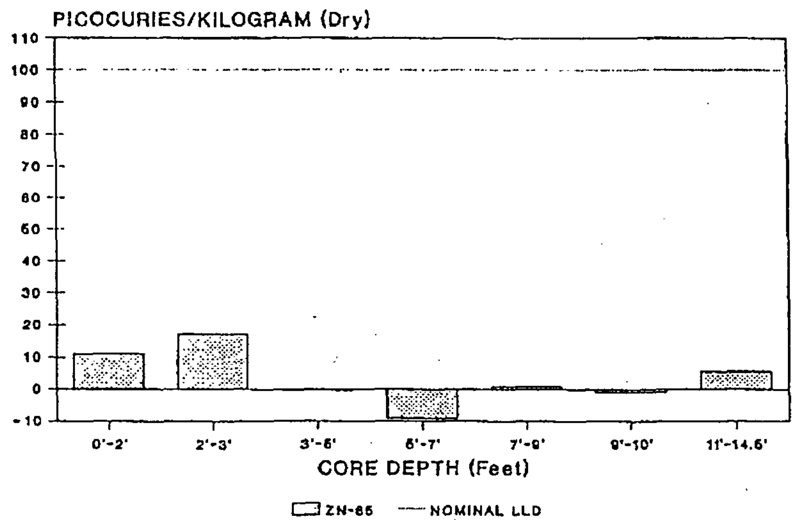
ST101 CORE SAMPLE RESULTS
STATION 101J



ST101 CORE SAMPLE RESULTS
STATION 101K



ST101 CORE SAMPLE RESULTS
STATION 101L



1993 ST101 CORE SAMPLE RESULTS - PICOCURIES/KILOGRAM DRY

DATE	ST101A DEPTH	CS-137	CS-134	CO-60	CO-58	CO-57	ZN-65	BE-7	K-40	FE-59	MN-54	ZR-95	NB-95	RU-103	RU-106	I-131	BA-140	LA-140	CE-141	CE-144	RA-226	TH-228	EU-152
04/22	0'-1'	3.00E+02	1.26E+02	1.26E+03	5.3E+00	-1.3E+00	5.8E+01	8.7E+01	1.08E+04	-2.5E+01	4.14E+01	-3.2E+01	1.3E+01	2.7E+00	-7.3E+01	-3.7E+01	3.2E+01	7.3E+00	-2.8E+01	-3.8E+01	1.12E+03	5.08E+02	8.9E+01
04/22	1'-2'	4.05E+02	1.42E+02	3.05E+03	-1.3E+01	-9.3E-01	1.92E+02	2.5E+02	1.14E+04	3.1E+01	3.3E+01	1.4E+02	5.2E+01	1.8E+01	-5.6E+00	-1.2E+02	-1.8E+01	-1.4E+01	-1.8E+01	-5.1E+01	2.06E+03	9.07E+02	1.2E+02
04/22	2'-3'	1.23E+02	5.9E+01	7.67E+02	-4.5E+00	-1.6E+01	7.03E+01	6.1E+01	1.85E+04	-5.4E+00	1.4E+01	-1.6E+01	1.7E+01	1.0E+00	1.7E+01	9.8E+00	-3.6E+01	9.3E+00	-1.4E+00	-6.0E+01	1.33E+03	7.39E+02	7.8E+01
04/22	3'-5'	9.83E+01	4.91E+01	5.11E+02	-1.4E+01	-5.3E+00	4.5E+01	3.2E+00	1.31E+04	-4.5E+00	-3.1E+00	6.9E+01	2.2E+01	-9.5E+00	-5.9E+00	-4.4E+00	-2.7E+01	-1.3E+01	5.4E+00	-1.0E+02	9.97E+02	5.05E+02	2.6E+01
04/22	5'-7'	1.5E+01	2.3E+01	1.04E+02	-7.7E+00	-5.9E+00	-4.7E-01	2.0E+01	1.52E+04	-8.0E+00	1.2E+00	-5.9E+00	1.1E+01	-7.2E+00	6.1E+00	9.8E+00	-4.8E+00	-1.6E+01	-9.6E-02	-6.2E+01	7.40E+02	5.34E+02	3.1E+01
04/22	7'-9'	2.1E+00	2.7E+01	4.1E+00	-1.0E+01	5.0E+00	-1.0E+01	0.0E+00	1.31E+04	-8.9E+00	6.3E+00	2.3E+01	1.6E+01	-4.7E-01	2.4E+01	2.0E+01	-4.5E+00	4.0E+00	1.5E+01	-4.1E+01	8.56E+02	4.97E+02	1.6E+01
04/22	9'-10.5'	5.2E+00	3.1E+01	1.7E+01	-1.3E+01	-6.1E+00	3.2E+01	-1.3E+00	1.59E+04	1.4E+01	5.7E+00	5.5E+01	1.9E+01	1.2E+00	5.1E+01	-8.2E+00	2.2E+01	-3.0E+01	5.3E+00	-1.1E+02	8.80E+02	5.73E+02	2.5E+01
04/22	11'-13'	4.4E+00	3.3E+01	3.4E+00	-7.4E+00	-8.8E+00	1.5E+00	3.2E+01	1.37E+04	3.2E+00	7.1E+00	-4.9E+01	-2.3E+00	2.1E+00	1.5E+01	-8.2E+00	4.7E+00	3.2E+00	8.4E+00	-5.7E+01	8.91E+02	5.36E+02	3.7E+01
04/22	13'-14.4'	-6.9E+00	3.9E+01	4.7E+00	-1.0E+01	-2.4E+00	5.0E+00	-4.8E+00	1.04E+04	1.8E+00	6.7E+00	2.5E+01	1.6E+01	-1.6E+01	5.3E+01	4.7E+01	1.2E+01	2.6E+00	6.8E+00	-7.4E+01	1.03E+03	4.33E+02	1.4E+02
04/22	0'-5'	9.80E+01	4.39E+01	1.20E+03	-7.6E+00	-3.7E+00	6.08E+01	5.6E+01	1.47E+04	-3.7E+00	2.65E+01	-9.9E+00	1.8E+01	-7.6E+00	-3.5E+01	3.3E-01	-4.0E+00	-8.1E+00	-6.2E+00	-7.6E+01	9.93E+02	5.43E+02	2.1E+01
04/22	5'-10'	1.67E+01	2.8E+01	1.55E+02	-6.6E+00	-7.0E+00	9.8E+00	5.2E+01	1.34E+04	3.9E+00	1.39E+01	1.3E+01	1.6E+01	-3.1E+00	-3.0E+01	-1.0E+01	3.1E+01	-9.8E+00	-3.7E+00	-6.4E+01	7.67E+02	4.79E+02	3.1E+01

DATE	ST101B DEPTH	CS-137	CS-134	CO-60	CO-58	CO-57	ZN-65	BE-7	K-40	FE-59	MN-54	ZR-95	NB-95	RU-103	RU-106	I-131	BA-140	LA-140	CE-141	CE-144	RA-226	TH-228	EU-152
04/21	0'-2'	3.1E+00	3.1E+01	5.30E+01	-3.9E+00	-2.2E+00	-1.2E+01	1.3E+01	1.58E+04	7.3E+00	1.63E+01	4.0E+00	2.3E+01	-2.2E+00	-1.8E+01	-2.8E+00	-1.9E+01	-1.5E+01	2.7E+00	-4.8E+01	1.13E+03	5.97E+02	5.4E+01
04/21	2'-3'	9.18E+00	3.7E+01	5.70E+01	-1.3E+00	-8.2E+00	-5.9E+00	2.6E+01	1.69E+04	-1.9E+00	1.48E+01	-2.3E+01	8.0E+00	2.0E+00	6.2E+01	-3.7E+00	4.4E+00	-1.9E+01	-2.9E+00	-1.0E+02	1.05E+03	6.44E+02	3.3E+01
04/21	3'-5'	5.9E+00	2.7E+01	2.16E+01	-1.7E+00	-4.1E+00	-5.4E+00	2.7E+01	1.24E+04	-2.0E+00	8.8E+00	-4.7E+00	1.1E+01	-1.8E+00	4.3E+01	-3.3E+00	2.3E+01	-9.2E+00	-2.7E+00	-8.0E+01	6.99E+02	4.51E+02	3.3E+01
04/21	5'-7'	5.7E+00	2.1E+01	7.5E+00	-2.9E+00	-1.2E+01	1.0E+01	5.9E+01	1.29E+04	-9.6E+00	1.8E-01	8.8E+01	1.3E+01	-3.0E+00	1.9E+01	1.2E+01	-8.7E+00	-1.3E+01	3.1E+00	3.1E+00	7.21E+02	4.89E+02	1.8E+01
04/21	7'-9'	5.2E-01	2.3E+01	3.7E+00	-4.3E+00	-5.7E+00	-5.0E+00	1.5E+01	1.29E+04	-8.9E+00	4.6E+00	1.6E+01	1.7E+01	2.4E+00	-8.9E+00	5.5E-01	-1.7E+01	-2.1E+01	1.1E+01	-5.3E+01	7.18E+02	4.49E+02	5.4E+01
04/21	9'-11'	2.2E+00	3.9E+01	2.5E+00	-4.1E+00	-1.1E+01	2.2E+01	1.1E+02	1.64E+04	-3.2E+00	6.0E+00	-6.6E+00	1.5E+01	-4.6E-01	-9.8E+01	-1.0E+00	7.1E+01	4.4E+00	-1.8E+00	-9.9E+01	1.06E+03	6.07E+02	5.2E+00
04/21	11'-12'	1.7E+01	1.9E+01	6.9E+00	0.0E+00	4.6E+00	3.5E+01	9.6E+01	1.21E+04	-2.2E+01	5.3E+00	5.2E+01	5.5E+00	-9.3E+00	-6.4E+01	1.2E+01	4.1E+01	-1.8E+01	0.0E+00	-1.1E+02	6.3E+02	4.39E+02	5.5E+01
04/21	0'-5'	1.4E+01	2.2E+01	9.94E+01	-4.2E+00	-5.8E+00	4.5E+00	-1.7E+01	1.32E+04	8.5E+00	9.8E+00	2.6E+01	1.6E+01	-7.8E+00	1.5E+01	-2.1E+00	-3.1E+01	-2.0E+00	1.0E+01	-4.7E+01	9.01E+02	4.83E+02	4.2E+01
04/21	5'-10'	6.2E+00	1.3E+01	5.99E+01	-3.8E+00	-7.9E+00	1.6E+01	7.0E+01	1.26E+04	-1.7E+01	6.6E+00	7.0E+01	2.2E+01	1.5E+00	-2.1E+01	6.8E+00	-1.1E+01	-1.6E+01	6.2E+00	-7.7E+01	8.53E+02	4.57E+02	5.6E+01
04/21	10'-12'	3.5E+00	2.2E+00	1.3E+01	-2.5E+00	-9.6E+00	-3.9E+00	1.8E+00	1.34E+04	-1.3E+00	2.6E+00	5.6E+00	9.5E+00	-2.6E+00	2.9E+01	-4.4E+00	4.6E+00	-1.8E+01	-3.1E+00	-4.4E+01	8.35E+02	4.87E+02	4.7E+01

DATE	ST101C DEPTH	CS-137	CS-134	CO-60	CO-58	CO-57	ZN-65	BE-7	K-40	FE-59	MN-54	ZR-95	NB-95	RU-103	RU-106	I-131	BA-140	LA-140	CE-141	CE-144	RA-226	TH-228	EU-152
04/21	0'-2'	3.72E+01	3.2E+01	3.23E+02	-1.1E+00	-1.0E+01	1.5E+01	2.5E+01	1.21E+04	3.8E+00	1.3E+01	2.2E+00	1.0E+01	1.1E+00	-1.8E+01	-4.1E+00	-1.1E+01	-2.3E+01	4.0E+00	-7.2E+01	7.63E+02	4.45E+02	3.2E+01
04/21	2'-3'	3.26E+02	1.28E+02	3.35E+03	-1.1E+01	-1.1E+01	2.46E+02	1.5E+02	1.58E+04	-1.4E+01	2.5E+01	7.3E+01	2.7E+01	-2.1E+00	-1.1E+01	-3.6E+01	9.8E+01	-2.6E+01	2.3E+01	-5.7E+01	1.63E+03	7.15E+02	9.4E+01
04/21	3'-5'	1.2E+01	2.2E+01	4.11E+02	-6.7E+00	-5.3E+00	5.4E+01	7.3E+01	1.45E+04	-1.2E+00	7.3E+00	4.7E+01	1.6E+01	-5.1E-01	3.0E+01	-2.7E+00	-1.4E+01	-1.3E+01	-1.8E+00	-1.0E+02	8.60E+02	5.21E+02	2.4E+01
04/21	5'-7'	3.4E+00	1.9E+01	2.25E+01	-9.2E-01	-3.9E+00	-1.6E+01	2.2E+01	1.02E+04	4.9E+00	1.17E+01	-5.4E+00	1.1E+01	-9.0E-01	2.9E+01	5.5E+00	1.7E+01	-1.1E+01	3.2E+00	-3.3E+01	6.08E+02	3.92E+02	3.3E+01
04/21	7'-9'	-2.3E-01	3.7E+01	1.6E+01	-4.4E+00	-1.1E+01	-6.7E+00	0.0E+00	1.48E+04	-2.2E+00	1.30E+01	1.6E+01	2.1E+01	0.0E+00	-3.5E+01	2.3E+00	-1.9E+01	-2.0E+01	-7.5E+00	-7.9E+01	9.21E+02	6.44E+02	6.9E+01
04/21	9'-11'	1.5E+01	3.1E+01	5.66E+02	-4.2E+00	-4.0E+00	2.7E+01	-4.1E+01	1.38E+04	-9.3E+00	1.1E+01	-1.7E+01	0.0E+00	-1.4E+01	3.9E+01	4.4E+01	-2.4E+01	-1.7E+01	-3.8E+00	-6.6E+01	9.10E+02	4.52E+02	3.8E+01
04/21	11'-12'	-2.3E+00	3.4E+01	1.7E+01	-4.4E+00	-7.0E+00	-6.5E-01	3.5E+01	1.84E+04	-1.7E+01	1.59E+01	-1.8E+01	1.1E+01	-1.5E+00	7.0E+01	4.2E+00	-5.5E+00	-1.8E+01	-5.9E+00	-9.0E+00	1.32E+03	7.57E+02	7.7E+01
04/21	0'-5'	3.82E+01	1.4E+01	3.81E+02	-4.1E-01	-5.0E+00	6.0E+01	1.1E+01	1.04E+04	-2.7E+00	1.3E+01	6.0E+01	1.7E+01	3.9E+00	-3.0E+00	0.0E+00	-9.0E+00	-2.1E+01	8.1E+00	-4.1E+01	7.73E+02	4.26E+02	4.2E+01
04/21	5'-10'	1.70E+01	2.2E+01	1.19E+02	-1.9E+00	-4.6E+00	2.0E+01	8.0E+00	1.16E+04	-4.0E+00	5.8E-01	9.5E+00	1.2E+01	-5.4E+00	-1.0E+01	5.6E+00	4.5E+00	-2.0E+01	-2.1E-01	-5.6E+01	7.38E+02	4.45E+02	4.6E+01
04/21	10'-12.5'	2.2E+01	4.8E+01	1.39E+02	-1.1E+01	-1.6E+01	1.8E+01	2.4E+01	1.87E+04	-7.6E+00	4.4E+00	4.4E+01	3.7E+01	-1.7E+00	4.5E+01	-3.2E+01	-1.3E+00	1.1E+00	-1.2E+01	-9.7E+01	8.81E+02	7.87E+02	2.7E+01

BOLD - Denotes detectable result.

DATE	ST101D DEPTH	CS-137	CS-134	CO-60	CO-58	CO-57	ZN-65	BE-7	K-40	FE-59	MN-54	ZR-95	NB-95	RU-103	RU-106	I-131	BA-140	LA-140	CE-141	CE-144	RA-226	TH-228	EU-152
04/19	0'-2'	1.6E+01	1.7E+01	7.70E+01	-7.3E+00	-8.8E+00	7.6E+00	1.8E+01	1.18E+04	7.5E-01	4.0E+00	4.2E+01	1.3E+01	-1.7E+00	-2.5E+01	6.5E+00	-5.1E+00	-4.9E+00	-1.3E+01	-5.5E+01	7.86E+02	4.61E+02	
04/19	2'-3'	5.9E+00	3.2E+01	4.42E+01	-4.3E+00	-5.5E+00	-2.5E+01	3.0E+01	1.56E+04	-2.0E+01	3.7E+00	-2.5E+01	1.2E+01	-5.8E+00	-4.7E+01	-2.4E+00	-3.6E+01	5.9E+00	4.9E+00	-2.4E+01	1.09E+03	7.22E+02	
04/19	3'-5'	6.7E+00	3.1E+01	-2.2E+00	-1.1E+01	-6.8E+00	1.9E+00	2.7E+01	1.33E+04	5.6E+00	3.7E-01	-9.3E+00	1.2E+01	-9.1E+00	6.7E+01	1.3E+00	2.7E+01	-6.1E+00	-4.7E+00	-9.8E+01	7.65E+02	4.81E+02	
04/19	5'-7'	5.2E+00	1.1E+01	2.3E+00	-7.7E+00	-3.6E+00	5.6E+01	-1.9E+01	1.69E+04	-7.3E+00	4.8E+00	1.2E+02	3.8E+01	9.8E-01	-3.9E+01	-5.1E+00	1.7E+01	-3.0E+01	1.6E+01	-8.1E+01	1.20E+03	7.22E+02	
04/19	7'-9'	1.4E+00	1.7E+01	-3.3E-01	-4.7E+00	-9.3E+00	7.5E+00	4.8E+01	1.29E+04	-3.4E+01	3.1E+00	8.4E+00	1.2E+01	3.5E+00	1.6E+01	-7.3E+00	5.3E+00	-1.7E+01	1.1E+01	-4.1E+01	5.22E+02	4.57E+02	
04/19	9'-11'	-1.0E+00	4.1E+01	-6.4E+00	-4.4E+00	6.8E+00	1.5E+01	2.0E+02	1.55E+04	3.8E+01	1.2E+01	1.7E+01	8.3E+00	-5.6E+00	-6.2E+01	-1.2E+01	1.6E+01	-2.9E+00	-3.5E-01	-3.5E+01	1.21E+03	5.30E+02	
04/19	11'-13'	4.0E+00	9.2E+00	-2.3E+00	-1.7E+01	-1.1E+01	2.6E+01	3.3E+01	1.25E+04	-2.3E+01	1.9E+00	5.8E+01	9.2E+00	1.0E+01	-4.0E+01	-3.5E+00	1.5E+01	-6.5E+00	-6.9E+00	-5.9E+01	6.84E+02	4.69E+02	
04/19	5'-10'	6.1E-01	1.7E+01	8.00E+00	-1.8E+00	-5.3E+00	1.1E+01	2.0E+01	1.16E+04	-3.8E+00	5.1E+00	-1.4E+01	1.0E+01	1.3E-01	2.4E+01	7.6E-01	1.7E+00	-1.7E+00	5.3E-01	-4.2E+01	7.80E+02	5.32E+02	

DATE	ST101E DEPTH	CS-137	CS-134	CO-60	CO-58	CO-57	ZN-65	BE-7	K-40	FE-59	MN-54	ZR-95	NB-95	RU-103	RU-106	I-131	BA-140	LA-140	CE-141	CE-144	RA-226	TH-228	EU-152
04/20	0'-2'	3.1E+01	1.8E+01	1.95E+02	-3.0E+00	-8.6E+00	3.6E+01	7.1E+01	1.50E+04	1.1E+01	1.55E+01	9.1E+01	2.4E+01	-1.4E+00	-1.7E+01	-4.8E+00	3.6E+00	-1.8E+01	6.0E+00	-5.9E+01	1.09E+03	6.23E+02	
04/20	2'-3'	1.0E+01	2.7E+01	3.25E+01	-7.2E+00	-7.2E+00	4.8E+00	3.2E+01	1.34E+04	6.1E+00	3.4E+00	2.7E+01	1.9E+01	-3.9E+00	-3.9E+01	4.3E+00	1.9E+00	-9.1E+00	-9.4E+00	-7.3E+01	7.98E+02	6.42E+02	
04/20	3'-5'	-3.5E-01	2.1E+01	1.99E+01	-2.1E+00	-3.4E+00	1.6E+01	1.9E+01	1.14E+04	4.6E+00	4.2E+00	-2.4E+00	1.1E+01	-7.1E+00	2.6E+01	2.6E+00	0.0E+00	2.7E+00	4.4E+00	-8.7E+01	6.74E+02	3.89E+02	
04/20	5'-6.5'	1.2E+01	1.3E+01	8.37E+01	-6.3E+00	-7.5E+00	7.1E+01	-1.4E+00	1.60E+04	-3.1E+00	5.5E+00	9.5E+01	1.9E+01	-2.7E+00	3.4E+00	-4.2E+00	-1.7E+01	-1.6E+01	-3.1E+00	-9.2E+01	1.11E+03	6.52E+02	
04/20	7'-10'	7.3E+00	2.4E+01	4.73E+01	-6.5E+00	-4.6E+00	-2.8E+00	1.6E+01	1.32E+04	7.3E+00	8.3E+00	3.1E+01	1.7E+01	4.5E-01	2.5E+01	-5.8E-01	1.1E+01	-1.6E+01	3.5E+00	-4.8E+01	8.66E+02	5.14E+02	
04/20	11'-13'	1.4E+01	8.8E+01	4.2E+01	-2.9E+00	6.3E+00	4.7E+00	7.1E+01	1.89E+04	-4.8E+01	9.3E-01	3.4E+01	3.4E+01	-2.2E+00	-9.5E+01	-1.8E+00	-5.4E+00	0.0E+00	2.5E+01	-2.4E+02	3.41E+03	9.91E+02	
04/20	0'-5'	7.2E+00	7.6E+00	1.79E+01	-1.6E+00	-8.8E+00	1.3E+01	1.7E+01	1.13E+04	-6.8E+00	2.3E+00	5.8E+01	2.0E+01	1.6E+00	1.8E+01	-8.5E+00	-9.1E+00	-8.0E+00	8.0E-01	-2.0E+01	6.93E+02	3.79E+02	
04/20	5'-10'	6.5E+00	1.9E+01	2.1E+01	-1.0E+00	-3.8E+00	2.7E+01	1.6E+01	1.07E+04	-8.4E+00	7.6E+00	3.1E+01	1.2E+01	-7.3E-01	4.0E+00	3.3E+00	-1.0E+01	-3.5E+00	8.1E-01	-4.0E+01	8.34E+02	4.02E+02	

DATE	ST101F DEPTH	CS-137	CS-134	CO-60	CO-58	CO-57	ZN-65	BE-7	K-40	FE-59	MN-54	ZR-95	NB-95	RU-103	RU-106	I-131	BA-140	LA-140	CE-141	CE-144	RA-226	TH-228	EU-152
04/20	0'-2'	1.48E+01	9.7E+00	1.06E+02	-9.2E-01	-7.1E+00	2.3E+01	0.0E+00	1.23E+04	2.4E+00	6.4E+00	7.7E+01	1.7E+01	0.0E+00	-6.9E+01	-4.6E+00	1.5E+00	-1.2E+01	-2.0E+00	-4.4E+01	8.43E+02	4.73E+02	5.2E+00
04/20	2'-3'	3.6E+00	2.4E+01	6.23E+01	-7.8E+00	-4.8E+00	3.7E+01	1.9E+01	1.51E+04	5.6E+00	1.0E+00	7.4E+01	3.0E+01	1.3E+00	-1.6E+01	5.2E+00	3.7E+00	-1.5E+01	-1.8E+01	-6.3E+01	9.06E+02	6.63E+02	6.3E+01
04/20	3'-5'	4.2E+00	2.2E+01	2.85E+01	-5.3E+00	-6.5E+00	-1.1E+00	2.6E+01	1.16E+04	-7.8E+00	7.3E+00	-2.9E+00	1.3E+01	4.0E+00	-5.4E+01	8.3E+00	-8.3E+00	9.7E+00	5.2E+00	-4.8E+01	6.48E+02	4.62E+02	4.6E+01
04/20	5'-7'	7.6E+00	6.7E+00	7.1E+00	-6.3E+00	-6.2E+00	2.6E+01	2.8E+01	1.03E+03	-4.2E+00	4.9E+00	6.0E+01	1.5E+01	-2.1E+00	-1.4E+01	-1.7E+00	-1.8E+00	-1.4E+01	6.1E+00	-4.8E+01	5.83E+02	3.96E+02	3.8E+01
04/20	7'-8'	6.0E-01	8.1E+00	6.30E+00	5.9E+00	7.5E-01	1.4E+01	1.7E+01	1.11E+04	3.3E+01	-8.8E+00	-1.2E+01	1.3E+01	2.7E+00	-1.5E+01	8.3E+00	-8.2E+00	1.8E+01	-7.1E+00	-1.5E+01	2.2E+02	4.62E+02	1.4E+01
04/20	11'-11.5'	-4.0E+00	2.9E+01	5.1E+00	6.0E+00	-7.6E+00	4.5E+01	2.9E+01	1.42E+04	-2.9E+01	4.4E-01	1.6E+01	4.0E+00	1.3E+01	-3.5E+01	-1.8E+01	-2.9E+01	7.6E+00	7.4E+00	-6.2E+01	4.9E+02	4.82E+02	6.4E+01
04/20	0'-5'	5.1E+00	2.4E+01	2.84E+01	1.6E+00	-5.5E+00	2.8E+00	1.9E+00	1.05E+04	4.6E+00	2.8E+00	1.5E+01	9.5E+00	-2.4E+00	1.9E+01	1.8E+00	1.3E+01	4.6E+00	4.0E-01	-4.8E+01	7.66E+02	4.10E+02	2.4E+01
04/20	5'-10'	-1.4E+00	1.9E+01	2.19E+01	-2.9E-01	-5.0E+00	-9.7E+00	1.9E+01	1.15E+04	1.7E-01	3.0E+00	5.1E+00	5.3E+00	-7.1E-01	-1.3E+01	1.8E-01	-8.5E+00	-1.2E+01	1.9E+00	-1.2E+01	6.38E+02	4.59E+02	4.4E+01

BOLD - Denotes detectable result.

DATE	ST101G DEPTH	CS-137	CS-134	CO-60	CO-58	CO-57	ZN-65	BE-7	K-40	FE-59	MN-54	ZR-95	NB-95	RU-103	RU-106	I-131	BA-140	LA-140	CE-141	CE-144	RA-226	TH-228	EU-152
04/20	0'-2'	1.9E+01	1.3E+01	9.09E+01	-3.1E+00	-7.9E+00	4.5E+01	3.7E+00	1.27E+04	-2.8E+00	4.4E+00	6.2E+01	1.4E+01	-9.3E-01	1.3E+01	-4.0E+00	2.3E+01	-9.6E+00	-5.1E+00	-5.5E+01	8.06E+02	5.11E+02	3.8E+01
04/20	2'-4.5'	-2.0E+00	2.4E+01	5.10E+01	-2.6E+00	-7.3E+00	-1.0E+01	4.1E+01	1.08E+04	-3.0E+00	4.5E+00	-1.2E+01	1.1E+01	9.5E+01	-1.3E+01	1.1E+00	-1.9E+00	-9.3E-01	9.6E+00	-6.7E+01	6.23E+02	4.97E+02	-7.3E+00
04/20	3'-5'	1.7E+01	1.8E+01	6.99E+01	-5.6E+00	-8.7E+00	4.3E+01	3.9E+01	1.65E+04	-1.3E+00	5.1E-01	1.3E+02	3.0E+01	4.2E+00	4.0E+01	-6.0E+00	-2.6E+01	-1.7E+01	-2.7E+00	-1.4E+02	1.06E+03	7.53E+02	3.0E+01
04/20	5'-7'	-7.8E-01	3.2E+01	2.93E+01	-3.7E+00	-9.5E+00	1.5E+01	7.5E+01	1.78E+04	-1.8E+01	8.1E+00	1.6E+01	1.3E+01	-2.5E+00	-2.3E+01	1.9E+00	-7.2E+00	-1.9E+01	-5.4E+00	-5.5E+01	1.25E+03	7.41E+02	4.0E+01
04/20	7'-8'	6.9E+00	9.2E+00	9.4E+00	-3.2E+00	-1.1E+01	1.5E+01	4.1E+01	1.31E+04	-1.3E+01	8.1E+00	8.2E+01	2.6E+01	-4.9E-01	-4.0E+01	-2.5E-01	-9.5E-01	-1.4E+01	-2.0E+00	-7.4E+01	1.02E+03	5.13E+02	5.5E+01
04/20	9'-11.8'	8.4E+00	3.1E+01	3.3E+00	-1.2E+01	-1.8E+01	-2.9E+01	-2.0E+01	1.49E+04	-1.9E+00	7.5E-01	-2.9E+01	1.6E+01	-1.4E+01	1.2E+02	2.1E+01	-2.1E+01	-2.2E+00	3.2E+00	-8.7E+00	1.24E+03	6.0E+02	5.3E+01
04/20	0'-4'	7.4E+00	2.4E+01	5.85E+01	-3.0E+00	-3.9E+00	7.9E+00	1.4E+01	1.19E+04	-2.6E+00	1.3E+00	4.1E+00	9.0E+00	2.1E+00	-4.3E+01	8.9E+00	-6.1E-01	-8.7E+00	4.0E+00	-4.9E+01	7.42E+02	4.39E+02	2.6E+01
04/20	5'-9'	7.2E+00	1.3E+01	1.68E+01	-3.5E+00	-6.2E+00	2.8E+01	2.1E+01	1.11E+04	-1.7E+01	4.7E+00	6.4E+01	1.6E+01	-1.9E+00	-1.8E+01	1.3E+00	-4.8E+00	-2.1E+01	1.1E+01	-2.2E+01	6.15E+02	4.52E+02	3.7E+01
04/20	10'-12'	3.5E+00	1.6E+00	2.95E+01	7.8E-01	-2.2E+00	-9.0E+00	5.6E+01	1.12E+04	-5.7E+00	7.0E+00	6.0E+01	1.9E+01	1.0E+00	3.5E+01	1.7E+00	-1.3E+01	-1.4E+01	-4.1E+00	3.1E+01	7.10E+02	4.77E+02	1.1E+01

DATE	ST101H DEPTH	CS-137	CS-134	CO-60	CO-58	CO-57	ZN-65	BE-7	K-40	FE-59	MN-54	ZR-95	NB-95	RU-103	RU-106	I-131	BA-140	LA-140	CE-141	CE-144	RA-226	TH-228	EU-152
04/20	0'-2'	3.02E+01	4.0E+01	2.03E+02	-1.3E+01	-4.3E+00	1.9E+01	5.6E+01	1.30E+04	5.9E-01	7.0E+00	2.8E+01	1.6E+01	3.9E+00	-3.5E+01	-6.0E-01	-1.1E+01	1.5E+01	-4.7E+00	-8.8E+01	6.03E+02	5.38E+02	-2.0E+01
04/20	2'-3'	7.76E+01	3.0E+01	4.42E+02	-5.1E+00	-1.3E+01	8.5E+01	1.6E+02	1.58E+04	-6.1E+00	7.0E+00	5.4E+01	1.9E+01	-1.5E+01	-6.0E+01	-1.0E+01	-7.8E+00	-1.2E+01	1.2E+01	-7.6E+01	1.48E+03	7.08E+02	1.2E+02
04/20	3'-5'	4.9E+00	2.2E+01	3.4E+00	-4.3E+00	-3.4E+00	3.5E+00	8.3E+02	1.12E+04	-1.1E+00	2.2E+00	-5.0E+00	1.3E+01	-1.5E+00	5.5E+00	-4.1E+00	-1.1E+01	-1.2E+01	6.4E+00	-1.9E+01	7.66E+02	5.01E+02	2.2E+01
04/20	5'-7'	0.0E+00	2.5E+01	1.60E+01	-7.2E+00	-3.8E+00	9.9E+00	3.8E+01	1.69E+04	2.2E+00	9.2E+00	1.2E+01	1.8E+01	-1.3E+00	-6.8E+00	1.2E+01	5.3E+00	3.9E+00	2.0E+00	-9.8E+01	9.23E+02	6.01E+02	1.6E+01
04/20	7'-7.8'	1.5E+01	1.9E+01	7.23E+01	-5.9E+00	-3.1E+00	4.4E+01	1.3E+02	1.07E+04	1.4E+01	4.5E+00	3.8E+01	2.8E+01	-9.4E-01	1.5E+02	3.5E+01	3.0E+01	-1.2E+01	-9.2E+00	-4.6E+01	1.17E+03	5.74E+02	1.7E+01
04/20	9'-11'	4.4E+00	1.4E+01	-1.8E+00	-3.9E+00	-5.5E+00	4.2E+01	-1.6E+00	1.47E+04	-8.9E+00	1.2E-01	5.4E+01	2.6E+01	-8.3E-01	5.9E+01	2.4E+00	8.7E+00	-1.2E+01	-2.5E-01	-6.0E+01	7.29E+02	4.55E+02	1.2E+01
04/20	11'-11.9'	2.02E+01	2.0E+01	5.60E+00	-3.6E+00	-1.1E+01	1.7E+01	6.5E+01	1.66E+04	-7.0E+00	1.3E+01	1.2E+02	2.35E+01	3.1E+00	4.1E+00	1.2E+01	1.0E+01	-2.5E+01	-3.1E+00	-5.2E+01	9.50E+02	6.56E+02	5.2E+01
04/20	13'-13.5'	4.1E+00	2.5E+01	9.0E+00	2.8E-01	-2.1E+01	1.5E+01	4.3E+01	1.27E+04	-6.5E-01	-1.3E+00	1.7E+01	1.3E+01	9.5E-01	0.0E+00	8.4E+00	-3.6E+01	7.3E-01	3.9E+00	-1.3E+02	8.03E+02	5.38E+02	3.8E+01
04/20	0'-5'	4.4E+00	2.3E+01	2.63E+01	-2.8E+00	-7.9E+00	-1.2E+01	-6.9E+00	1.14E+04	2.7E-01	6.0E+00	4.7E+01	1.2E+01	-4.3E+00	-1.6E+01	5.6E+00	-7.0E+00	-7.9E+00	-5.3E+00	-6.1E+01	7.81E+02	4.61E+02	2.8E+01
04/20	6'-12'	4.90E+00	2.5E+01	2.67E+01	-4.2E+00	-2.8E+00	-2.2E+00	1.2E+01	1.11E+04	-3.9E+00	6.97E+00	-1.3E+01	8.6E+00	-4.8E-01	-6.6E+00	-1.1E+00	-2.7E+00	-9.3E+00	-1.4E+00	-3.7E+01	7.11E+02	4.36E+02	2.8E+01

DATE	ST101I DEPTH	CS-137	CS-134	CO-60	CO-58	CO-57	ZN-65	BE-7	K-40	FE-59	MN-54	ZR-95	NB-95	RU-103	RU-106	I-131	BA-140	LA-140	CE-141	CE-144	RA-226	TH-228	EU-152
04/21	0'-2'	5.52E+01	1.7E+01	1.76E+02	3.3E+00	-8.5E+00	2.7E+01	7.0E+01	1.35E+04	-3.9E-01	2.5E+00	3.4E+01	2.0E+01	2.1E+00	-6.9E+00	8.4E+00	-1.7E+01	-1.3E+01	5.3E+00	-7.9E+01	9.29E+00	5.66E+02	4.1E+01
04/21	2'-4.2'	1.2E+01	2.4E+01	1.26E+02	-3.2E+00	-8.8E+00	6.7E+00	3.8E+01	1.23E+04	1.2E+01	6.5E+00	-2.9E+01	3.8E+00	-2.1E+00	-9.6E+00	1.5E+01	1.6E+00	-8.8E+00	3.0E+00	-7.3E+01	8.53E+02	4.78E+02	2.5E+01
04/21	5'-7.8'	2.76E+01	3.8E+01	1.82E+02	-5.4E+00	-5.1E+00	-1.2E+00	9.1E+01	1.57E+04	-4.2E-01	9.8E+00	-5.1E+01	2.2E+00	-4.4E+00	1.9E+01	-1.9E+00	3.1E+00	-3.2E+00	1.6E+01	-6.2E+01	1.22E+03	6.26E+02	7.2E+01
04/21	9'-11.7'	6.3E+00	2.1E+01	1.6E+01	-4.0E+00	-1.6E+00	-5.1E+00	3.5E+01	1.07E+04	4.5E+00	2.0E+00	3.4E+00	-1.4E+00	7.8E+00	-1.0E+02	1.1E+01	2.0E+01	-1.4E+01	3.7E+00	-1.1E+01	1.08E+03	4.78E+02	-2.6E+00
04/21	0'-5'	3.06E+01	2.7E+01	1.85E+02	-2.1E+00	-5.1E+00	1.4E+01	4.0E+01	1.16E+04	-1.3E+01	7.3E+00	1.3E+00	4.2E+00	-2.8E+00	-8.9E+00	5.3E+00	8.6E+00	-1.3E+01	-5.7E+00	-4.5E+01	7.90E+02	4.41E+02	2.9E+01
04/21	5'-10'	8.5E+00	2.3E+01	7.34E+01	-8.3E+00	-5.1E+00	9.3E+00	2.6E+01	1.23E+04	5.9E-01	6.9E+00	7.5E+00	2.3E+01	-5.2E+00	-3.6E+00	-7.5E+00	2.1E+01	-1.7E+01	4.3E+00	-4.5E+01	7.94E+02	4.79E+02	5.5E+01
04/21	10'-12'	-1.2E+00	2.9E+01	6.3E+00	-1.4E+00	-5.8E+00	2.2E+00	5.2E+01	1.15E+04	-1.2E+01	9.38E+00	1.7E+00	1.4E+01	1.7E+00	1.4E+01	1.3E+00	-2.0E+01	-1.7E+01	1.3E+01	-4.5E+01	7.83E+02	4.66E+02	1.8E+01

BOLD – Denotes detectable result.

DATE	ST101J DEPTH	CS-137	CS-134	CO-60	CO-58	CO-57	ZN-65	BE-7	K-40	FE-59	MN-54	ZR-95	NB-95	RU-103	RU-106	I-131	BA-140	LA-140	CE-141	CE-144	RA-226	TH-228	EU-152	U-235	U-238
04/21	0'-2'	1.9E+01	3.0E+01	**9.02E+01**	-3.1E+00	-9.2E+00	2.4E+01	2.2E+01	**1.29E+04**	1.7E+01	6.5E+00	2.9E+01	1.3E+01	-9.5E+00	-1.1E+01	-2.7E+00	3.2E+00	-5.6E+00	7.1E+00	-9.4E+01	**9.82E+02**	**4.64E+02**	4.8E+01		
04/21	2'-3'	4.2E+00	3.0E+01	**3.97E+01**	-1.8E+00	-6.7E+00	3.8E-01	7.4E+00	**1.67E+04**	-5.2E+00	6.6E+00	2.4E+01	2.0E+01	-5.6E+00	1.2E+01	2.1E+00	1.0E+01	-1.6E+01	3.6E+00	-5.1E+01	**9.53E+02**	**6.71E+02**	5.7E+01		
04/21	3'-5'	8.6E+00	2.9E+01	**1.50E+01**	-7.1E+00	-3.7E+00	-1.8E+01	5.5E+01	**1.20E+04**	-1.5E+01	5.1E+00	3.1E+01	1.5E+01	1.5E-01	6.3E+00	-1.4E+01	-5.0E+00	0.0E+00	0.0E+00	-6.2E+01	**7.20E+02**	**4.45E+02**	8.6E+00		
04/21	5'-7'	3.6E+00	3.2E+01	**3.67E+01**	-2.4E+00	-7.4E+00	-6.1E+00	8.1E+00	**1.31E+04**	-1.1E+01	8.34E+00	-9.8E+00	6.8E+00	4.0E-01	-1.8E+01	4.3E+00	3.7E-01	-8.3E+00	-3.7E+00	-6.0E+01	**8.04E+02**	**4.90E+02**	4.2E+01	6.34E+01	**1.03E+03**
04/21	7'-9'	-3.5E+00	2.5E+01	-1.3E+00	2.3E+00	-3.3E+00	-1.2E+00	6.6E+00	**1.20E+04**	-4.0E+00	9.04E+00	1.0E+00	9.1E+00	-2.5E+00	-1.1E+01	-5.0E+00	-5.0E+00	-1.1E+01	4.4E+00	-3.0E+01	**7.65E+02**	**4.57E+02**	2.5E+01		
04/21	9'-11'	-1.4E+00	2.4E+01	-2.0E+00	-3.1E+00	-2.5E+00	8.8E+00	-1.1E+01	1.26E+04	-2.1E+00	1.14E+01	-2.3E+01	5.7E+00	5.5E+00	-5.7E+00	4.4E+00	9.2E+00	-1.7E+01	5.2E+00	-3.4E+01	8.21E+02	**5.04E+02**	3.5E+01		
04/21	11'-13'	-2.5E+00	2.5E+01	1.5E+00	-2.1E+00	-5.0E+00	-7.9E+00	2.9E+01	1.19E+04	-1.5E+01	8.13E+00	-1.2E+01	6.0E+00	2.1E+00	5.1E+00	-3.4E+00	-3.5E+00	-7.9E+00	6.1E+00	4.2E+01	**6.48E+00**	4.59E+00	3.2E+01		
04/21	13'-14'	5.6E+00	1.5E+01	-2.3E+00	1.1E+01	-1.1E+01	1.1E+01	2.0E+01	1.52E+04	-2.0E+01	7.6E+00	1.1E+02	2.7E+01	-3.1E+00	0.0E+00	2.8E+01	-2.1E+01	-2.3E+01	1.9E+00	-6.4E+01	**1.06E+03**	**6.31E+02**	5.0E+01		
04/21	0'-5'	7.8E+00	2.6E+01	**1.68E+01**	-1.2E+00	-2.5E+00	-6.2E+00	2.6E+01	1.20E+04	-2.5E+00	6.8E+00	-2.1E+01	1.2E+01	-3.3E+00	-1.7E+01	-7.6E+00	1.7E+01	-3.6E+00	-1.4E+01	-4.9E+01	**6.83E+02**	**5.54E+02**	1.6E+01		
04/21	5'-11'	-2.5E+00	2.4E+01	7.8E+00	-2.2E+00	-4.8E+00	-2.6E+00	3.2E+01	1.15E+04	-1.5E+00	3.8E+00	-1.5E+01	1.6E+01	3.4E-01	2.5E+01	9.6E+00	1.3E+01	-5.7E+00	3.5E+00	-4.4E+01	7.22E+02	4.08E+02	2.9E+01		

DATE	ST101K DEPTH	CS-137	CS-134	CO-60	CO-58	CO-57	ZN-65	BE-7	K-40	FE-59	MN-54	ZR-95	NB-95	RU-103	RU-106	I-131	BA-140	LA-140	CE-141	CE-144	RA-226	TH-228	EU-152
04/22	0'-2'	3.80E+01	4.3E+01	1.12E+02	-8.6E+00	-5.7E+00	-7.6E+00	3.7E+01	1.48E+04	-1.4E+00	6.1E+00	9.0E+00	9.7E+00	-7.1E+00	2.2E+01	-2.2E-01	-1.5E+01	-5.0E+00	2.1E+00	-7.2E+01	9.85E+02	6.08E+02	4.3E+01
04/22	2'-3'	1.4E+01	3.0E+01	6.51E+01	-1.0E+01	-4.3E+00	-9.6E+00	-4.1E+01	1.34E+04	-1.0E+01	5.4E+00	1.6E+01	1.9E+01	-6.4E+00	-4.3E+01	4.4E+01	2.4E+01	-2.5E+01	7.1E+00	-2.1E+01	1.02E+03	6.31E+02	3.2E+00
04/22	3'-5'	2.1E+01	3.6E+01	2.3E+01	-1.4E+01	-1.7E+01	1.1E+02	5.2E+01	4.23E+04	-3.1E+01	2.3E+01	1.8E+01	3.6E+01	9.0E+00	-9.6E+01	9.3E+00	3.4E+01	-5.2E+01	4.4E+00	-2.5E+02	2.08E+03	1.59E+03	1.9E+02
04/22	5'-7'	1.1E+00	2.1E+01	3.8E-01	-2.1E+00	-8.1E+00	3.6E+01	3.7E+01	1.21E+04	-6.0E+00	3.9E+00	2.7E+01	7.1E+00	1.5E+00	-1.8E+01	2.3E+00	7.1E+00	-8.8E+00	5.0E+00	-5.8E+01	6.83E+02	4.14E+02	3.3E+01
04/22	7'-9'	-1.4E+00	1.8E+01	0.0E+00	-8.4E-01	-4.5E+00	-2.2E-01	-4.8E+00	1.14E+04	2.1E+00	5.4E+00	-3.6E+01	2.5E+00	-3.9E-01	-3.5E+01	7.7E+00	4.3E+00	1.3E+00	1.8E+00	-3.5E+01	6.72E+02	4.03E+02	2.8E+01
04/22	9'-10.5'	1.3E+00	2.6E+01	6.3E+00	-3.1E-01	-5.6E+00	-1.4E+01	2.9E+01	1.49E+04	-6.1E+00	-4.3E-01	7.3E+00	1.4E+01	5.6E+00	-1.7E+01	6.6E+00	-6.0E-01	-1.8E+01	0.0E+00	-5.2E+01	9.02E+02	6.05E+02	4.9E+01
04/22	11'-12.4'	-5.3E+00	3.9E+01	7.0E-01	1.32E+01	-1.7E+01	2.2E+01	-1.1E+01	1.52E+04	4.0E+00	4.1E+00	6.1E-01	3.2E+01	-2.8E+00	-7.8E+01	6.4E+00	0.0E+00	-2.0E+01	9.3E+00	-5.7E+01	1.18E+03	6.72E+02	5.0E+01
04/22	13'-13.8'	4.6E+00	2.4E+01	5.9E+00	-3.8E+00	4.0E+00	5.5E+00	1.6E+01	9.73E+03	-2.6E+01	-2.2E+00	-1.7E+01	1.1E+01	-2.3E+00	-5.9E+00	-1.5E+00	-1.8E+01	-2.2E+01	-9.2E+00	1.1E+01	5.44E+02	3.72E+02	0.0E+00
04/22	0'-5'	2.16E+01	2.7E+01	6.84E+01	-8.7E-02	-3.5E+00	-2.5E+00	1.5E+01	1.31E+04	-7.2E+00	9.81E+00	-1.8E+01	4.7E+00	2.1E+00	-4.4E+00	1.1E+00	-6.7E-01	-2.0E+01	-8.6E+00	-8.8E+01	8.76E+02	4.69E+02	3.3E+01
04/22	5'-10'	2.02E+01	2.7E+01	4.01E+01	-6.0E+00	-2.5E+00	-5.1E-01	3.3E+01	1.33E+04	3.0E+00	1.36E+01	-5.2E+00	1.1E+01	1.9E+00	-1.6E+00	-1.8E+01	3.1E+00	-2.0E+01	1.2E+01	-4.8E+01	8.06E+02	4.45E+02	3.0E+01
04/22	10'-13'	3.59E+01	3.0E+01	6.46E+01	-5.6E+00	-6.6E+00	-4.6E-01	-1.9E+01	1.37E+04	-1.0E+01	5.1E+00	-9.2E+00	1.5E+01	-5.1E+00	1.9E+01	-5.2E+00	4.0E-01	-1.8E+01	3.0E+00	-4.2E+01	8.89E+02	5.11E+02	3.1E+01

DATE	ST101L DEPTH	CS-137	CS-134	CO-60	CO-58	CO-57	ZN-65	BE-7	K-40	FE-59	MN-54	ZR-95	NB-95	RU-103	RU-106	I-131	BA-140	LA-140	CE-141	CE-144	RA-226	TH-228	EU-152
04/22	0'-2'	2.17E+01	1.4E+01	1.13E+02	-3.6E+00	-8.9E+00	1.1E+01	-4.3E+00	1.45E+04	1.0E+01	7.2E+00	1.0E+02	2.3E+01	-7.0E+00	2.3E+01	-8.6E+00	-2.0E+01	-8.6E+00	-1.2E+00	-5.0E+01	8.65E+02	5.45E+02	6.2E+01
04/22	2'-3'	3.35E+01	3.7E+01	6.91E+02	-1.1E+00	-4.3E+00	1.71E+01	5.3E+00	1.77E+04	-7.2E+00	1.39E+01	-1.8E+01	1.2E+01	-2.0E+00	-2.2E+01	-2.1E+00	4.8E+00	-1.3E+01	2.0E-01	-7.0E+01	1.14E+03	7.17E+02	4.0E+01
04/22	3'-5'	3.6E-01	2.8E+01	1.02E+01	-5.0E+00	-6.2E+00	-4.7E-01	6.4E+00	1.49E+04	-4.5E+00	7.30E+00	-2.8E+00	9.2E+00	-2.2E+00	-2.0E+01	-4.8E-02	-2.0E+00	-1.3E+01	1.4E+00	-3.3E+01	8.61E+02	5.44E+02	2.7E+01
04/22	5'-7'	-2.7E+00	3.3E+01	9.2E+00	-1.9E+00	-7.8E+00	-9.2E+00	3.1E+00	1.60E+04	-2.4E+00	7.2E+00	1.7E+01	1.8E+01	6.0E+00	-2.2E+01	-6.2E-01	5.8E+00	-1.1E+01	-1.7E+00	-9.8E+01	9.46E+02	6.19E+02	4.9E+01
04/22	7'-9'	-4.4E-01	2.4E+01	-8.2E-01	-5.9E+00	-4.0E+00	8.7E-01	-7.8E+00	1.37E+04	-3.9E+00	9.38E+00	-6.4E-01	1.1E+01	-2.6E+00	-1.4E+01	4.4E+00	-2.7E+00	-9.5E+00	-2.8E+00	-5.4E+01	6.85E+02	4.68E+02	3.2E+01
04/22	9'-10'	-4.1E+00	3.2E+01	3.1E+00	-3.2E-01	-7.8E+00	-1.0E+00	2.7E+01	1.72E+04	-8.1E+00	1.40E+01	-2.4E+01	1.0E+01	-5.9E-02	-3.6E+01	-1.6E+00	-2.4E+01	-1.7E+01	-4.0E+00	-7.5E+01	1.04E+03	6.82E+02	3.2E+01
04/22	11'-14.5'	-2.7E-01	6.5E+01	2.7E-01	-9.2E+00	-1.1E+01	5.7E+00	-6.5E-01	1.92E+04	-3.6E+00	1.09E+01	2.5E+01	2.9E+01	-4.0E+00	-1.3E+01	2.1E-01	1.7E+01	-1.5E+01	3.6E+00	-9.0E+01	1.26E+03	7.34E+02	5.1E+01
04/22	0'-5'	2.04E+01	2.3E+01	5.56E+01	-2.7E+00	-3.1E+00	3.7E+00	3.2E+01	1.25E+04	1.3E+00	1.1E+00	4.2E+01	1.7E+01	2.3E+00	2.0E+01	-7.0E+00	2.6E+01	-4.9E+00	2.5E+00	-6.0E+01	6.51E+02	4.41E+02	5.5E+01
04/22	5'-10'	7.60E+00	2.5E+01	1.58E+01	-2.0E-01	-4.5E+00	1.8E+01	-5.7E+00	1.29E+04	-3.6E+00	1.02E+01	-8.7E+00	9.9E+00	2.0E+00	-3.0E+01	-1.5E+01	1.4E+01	-8.9E-01	4.2E+00	-4.9E+01	6.73E+02	4.24E+02	4.0E+01
04/22	10'-14'	1.4E+01	8.9E+00	8.2E+00	-2.5E+00	-4.3E+00	3.3E+01	-1.9E+01	1.16E+04	2.1E+00	3.1E+00	6.4E+01	2.0E+01	-2.1E+00	-1.1E+01	4.3E+00	-4.0E+00	-1.4E+01	1.2E+00	-3.3E+01	7.18E+02	4.42E+02	4.6E+01

BOLD – Denotes detectable result.

WASHINGTON PUBLIC POWER
SUPPLY SYSTEM

INTEROFFICE MEMORANDUM

DATE: April 24, 1992

TO: A.I. Davis, Pr. Health Physicist (927K)

J.E. McDonald

FROM: J.E. McDonald, Env. Scientist I, REMP (1025)

SUBJECT: RESULTS FOR ST101 THROUGH MARCH 4, 1992

The attached tables and graphs show the results of gamma spectrometry analysis on ST101 sediment for the period 1987-92 and also for October 1991 to March 1992. Another table shows the results of gamma spectrometry and gross beta analyses on water samples taken at ST101.

Please note that the latest result for Co-60 in sediment is approximately five times higher than in the sample taken two weeks earlier. This sample is also approximately three times higher than the mean of all samples taken the last six months. The results for Cs-134 and Cs-137 for the latest sample show smaller increases of approximately 1.5 to 1.7 times that of the mean of samples taken the last six months.

We would appreciate an investigation of the possible causes of the increases measured in the March 4, sample. Please send the results of this investigation to me at M/D 1025 as soon as possible.

JEM/pg
Attachments

Distribution:

JC Bell (1025)
CJ Card (1025)
JP Chasse (280)
PJ MacBeth (927K)
CR Madden (PE21)
RF Haight (PE12)
DIC 504.6.2.1
JEM/lb

1991-92 ST101 RESULTS - PICOCURIES/KILOGRAM (NOTE: Analysis by Teledyne began 01/23/92)

DATE	CS-137	CS-134	CO-60	CO-58	CO-57	ZN-65	BE-7	K-40	FE-59	MN-54	ZR-95
10/01	8.2E+01	5.7E+01	2.0E+02			7.7E+01				2.1E+01	
10/18	8.3E+01	5.1E+01	1.1E+02	4.8E+00		5.6E+01				8.2E+00	
10/31	9.5E+01	5.2E+01	1.8E+02			0.0E+00					
11/21	4.8E+01	3.9E+01	1.2E+02			4.0E+01	4.5E+01				
12/12	6.3E+01	4.2E+01	9.0E+01			3.1E+01				8.2E+00	
12/31	8.7E+01	4.3E+01	7.7E+01			6.0E+01					
01/23(S/S)	7.8E+01	5.6E+01	1.0E+02			5.8E+01				1.3E+01	
01/23(TEL)	1.15E+02	4.8E+01	1.03E+02	-2.8E+00	2.5E+00	6.6E+01	1.3E+01	1.02E+04	-1.0E+01	1.9E+01	1.4E+01
02/05	9.95E+01	5.37E+01	8.22E+01	-9.2E+00	-6.2E+00	5.51E+01	2.8E+02	9.20E+03	-1.0E+00	5.5E+00	9.6E+01
02/19	8.3E+01	1.5E+01	1.04E+02	-3.4E+00	3.8E+00	9.08E+01	1.3E+02	8.58E+03	-1.3E+01	1.5E+01	9.2E+01
03/04	1.43E+02	7.09E+01	5.11E+02	3.4E+00	-1.2E+01	9.3E+01	2.3E+02	8.75E+03	1.2E+01	9.6E+00	5.5E+01

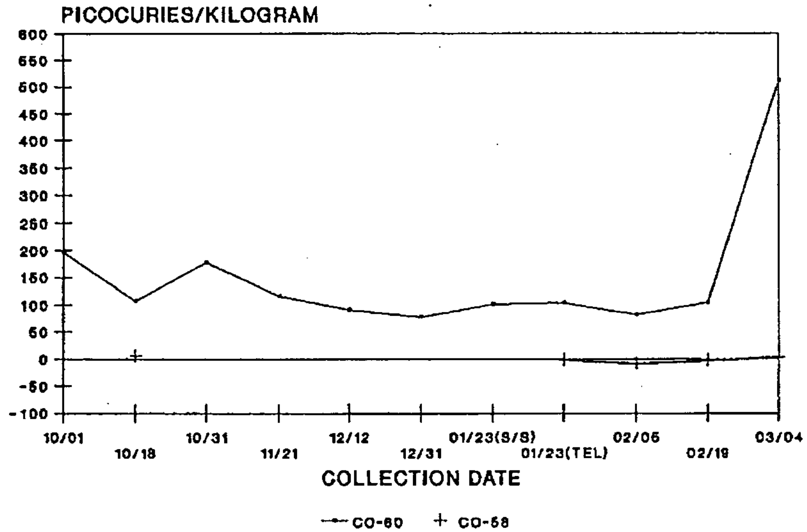
DATE	NB-95	RU-103	RU-106	I-131	BA-140	LA-140	CE-141	CE-144	RA-226	TH-228	EU-152	EU-154
10/01												
10/18												
10/31												
11/21												
12/12												
12/31												
01/23(S/S)												
01/23(TEL)	7.2E+00	-1.7E+00	-4.0E+01	-3.5E+01	-1.3E+01	-4.8E+00	-4.7E+00	-9.0E+01	5.6E+02	3.95E+02		4.9E+01
02/05	3.3E+01	-2.5E+00	-8.1E+01	1.9E+01	1.1E+01	-2.3E+00	6.2E+00	-5.4E+00	7.68E+02	5.10E+02	9.6E+00	
02/19	2.7E+01	8.9E-01	-2.9E+01	-4.2E-01	5.5E+00	-3.0E+00	0.0E+00	-2.7E+01	1.03E+03	3.83E+02		
03/04	3.6E+01	-4.8E+00	-6.8E+01	-8.8E+00	-5.1E+01	-4.1E+01	4.7E+00	-8.2E+01	2.1E+01	4.33E+02		

1992 ST101 GROSS BETA AND GAMMA IN WATER RESULTS - PICOCURIES/LITER

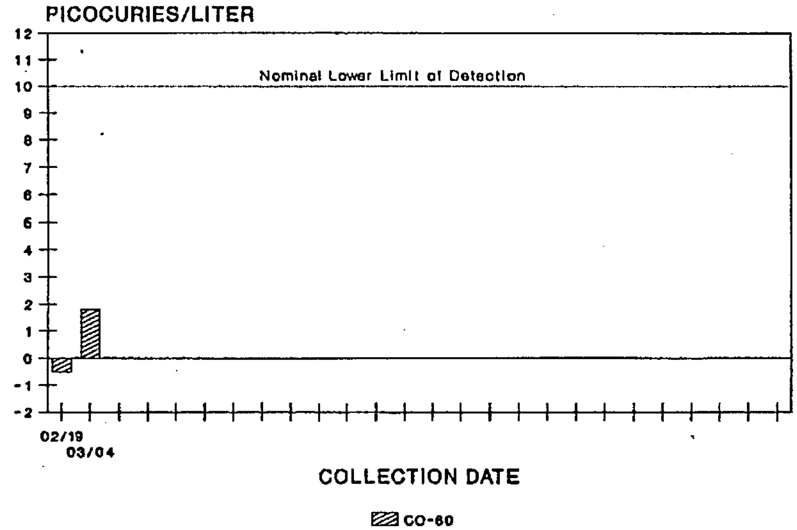
DATE	GR-B	CS-137	CS-134	CO-60	CO-58	CO-57	ZN-65	BE-7	K-40	FE-59	MN-54
02/19	2.6E+00	1.3E+00	-3.3E-01	-5.2E-01	-4.7E-01	2.0E+00	6.6E+00	-1.1E+01	-4.9E+00	2.1E+00	2.6E+00
03/04	1.9E+00	2.3E+00	-2.3E+00	1.8E+00	5.1E-01	1.1E+00	1.0E+00	2.5E+00	-1.3E+01	-1.8E+00	-9.9E-02

DATE	ZR-95	NB-95	RU-103	RU-106	I-131	BA-140	LA-140	CE-141	CE-144	RA-226	TH-228
02/19	3.1E+00	1.4E+00	-4.1E-01	-6.9E+00	2.7E-01	4.2E+00	-6.3E-01	-3.1E-01	-7.3E+00	-1.9E+00	3.6E+00
03/04	3.4E+00	2.4E-01	-3.6E-01	-5.8E+00	-7.1E-01	7.0E-01	3.8E-01	-3.5E+00	-9.4E-01	2.4E+01	-1.0E+01

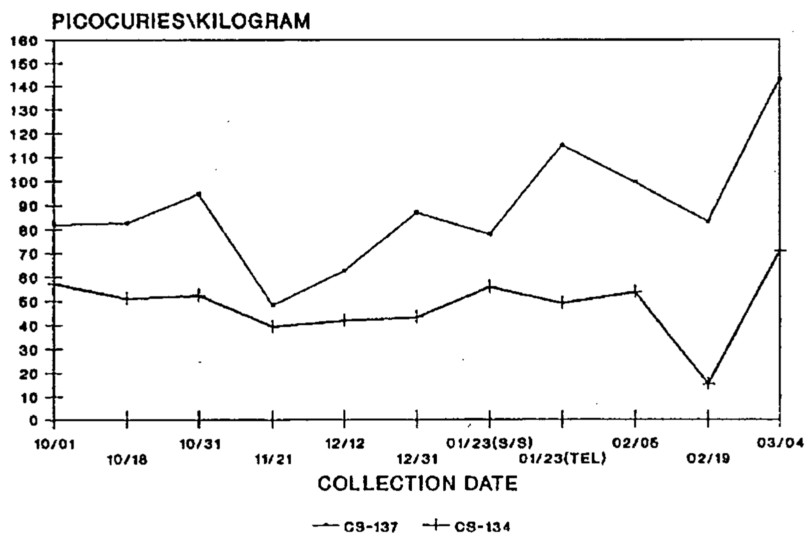
1991-92 ST101 RESULTS
ACTIVATION PRODUCTS



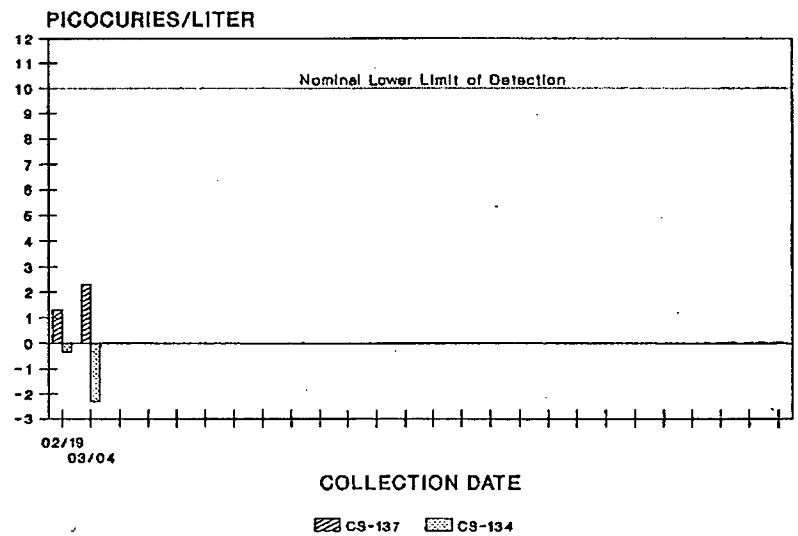
1992 CO-60 IN WATER RESULTS
ST101 DRAINAGE LAGOON



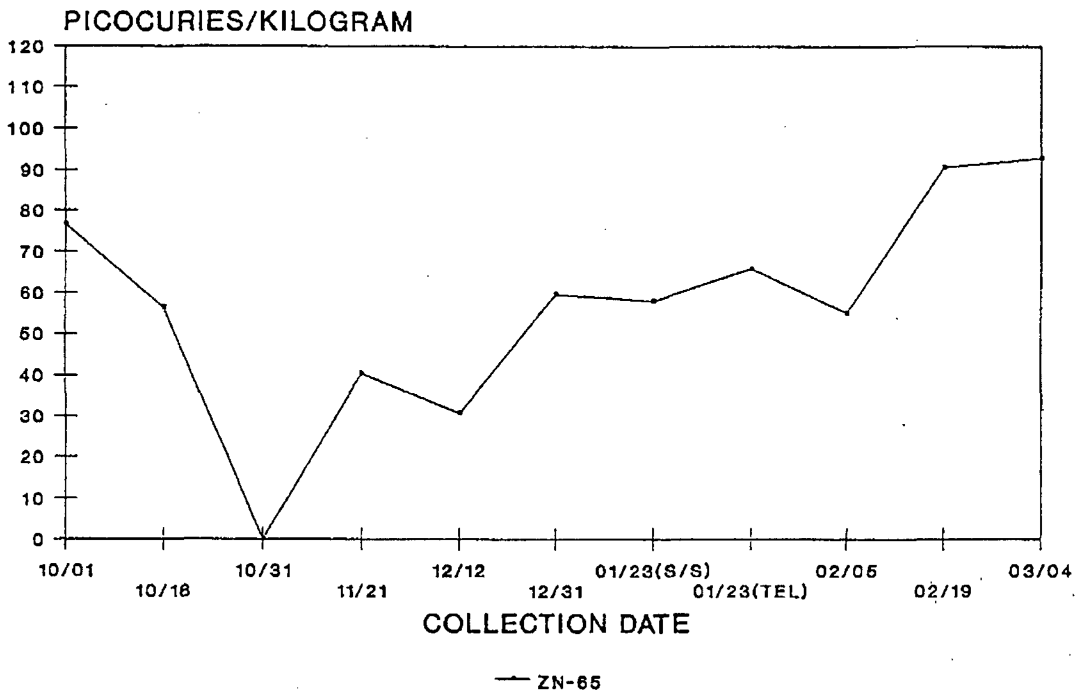
1991-92 ST101 RESULTS
FISSION PRODUCTS



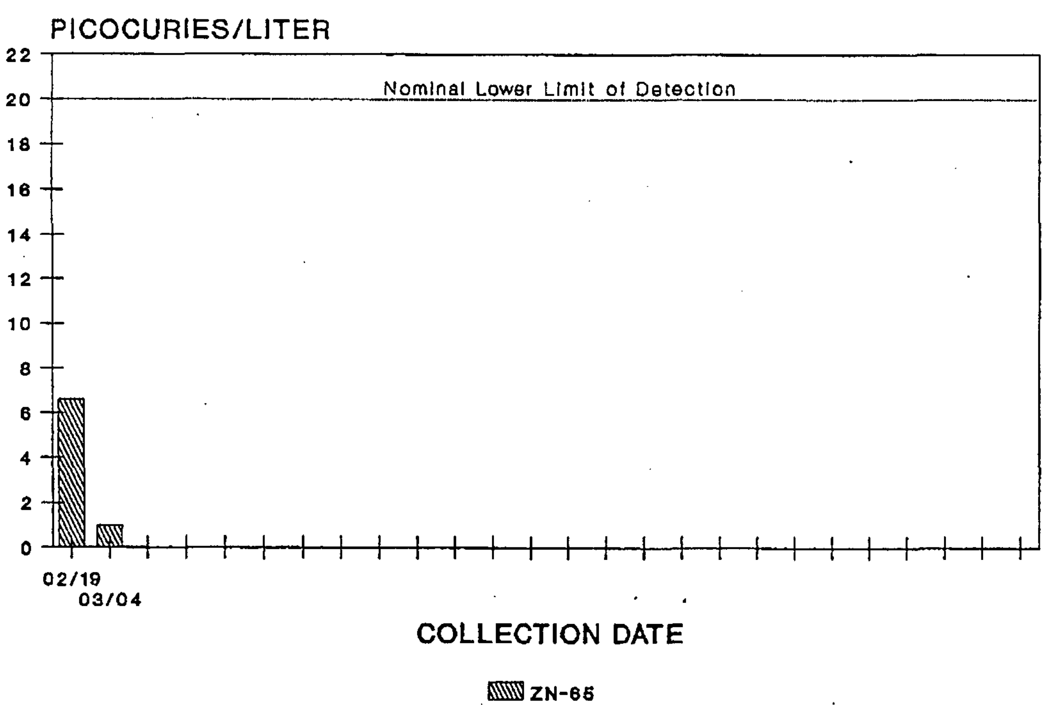
1992 CS-137 AND -134 IN WATER RESULTS
ST101 DRAINAGE LAGOON



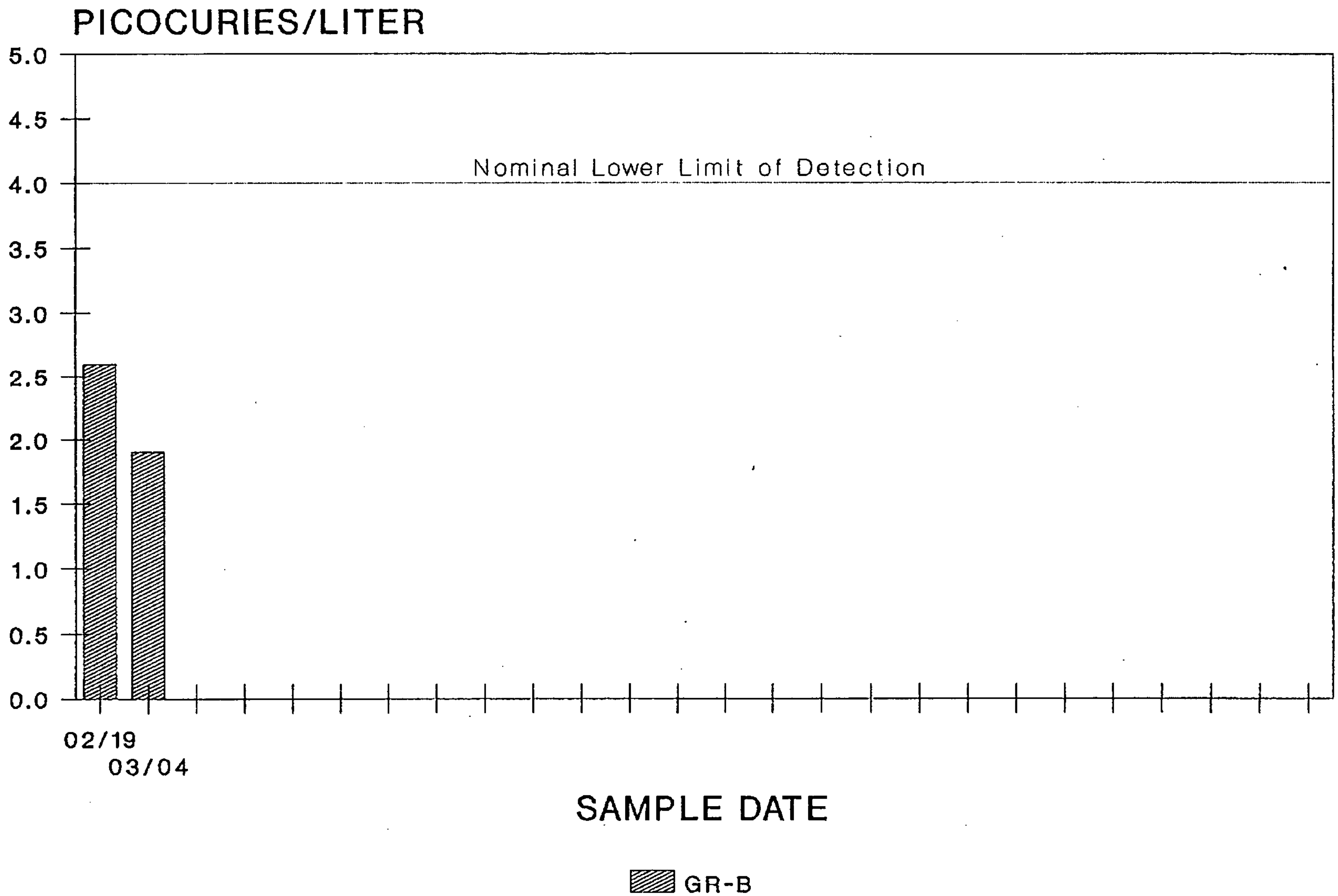
1991-92 ST101 RESULTS
ACTIVATION PRODUCTS



1992 ZN-65 IN WATER RESULTS
ST101 DRAINAGE LAGOON



1992 GROSS BETA IN WATER RESULTS
FOR ST101 DRAINAGE LAGOON



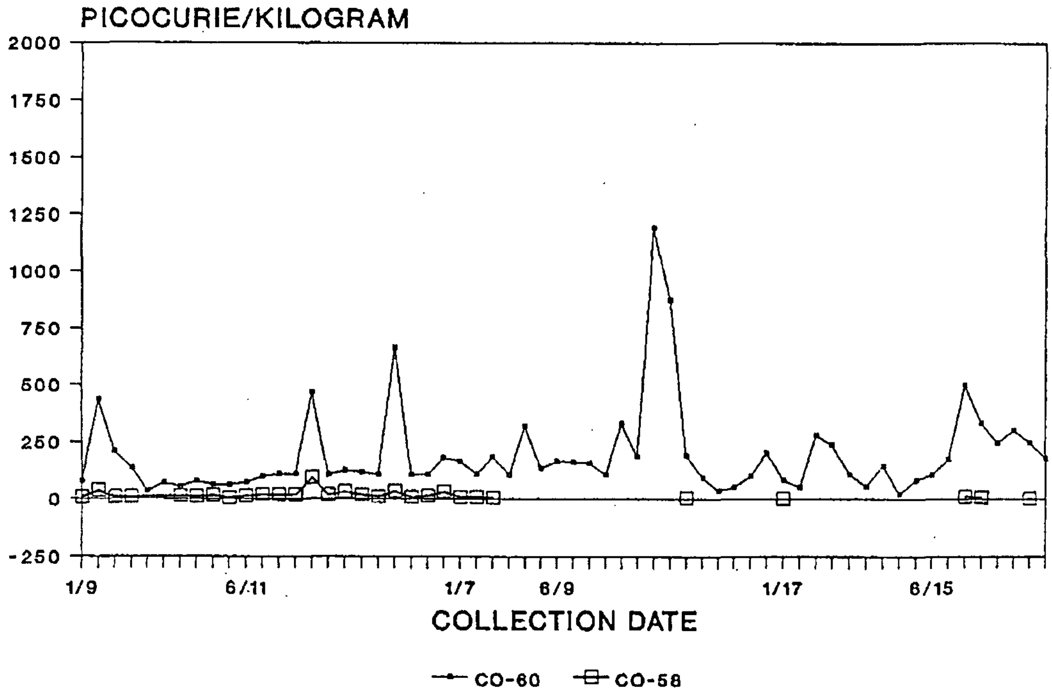
1987-92 ST101 SEDIMENT RESULTS - PICOCURIES/KILOGRAM

DATE	CS-137	CS-134	CO-60	CO-58	ZN-65	I-131
01/09/87	3.80E+01	4.50E+00	7.80E+01	7.90E+00	8.40E+02	
01/27/87	4.81E+01		4.35E+02	3.93E+01	1.84E+03	
02/05/87	3.57E+01		2.08E+02	9.20E+00	1.09E+03	
02/19/87	4.70E+01		1.37E+02	7.78E+00	9.28E+02	
03/20/87	3.63E+01		3.44E+01		5.07E+02	
04/02/87	4.32E+01		6.93E+01		6.89E+02	
04/23/87	3.15E+01		5.33E+01	1.55E+01	6.66E+02	
05/01/87	4.93E+01	4.90E+00	7.85E+01	1.29E+01	8.76E+02	
05/21/87	4.99E+01		6.16E+01	1.62E+01	7.81E+02	
05/29/87	4.70E+01	8.82E+00	6.11E+01	7.62E+00	6.97E+02	
06/11/87	4.39E+01	7.75E+00	7.17E+01	1.41E+01	8.10E+02	
06/28/87	4.66E+01	8.90E+00	1.00E+02	2.07E+01	8.87E+02	
07/10/87	4.09E+01		1.09E+02	2.03E+01	1.00E+03	
07/13/87	4.80E+01	1.27E+01	1.10E+02	1.86E+01	9.75E+02	
07/23/87	5.35E+01	1.48E+01	4.66E+02	9.36E+01	1.78E+03	
08/10/87	4.21E+01		1.07E+02	2.01E+01	9.42E+02	
08/20/87	4.69E+01		1.25E+02	3.35E+01	9.14E+02	
09/03/87	3.83E+01	9.79E+00	1.18E+02	2.02E+01	8.52E+02	
10/09/87	4.44E+01		1.07E+02	1.21E+01	6.94E+02	
10/28/87	1.50E+02	5.42E+01	6.64E+02	3.49E+01	1.81E+03	
11/12/87	4.34E+01		1.08E+02	1.03E+01	7.29E+02	
11/24/87	4.89E+01	2.35E+01	1.07E+02	1.46E+01	6.82E+02	
12/10/87	5.29E+01	2.82E+01	1.81E+02	3.28E+01	6.85E+02	6.06E+00
01/07/88	5.62E+01	2.54E+01	1.66E+02	9.49E+00	6.46E+02	
01/21/88	5.49E+01	2.39E+01	1.09E+02	1.04E+01	5.43E+02	
02/12/88	7.29E+01	2.71E+01	1.84E+02	6.36E+00	7.57E+02	
03/23/88	3.65E+01	1.78E+01	1.08E+02		3.60E+02	
04/18/88	4.87E+01	2.16E+01	3.20E+02		5.62E+02	1.79E+01
05/11/88	5.67E+01	2.76E+01	1.36E+02		4.27E+02	2.86E+01
06/09/88	3.75E+01	2.94E+01	1.64E+02		3.73E+02	1.54E+01
06/28/88	6.88E+01	3.14E+01	1.63E+02		3.93E+02	
07/08/88	6.94E+01	4.83E+01	1.57E+02		3.93E+02	
07/21/88	6.85E+01	3.37E+01	1.06E+02		3.15E+02	
08/04/88	7.78E+01	4.65E+01	3.31E+02		4.77E+02	
08/19/88	6.64E+01	4.38E+01	1.87E+02		3.55E+02	
09/01/88	9.54E+01	4.89E+01	1.19E+03		1.01E+03	
09/19/88	8.76E+01	3.71E+01	8.74E+02		7.82E+02	
10/10/88	6.88E+01	4.25E+01	1.91E+02	6.23E+00	3.81E+02	
10/25/88	6.02E+01	3.75E+01	9.39E+01		2.33E+02	
11/17/88	2.77E+01		3.86E+01		5.55E+01	
11/29/88	3.06E+01	2.41E+01	5.39E+01		4.15E+01	
12/09/88	4.92E+01	4.60E+01	1.02E+02		1.48E+02	
12/22/88	4.54E+01	3.70E+01	2.05E+02		1.50E+02	
01/17/89	5.76E+01	4.53E+01	8.44E+01	4.85E+00	1.74E+02	
01/31/89	5.03E+01	3.26E+01	5.41E+01		8.48E+01	
02/17/89	7.16E+01	6.40E+01	2.82E+02		2.69E+02	
02/28/89	8.68E+01	6.35E+01	2.40E+02		1.97E+02	
03/23/89	5.02E+01	4.84E+01	1.11E+02		1.43E+02	
04/14/89	4.95E+01	6.60E+01	5.73E+01		8.08E+01	
04/28/89	8.00E+01	7.04E+01	1.46E+02		1.04E+02	
05/18/89	2.99E+01	4.08E+01	2.34E+01		4.72E+01	
05/31/89	5.49E+01	4.09E+01	8.28E+01		1.00E+02	
06/15/89	6.53E+01	3.58E+01	1.07E+02		1.19E+02	
07/05/89	6.36E+01	3.91E+01	1.72E+02		6.74E+02	
08/28/89	1.14E+02	1.27E+02	5.00E+02	1.29E+01	1.08E+03	
09/13/89	5.81E+01	6.28E+01	3.33E+02	1.04E+01	6.33E+02	
09/26/89	1.09E+02	7.22E+01	2.46E+02		6.94E+02	
10/13/89	6.20E+01	5.73E+01	3.03E+02		5.08E+02	
10/30/89	7.67E+01	5.84E+01	2.48E+02	4.68E+00	5.44E+02	7.61E+00
11/21/89	6.38E+01	4.19E+01	1.82E+02		3.25E+02	
12/07/89	9.31E+01	6.63E+01	3.98E+02		5.81E+02	
12/20/89	9.95E+01	6.62E+01	3.50E+02		6.00E+02	6.67E+00
01/08/90	8.70E+01	6.11E+01	2.76E+02		4.18E+02	
02/05/90	8.37E+01	6.17E+01	2.99E+02		4.25E+02	4.50E+00
03/23/90						
06/07/90	1.08E+02	6.43E+01	3.36E+02		1.92E+02	
06/29/90	1.12E+02	7.44E+01	2.46E+02		1.42E+02	
07/13/90	8.23E+01	5.88E+01	1.78E+03		2.32E+02	
07/19/90	1.49E+02	9.41E+01	4.06E+02		2.23E+02	
08/08/90	1.07E+02	6.87E+01	2.42E+02		1.70E+02	
08/31/90	1.04E+02	4.50E+01	1.97E+02		6.70E+01	
09/05/90	7.89E+01	4.98E+01	1.24E+02		1.41E+02	
10/05/90	1.47E+02	9.67E+01	2.06E+02		1.49E+02	
10/30/90	1.53E+02	9.24E+01	2.60E+02		1.12E+02	
11/08/90	1.79E+02	1.13E+02	1.75E+02		1.13E+02	
11/28/90	1.56E+02	8.66E+01	7.55E+02		2.57E+02	
12/28/90	1.55E+02	9.13E+01	2.68E+02		1.00E+02	
01/18/91	1.45E+02	7.97E+01	2.63E+02		1.02E+02	

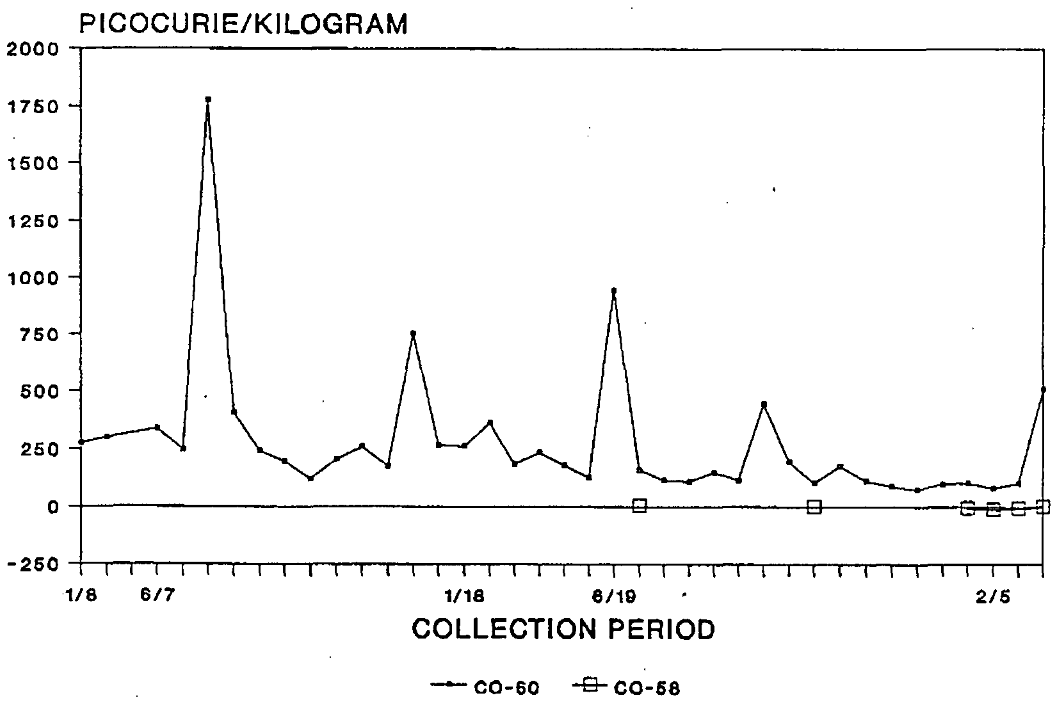
1987-92 ST101 SEDIMENT RESULTS – PICOCURIES/KILOGRAM

DATE	CS-137	CS-134	CO-60	CO-58	ZN-65	I-131
02/15/91	1.45E+02	8.21E+01	3.62E+02		1.18E+02	
03/15/91	1.51E+02	9.05E+01	1.37E+02		7.09E+01	8.96E+00
03/29/91	1.68E+02	8.64E+01	2.37E+02		8.14E+01	
04/17/91	1.58E+02	8.90E+01	1.80E+02		7.02E+01	
05/15/91	1.66E+02	1.04E+02	1.28E+02		1.70E+02	
06/19/91	1.44E+02	1.04E+02	9.48E+02		1.47E+02	
06/28/91	8.57E+01	5.93E+01	1.63E+02	6.00E+00	7.30E+01	
07/11/91	5.59E+01	4.67E+01	1.19E+02		5.87E+01	
07/25/91	6.68E+01	4.65E+01	1.13E+02		6.14E+01	
08/20/91	7.50E+01	4.98E+01	1.53E+02		4.49E+01	
08/30/91	8.03E+01	4.90E+01	1.17E+02		4.05E+01	
09/13/91	1.01E+02	6.35E+01	4.49E+02		8.75E+01	
10/01/91	8.20E+01	5.73E+01	1.96E+02		7.67E+01	
10/18/91	8.25E+01	5.10E+01	1.06E+02	4.95E+00	5.64E+01	
10/31/91	9.47E+01	5.25E+01	1.77E+02			
11/21/91	4.83E+01	3.62E+01	1.16E+02		4.04E+01	
12/12/91	6.28E+01	4.17E+01	9.04E+01		3.07E+01	
12/31/91	8.69E+01	4.30E+01	7.71E+01		5.96E+01	
(S/S) 01/23/92	7.79E+01	5.57E+01	1.01E+02		5.80E+01	
(TELE) 01/23/92	1.15E+02	4.90E+01	1.03E+02	-2.80E+00	5.60E+01	-3.50E+01
02/05/92	9.95E+01	5.37E+01	8.22E+01	-9.20E+00	5.51E+01	1.90E+01
02/19/92	8.30E+01	1.50E+01	1.04E+02	-3.40E+00	9.08E+01	-4.20E-01
03/04/92	1.43E+02	7.09E+01	5.11E+02	3.40E+00	9.30E+01	-8.80E+00
6 MONTH STATISTICS COMPARED TO LAST SAMPLE (9/13/91–2/19/92)						
MEAN	8.49E+01	4.71E+01	1.46E+02	-2.61E+00	6.21E+01	-5.47E+00
LOW	4.83E+01	1.50E+01	7.71E+01	-9.20E+00	3.07E+01	-3.50E+01
HIGH	1.15E+02	6.35E+01	4.49E+02	4.95E+00	9.08E+01	1.90E+01
% +/- 6 MOS. MEAN	168.49%	150.41%	350.93%	-130.11%	149.72%	160.78%
% +/- 6 MOS. LOW	296.00%	472.67%	662.43%	-36.96%	302.73%	25.14%
% +/- 6 MOS. HIGH	124.35%	111.72%	113.88%	68.73%	102.42%	-46.32%
YEAR TO DATE STATISTICS COMPARED TO LAST SAMPLE (1/23–2/19/92)						
MEAN	9.38E+01	4.33E+01	9.75E+01	-5.13E+00	6.75E+01	-5.47E+00
LOW	7.79E+01	1.50E+01	8.22E+01	-9.20E+00	5.51E+01	-3.50E+01
HIGH	1.15E+02	5.57E+01	1.04E+02	-2.80E+00	9.08E+01	1.90E+01
% +/- YTD MEAN	152.39%	163.59%	524.10%	-66.23%	137.83%	160.78%
% +/- YTD LOW	183.66%	472.67%	621.65%	-36.96%	168.78%	25.14%
% +/- YTD HIGH	124.35%	127.38%	491.35%	-121.43%	102.42%	-46.32%

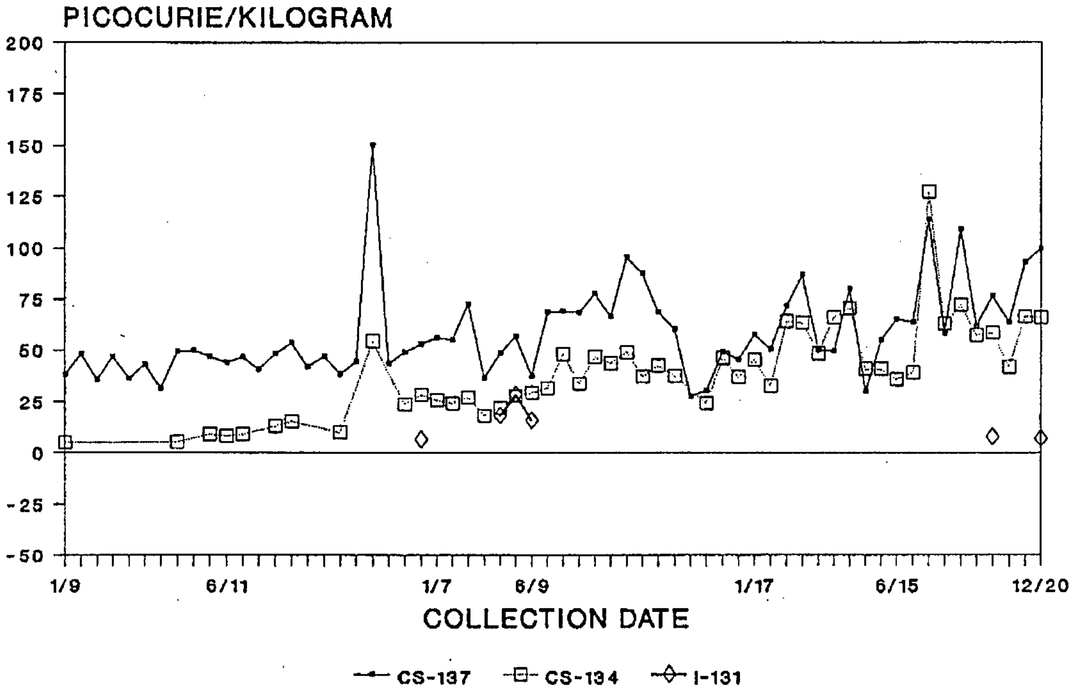
1987-89 ST101 RESULTS
ACTIVATION PRODUCTS



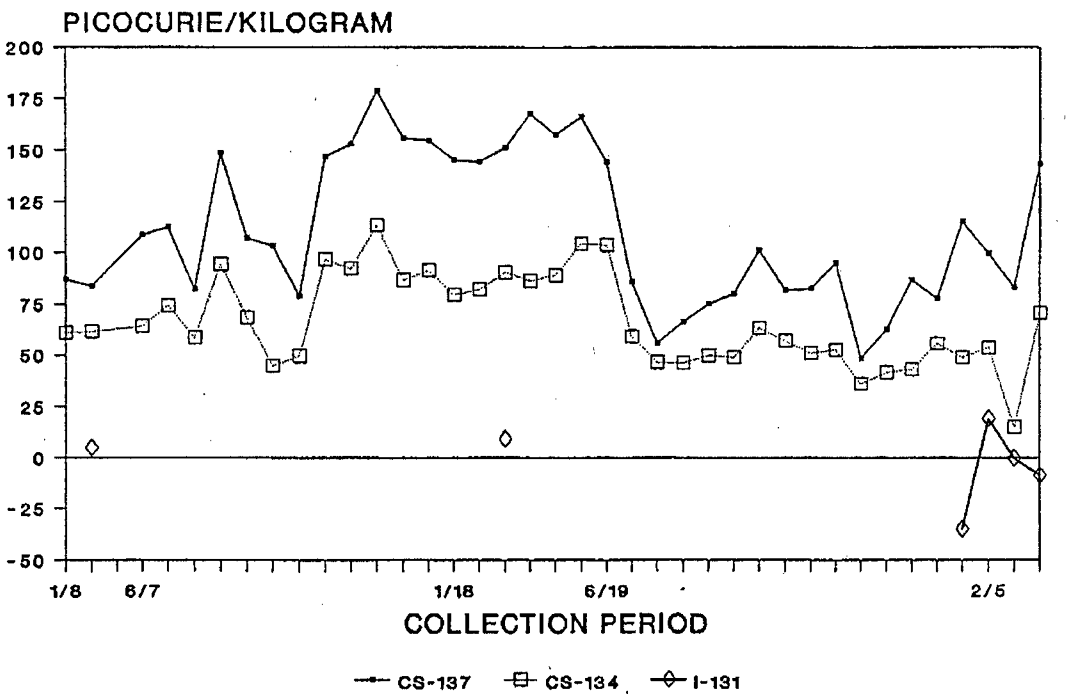
1990-92 ST101 RESULTS
ACTIVATION PRODUCTS



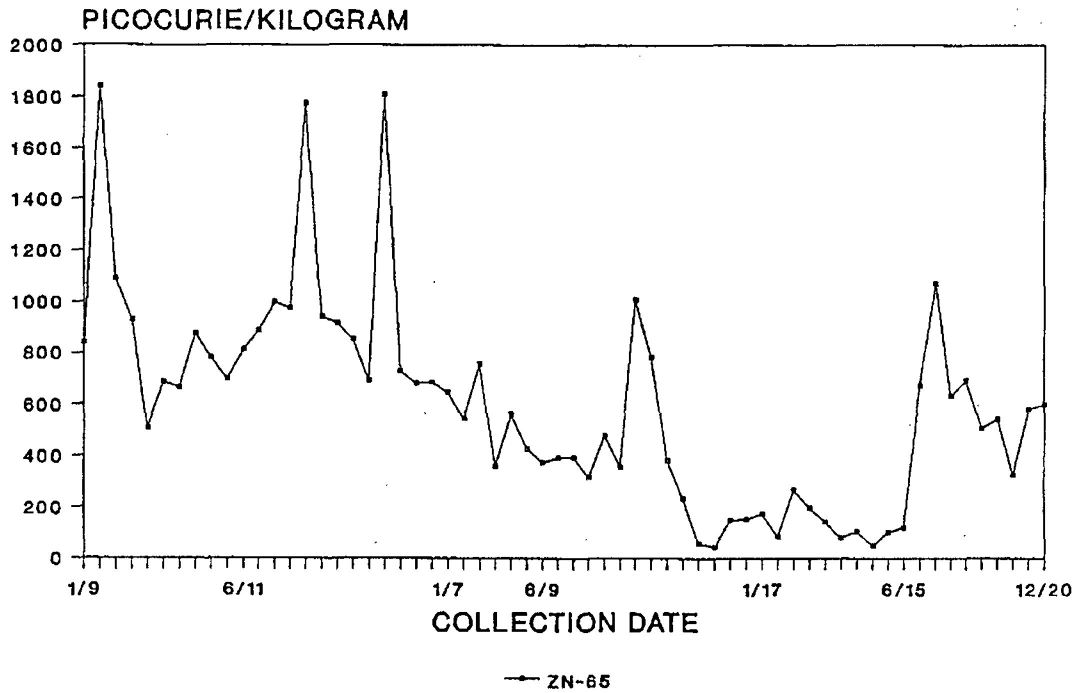
1987-89 ST101 RESULTS
FISSION PRODUCTS



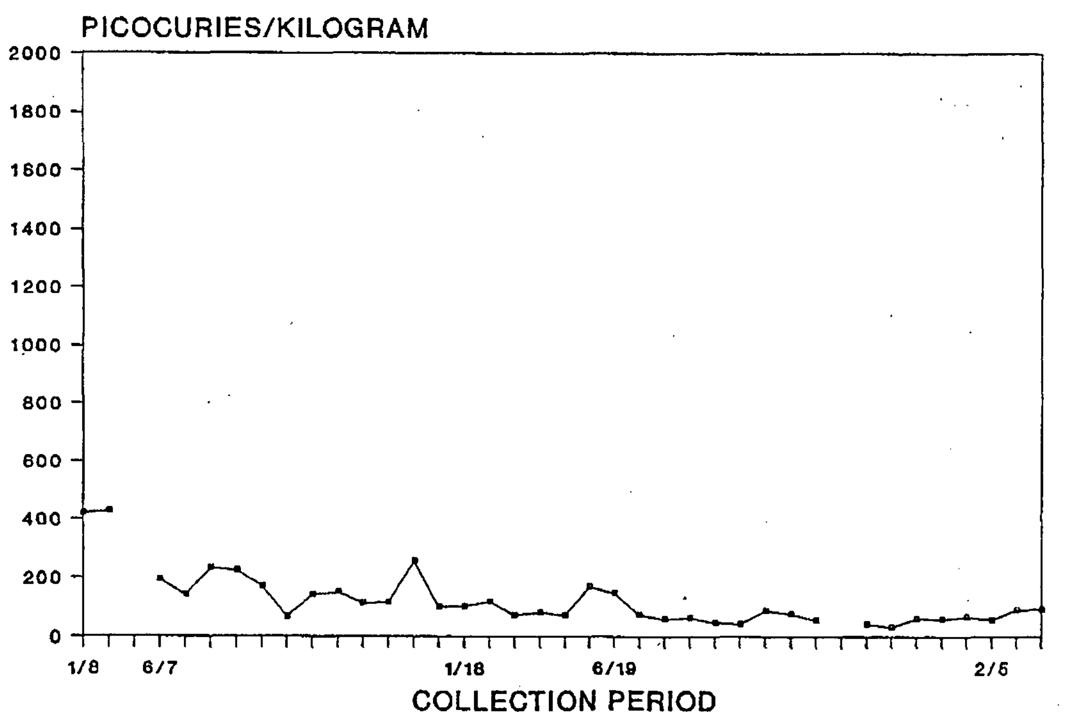
1990-92 ST101 RESULTS
FISSION PRODUCTS



1987-89 ST101 RESULTS
FISSION PRODUCTS



1990-92 ST101 RESULTS
FISSION PRODUCTS



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July 30, 1992
GO2-92-182
Docket No. 50-397

Mr. J.B. Martin, Regional Administrator
U.S. Nuclear Regulatory Commission
Region V
1450 Maria Lane, Suite 210
Walnut Creek, California 94596

Dear Mr. Martin:

Subject: **WNP-2 OPERATING LICENSE NPF-21, RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SPECIAL REPORT**

The attached nonroutine Radiological Environmental Monitoring Program report was written to fulfill the requirements of the Offsite Dose Calculation Manual (ODCM) Requirement For Operability 6.3.1.1. The Second Quarter 1992 average concentrations of iodine-131 and tritium in water sampled from the Plant 2 storm water drain exceeded the reporting levels listed in ODCM Table 6.3.1.1-2. An explanation of the problem, environmental sample results, and the causes are presented in the attached report.

Sincerely,

GC Sorensen

G.C. Sorensen, Manager
Regulatory Programs (Mail Drop 280)

CJC:pk
Attachment
cc: RR Assa, NRC
JL Erickson, WDOH
DL Williams, BPA (399)
NRC Site Inspector (901A)
NS Reynolds, Winston & Strawn
NRC, Document Control Desk
JJ Zeller, EFSEC

Author:	CJ Card CJ Card 7/30/92		**For Signature of:**	GC Sorensen 7/30/92	
Section:					
For Approval of:	JC Bell	JW Baker			
Approved:	JC Bell	JW Baker			
Date:	7/30/92	7/30/92			

WP-387 R2

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

P.O. Box 968 • 3000 George Washington Way • Richland, Washington 99352

July 30, 1992
GO2-92-182
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RADIOLOGICAL ENVIRONMENTAL MONITORING SPECIAL REPORT
JULY 1992

STATEMENT OF THE PROBLEM:

Water samples taken on April 29, May 13 and May 18, 1992, from the outfall to the storm drain effluent pond on the Plant 2 site contained elevated levels of iodine-131, cerium-141, and tritium. These samples also contained detectable levels of manganese-54, zinc-65, antimony-125, cesium-137 and cobalt-60. The concentrations of iodine-131 found in these three samples were 12.6, 21.1 and 1.2 pCi/liter. The tritium concentrations were 270,000 and 120,000 pCi/liter for the May 13 and May 18 samples, respectively.[1] The estimated second quarter 1992 average concentrations determined for iodine-131 and tritium were 2.4 pCi/liter and 46,000 pCi/liter, respectively.[2] These estimated average concentrations exceed the Nuclear Regulatory Commission's (NRC's) reporting levels for iodine-131 and for tritium, as given in Table 6.3.1.1-2 of the Offsite Dose Calculation Manual (ODCM). In addition, the individual results exceeded the investigation levels set by the Washington State Department of Health (DOH) and the Supply System for Radiological Environmental Monitoring Program (REMP) samples.[3]

DISCUSSION

The Plant 2 storm drain system receives water from several sources, including building roof drains, the Service Building floor drain sump, Diesel Generator Building floor drains, air-handling unit drains, backwash effluent from gravity and carbon filters in the Service Building, Turbine Building nonradioactive floor drains, and the dike around the condensate storage tanks. Water released through this system flows to a small pond area, about 400 feet

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[1] No tritium data is available for the April 29 sample.

[2] Based on time-weighted averages of all sample results. Averages of only the biweekly samples taken during the quarter were 4.0 and 91,000 pCi/liter for iodine-131 and tritium, respectively.

[3] Letter from R.A. Chitwood, Supply System, to Bob Mooney, DOH, "Establishing Reporting Levels for Supply System REMP Results," dated March 26, 1986; letter from John L. Erickson, DOH, to Joe Bell, Supply System, dated January 17, 1991.

in length, which is situated approximately 1500 feet northeast of the plant. The estimated water flow to the storm drain is approximately 30,000 gallons per day.

Floor drains in the Diesel Generator, Service, and Turbine Buildings, as well as the storm water drainage, are normally considered nonradioactive. However, the potential for radioactivity to enter these systems has been recognized. The drainage from the nonradioactive floor drain sumps in the Turbine Building is monitored before and during release to the storm drain by detectors which have alarm setpoints at 80% of the 10 CFR 20 Appendix B Table II value for cesium-137. The other floor and equipment drain systems connected to the storm drain system are not monitored. Drainage from the dike around the condensate storage tanks is analyzed before being routed to the storm drain or to radwaste.

Sediment samples and occasional water and vegetation samples have been collected from the storm drain since 1985. Low levels of cesium-137, cesium-134, cobalt-60 and zinc-65 have been routinely detected in the storm drain sediments, but no detectable radioactivity has been found in the vegetation and water prior to this year. The REMP began in February 1992 to take biweekly water (grab) samples and quarterly soil and vegetation samples, in addition to the monthly sediment samples from the storm drain outfall. Summaries and graphs of the sediment, water and vegetation results prior to 1992 and during the first four months of 1992 are presented in Attachments 1 and 2. The soil sample results are not included, since they are not directly related to the issues presented here.

On April 29 and May 13, 1992, the biweekly water samples and the monthly sediment samples were collected from the storm drain outfall. On May 15, Teledyne Isotopes, the analytical contractor for the REMP, reported that the gamma isotopic analysis results for the April 29 water sample indicated that it contained 12.6 pCi/liter of iodine-131. Recounts of the sample supported that analysis. On May 21, gamma isotopic analysis results for the May 13 water sample indicated not only detectable iodine-131, but detectable levels of several other radionuclides. A later tritium analysis indicated significant levels of that radionuclide, as well. The May 13 water sample results are presented in the following table. Also included in that table are the NRC reporting levels, the DOH investigation levels and

80% of the 10 CFR 20 Appendix B Table II maximum permissible concentrations (MPCs) for comparison.

MAY 13, 1992, WATER SAMPLE RESULTS COMPARED TO REGULATORY LEVELS
(pCi/liter)

Nuclide[4]	Sample Result ± 2σ	NRC Reporting Level *	DOH Investigation Level	80% Table II Value
iodine-131	21.1 ± 5.0	2	1	240
manganese-54	5.8 ± 3.6	1000	100	80,000
cobalt-60	124.7 ± 7.7	300	100	40,000
zinc-65	52.9 ± 10.2	300	100	80,000
antimony-125	20.8 ± 9.6	Not given	100	80,000
cesium-137	5.7 ± 3.3	50	100	16,000
cerium-141	707.0 ± 11.6	Not given	100	72,000
tritium	270,000 ± 10,000	30,000	1000	2,400,000

* quarterly average concentration

On May 22, PER # 292-0531, describing the storm drain water radioactivity, was completed. The State of Washington DOH was notified that the investigation levels for iodine-131, cerium-141 and cobalt-60 had been exceeded. The Region V office of the Nuclear Regulatory Commission was also notified of the results. Later, when the tritium result for the May 13 sample was received, DOH was again notified that an investigation level had been exceeded.

Tritium analyses were also performed on later samples, but none were as high as the May 13 sample. The second highest concentration was in the May 18 sample, which contained 120,000 pCi/liter. The quarterly average concentrations for iodine-131 and tritium estimated for the Second Quarter 1992 were, therefore, 2.4 and 46,000 pCi/liter, respectively.

[4] Analyses for strontium were also performed on this sample. The strontium-90 and strontium-89 results were below detection limits.

Summaries of the water sample results and percentages of the MPCs from 10 CFR 20 Appendix B Table II for water samples collected during the Second Quarter 1992 are presented in Attachment 3. The highest percent of an MPC during the quarter was the May 13 tritium result, which was 9% of the MPC value. Water samples collected after May 29 have not contained detectable levels of gamma-emitters or tritium.

The results of gamma and tritium analyses performed on other water samples taken before and during the second quarter indicate that the ratios of tritium concentrations to the concentrations of gamma-emitters, such as cesium-137, vary greatly. In storm drain water collected March 18, for example, the tritium concentration was elevated, 15,000 pCi/liter, while the only principal gamma-emitter detected was cobalt-60, which was present at a low concentration. The sump monitors, which can detect only gamma radiation, are therefore, not effective in preventing the release of water containing significant levels of tritium via the storm drain.

Some sediment samples taken at the storm drain outfall and pond during May also contained the same radionuclides observed in the May 13 water sample. A sediment sample taken on May 18 contained detectable levels of manganese-54, cerium-141 and cesium-134, in addition to the cobalt-60, zinc-65 and cesium-137 previously observed in the sediment. These radionuclides continued to be detected in sediment samples in June and July. A summary and graphs of these recent sediment sample results are presented in Attachment 4.

A special set of water, vegetation, and sediment samples was taken on May 22 at the pipe outfall and at five other locations around the pond, in order to characterize the spread of radionuclides to various parts of the pond. The concentrations of gamma-emitters in the water were below detection levels at all locations. The tritium results, however, were above detection levels at all locations. One water sample taken from the point furthest from the drain outfall, Location E, had a tritium result that exceeded the 1,000 pCi/liter DOH investigation level. The cobalt-60, zinc-65, cesium-137 and cerium-141 concentrations found in the sediment at some locations, especially at the point where the narrow stream bed widens into the main pond area, were above DOH investigation levels. Cattails collected at two locations in the pond had no detectable radioactivity, aside from potassium-40, which is naturally-occurring. As shown in Attachment 2, vegetation samples taken since then, however, have contained detectable levels of cesium-137, zinc-65, and cobalt-60. A summary and graphs of the water, vegetation, and sediment results for each sampling location used in this special study are presented in Attachment 5.

DOSE CALCULATIONS

The ODCM Requirement for Operability 6.3.1.1, applies to cases when, as result of plant effluents, levels of radioactivity in an environmental medium exceed NRC reporting levels. It requires that, in response to those levels, corrective actions be taken to reduce radioactive liquid effluents so that the potential annual dose to a member of the public is: (1) $\leq$ 1.5 mrem to the total body and $\leq$ 5 mrem to any organ during any calendar quarter, and (2) $\leq$ 3 mrem to the total body and $\leq$ 10 mrem to any organ for any calendar year. The storm drain has no direct pathway to members of the public, so it is highly unlikely that the measured radioactivity in the pond water would impact the dose to members of the public. Even if an individual drank this water every day, the annual dose to total body and to the maximum organ would still be below the above limits.[5]

CAUSES OF THE RELEASES TO THE STORM DRAIN:

The most probable sources of the radioactivity observed in the storm drain pond were releases of liquids associated with the turbine replacement and other nonroutine outage work in the Turbine Building. Other contributing factors include the use of 10 CFR 20 Appendix B Table II levels as the criteria for releases, sump monitor setpoints, the assumption that sufficient levels of gamma-emitters would accompany the beta-emitters and the limited ability of the radwaste processing system to handle water with high organic and silica content.

[5] The estimated total body and maximum organ doses for the second quarter are 0.4 and 1.5 mrem, respectively. The estimated annual doses to the total body and to the maximum organ are 1.6 and 5.9 mrem, respectively. These estimated doses were calculated using the quarterly averages and ODCM Equation 5.

The specific factors that have been considered in order to resolve the problem are:

a) Some water has been released to the storm drain if the radioactivity it contained was below 80% of 10 CFR 20 Appendix B, Table II levels. Since the sump monitoring systems are designed to detect 80% of the 10 CFR 20 Appendix B Table II levels of radioactivity, levels below the Table II values could be released to the environment. These levels are up to 1000 times greater than the NRC reporting levels for environmental samples;

b) The sensitivity of the sump monitors and the residual radioactivity in the Turbine Building nonradioactive sumps makes the monitoring equipment appropriate only for detecting gamma radioactivity in the sump. The monitors are not designed to detect beta-emitters;

c) Supply System policies and procedures do not clearly specify the criteria for the release or the transfer of water from potentially contaminated sumps to clean drain systems.

CORRECTIVE ACTIONS:

The ODCM Requirement for Operability 6.3.1.1 requires that corrective actions be taken to reduce radioactive effluents so that the potential annual dose to a member of the public would be within the limits discussed in the Dose Calculation section of this report. Based on the conservative evaluation performed, no corrective actions are needed to reduce the dose to the public.

The Supply System's response to PER 292-0531 (elevated levels of radioactivity detected in the storm drain pond) included the following actions:

a) Administrative controls were tightened on release of liquids to the storm drain system to preclude further releases of radioactivity;

b) A formal root cause analysis was instituted to identify the causes of the elevated readings and further corrective actions to prevent recurrence of the problem;

c) Efforts underway prior to the event were accelerated to ensure that all floor drains were properly and clearly labeled to distinguish between radioactive and nonradioactive drains, and established policy prohibiting discharge of liquids to plant drains was reinforced.

Proposed corrective actions from the root cause analysis include strengthening and clarifying the policies and procedures, investigating the monitoring system capabilities and sensitivities to determine the feasibility of improving the sensitivity to low levels of activity, and investigating other leak paths into the system to ensure that all sources of radioactive water are isolated. These actions are judged to be sufficient to prevent recurrence of the spikes of activity observed in the storm drain pond.

ATTACHMENT 1

ST101 SEDIMENT - 1987 TO APRIL 1992

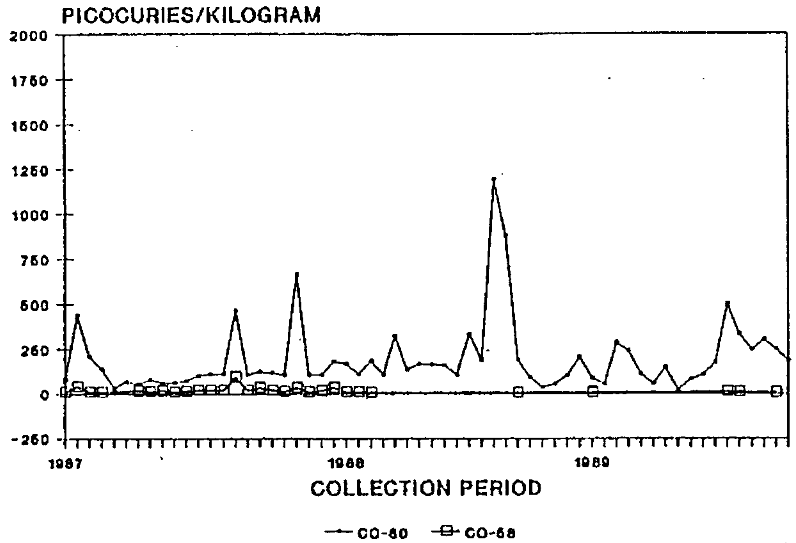
1987-92 ST101 SEDIMENT RESULTS - PICOCURIES/KILOGRAM

DATE	CS-137	CS-134	CO-60	CO-58	ZN-65	I-131
01/09/87	3.80E+01	4.50E+00	7.80E+01	7.90E+00	8.40E+02	
01/27/87	4.81E+01		4.35E+02	3.93E+01	1.84E+03	
02/05/87	3.57E+01		2.08E+02	9.20E+00	1.09E+03	
02/19/87	4.70E+01		1.37E+02	7.78E+00	9.28E+02	
03/20/87	3.63E+01		3.44E+01		5.07E+02	
04/02/87	4.32E+01		6.93E+01		6.89E+02	
04/23/87	3.15E+01		5.33E+01	1.55E+01	6.66E+02	
05/01/87	4.93E+01	4.90E+00	7.85E+01	1.29E+01	8.76E+02	
05/21/87	4.99E+01		6.16E+01	1.62E+01	7.81E+02	
05/29/87	4.70E+01	8.82E+00	6.11E+01	7.62E+00	6.97E+02	
06/11/87	4.39E+01	7.75E+00	7.17E+01	1.41E+01	8.10E+02	
06/28/87	4.66E+01	8.90E+00	1.00E+02	2.07E+01	8.87E+02	
07/10/87	4.09E+01		1.09E+02	2.03E+01	1.00E+03	
07/13/87	4.80E+01	1.27E+01	1.10E+02	1.86E+01	9.75E+02	
07/23/87	5.35E+01	1.48E+01	4.66E+02	9.36E+01	1.78E+03	
08/10/87	4.21E+01		1.07E+02	2.01E+01	9.42E+02	
08/20/87	4.69E+01		1.25E+02	3.35E+01	9.14E+02	
09/03/87	3.83E+01	9.79E+00	1.18E+02	2.02E+01	8.52E+02	
10/09/87	4.44E+01		1.07E+02	1.21E+01	6.94E+02	
10/28/87	1.50E+02	5.42E+01	6.64E+02	3.49E+01	1.81E+03	
11/12/87	4.34E+01		1.08E+02	1.03E+01	7.29E+02	
11/24/87	4.89E+01	2.35E+01	1.07E+02	1.46E+01	6.82E+02	
12/10/87	5.29E+01	2.82E+01	1.81E+02	3.28E+01	6.85E+02	6.06E+00
01/07/88	5.62E+01	2.54E+01	1.66E+02	9.49E+00	6.46E+02	
01/21/88	5.49E+01	2.39E+01	1.09E+02	1.04E+01	5.43E+02	
02/12/88	7.29E+01	2.71E+01	1.84E+02	6.36E+00	7.57E+02	
03/23/88	3.65E+01	1.78E+01	1.08E+02		3.60E+02	
04/18/88	4.87E+01	2.16E+01	3.20E+02		5.62E+02	1.79E+01
05/11/88	5.67E+01	2.76E+01	1.36E+02		4.27E+02	2.86E+01
06/09/88	3.75E+01	2.94E+01	1.64E+02		3.73E+02	1.54E+01
06/28/88	6.88E+01	3.14E+01	1.63E+02		3.93E+02	
07/08/88	6.94E+01	4.83E+01	1.57E+02		3.93E+02	
07/21/88	6.85E+01	3.37E+01	1.06E+02		3.15E+02	
08/04/88	7.78E+01	4.65E+01	3.31E+02		4.77E+02	
08/19/88	6.64E+01	4.38E+01	1.87E+02		3.55E+02	
09/01/88	9.54E+01	4.89E+01	1.19E+03		1.01E+03	
09/19/88	8.76E+01	3.71E+01	8.74E+02		7.82E+02	
10/10/88	6.88E+01	4.25E+01	1.91E+02	6.23E+00	3.81E+02	
10/25/88	6.02E+01	3.75E+01	9.39E+01		2.33E+02	
11/17/88	2.77E+01		3.86E+01		5.55E+01	
11/29/88	3.06E+01	2.41E+01	5.39E+01		4.15E+01	
12/09/88	4.92E+01	4.60E+01	1.02E+02		1.48E+02	
12/22/88	4.54E+01	3.70E+01	2.05E+02		1.50E+02	
01/17/89	5.76E+01	4.53E+01	8.44E+01	4.85E+00	1.74E+02	
01/31/89	5.03E+01	3.26E+01	5.41E+01		8.48E+01	
02/17/89	7.16E+01	6.40E+01	2.82E+02		2.69E+02	
02/28/89	8.68E+01	6.35E+01	2.40E+02		1.97E+02	
03/23/89	5.02E+01	4.84E+01	1.11E+02		1.43E+02	
04/14/89	4.95E+01	6.60E+01	5.73E+01		8.08E+01	
04/28/89	8.00E+01	7.04E+01	1.46E+02		1.04E+02	
05/18/89	2.99E+01	4.08E+01	2.34E+01		4.72E+01	
05/31/89	5.49E+01	4.09E+01	8.28E+01		1.00E+02	
06/15/89	6.53E+01	3.58E+01	1.07E+02		1.19E+02	
07/05/89	6.36E+01	3.91E+01	1.72E+02		6.74E+02	
08/28/89	1.14E+02	1.27E+02	5.00E+02	1.29E+01	1.08E+03	

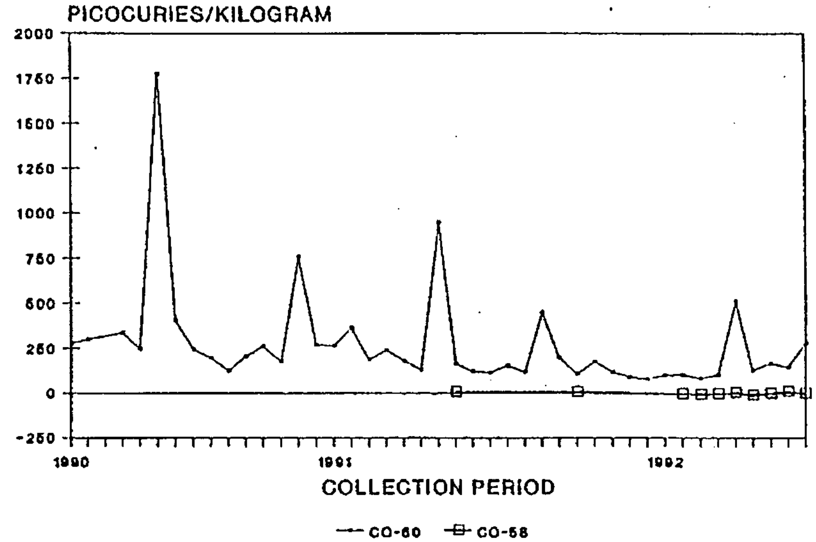
1987-92 ST101 SEDIMENT RESULTS – PICOCURIES/KILOGRAM

DATE	CS-137	CS-134	CO-60	CO-58	ZN-65	I-131
09/13/89	5.81E+01	6.28E+01	3.33E+02	1.04E+01	6.33E+02	
09/26/89	1.09E+02	7.22E+01	2.46E+02		6.94E+02	
10/13/89	6.20E+01	5.73E+01	3.03E+02		5.08E+02	
10/30/89	7.67E+01	5.84E+01	2.48E+02	4.68E+00	5.44E+02	7.61E+00
11/21/89	6.38E+01	4.19E+01	1.82E+02		3.25E+02	
12/07/89	9.31E+01	6.63E+01	3.98E+02		5.81E+02	
12/20/89	9.95E+01	6.62E+01	3.50E+02		6.00E+02	6.67E+00
01/08/90	8.70E+01	6.11E+01	2.76E+02		4.18E+02	
02/05/90	8.37E+01	6.17E+01	2.99E+02		4.25E+02	4.50E+00
03/23/90						
06/07/90	1.08E+02	6.43E+01	3.36E+02		1.92E+02	
06/29/90	1.12E+02	7.44E+01	2.46E+02		1.42E+02	
07/13/90	8.23E+01	5.88E+01	1.78E+03		2.32E+02	
07/19/90	1.49E+02	9.41E+01	4.06E+02		2.23E+02	
08/08/90	1.07E+02	6.87E+01	2.42E+02		1.70E+02	
08/31/90	1.04E+02	4.50E+01	1.97E+02		6.70E+01	
09/05/90	7.89E+01	4.98E+01	1.24E+02		1.41E+02	
10/05/90	1.47E+02	9.67E+01	2.06E+02		1.49E+02	
10/30/90	1.53E+02	9.24E+01	2.60E+02		1.12E+02	
11/08/90	1.79E+02	1.13E+02	1.75E+02		1.13E+02	
11/28/90	1.56E+02	8.66E+01	7.55E+02		2.57E+02	
12/28/90	1.55E+02	9.13E+01	2.68E+02		1.00E+02	
01/18/91	1.45E+02	7.97E+01	2.63E+02		1.02E+02	
02/15/91	1.45E+02	8.21E+01	3.62E+02		1.18E+02	
03/15/91	1.51E+02	9.05E+01	1.87E+02		7.09E+01	8.96E+00
03/29/91	1.68E+02	8.64E+01	2.37E+02		8.14E+01	
04/17/91	1.58E+02	8.90E+01	1.80E+02		7.02E+01	
05/15/91	1.66E+02	1.04E+02	1.28E+02		1.70E+02	
06/19/91	1.44E+02	1.04E+02	9.48E+02		1.47E+02	
06/28/91	8.57E+01	5.93E+01	1.63E+02	6.00E+00	7.30E+01	
07/11/91	5.59E+01	4.67E+01	1.19E+02		5.87E+01	
07/25/91	6.68E+01	4.65E+01	1.13E+02		6.14E+01	
08/20/91	7.50E+01	4.98E+01	1.53E+02		4.49E+01	
08/30/91	8.03E+01	4.90E+01	1.17E+02		4.05E+01	
09/13/91	1.01E+02	6.35E+01	4.49E+02		8.75E+01	
10/01/91	8.20E+01	5.73E+01	1.96E+02		7.67E+01	
10/18/91	8.25E+01	5.10E+01	1.06E+02	4.95E+00	5.64E+01	
10/31/91	9.47E+01	5.25E+01	1.77E+02			
11/21/91	4.83E+01	3.62E+01	1.16E+02		4.04E+01	
12/12/91	6.28E+01	4.17E+01	9.04E+01		3.07E+01	
12/31/91	8.69E+01	4.30E+01	7.71E+01		5.96E+01	
(S/S) 01/23/92	7.79E+01	5.57E+01	1.01E+02		5.80E+01	
(TELE 01/23/92	1.15E+02	4.90E+01	1.03E+02	-2.80E+00	6.60E+01	-3.50E+01
02/05/92	9.95E+01	5.37E+01	8.22E+01	-9.20E+00	5.51E+01	1.90E+01
02/19/92	8.30E+01	1.50E+01	1.04E+02	-3.40E+00	9.08E+01	-4.20E-01
03/04/92	1.43E+02	7.09E+01	5.11E+02	3.40E+00	9.30E+01	-8.80E+00
03/18/92	1.43E+02	7.86E+01	1.27E+02	-1.30E+01	9.40E+01	-1.80E+01
04/02/92	1.40E+02	6.16E+01	1.64E+02	-1.80E+00	1.22E+02	1.20E+01
04/15/92	1.08E+02	2.70E+01	1.46E+02	9.20E+00	1.31E+02	-5.50E+00
04/29/92	1.47E+02	8.90E+01	2.79E+02	-9.70E-01	1.43E+02	6.10E+00
Average	8.07E+01	5.18E+01	2.28E+02	1.33E+01	4.08E+02	4.07E+00
High	1.79E+02	1.27E+02	1.78E+03	9.36E+01	1.84E+03	2.86E+01
Low	2.77E+01	4.50E+00	2.34E+01	-1.30E+01	3.07E+01	-3.50E+01
# of Sample	104	91	104	39	103	16

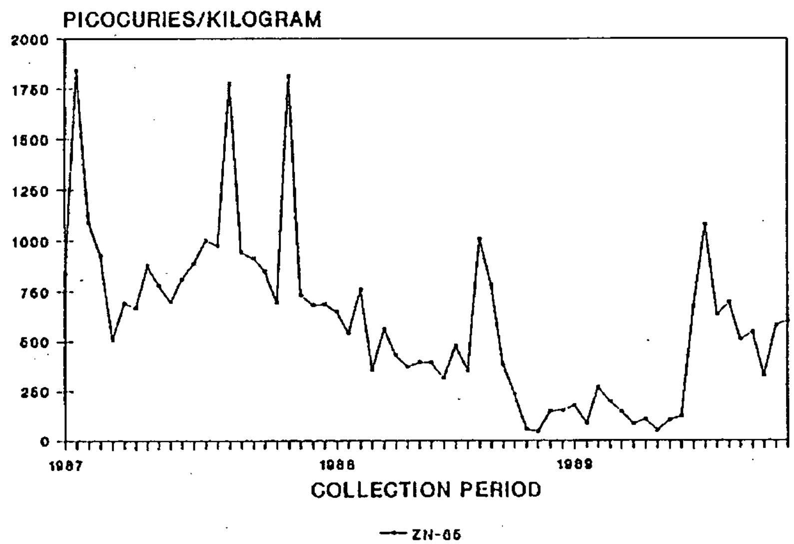
1987-89 ST101 RESULTS
Co-60 and Co-58 Thru 12/20/89



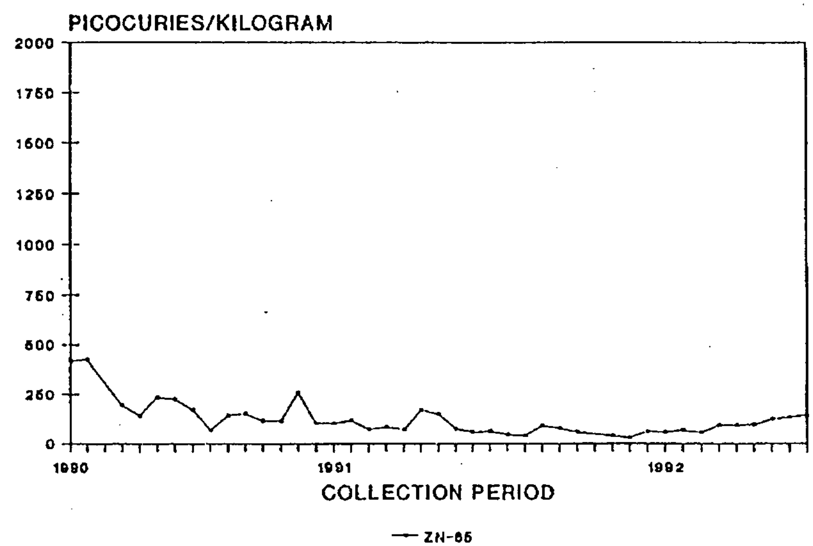
1990-92 ST101 RESULTS
Co-60 and Co-58 thru 04/29/92



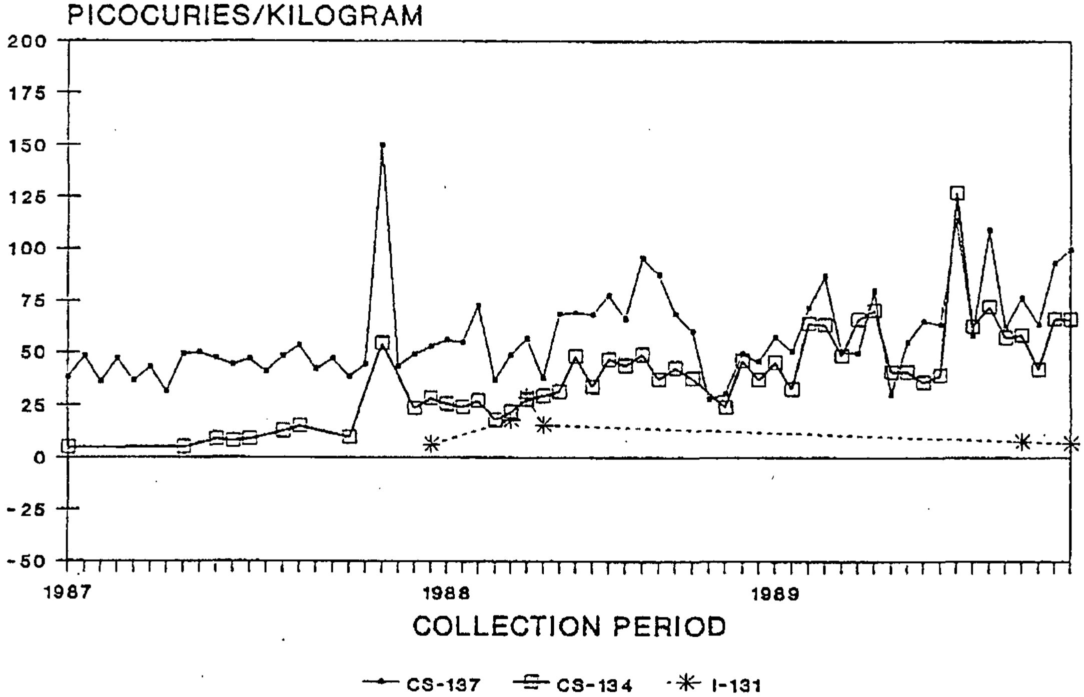
1987-89 ST101 RESULTS
Zn-65 thru 12/20/89



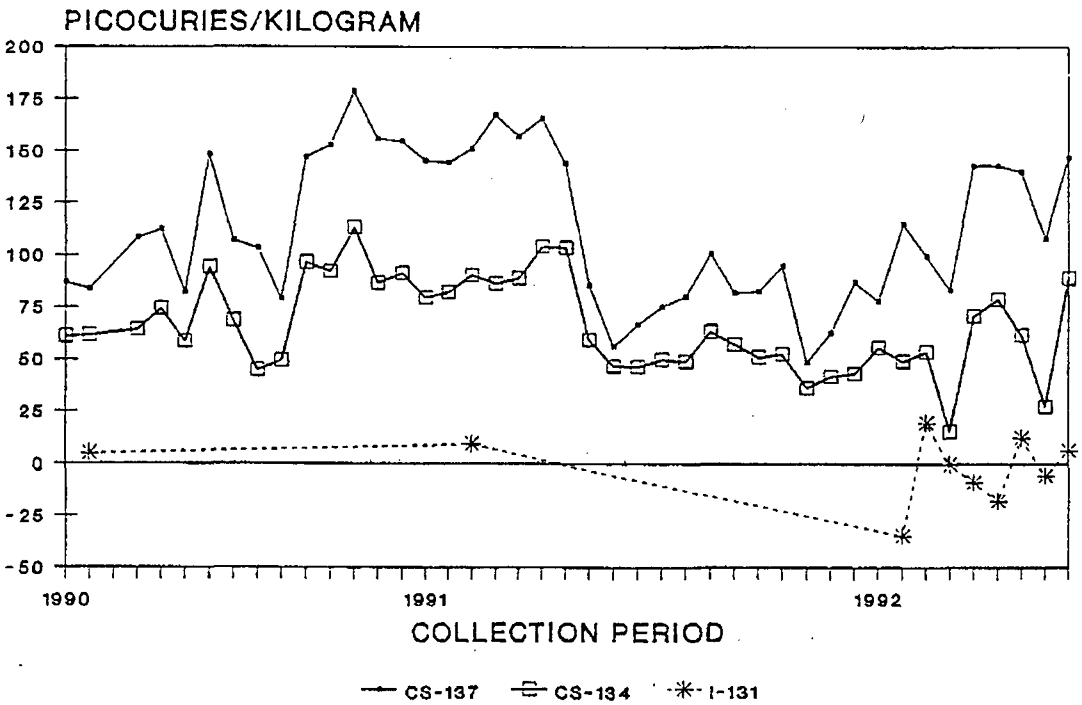
1990-92 ST101 RESULTS
Zn-65 thru 04/29/92



1987-89 ST101 RESULTS
Cs-137, Cs-134 and I-131 thru 12/20/89



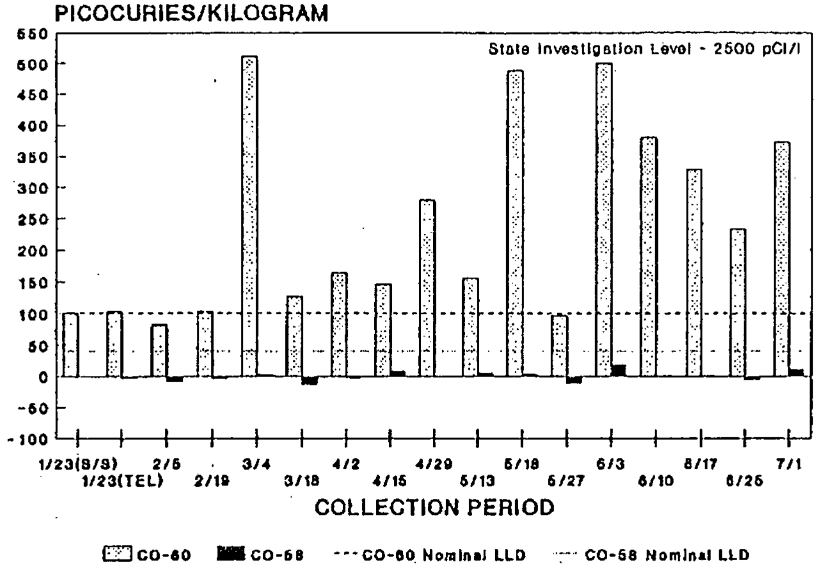
1990-92 ST101 RESULTS
Cs-137, Cs-134 and I-131 thru 04/29/92



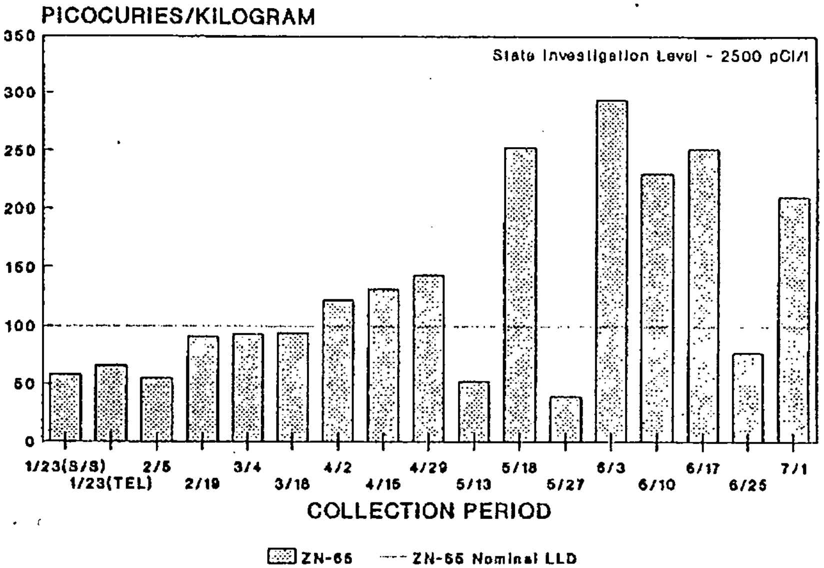
ATTACHMENT 2

1992 ST101 SEDIMENT, WATER AND VEGETATION RESULTS

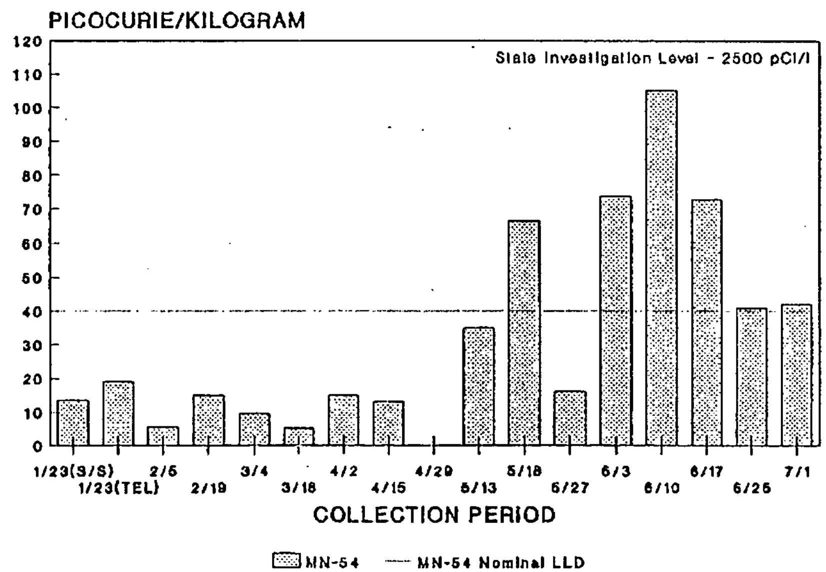
1992 ST101 SEDIMENT RESULTS
ACTIVATION PRODUCTS



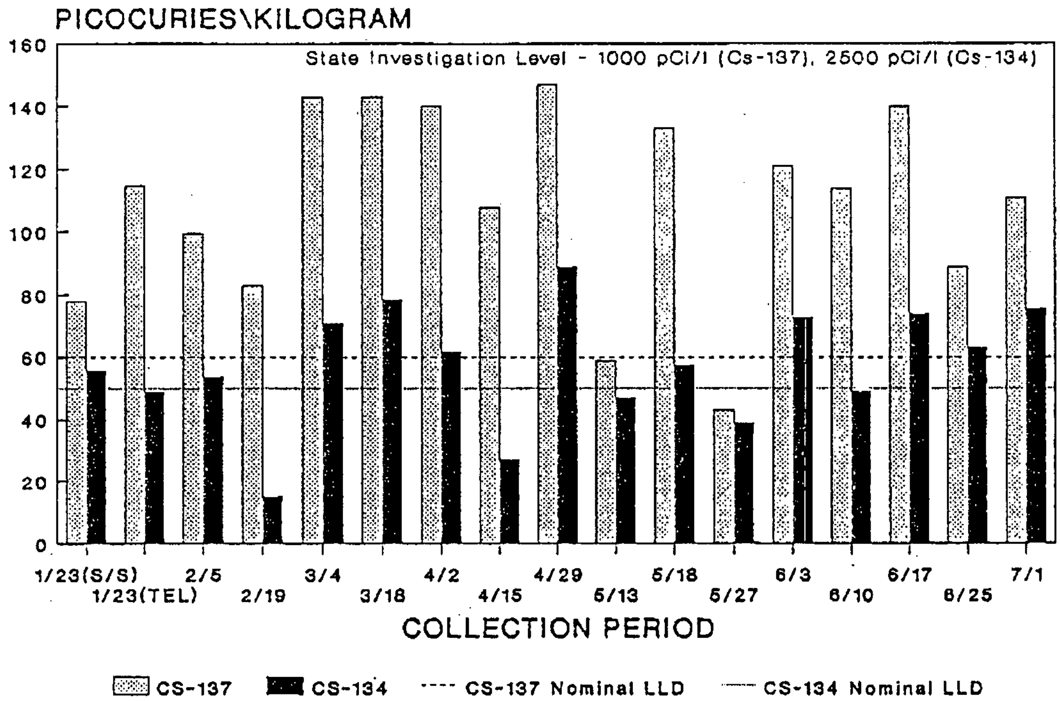
1992 ST101 SEDIMENT RESULTS
ACTIVATION PRODUCTS



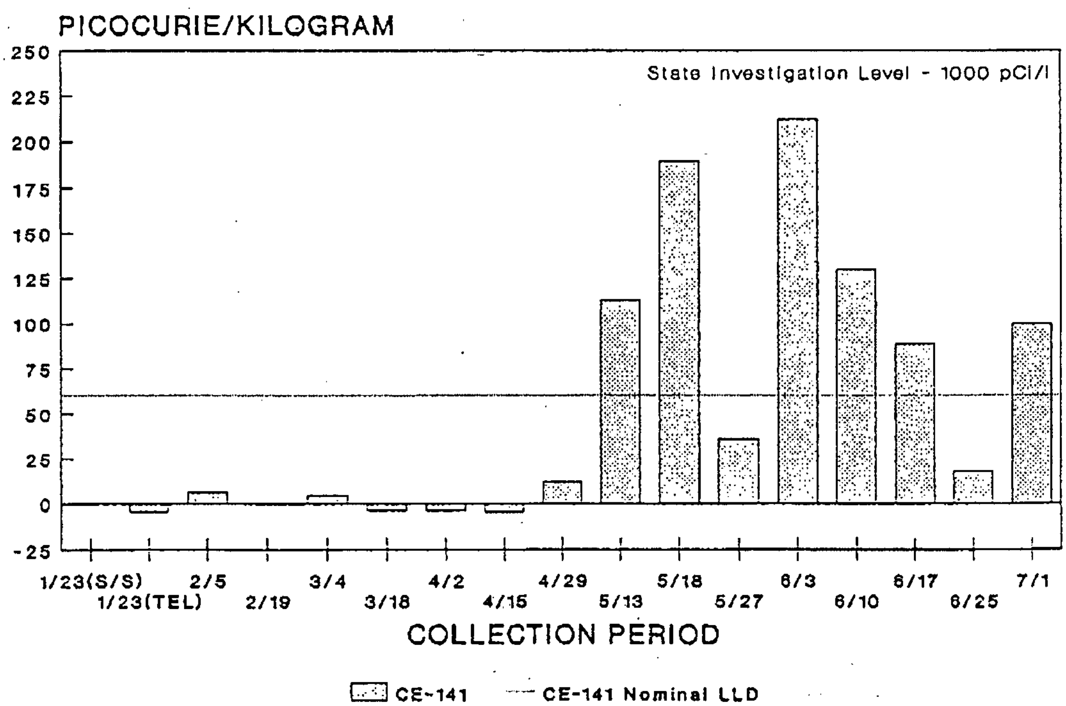
1992 ST101 SEDIMENT RESULTS
ACTIVATION PRODUCTS



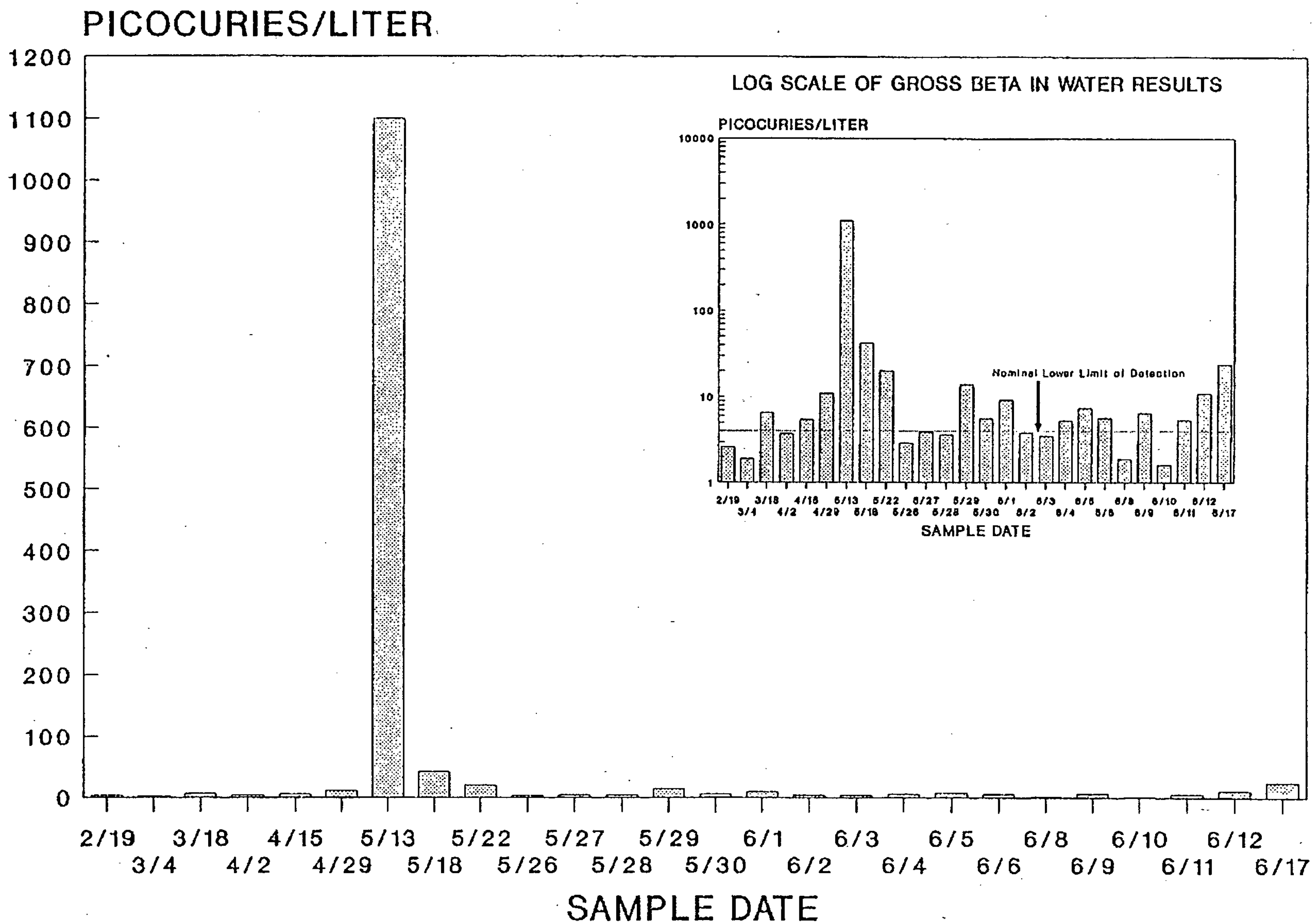
1992 ST101 SEDIMENT RESULTS
FISSION PRODUCTS



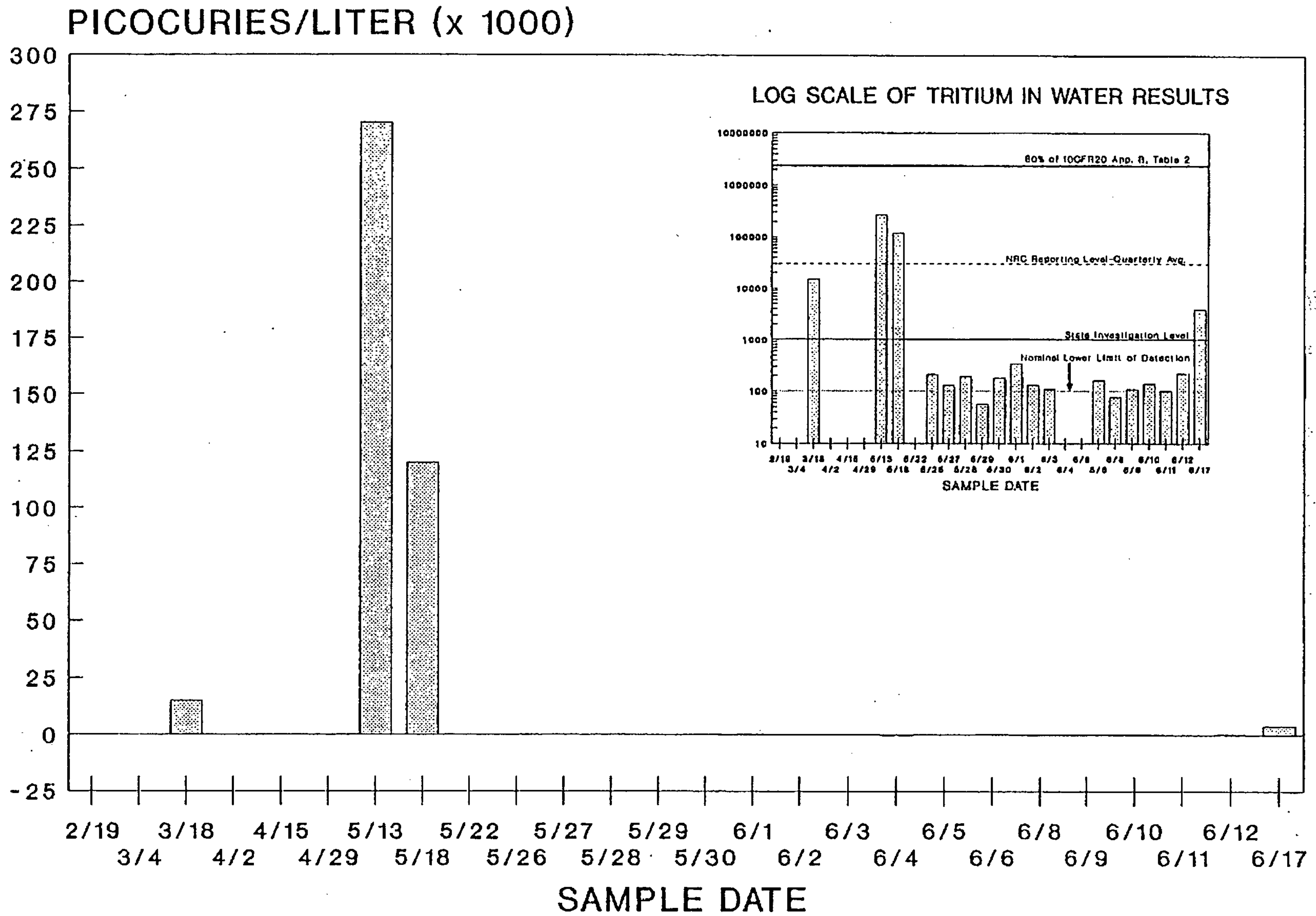
1992 ST101 SEDIMENT RESULTS
FISSION PRODUCTS



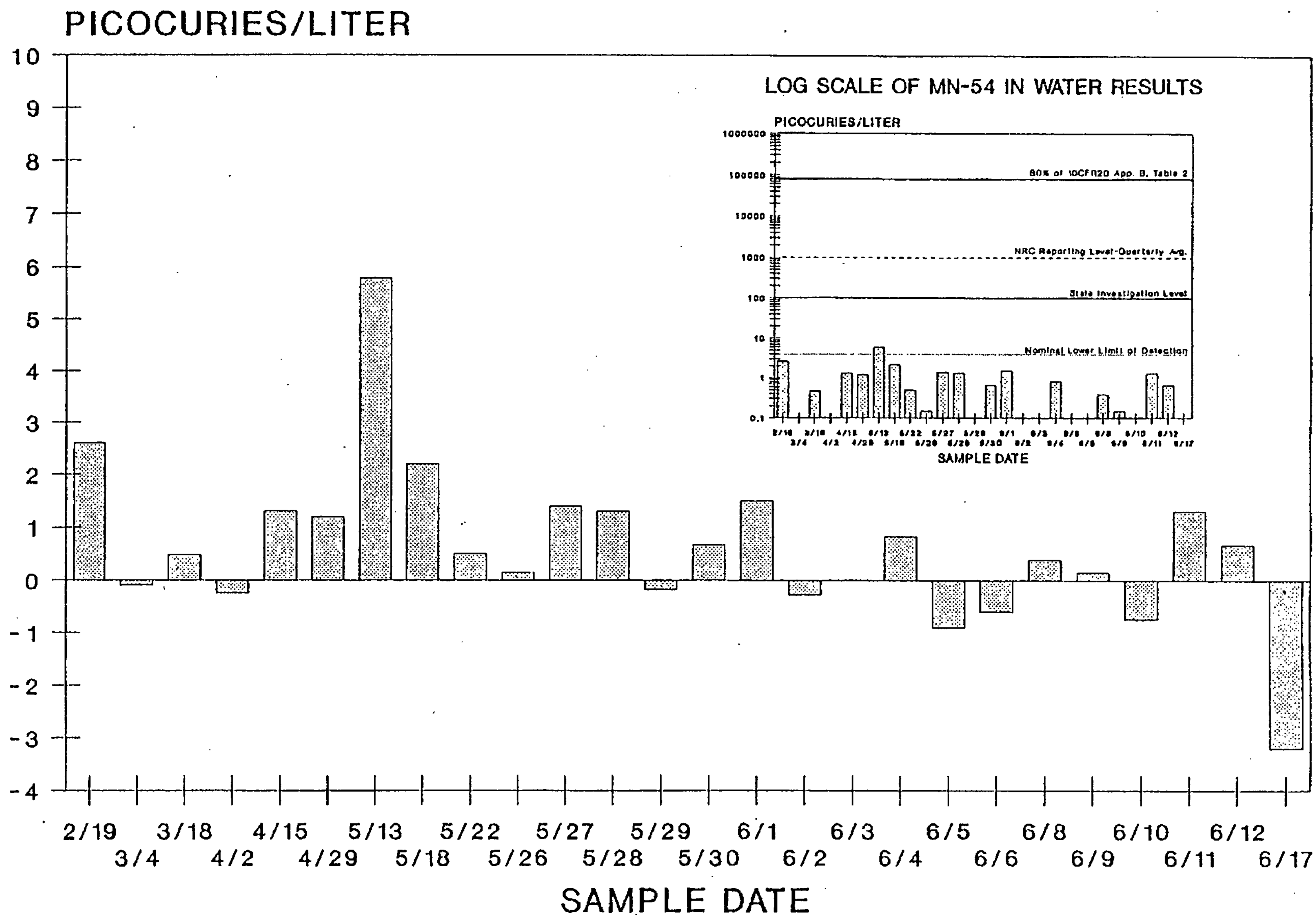
1992 GROSS BETA IN WATER RESULTS
FOR ST101 DRAINAGE LAGOON

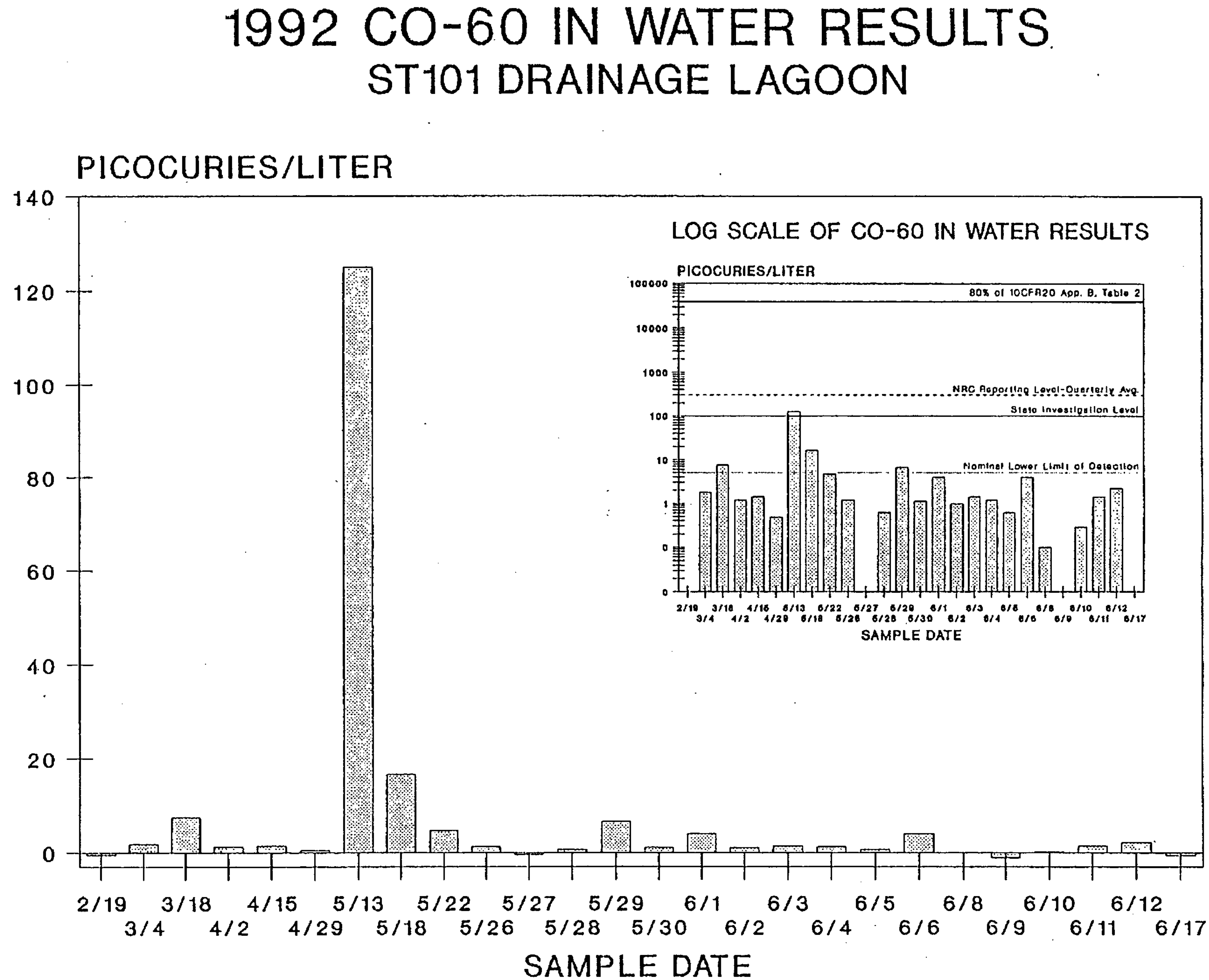


1992 TRITIUM IN WATER RESULTS
FOR ST101 DRAINAGE LAGOON



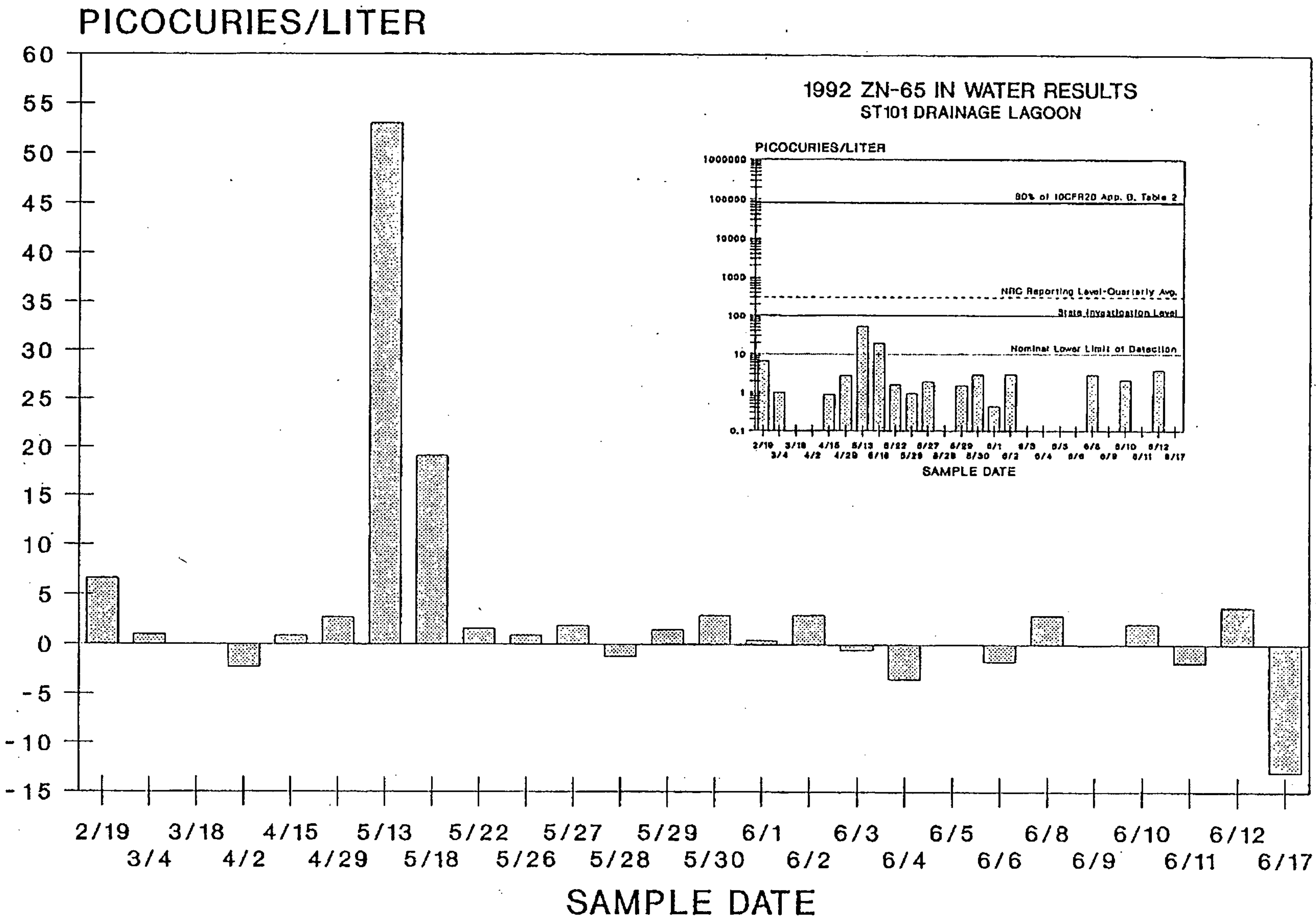
1992 MN-54 IN WATER RESULTS
ST101 DRAINAGE LAGOON



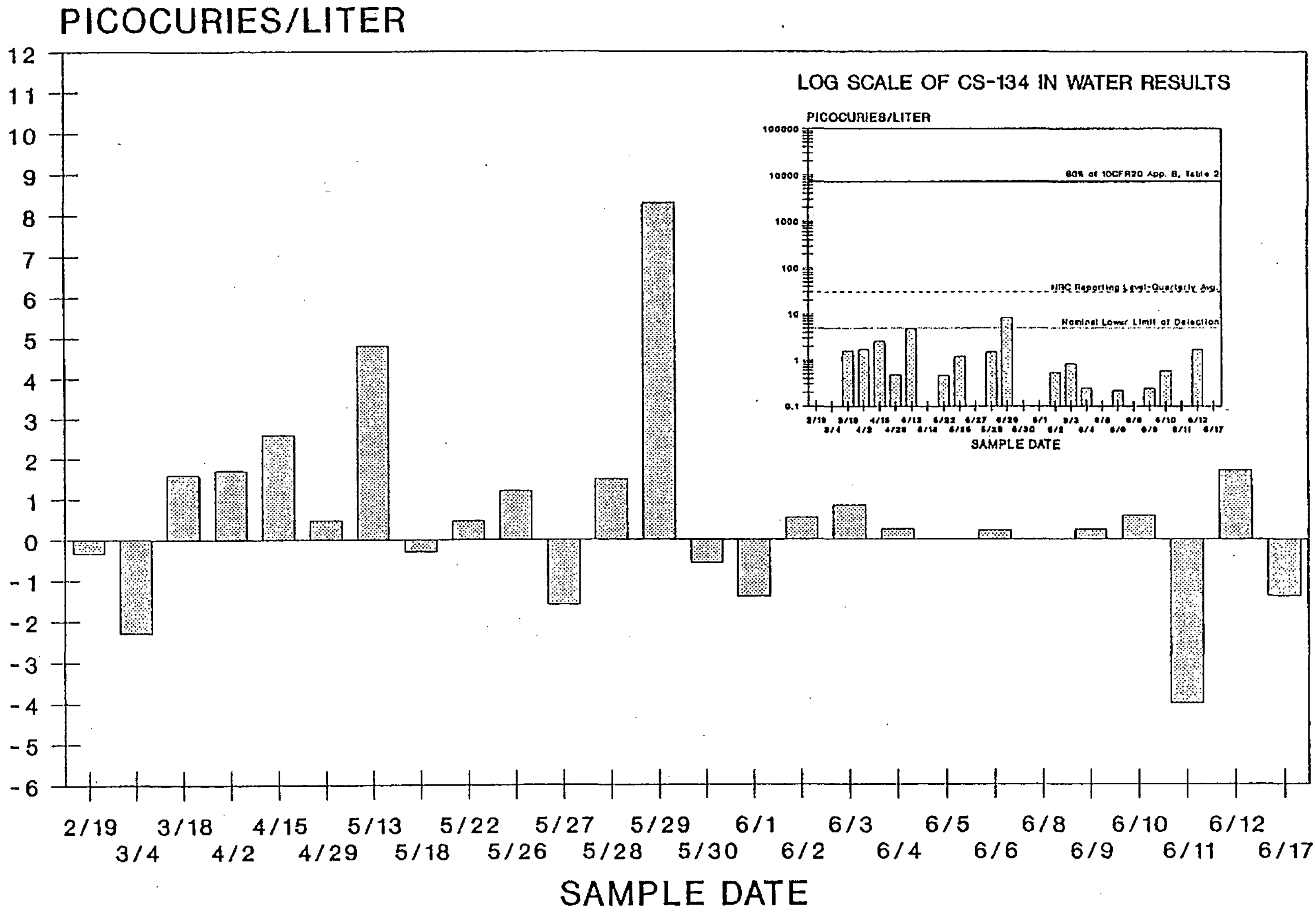


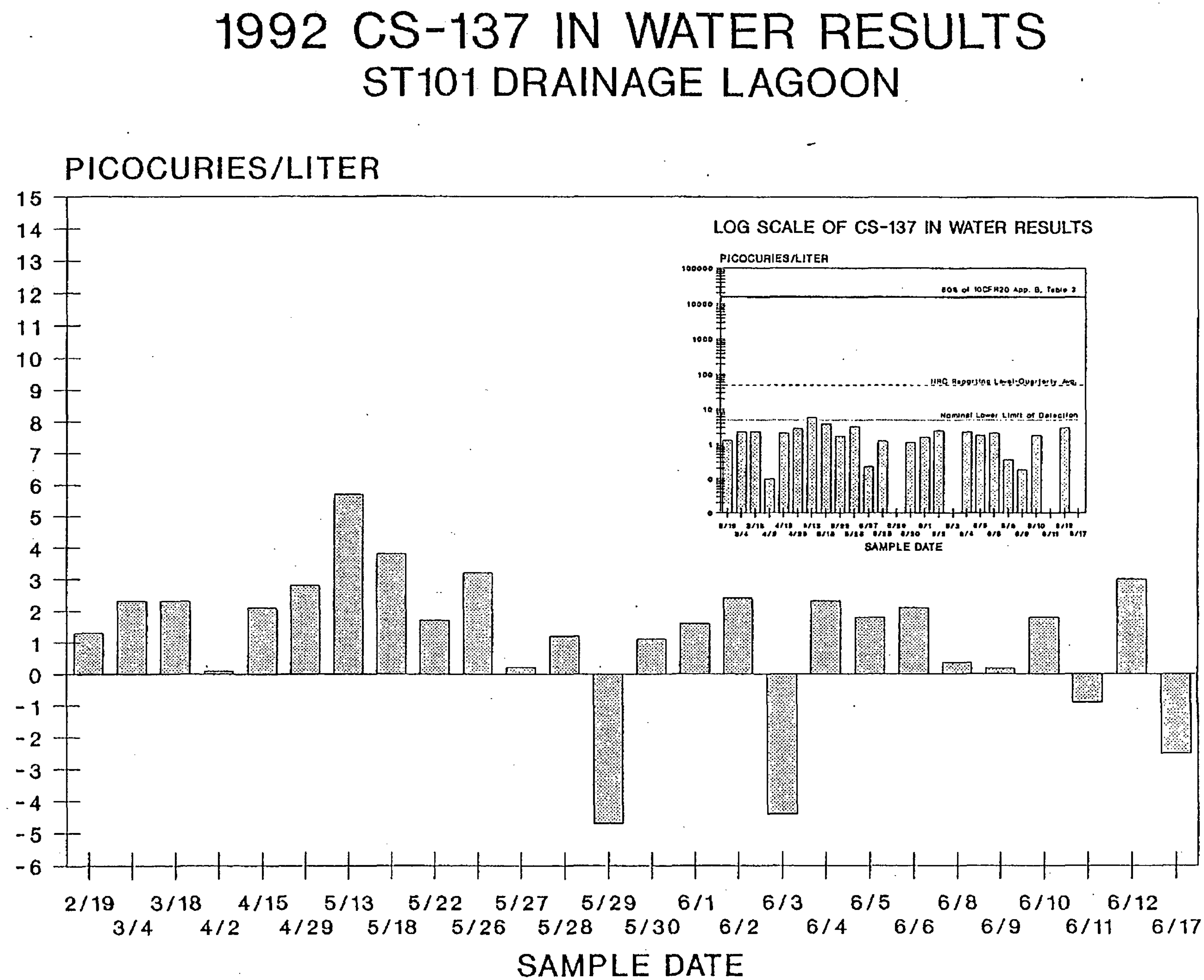
1992 CO-60 IN WATER RESULTS
ST101 DRAINAGE LAGOON
PICOCURIES/LITER
140
120
100
80
60
40
20
0
2/19
3/4
3/18
4/2
4/15
4/29
5/13
5/18
5/22
5/26
5/27
5/28
5/29
5/30
6/1
6/2
6/3
6/4
6/5
6/6
6/8
6/9
6/10
6/11
6/12
6/17
SAMPLE DATE
LOG SCALE OF CO-60 IN WATER RESULTS
PICOCURIES/LITER
100000
10000
1000
100
10
1
0
80% of 10CFR20 App. B, Table 2
NRC Reporting Level-Quarterly Avg.
State Investigation Level
Nominal Lower Limit of Detection
SAMPLE DATE

1992 ZN-65 IN WATER RESULTS
ST101 DRAINAGE LAGOON



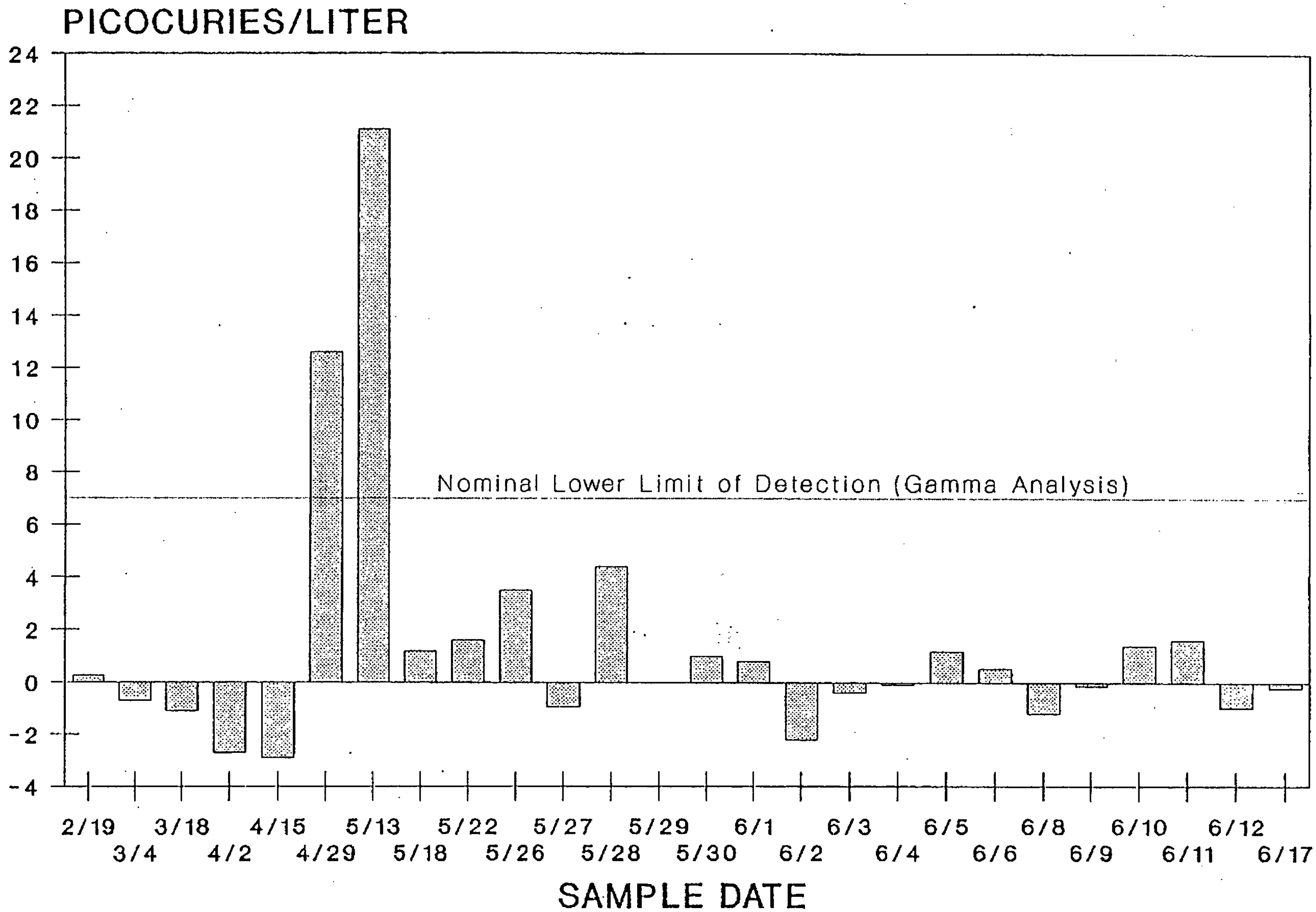
1992 CS-134 IN WATER RESULTS
ST101 DRAINAGE LAGOON



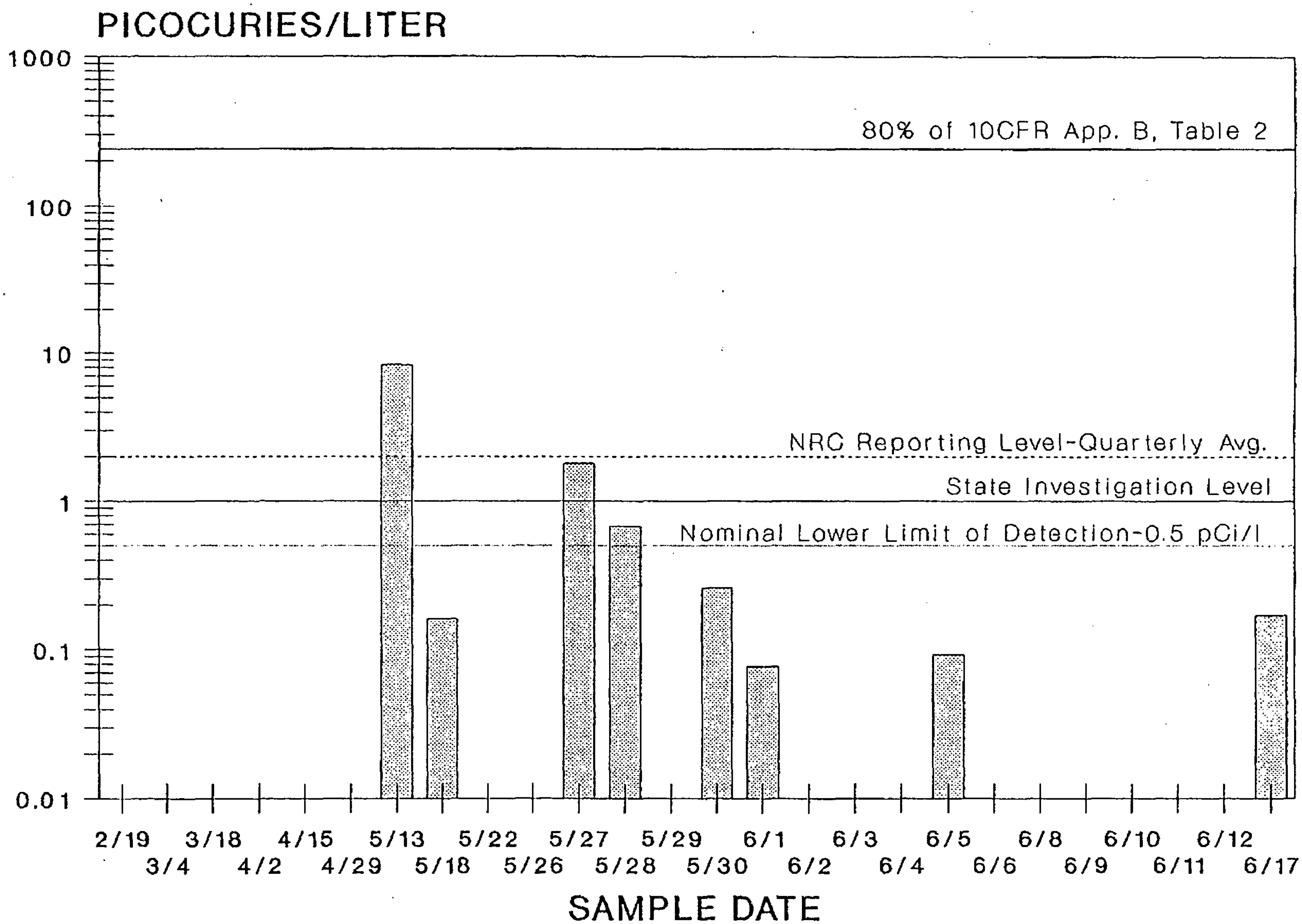


1992 CS-137 IN WATER RESULTS
ST101 DRAINAGE LAGOON
PICOCURIES/LITER
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
2/19 3/4 3/18 4/2 4/15 4/29 5/13 5/18 5/22 5/26 5/27 5/28 5/29 5/30 6/1 6/2 6/3 6/4 6/5 6/6 6/8 6/9 6/10 6/11 6/12 6/17
SAMPLE DATE
LOG SCALE OF CS-137 IN WATER RESULTS
PICOCURIES/LITER
100000
10000
1000
100
10
1
SAMPLE DATE

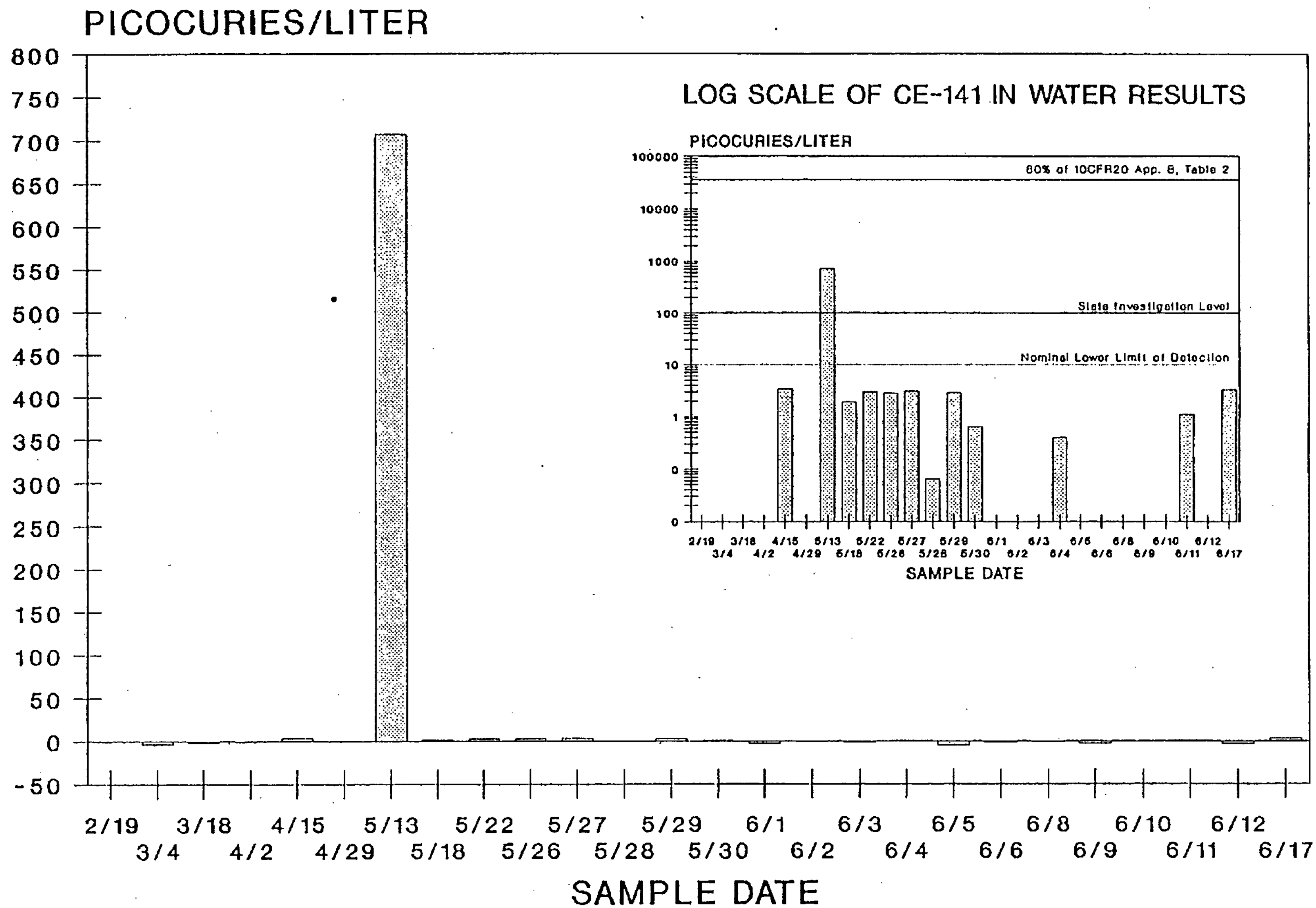
1992 I-131 IN WATER RESULTS
FOR ST101 DRAINAGE LAGOON (GAMMA)



1992 I-131 IN WATER RESULTS
FOR ST101 DRAINAGE LAGOON (RESIN)



1992 CE-141 IN WATER RESULTS
ST101 DRAINAGE LAGOON

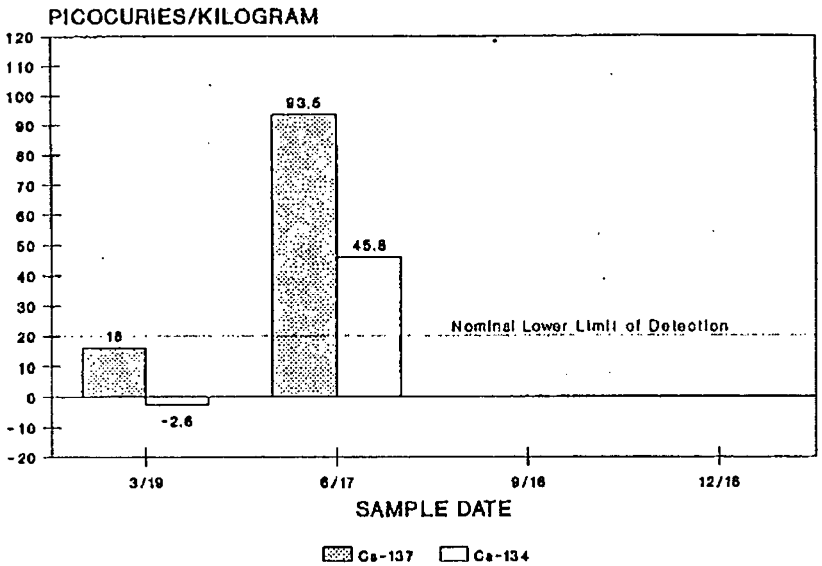


1992 ST101 QUARTERLY GAMMA IN VEGETATION RESULTS – pCi/kg

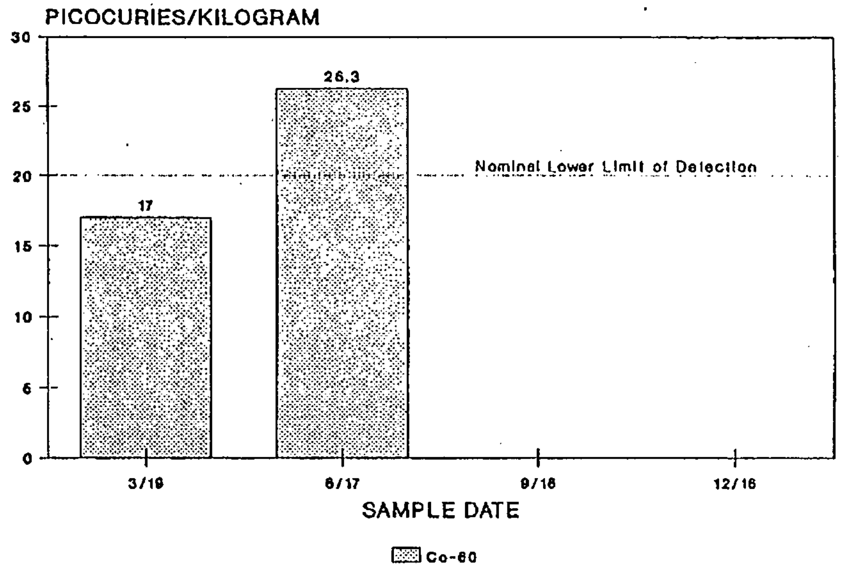
DATE	CS-137	CS-134	CO-60	CO-58	ZN-65	MN-54	I-131	CE-141	CE-144
03/19/92	1.6E+01	-2.6E+00	1.7E+01	-7.2E+00	4.3E+01	1.7E+01	5.9E-01	-1.3E+01	-3.1E+01
06/17/92	***9.4E+01***	***4.6E+01***	***2.6E+01***	-1.1E-01	***5.7E+01***	***3.2E+01***	2.8E+00	6.1E+00	-5.1E+00
AVERAGE	5.5E+01	2.2E+01	2.2E+01	-3.7E+00	5.0E+01	2.5E+01	1.7E+00	-3.5E+00	-1.8E+01
HIGH	9.4E+01	4.6E+01	2.6E+01	-1.1E-01	5.7E+01	3.2E+01	2.8E+00	6.1E+00	-5.1E+00
LOW	1.6E+01	-2.6E+00	1.7E+01	-7.2E+00	4.3E+01	1.7E+01	5.9E-01	-1.3E+01	-3.1E+01
# OF SAMPLES	2	2	2	2	2	2	2	2	2

NOTE: Larger, darker print indicates result above detection level.

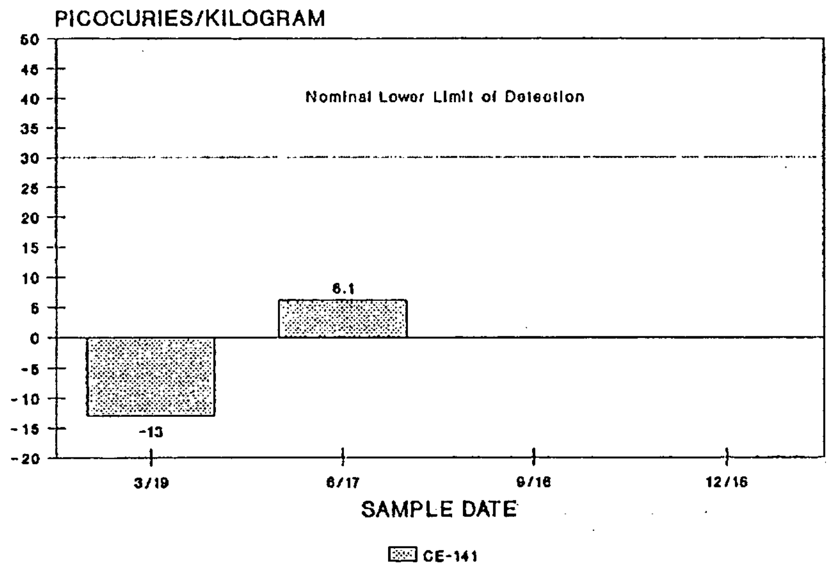
ST101 QUARTERLY VEGETATION SAMPLE
1992 RESULTS

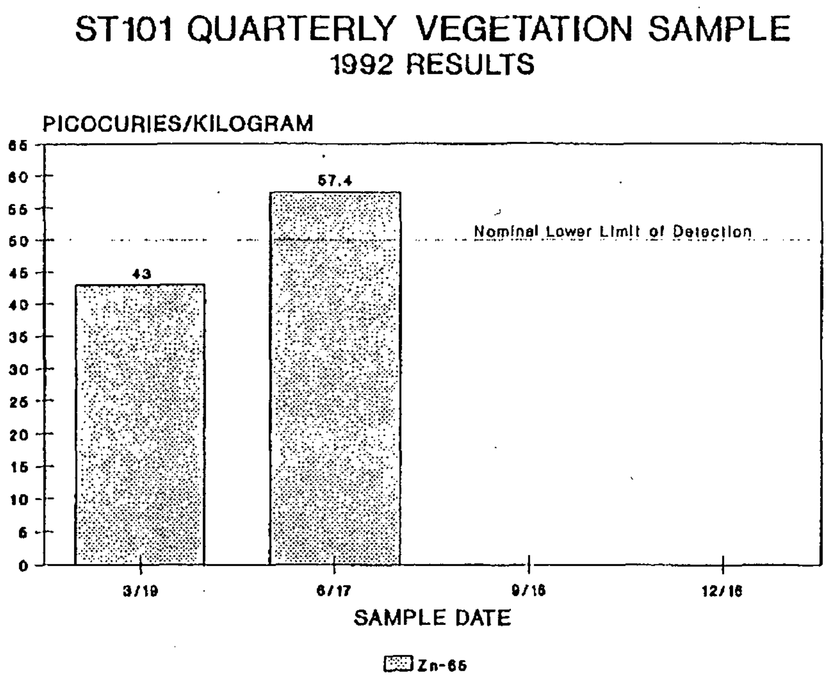


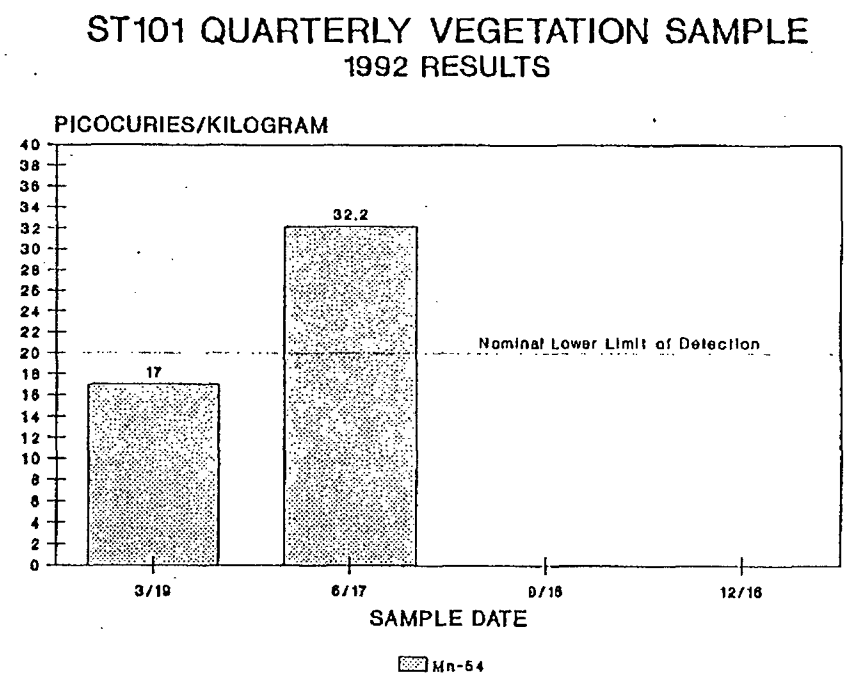
ST101 QUARTERLY VEGETATION SAMPLE
1992 RESULTS

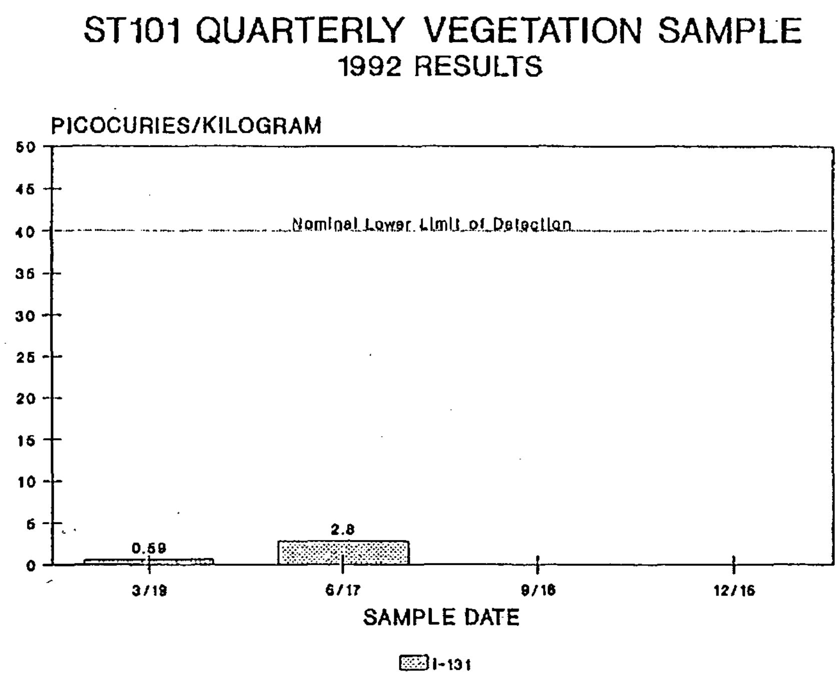


ST101 QUARTERLY VEGETATION SAMPLE
1992 RESULTS




ST101 QUARTERLY VEGETATION SAMPLE
1992 RESULTS
PICOCURIES/KILOGRAM
57.4
43
Nominal Lower Limit of Detection
3/19
6/17
9/16
12/16
SAMPLE DATE
Zn-65


ST101 QUARTERLY VEGETATION SAMPLE
1992 RESULTS
PICOCURIES/KILOGRAM
32.2
17
Nominal Lower Limit of Detection
3/19
6/17
9/16
12/16
SAMPLE DATE
Mn-54


ST101 QUARTERLY VEGETATION SAMPLE
1992 RESULTS
PICOCURIES/KILOGRAM
Nominal Lower Limit of Detection
0.59
2.8
3/19
6/17
9/16
12/16
SAMPLE DATE
I-131

ATTACHMENT 3

SECOND QUARTER 1992 ST101 WATER SAMPLE RESULTS AND % MPC LISTING

1992 ST101 IN WATER RESULTS (pCi/l)													
DATE	Cs-137	Cs-134	Co-60	Co-58	Zn-65	Mn-54	I-131	Ce-141	Ce-144	Sb-124	Sb-125	I-131R	H-3
04/02/92	9.7E-02	1.7E+00	1.2E+00	-1.6E+00	-2.3E+00	-2.5E-01	-2.7E+00	-5.6E-01	-2.8E+00				
04/15/92	2.1E+00	2.6E+00	1.4E+00	-1.3E+00	8.9E-01	1.3E+00	-2.9E+00	3.4E+00	1.7E+00				
04/29/92	2.8E+00	4.8E-01	4.9E-01	-1.7E-01	2.7E+00	1.2E+00	1.26E+01	-7.6E-01	-3.5E+00				
05/13/92	5.69E+00	4.8E+00	1.25E+02	3.4E+00	5.30E+01	5.79E+00	2.11E+01	7.07E+02	1.1E+01	1.15E+01	2.08E+01	8.3E+00	2.7E+05
05/18/92	3.8E+00	-3.0E-01	1.66E+01	-4.2E-01	1.91E+01	2.2E+00	1.2E+00	1.9E+00	-1.5E+01			1.6E-01	1.2E+05
05/22/92	1.7E+00	4.6E-01	4.7E+00	-7.3E-02	1.6E+00	5.0E-01	1.6E+00	3.0E+00	8.0E+00			-1.0E-01	
05/26/92	3.2E+00	1.2E+00	1.2E+00	8.9E-01	9.3E-01	1.5E-01	3.5E+00	2.8E+00	-3.3E+00			-1.8E-02	2.1E+02
05/27/92	2.2E-01	-1.6E+00	-4.50E-01	4.7E-01	1.9E+00	1.4E+00	-9.5E-01	3.1E+00	-5.1E+00			1.8E+00	1.3E+02
05/28/92	1.2E+00	1.5E+00	6.2E-01	-5.4E-02	-1.2E+00	1.3E+00	4.4E+00	6.5E-02	-8.8E+00			6.8E-01	1.9E+02
05/29/92	-4.7E+00	8.3E+00	6.65E+00	4.8E-01	1.5E+00	-1.8E-01	0.0E+00	2.9E+00	-6.4E+00			-4.4E-02	5.7E+01
05/30/92	1.1E+00	-5.8E-01	1.1E+00	-3.4E-01	2.9E+00	6.7E-01	1.0E+00	6.4E-01	-3.4E+00			2.6E-01	1.8E+02
06/01/92	1.6E+00	-1.4E+00	4.0E+00	1.1E+00	4.4E-01	1.5E+00	8.1E-01	-2.8E+00	-6.2E+00			7.7E-02	3.4E+02
06/02/92	2.4E+00	5.4E-01	1.0E+00	-1.8E-01	3.0E+00	-2.7E-01	-2.2E+00	-6.5E-01	-5.4E+00			-2.2E-02	1.3E+02
06/03/92	-4.4E+00	8.4E-01	1.4E+00	-1.4E+00	-5.2E-01	0.0E+00	-3.9E-01	-1.9E+00	-1.1E+01			-5.9E-02	1.1E+02
06/04/92	2.3E+00	2.5E-01	1.2E+00	5.2E-01	-3.5E+00	8.3E-01	-8.0E-02	4.0E-01	-1.1E+01			-2.6E-02	-9.3E+01
06/05/92	1.8E+00	0.0E+00	6.2E-01	-1.8E+00	0.0E+00	-9.0E-01	1.2E+00	-4.5E+00	-8.2E+00			9.3E-02	-1.8E+01
06/06/92	2.1E+00	2.2E-01	4.0E+00	0.0E+00	-1.7E+00	-6.0E-01	5.3E-01	-1.9E+00	-3.4E+00				1.6E+02
06/08/92	3.5E-01	0.0E+00	1.0E-01	-1.4E-01	2.9E+00	3.9E-01	-1.2E+00	-1.2E+00	-2.2E+01				7.7E+01
06/09/92	1.8E-01	2.4E-01	-1.1E+00	-9.8E-01	-9.2E-02	1.5E-01	-1.4E-01	-3.0E+00	-7.7E+00			-2.0E-01	1.1E+02
06/10/92	1.8E+00	5.9E-01	2.9E-01	-1.0E-01	2.1E+00	-7.4E-01	1.4E+00	-1.3E-01	3.0E+00			-1.6E-01	1.4E+02
06/11/92	-8.9E-01	-4.0E+00	1.4E+00	-1.1E+00	-1.8E+00	1.3E+00	1.6E+00	1.1E+00	-9.7E+00			-1.4E-01	1.0E+02
06/12/92	3.0E+00	1.7E+00	2.2E+00	-1.4E+00	3.8E+00	6.7E-01	-9.7E-01	-3.5E+00	-1.0E+00			-9.6E-02	2.2E+02
06/17/92	-2.5E+00	-1.4E+00	-6.6E-01	-2.3E-01	-1.3E+01	-3.2E+00	-2.2E-01	3.3E+00	4.5E+00			1.7E-01	3.9E+03
* AVERAGE	1.08E+00	7.02E-01	7.52E+00	-1.92E-01	3.16E+00	5.74E-01	1.70E+00	3.08E+01	-4.60E+00	1.15E+01	2.08E+01	5.93E-01	2.08E+04
HIGH	5.69E+00	8.30E+00	1.25E+02	3.40E+00	5.30E+01	5.79E+00	2.11E+01	7.07E+02	1.10E+01	1.15E+01	2.08E+01	8.30E+00	2.70E+05
LOW	-4.70E+00	-4.00E+00	-1.10E+00	-1.80E+00	-1.30E+01	-3.20E+00	-2.90E+00	-4.50E+00	-2.20E+01	1.15E+01	2.08E+01	-2.00E-01	-9.30E+01
# SAMPLES	23	23	23	23	23	23	23	23	23	1	1	18	19

% MPC													
DATE	Cs-137	Cs-134	Co-60	Co-58	Zn-65	Mn-54	I-131	Ce-141	Ce-144	Sb-124	Sb-125	I-131R	H-3
04/02/92	0.0005%	0.0189%	0.0024%										
04/15/92	0.0105%	0.0289%	0.0028%		0.0009%	0.0013%		0.0038%	0.0170%				
04/29/92	0.0140%	0.0053%	0.0010%		0.0027%	0.0012%	4.2000%						
05/13/92	0.0285%	0.0533%	0.2500%	0.0034%	0.0530%	0.0058%	7.0333%	0.7856%	0.1100%	0.0575%	0.0208%	2.7667%	9.0000%
05/18/92	0.0190%		0.0332%		0.0191%	0.0022%	0.4000%	0.0021%				0.0533%	4.0000%
05/22/92	0.0085%	0.0051%	0.0094%		0.0016%	0.0005%	0.5333%	0.0033%	0.0800%				
05/26/92	0.0160%	0.0133%	0.0024%	0.0009%	0.0009%	0.0002%	1.1667%	0.0031%					0.0070%
05/27/92	0.0011%			0.0005%	0.0019%	0.0014%		0.0034%				0.6000%	0.0043%
05/28/92	0.0060%	0.0167%	0.0012%			0.0013%	1.4667%	0.0001%				0.2267%	0.0063%
05/29/92		0.0922%	0.0133%	0.0005%	0.0015%			0.0032%					0.0019%
05/30/92	0.0055%		0.0022%		0.0029%	0.0007%	0.3333%	0.0007%				0.0867%	0.0060%
06/01/92	0.0080%		0.0080%	0.0011%	0.0004%	0.0015%	0.2700%					0.0257%	0.0113%
06/02/92	0.0120%	0.0060%	0.0020%		0.0030%								0.0043%
06/03/92		0.0093%	0.0028%										0.0037%
06/04/92	0.0115%	0.0028%	0.0024%	0.0005%		0.0008%		0.0004%					
06/05/92	0.0090%		0.0012%				0.4000%					0.0310%	
06/06/92	0.0105%	0.0024%	0.0080%				0.1767%						0.0053%
06/08/92	0.0017%		0.0002%		0.0029%	0.0004%							0.0026%
06/09/92	0.0009%	0.0027%				0.0002%							0.0037%
06/10/92	0.0090%	0.0066%	0.0006%		0.0021%		0.4667%		0.0300%				0.0047%
06/11/92			0.0028%			0.0013%	0.5333%	0.0012%					0.0033%
06/12/92	0.0150%	0.0189%	0.0044%		0.0038%	0.0007%							0.0073%
06/17/92								0.0037%	0.0450%			0.0567%	0.1300%

* Arithmetic average, not time-weighted.

ATTACHMENT 4

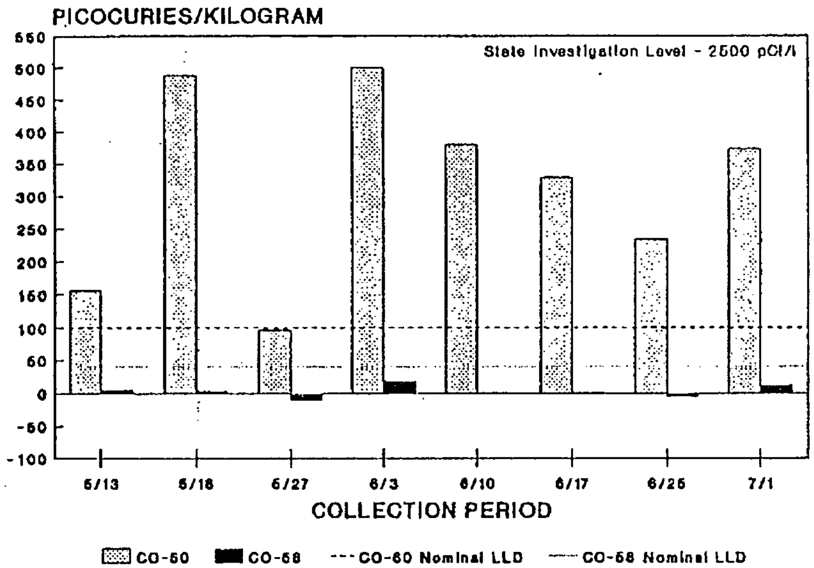
MAY - JULY 1992 ST101 SEDIMENT RESULTS

1992 ST101 GAMMA IN SEDIMENT RESULTS - pCi/kg

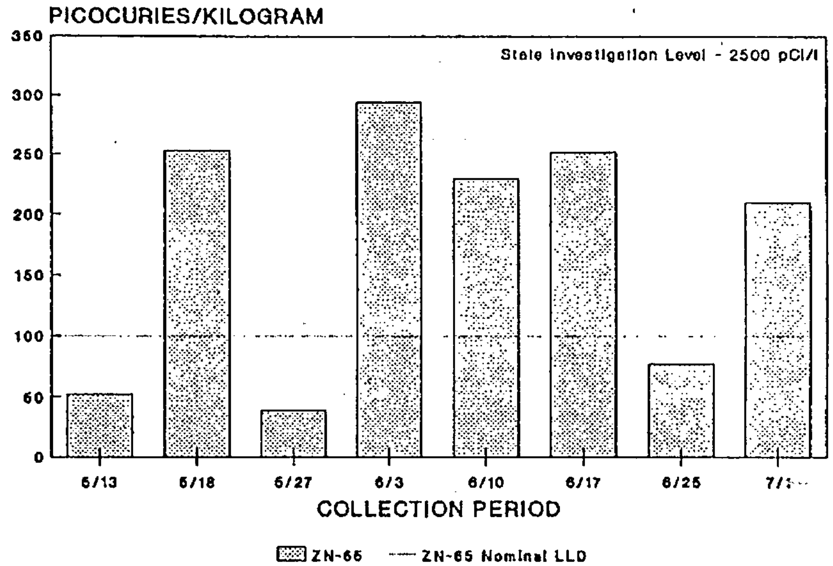
DATE	CS-137	CS-134	CO-60	CO-58	ZN-65	MN-54	I-131	CE-141	CE-144	EU-152
05/13/92	***5.9E+01***	4.7E+01	***1.6E+02***	5.6E+00	5.2E+01	3.5E+01	0.0E+00	***1.1E+02***	2.5E+00	
05/18/92	***1.3E+02***	***5.7E+01***	***4.9E+02***	3.8E+00	***2.5E+02***	***6.7E+01***	9.4E+00	***1.9E+02***	-4.2E+01	
05/27/92	4.3E+01	3.9E+01	***9.6E+01***	-1.1E+01	3.9E+01	1.6E+01	1.8E+01	3.6E+01	1.3E+01	
06/03/92	***1.2E+02***	***7.3E+01***	***5.0E+02***	1.9E+01	***2.9E+02***	***7.4E+01***	1.9E+01	***2.1E+02***	-1.5E+01	
06/10/92	***1.1E+02***	4.9E+01	***3.8E+02***	5.5E-01	2.3E+02	***1.1E+02***	-1.2E+01	***1.3E+02***	-1.1E+02	
06/17/92	***1.4E+02***	7.4E+01	***3.3E+02***	1.4E+00	***2.5E+02***	***7.3E+01***	8.9E-01	***8.9E+01***	-8.3E+01	1.3E+01
06/25/92	***8.9E+01***	6.3E+01	***2.3E+02***	-5.2E+00	7.7E+01	4.1E+01	3.1E+01	1.8E+01	-1.3E+02	
07/01/92	***1.1E+02***	***7.6E+01***	***3.7E+02***	1.2E+01	2.1E+02	4.2E+01	5.2E+00	***1.0E+02***	4.3E+00	
AVERAGE	1.0E+02	6.0E+01	3.2E+02	3.3E+00	1.8E+02	5.7E+01	8.9E+00	1.1E+02	-4.5E+01	1.3E+01
HIGH	1.4E+02	7.6E+01	5.0E+02	1.9E+01	2.9E+02	1.1E+02	3.1E+01	2.1E+02	1.3E+01	1.3E+01
LOW	4.3E+01	3.9E+01	9.6E+01	-1.1E+01	3.9E+01	1.6E+01	-1.2E+01	1.8E+01	-1.3E+02	1.3E+01
# SAMPLES	8.0E+00	8.0E+00	8.0E+00	8.0E+00	8.0E+00	8.0E+00	8.0E+00	8.0E+00	8.0E+00	1.0E+00

NOTE: Larger, darker print indicates result above detection level.

1992 ST101 SEDIMENT RESULTS
ACTIVATION PRODUCTS

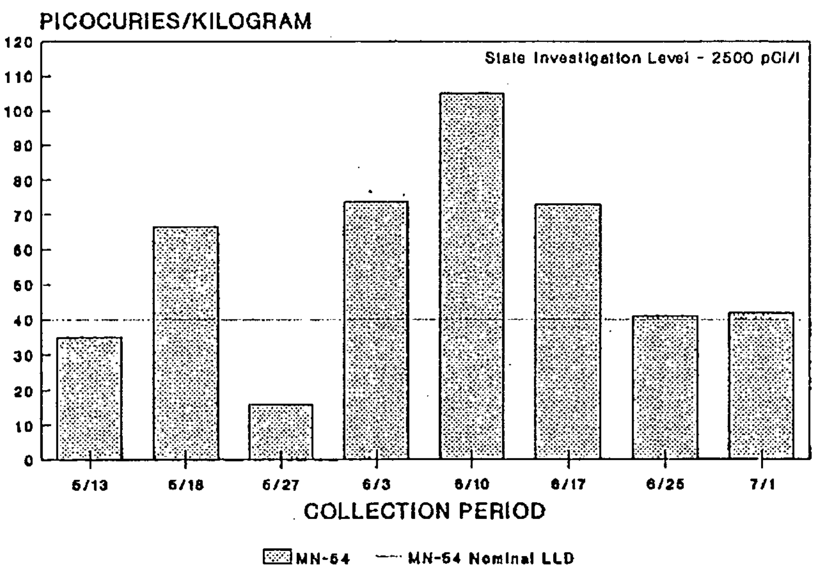


1992 ST101 SEDIMENT RESULTS
ACTIVATION PRODUCTS

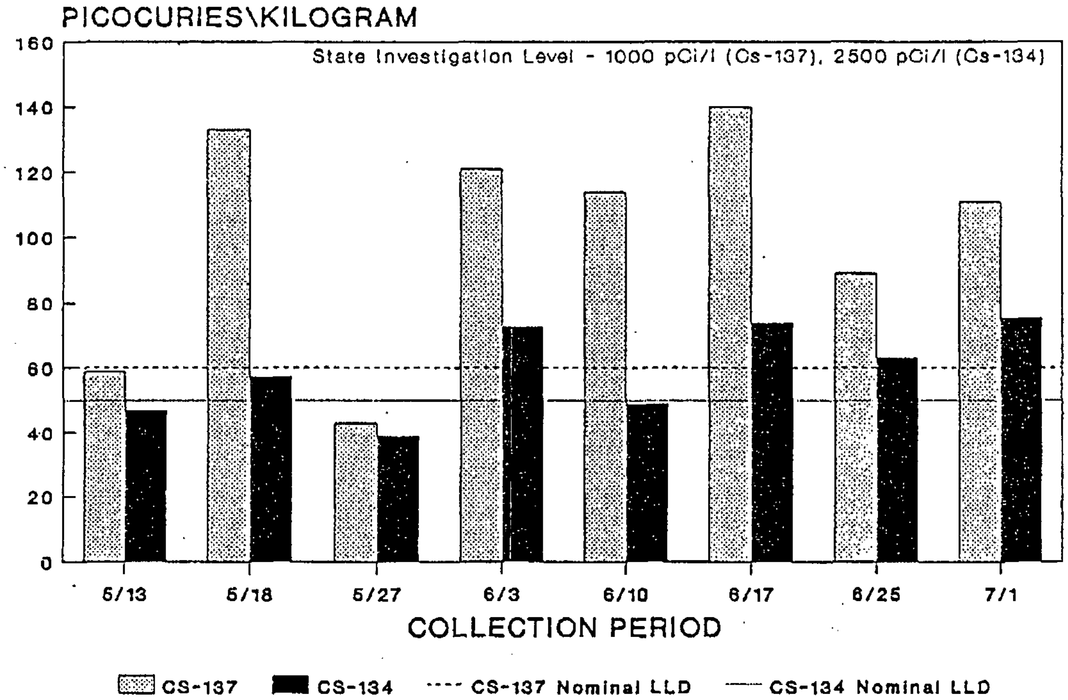


4-3

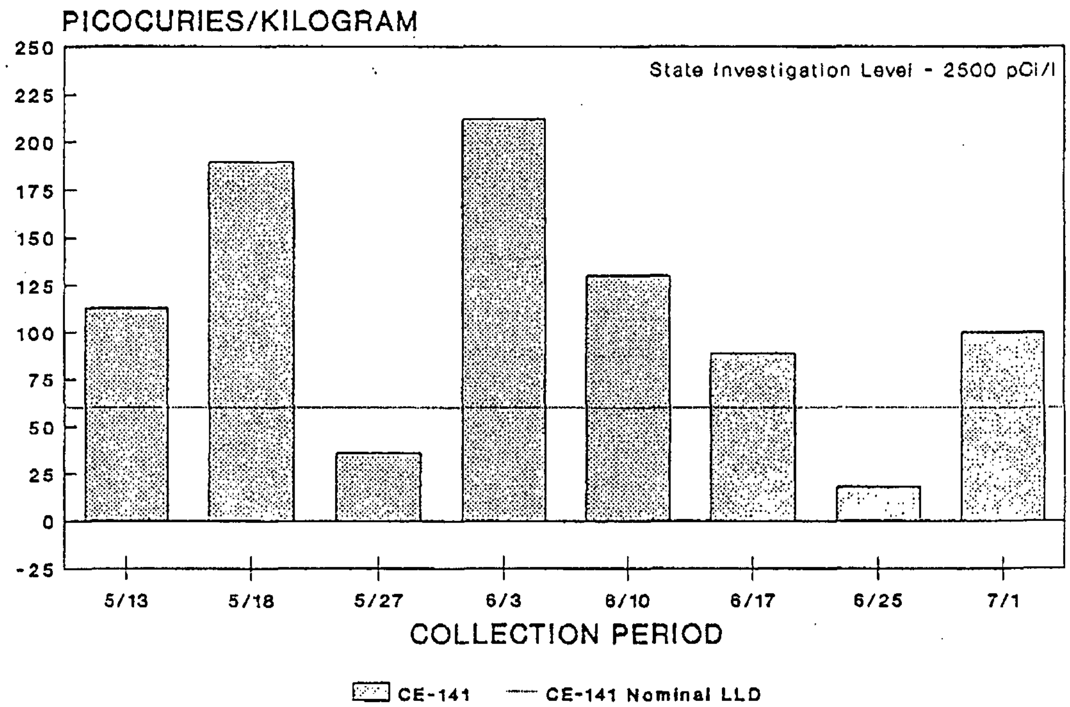
1992 ST101 SEDIMENT RESULTS
ACTIVATION PRODUCTS



1992 ST101 SEDIMENT RESULTS
FISSION PRODUCTS



1992 ST101 SEDIMENT RESULTS
FISSION PRODUCTS



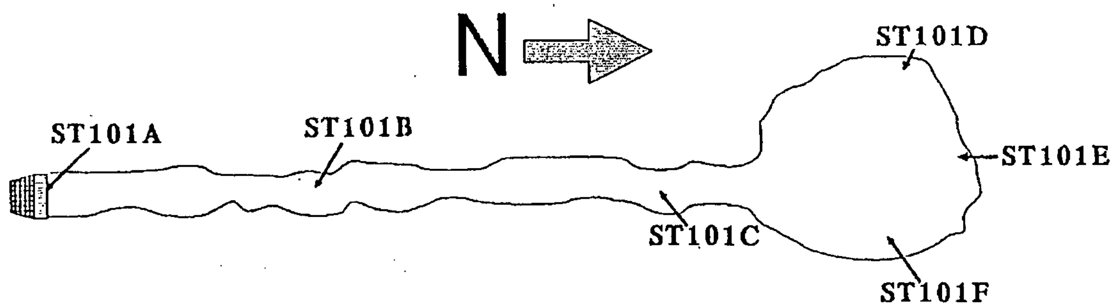
ATTACHMENT 5

ST101 MAY 22 SPECIAL STUDY RESULTS

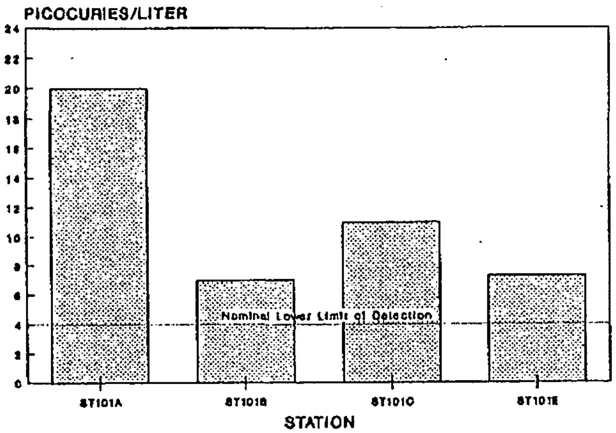
MAY 22 STORM DRAIN POND SEDIMENT SAMPLE RESULTS (pCi/kg)

Radionuclide Concentrations	Sample Location[1]
cobalt-60	
200	Location A (near pipe)
18,000[2]	" B (mid channel)
25,400[2]	" C (mouth of channel)
483	" D (west side of pond)
935	" E (north side of pond)
1920	" F (east side of pond)
zinc-65	
184	Location A (near pipe)
4650[2]	" B (mid channel)
2870[2]	" C (mouth of channel)
150	" D (west side of pond)
130	" E (north side of pond)
300	" F (east side of pond)
cesium-134	
64	Location A (near pipe)
1140	" B (mid channel)
737	" C (mouth of channel)
81	" D (west side of pond)
98	" E (north side of pond)
202	" F (east side of pond)
cesium-137	
94	Location A (near pipe)
2900[2]	" B (mid channel)
2500[2]	" C (mouth of channel)
270	" D (west side of pond)
275	" E (north side of pond)
500	" F (east side of pond)
cerium-141	
144	Location A (near pipe)
3474[2]	" B (mid channel)
1390	" C (mouth of channel)
67	" D (west side of pond)
manganese-54	
670	Location B (mid channel)
448	" C (mouth of channel)

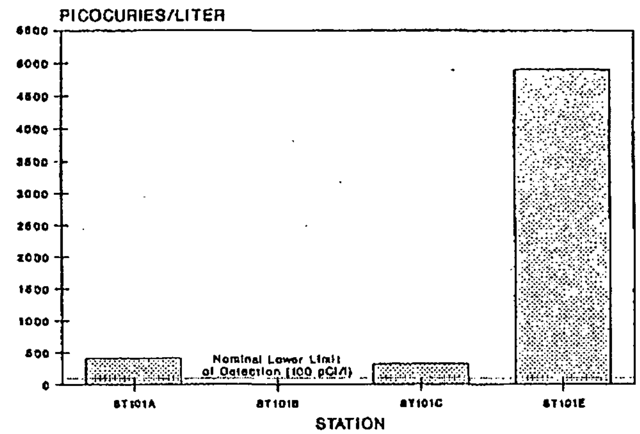
(1) Sketch of sample locations on the following page of this attachment.
(2) Exceed the DOH investigation levels of 1000 pCi/kg for cesium-137 and 2500 pCi/kg for other radionuclides.



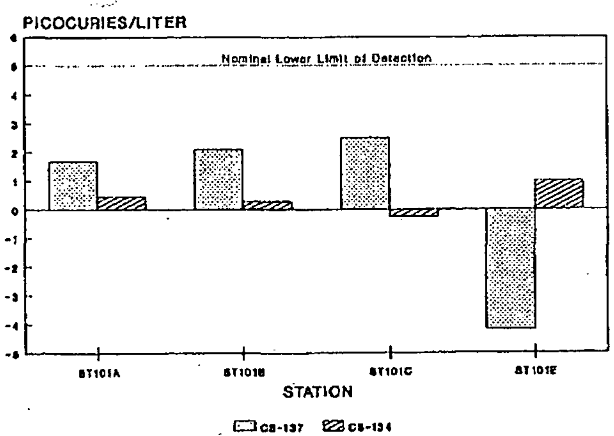
ST101 GROSS BETA IN WATER RESULTS
SPECIAL SAMPLE 5/22/92



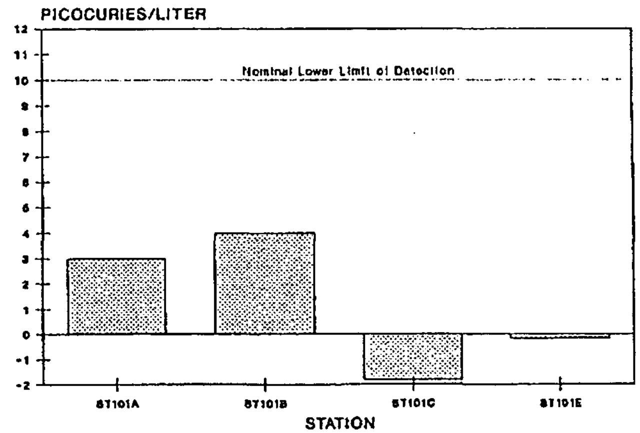
ST101 TRITIUM IN WATER RESULTS
SPECIAL SAMPLE 5/22/92

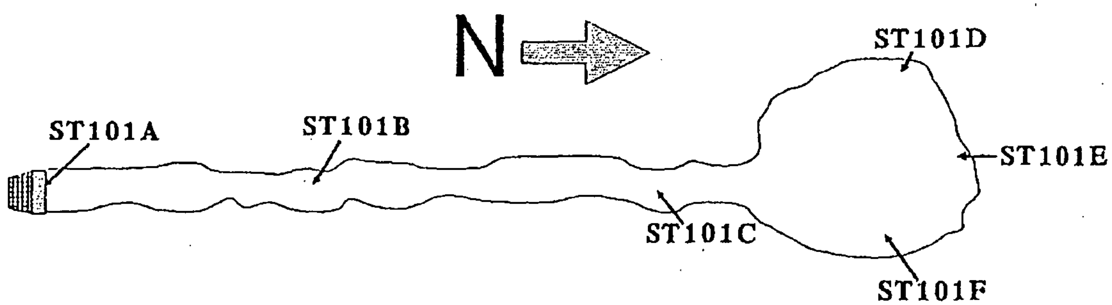


ST101 CS-137 & CS-134 IN WATER RESULTS
SPECIAL SAMPLE 5/22/92

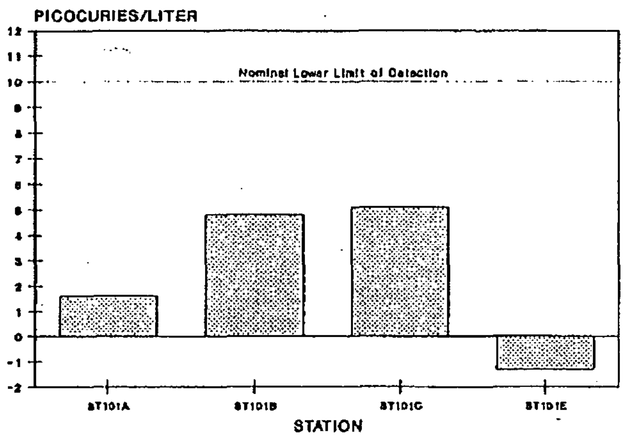


ST101 CE-141 IN WATER RESULTS
SPECIAL SAMPLE 5/22/92

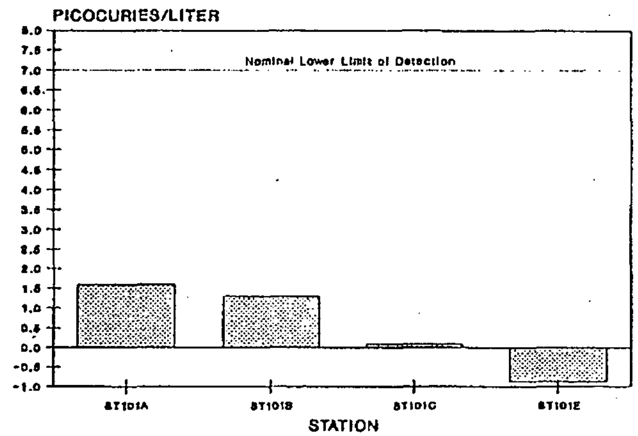




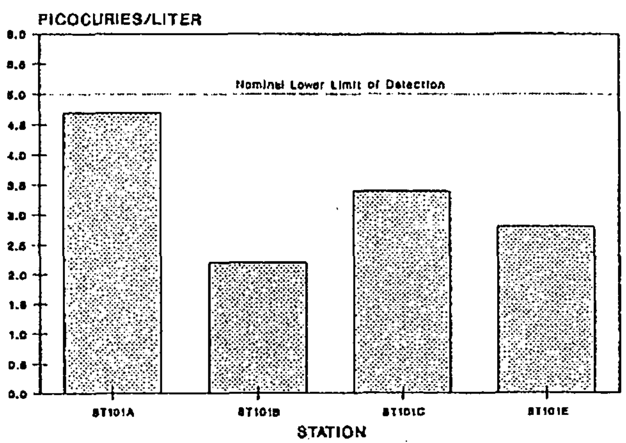
ST101 ZN-65 IN WATER RESULTS
SPECIAL SAMPLE 5/22/92



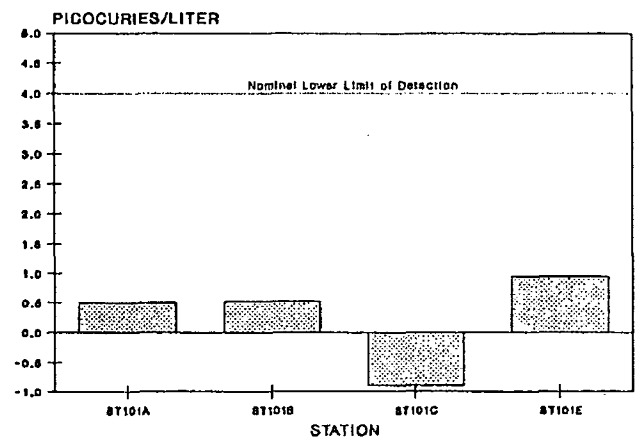
ST101 I-131 IN WATER RESULTS
SPECIAL SAMPLE 5/22/92



ST101 CO-60 IN WATER RESULTS
SPECIAL SAMPLE 5/22/92



ST101 MN-54 IN WATER RESULTS
SPECIAL SAMPLE 5/22/92

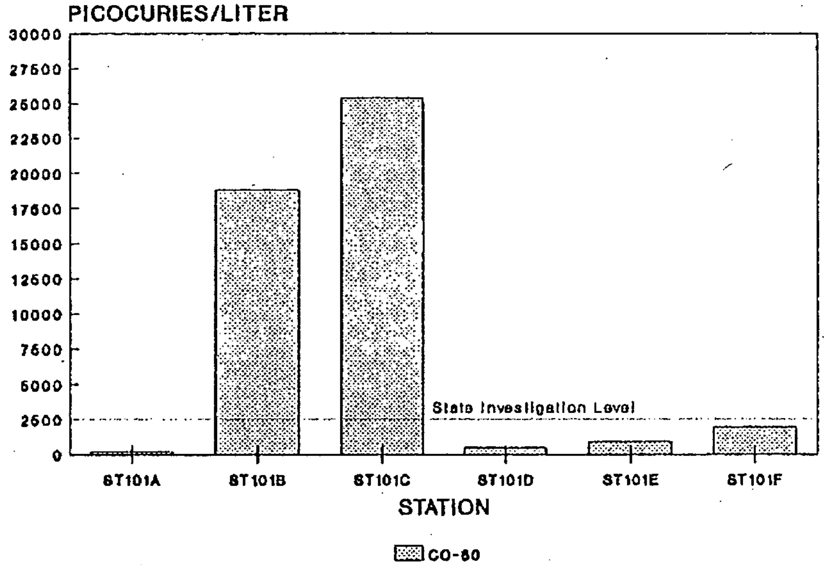


1992 ST101 GAMMA IN SPECIAL SEDIMENT SAMPLE RESULTS - pCi/kg

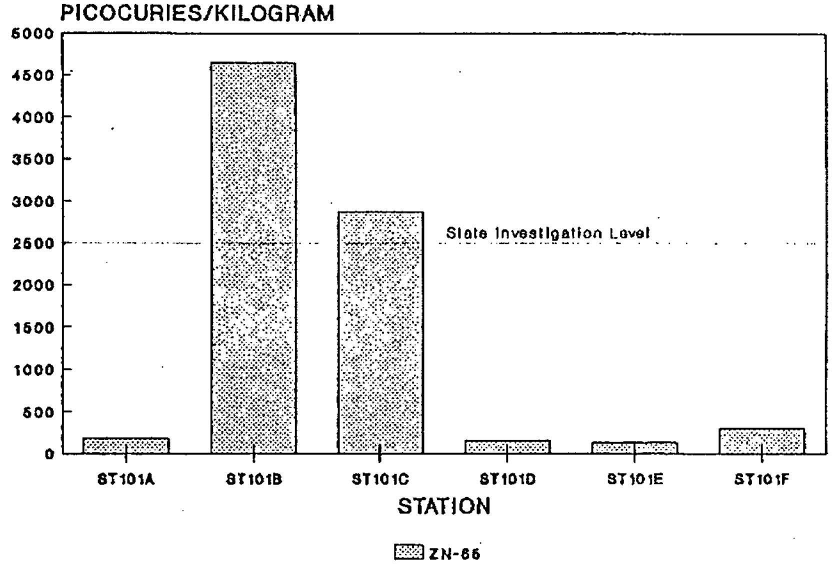
DATE	LOCATION	CS-137	CS-134	CO-60	CO-58	ZN-65	MN-54	I-131	CE-141	CE-144	EU-152
05/22/92	ST101A	*9.4E+01*	*6.4E+01*	*2.0E+02*	*1.5E+01*	*1.8E+02*	2.3E+01	5.4E+00	*1.4E+02*	-5.4E+01	-9.2E+00
05/22/92	ST101B	*2.9E+03*	*1.1E+03*	*1.9E+04*	5.8E+01	*4.7E+03*	*6.7E+02*	7.2E+02	*3.7E+03*	6.6E+01	1.5E+02
05/22/92	ST101C	*2.5E+03*	*7.4E+02*	*2.5E+04*	2.1E+00	*2.9E+03*	*4.5E+02*	1.3E+02	*1.4E+03*	1.5E+02	-3.2E+02
05/22/92	ST101D	*2.7E+02*	*8.1E+01*	*4.8E+02*	-6.8E+00	*1.5E+02*	4.2E+00	-7.2E+00	*6.7E+01*	-5.0E+01	-1.6E+01
05/22/92	ST101E	*2.8E+02*	*9.8E+01*	*9.4E+02*	6.3E+00	*1.3E+02*	1.6E+01	-9.2E+00	3.1E+01	-3.4E+01	3.1E+01
05/22/92	ST101F	*5.0E+02*	*2.0E+02*	*1.9E+03*	-2.0E+00	3.0E+02	5.1E+01	4.2E+00	*9.9E+01*	-5.6E+01	2.4E+01
05/28/92	MID-POND	*4.0E+01*	3.3E+01	*1.6E+02*	-1.0E+01	2.4E+01	6.8E+00	7.5E+00	2.2E+01	-1.4E+02	
	AVERAGE	9.4E+02	3.4E+02	6.8E+03	8.9E+00	1.2E+03	1.7E+02	1.2E+02	7.8E+02	-1.7E+01	-2.3E+01
	HIGH	2.9E+03	1.1E+03	2.5E+04	5.8E+01	4.7E+03	6.7E+02	7.2E+02	3.7E+03	1.5E+02	1.5E+02
	LOW	4.0E+01	3.3E+01	1.6E+02	-1.0E+01	2.4E+01	4.2E+00	-9.2E+00	2.2E+01	-1.4E+02	-3.2E+02
	# SAMPLES	7.0E+00	7.0E+00	7.0E+00	7.0E+00	7.0E+00	7.0E+00	7.0E+00	7.0E+00	7.0E+00	6.0E+00

NOTE: Larger, darker print indicates result above detection level.

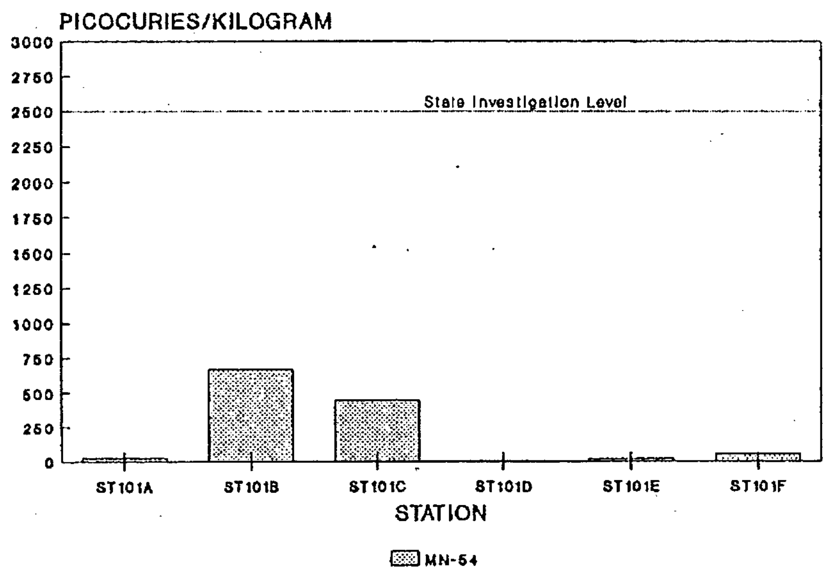
1992 ST101 SPECIAL SEDIMENT RESULTS
SAMPLES TAKEN 5/22/92



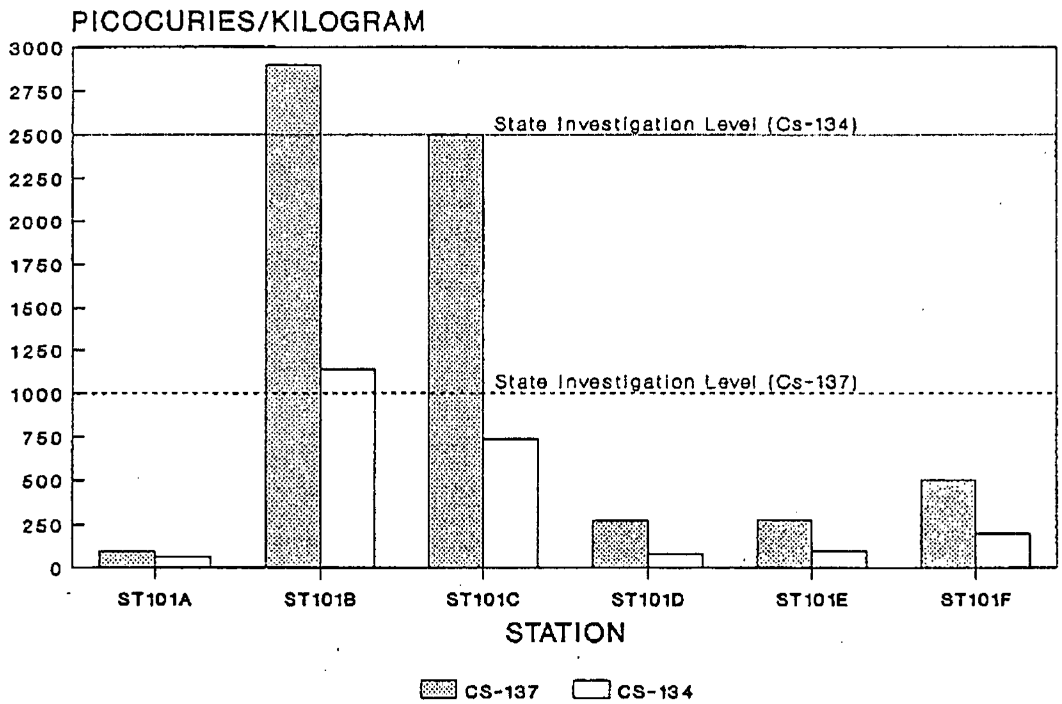
1992 ST101 SPECIAL SEDIMENT RESULTS
SAMPLES TAKEN 5/22/92



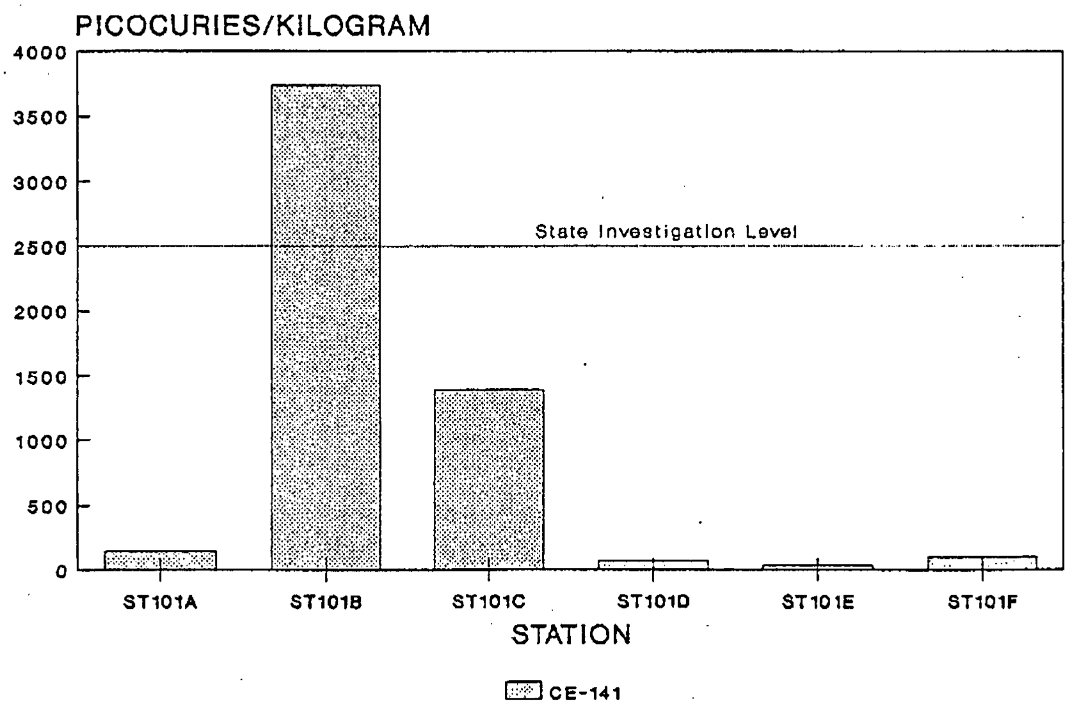
1992 ST101 SPECIAL SEDIMENT RESULTS
SAMPLES TAKEN 5/22/92



1992 ST101 SPECIAL SEDIMENT RESULTS
SAMPLES TAKEN 5/22/92



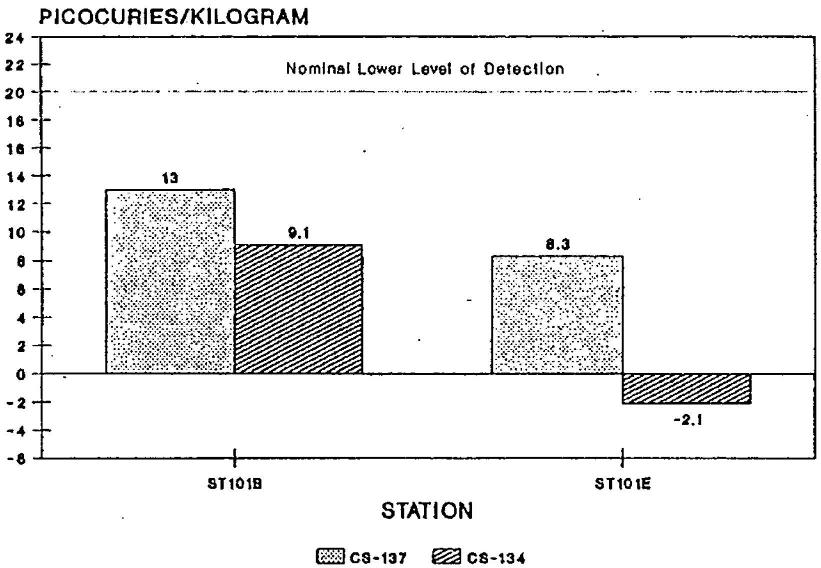
1992 ST101 SPECIAL SEDIMENT RESULTS
SAMPLES TAKEN 5/22/92



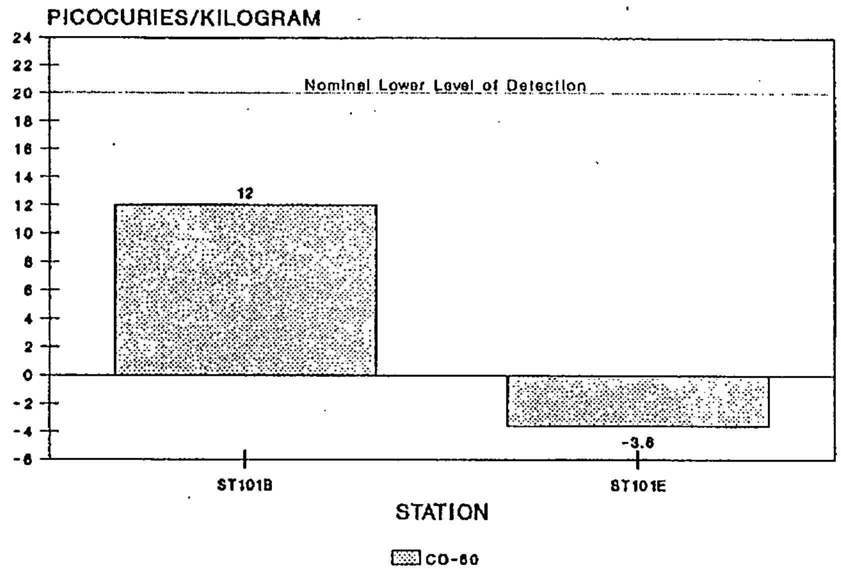
GAMMA IN SPECIAL 05/22/92 VEGETATION SAMPLE RESULTS - pCi/kg

LOCATION	CS-137	CO-58	CO-60	MN-54	CS-134	CE-141	I-131	ZN-65	CE-144
ST101B	1.3E+01	3.4E+00	1.2E+01	9.6E+00	9.1E+00	1.2E+01	-1.2E+00	4.1E+00	-2.1E+01
ST101E	8.3E+00	1.5E+00	-3.6E+00	1.7E+01	-2.1E+00	-6.5E-01	2.4E+00	2.8E+01	-5.4E+01
AVERAGE	1.1E+01	2.5E+00	4.2E+00	1.3E+01	3.5E+00	5.7E+00	6.0E-01	1.6E+01	-3.8E+01
HIGH	1.3E+01	3.4E+00	1.2E+01	1.7E+01	9.1E+00	1.2E+01	2.4E+00	2.8E+01	-2.1E+01
LOW	8.3E+00	1.5E+00	-3.6E+00	9.6E+00	-2.1E+00	-6.5E-01	-1.2E+00	4.1E+00	-5.4E+01
# OF SAMPLES	2	2	2	2	2	2	2	2	2

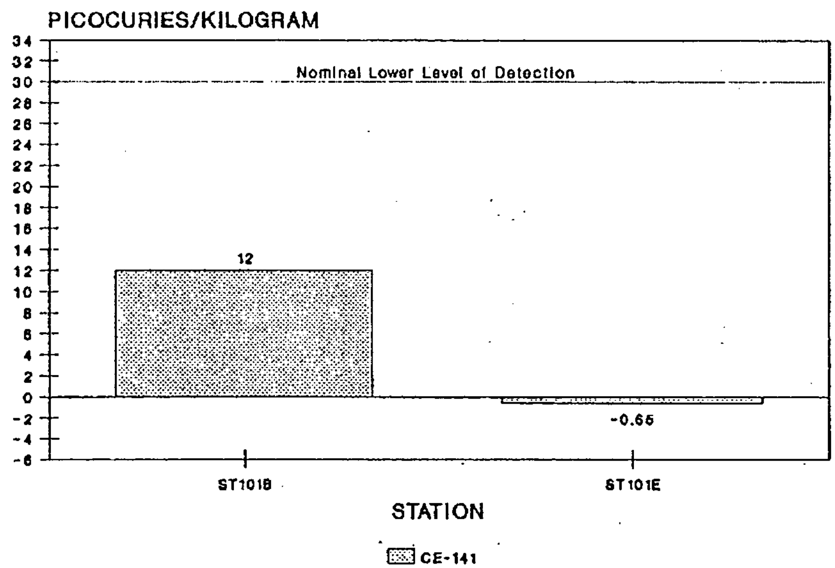
ST101 SPECIAL VEGETATION SAMPLES
SAMPLES TAKEN 5/22/92



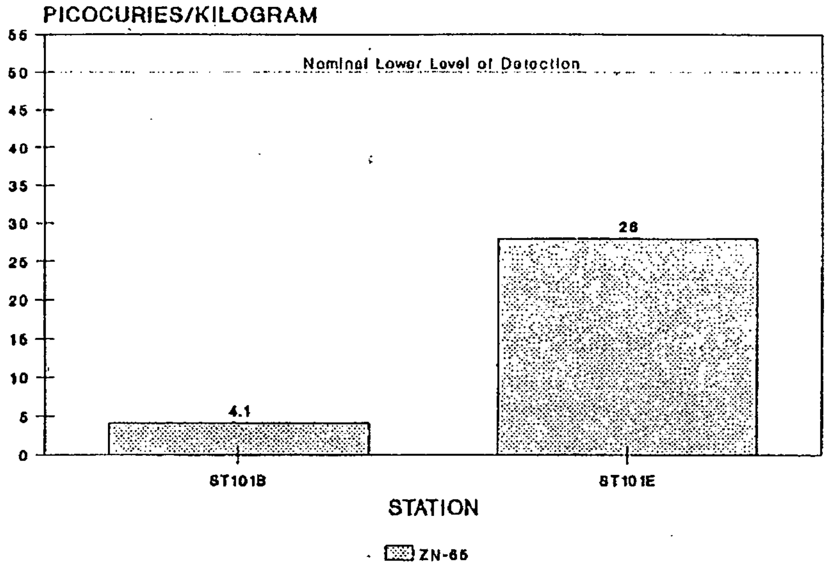
ST101 SPECIAL VEGETATION SAMPLES
SAMPLES TAKEN 5/22/92



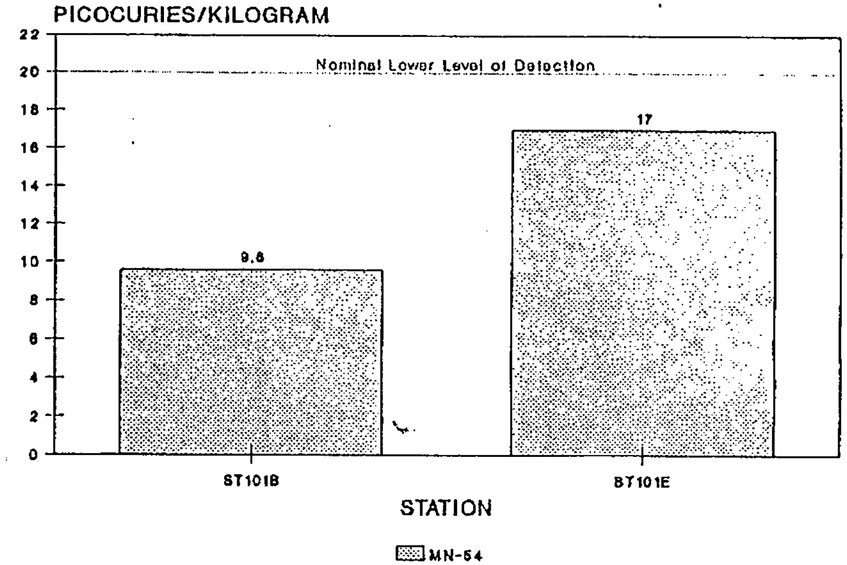
ST101 SPECIAL VEGETATION SAMPLES
SAMPLES TAKEN 5/22/92



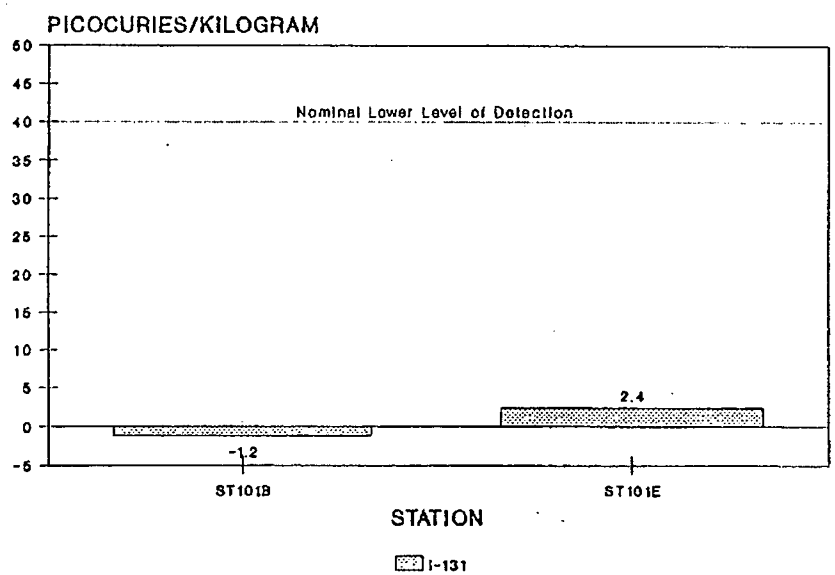
ST101 SPECIAL VEGETATION SAMPLES
SAMPLES TAKEN 5/22/92



ST101 SPECIAL VEGETATION SAMPLES
SAMPLES TAKEN 5/22/92



ST101 SPECIAL VEGETATION SAMPLES
SAMPLES TAKEN 5/22/92



WASHINGTON PUBLIC POWER
SUPPLY SYSTEM

PROBLEM EVALUATION REQUEST

PPM 1.3.12

PTL NO.

PER NO. 289-0731

ORIGINATOR

PLANT PROBLEM DESCRIPTION

The August soil sample from the roof drain leach pond (located near the fire training building) contained 1.1 E-6 μCi/gram Zn-65 and lesser quantities of other radionuclides. Radioactivity was first discovered at this location in October 1984. Several Plant modifications have been made to correct the problem but periodic releases continue to be detected as shown on the attached chart.

RECEIVED
NOV 20 1989
WNP-2 OPS File

CONTINUATION SHEETS ☐ YES ☐ NO

TECH. SPEC/PROCEDURE/REGULATION/ETC.

ORIGINATOR NAME (PRINT) D. E. Larson

MEL EPN CONTINUATION SHEET ☐ YES ☐ NO

ORIGINATOR SIGNATURE/DATE 9/5/89

MEL SYSTEM NO. MEL MANUFACTURER CODE

VALIDATION SIGNATURE/DATE 9-5-89

SHIFT MANAGER

DISCOVERY DATE/TIME	EVENT DATE/TIME	PLANT MODE	% POWER
9-6-89 1500	9-6-89	1	70

☒ NON REPORTABLE
☐ POTENTIALLY REPORTABLE
☐ REPORTABLE

REQUIREMENT 10CFR N/A
OTHER

POC IMM. DISPOSITION ☐ YES
APPROVAL REQUEST ☒ NO

TECH. SPEC. VIOLATION ☐ YES ☒ NO
LCO ENTERED ☐ YES ☒ NO
TS NO.

VITAL MWR ☐ YES ☒ NO
VITAL MWR NO. N/A

SHIFT MANAGER/DATE 9-6-89

MANAGEMENT REVIEW COMMITTEE

COMMENTS T.E.R. # ______ WAS PREVIOUSLY GENERATED ON THIS SUBJECT. ACTION FOR TEAM MADE UP FROM THE BELOW NAMED INDIVIDULES TO INVESTIGATE AND PROVIDE RECOMMENDATION ON ORIGINAL TER.
D. LARSON, N. Pike, G. Bishop, P. MACBeth, D. Pisarcik

PROBLEM RESOLUTION METHOD

☐ NCR ☐ MWR ☐ PDF ☐ ROR ☐ NONE REQUIRED CLOSE PER
☐ PDR ☒ TER ☐ PRF ☐ ISCR ☐ PTL ENTRY
☐ MDR ☐ RFTS ☐ IOM ☐ SCN ☐ OTHER (LIST)

TRACK AND INCORPORATE UNDER PREVIOUS TER.

RESPONSIBLE DEPARTMENT/ORGANIZATION Tech. / Koenigs

ACTION DUE DATE 9-9-89

INDUSTRIAL SAFETY/RISK ASSESSMENT REQUIRED ☐ YES ☒ NO

RXSU REVIEW REQUIRED ☐ YES ☒ NO

PLANT MGR SIGNATURE/DATE 9/7/89

IMPLEMENTING DOC. NO. OR PTL NO. TER 88-0157-0

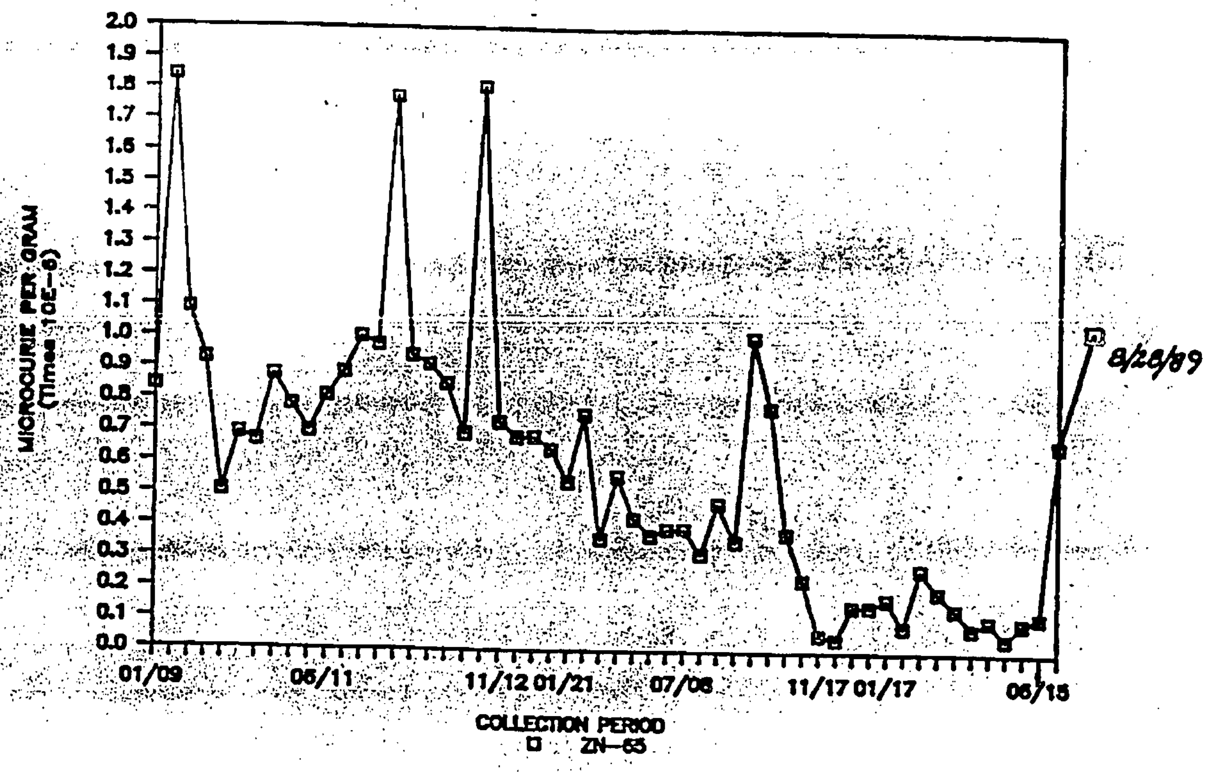
CLOSEOUT REVIEW SIGNATURE/DATE

PER CLOSURE DATE 9-15-89

968-23623 (11/88)

PER 289-0731

1987-89 ST101 RESULTS



WASHINGTON PUBLIC POWER
SUPPLY SYSTEM

INTEROFFICE MEMORANDUM

7/6/89

DISTRIBUTION: MAIL DROP:

- [ ] WNP-1 FILE
- [ ] WNP-2 FILE
- [ ] WNP-3 FILE
- [ ] WNP-4 FILE
- [ ] WNP-5 FILE
- [ ] HGP FILE
- [ ] PKWD FILE
- [ ] LEGAL FILE
- [ ] ADMIN FILE

CJ Card
File
JEM/lb

Guy Oldfield

DATE: July 6, 1989

TO: D. E. Larson, Mgr., Rad. Programs & Inst. Cal.

FROM: J. E. McDonald, Environmental Scientist I
J.E. McDonald

SUBJECT: ST101 SAMPLE RESULTS FOR JUNE

REFERENCE:

Attached are the results of the ST101 storm drain sediment sample through July 5. Also included are the graphs showing CS-134 and 137, Zn-65 and Co-60 for 1989 and for 1987 through 1989.

Attachments

JEM/slp

1989 ST101 Results-Microcuries per Unit.

DATE	CS-137	CS-134	CS RATIO	CO-60	CO-58	CO-57	CO58/CO60	CO57/CO60	ZN-65	MN-54	MN54/ZN65	CD-109	NB-95
01/[illegible]	[illegible]76E-08	4.53E-08	7.86E-01	8.44E-08	4.85E-09	-	5.75E-02	0.00E+00	1.74E-07	1.35E-08	7.77E-02	9.26E-07	-
01/[illegible]	[illegible]3E-08	3.26E-08	6.47E-01	5.41E-08	-	-	0.00E+00	0.00E+00	8.48E-08	9.42E-09	1.11E-01	8.86E-07	-
02/17	7.16E-08	6.40E-08	8.93E-01	2.82E-07	-	-	0.00E+00	0.00E+00	2.69E-07	2.66E-08	9.86E-02	9.60E-07	-
02/28	8.68E-08	6.35E-08	7.31E-01	2.40E-07	-	-	0.00E+00	0.00E+00	1.97E-07	1.39E-08	7.04E-02	9.68E-07	-
03/23	5.02E-08	4.83E-08	9.63E-01	1.11E-07	-	-	0.00E+00	0.00E+00	1.43E-07	1.49E-08	1.04E-01	1.01E-06	-
04/14	4.95E-08	6.60E-08	1.33E+00	5.73E-08	-	-	0.00E+00	0.00E+00	8.88E-08	6.83E-09	8.45E-02	7.71E-07	-
04/28	7.99E-08	7.04E-08	8.81E-01	1.46E-07	-	-	0.00E+00	0.00E+00	1.04E-07	1.01E-08	9.66E-02	6.49E-07	-
05/18	2.99E-08	4.08E-08	1.37E+00	2.34E-08	-	-	0.00E+00	0.00E+00	4.72E-08	5.29E-09	1.12E-01	4.24E-07	-
05/31	5.49E-08	4.09E-08	7.44E-01	8.28E-08	-	-	0.00E+00	0.00E+00	1.00E-07	9.45E-09	9.41E-02	8.34E-07	-
06/15	6.53E-08	3.58E-08	5.48E-01	1.07E-07	-	-	0.00E+00	0.00E+00	1.19E-07	1.38E-08	1.16E-01	8.05E-07	-
07/05	6.36E-08	3.91E-08	6.14E-01	1.72E-07	-	-	0.00E+00	0.00E+00	6.74E-07	1.68E-08	2.49E-02	5.71E-07	-

DATE	NB-97	ZR-95	XE-133	RU-103	CR-51	SN-113	SR-85	SR-92	Y-92	I-131	NA-24	BE-7
01/17	2.24E-08	-	-	-	-	-	-	-	8.36E-07	-	-	3.90E-07
01/31	3.14E-08	-	-	-	-	-	-	-	-	-	-	3.32E-07
02/17	2.44E-08	-	-	-	-	-	-	7.00E-08	2.44E-07	-	-	5.45E-07
02/28	2.41E-08	-	-	-	-	-	-	-	2.93E-07	-	-	4.95E-07
03/23	-	-	-	-	-	-	-	-	-	-	-	1.74E-07
04/14	2.12E-07	-	-	-	-	-	-	-	-	-	-	1.16E-07
04/28	-	-	-	-	-	-	-	-	-	-	-	4.26E-07
05/18	-	-	-	-	-	-	-	-	9.71E-08	-	-	7.67E-08
05/31	6.12E-09	-	-	-	-	-	-	2.63E-08	3.78E-07	-	-	1.35E-07
06/15	-	-	-	-	-	-	-	3.12E-08	2.53E-07	-	-	1.12E-07
07/05	-	-	-	-	-	-	-	-	2.58E-07	-	-	5.78E-08

1989 GRAPH RESULTS-(MICROCURIES PER UNIT)

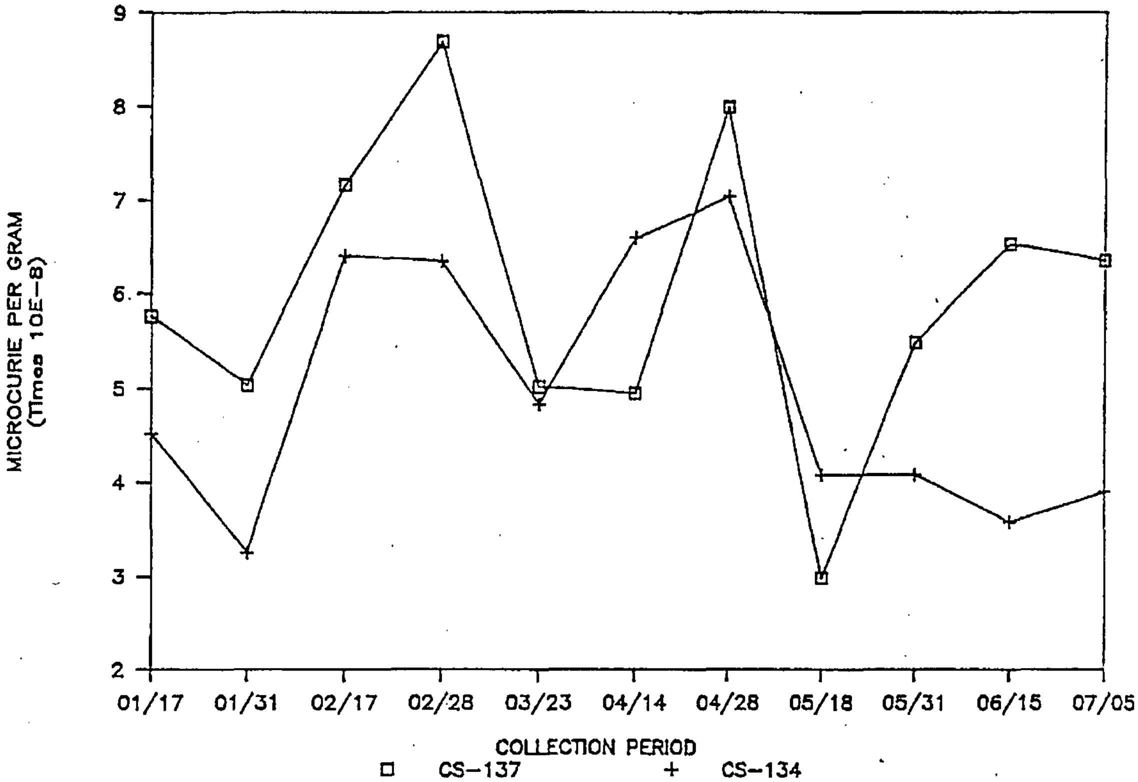
DATE	CS-137	CS-134	CS RATIO	CO-60	CO-58	CO RATIO	ZN-65	I-131
01/17	5.76E-08	4.53E-08	7.86E-01	8.44E-08	4.85E-09	5.75E-02	1.74E-07	-
01/31	5.83E-08	3.26E-08	6.47E-01	5.41E-08	-	-	8.48E-08	-
02/17	7.16E-08	6.49E-08	8.93E-01	2.82E-07	-	-	2.69E-07	-
02/28	8.68E-08	6.35E-08	7.31E-01	2.40E-07	-	-	1.97E-07	-
03/23	5.02E-08	4.93E-08	9.63E-01	1.11E-07	-	-	1.43E-07	-
04/14	4.95E-08	6.60E-08	1.33E+00	5.73E-08	-	-	8.08E-08	-
04/28	7.99E-08	7.04E-08	8.81E-01	1.46E-07	-	-	1.04E-07	-
05/18	2.99E-08	4.08E-08	1.37E+00	2.34E-08	-	-	4.72E-08	-
05/31	5.49E-08	4.09E-08	7.44E-01	8.28E-08	-	-	1.00E-07	-
06/15	6.53E-08	3.58E-08	5.48E-01	1.07E-07	-	-	1.19E-07	-
07/05	6.36E-08	3.91E-08	6.14E-01	1.72E-07	-	-	6.74E-07	-

Error Check (%ERR>20%=(+); %ERR<20%=(.); N/A=(-)).

DATE	CS-137	CS-134	CO-60	CO-58	CO-57	ZN-65	MN-54	CD-109	NB-95	NB-97	ZR-95	XE-133	RU-103	CR-51	SN-113	SR-85	SR-92	Y-92	I-131	NA-24	BE-7
1/17	.	.	.	+	-	.	+	.	-	+	-	-	-	-	-	-	-	+	-	-	.
1/31	.	.	.	-	-	.	+	.	-	+	-	-	-	-	-	-	-	-	-	-	.
2/17	.	.	.	-	-	.	.	.	-	+	-	-	-	-	-	-	.	+	-	-	.
2/28	.	.	.	-	-	.	+	.	-	.	-	-	-	-	-	-	-	+	-	-	.
3/23	.	.	.	-	-	.	+	.	-	-	-	-	-	-	-	-	-	-	-	-	.
4/14	.	.	.	-	-	.	+	.	-	+	-	-	-	-	-	-	-	-	-	-	.
4/28	.	.	.	-	-	.	+	.	-	-	-	-	-	-	-	-	-	-	-	-	.
5/18	.	.	.	-	-	.	+	.	-	-	-	-	-	-	-	-	-	+	-	-	.
5/31	.	.	.	-	-	.	+	.	-	+	-	-	-	-	-	-	+	+	-	-	+
6/15	.	.	.	-	-	.	+	.	-	-	-	-	-	-	-	-	+	+	-	-	+
7/05	.	.	.	-	-	.	+	.	-	-	-	-	-	-	-	-	-	+	-	-	+

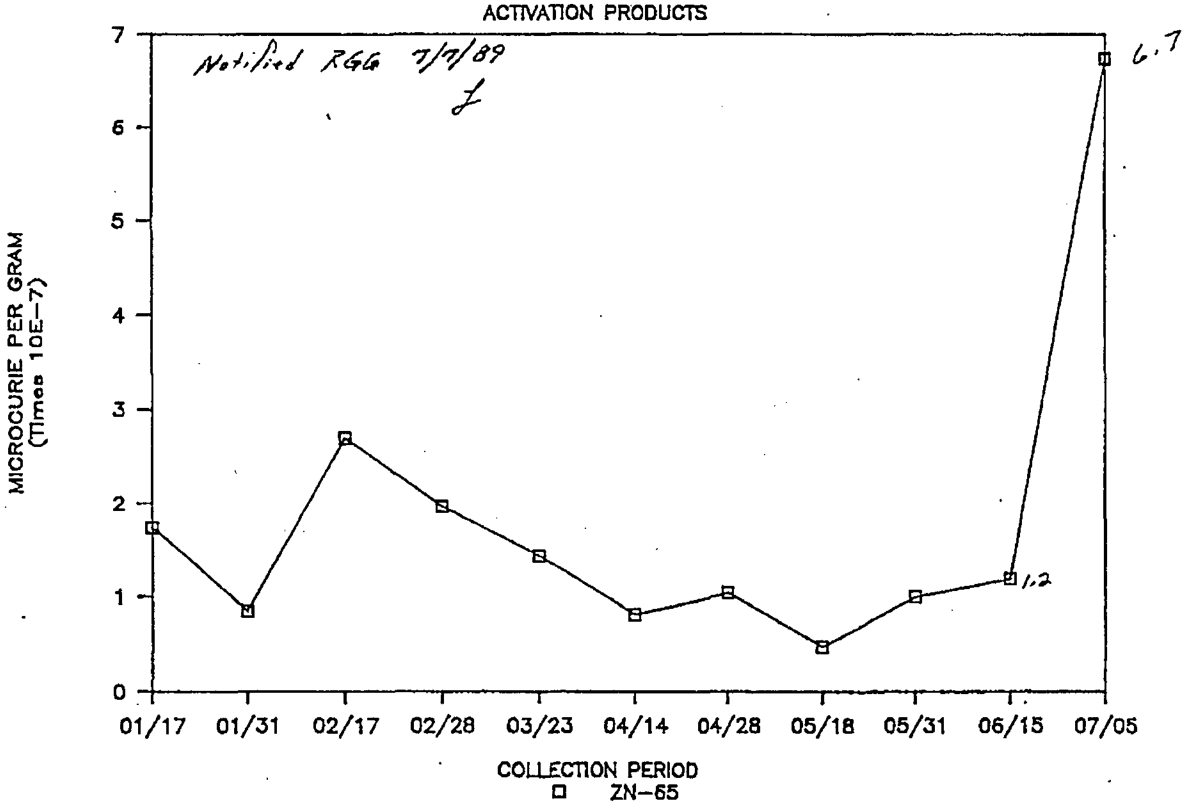
1989 ST101 RESULTS

FISSION PRODUCTS

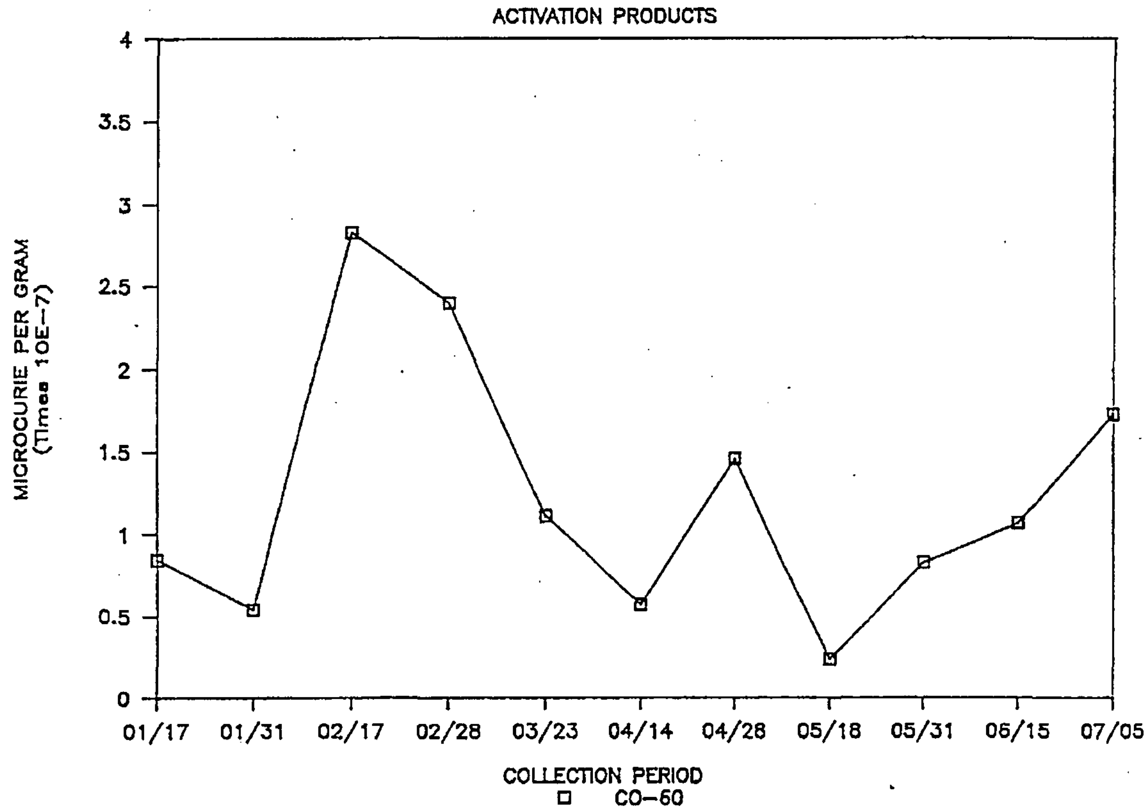


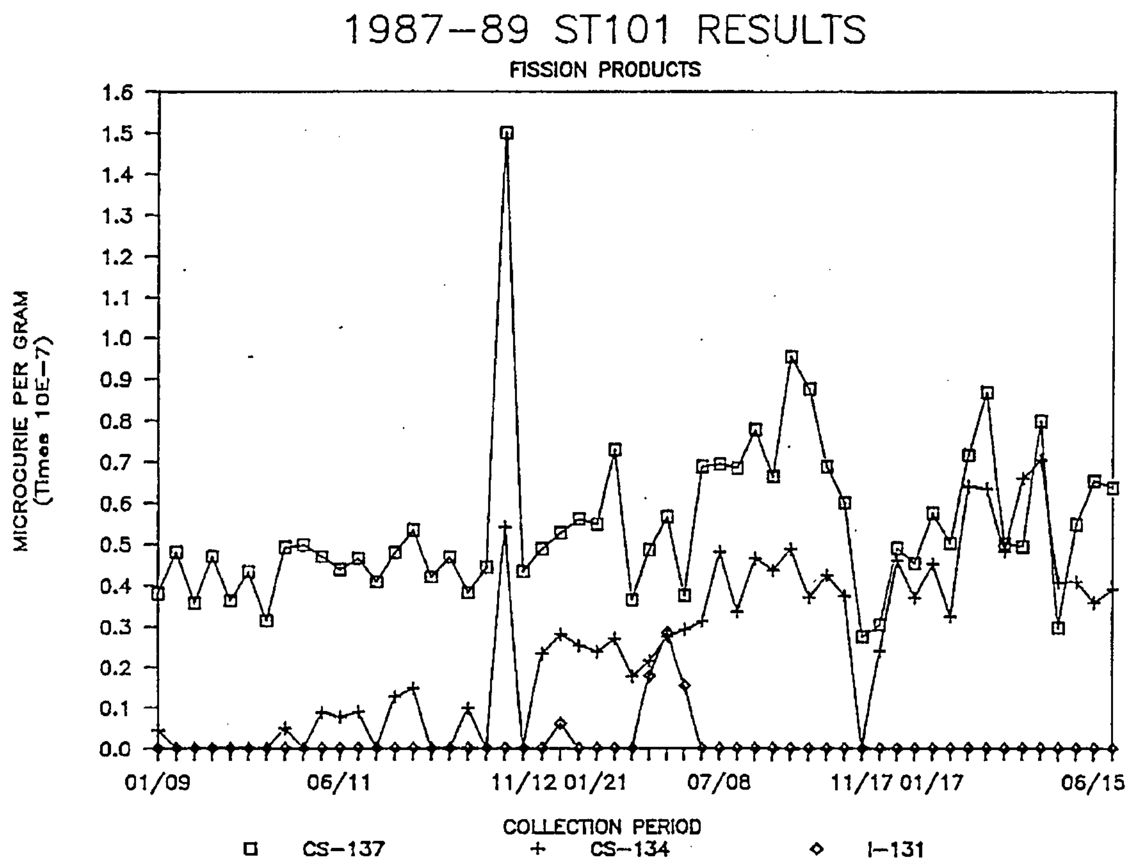
1989 ST101 RESULTS

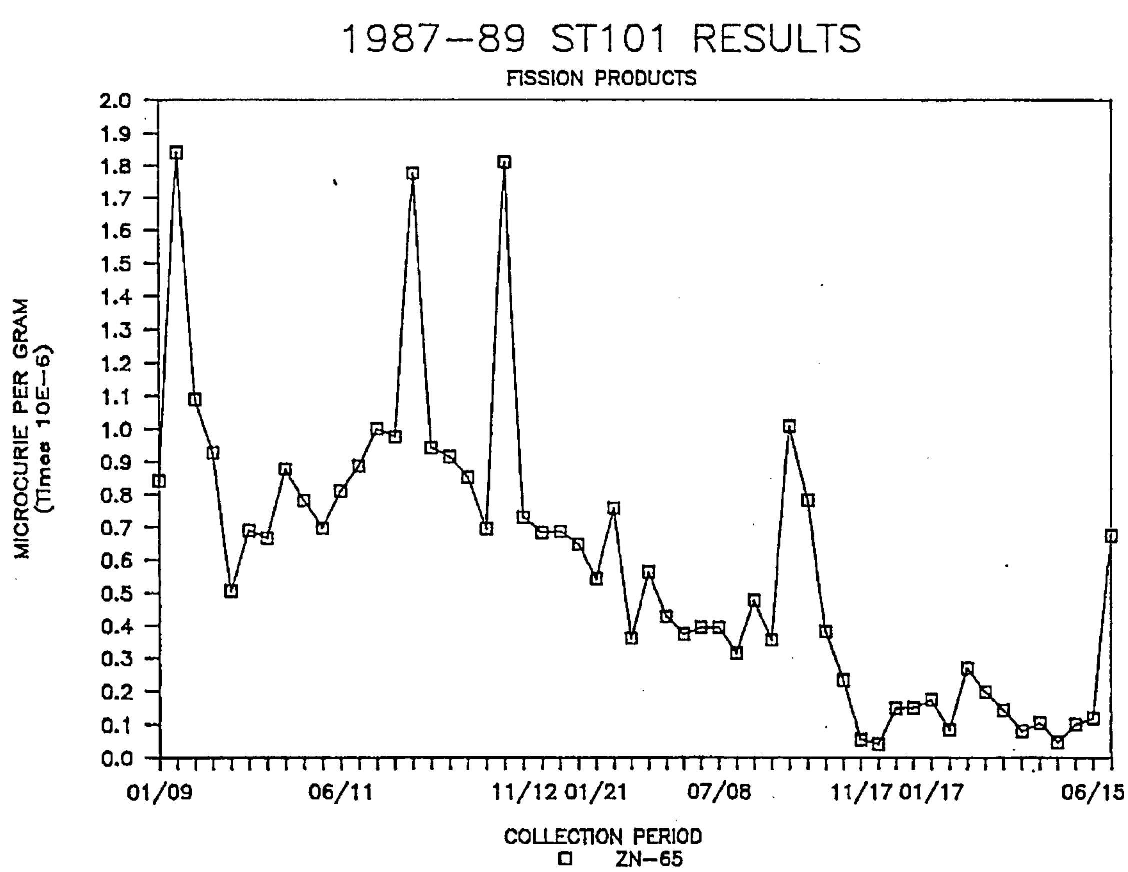
ACTIVATION PRODUCTS



1989 ST101 RESULTS

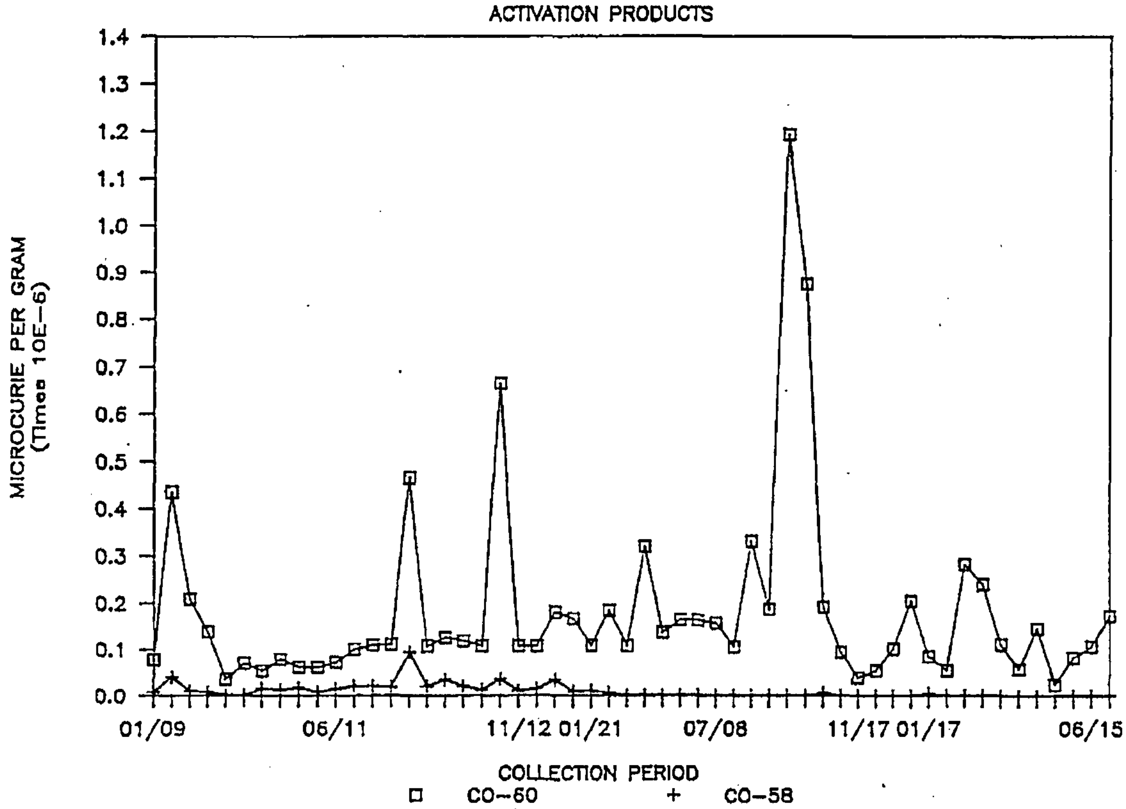



1987–89 ST101 RESULTS
FISSION PRODUCTS
MICROCURIE PER GRAM (Times 10E–7)
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
01/09
06/11
11/12 01/21
07/08
11/17 01/17
06/15
COLLECTION PERIOD
CS–137
CS–134
I–131


1987–89 ST101 RESULTS
FISSION PRODUCTS
MICROCURIE PER GRAM (Times 10E–6)
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
01/09
06/11
11/12 01/21
07/08
11/17 01/17
06/15
COLLECTION PERIOD
ZN–65

1987–89 ST101 RESULTS

ACTIVATION PRODUCTS



WASHINGTON PUBLIC POWER
SUPPLY SYSTEM

INTEROFFICE MEMORANDUM

KDC Recd 10/2/89

DISTRIBUTION: MAIL DROP:

- [ ] WNP-1 FILE
- [ ] WNP-2 FILE
- [ ] WNP-3 FILE
- [ ] WNP-4 FILE
- [ ] WNP-5 FILE
- [ ] HGP FILE
- [ ] PKWD FILE
- [ ] LEGAL FILE
- [ ] ADMIN FILE

DATE: September 29, 1989

TO: K. D. Cowan, Manager of Operational Experience Assessment (956B)

FROM: T. S. Gray, Sr. Health Physicist, Radiological Assessment (1020) TS Gray

SUBJECT: OER 83022F STATUS

REFERENCE:

RG Graybeal-927K
BJ Hahn-956B
DE Larson
DJ Pisarcik-927K
TSG/lb

The subject OER involves monitoring and possible disposal requirements for sludge contaminated to very low levels from three (3) sources: The sewage treatment plant, cooling towers, and roof drain field.

The sewage treatment plant sludge has been sampled for low levels of contamination. Very low levels of radioactivity were found but were determined to be of Department of Energy (DOE) origin and therefore not subject to our control or regulation. When the sewage treatment sludge is disposed of, representative samples will be taken to determine if any contamination exists.

A draft cooling tower sludge disposal evaluation has been performed and is attached. In the evaluation, the low levels of activity were possibly determined to be of DOE and WNP-2 stack origin and therefore no 10 CFR 20.302a application would be necessary. However, information to support this position is still being accumulated. In the meantime, routine samples will continue to be taken to monitor the low levels of radioactivity. A final cooling tower sludge disposal evaluation is expected by 2/1/90.

The roof drain field, that serves the WNP-2 roof drains and "clean" Turbine Generator Building sumps, has been found to contain very low levels of DOE and WNP-2 origin radionuclides. A PER 289-0731 has been written to investigate any suspected paths of contamination and to initiate corrective actions to eliminate any identified paths. Meanwhile, routine samples of sludge at the outfall are being taken. Also samples outside of the outfall area are being taken to define the extent of the low level contamination. Based on the results of these samples, disposal options, if necessary, will be evaluated.

TSG/mes

DRAFT

COOLING TOWER SLUDGE DISPOSAL EVALUATION

1.0 Background

During routine operation of the WNP-2 cooling towers, the annular water distribution flumes, located on top of the cooling towers, become clogged with sludge. The sludge is removed approximately twice a year as part of the annual refueling outage and whenever unscheduled outages/sludge levels permit to ensure adequate cooling tower performance and to minimize corrosion of the Circulating Water System. The wet sludge is removed by vacuuming or sucking the material into a 3000 gallon tank truck. The material is then taken to the WNP-2 landfill and dumped where it quickly dries taking on the appearance of dry parched earth.

Cooling tower sludge accumulates mostly in the flumes opposite the incoming water riser where there is minimal turbulence. The buildup and composition of the sludge varies according to river flow, air and water temperature, and wind conditions. The sludge is composed of a mixture of river sediment, windblown silt from the desert, and biomass. An analysis of the cooling tower sludge, performed by Calgon Corporation, identified the major sludge constituents as aluminum silicates (plagioclase and montonorillonite) and silica from diatoms and quartz. Biofouling monitoring by the Supply System has shown a seasonal variation in biomass formation with less growth measured during the winter months.

Percent organic material measurements, related to biomass production, have indicated anywhere from 8 to 26% of the sludge is of organic origin.

2.0 Radiological Characteristics

Cooling tower sludge data and radioactivity content calculations are shown in Table 1. Total radioactivity estimates were based on isotopic analyses of dried sludge samples and by assuming an average of two cooling tower cleanouts per year. A summary of the estimated activity per year and total activity at the end of forty years is shown below.

Radionuclide	Half-life	uCi/year	Total uCi @ 40 yr
Mn-54	0.855	2.5	3.1
Co-60	5.271	16	120
Zn-65	0.67	7.0	7.0
Cs-134	2.065	8.8	26
Cs-137	30.0	19	500

The very low levels of radioactivity contained in the sludge have been found to originate from materials suspended in the Columbia River and from routine plant airborne effluents. The presence of cobalt and cesium isotopes in the Columbia River, a result of Hanford plutonium production activities, has been documented for some time. These radionuclides in the Columbia River are introduced into the WNP-2 water systems via the make-up flow of the TMU system.

An estimate of the total solids introduced, based on average 1987 suspended solids in the make-up water, indicate approximately 4,000 pounds are available each month for accumulation. These solids, with the attendant biomass, tend to settle out in the distribution flumes of the cooling towers.

The low levels of radionuclides in the sludge from routine plant airborne effluents result from air drawn into the cooling towers to aid in the water cooling process. This is due primarily to the close proximity of the cooling towers to the Reactor Building release point. Particulate emmissions in the effluent are effectively washed out and trapped in the cooling tower sludge. Since the radioactive material in the sludge originates partly from the Reactor Building release point, it has already been accounted for in terms of license requirements and therefore represents environmental radioactivity. The accumulation of airborne effluents in the cooling tower sludge, however, represents an alternative pathway for the radionuclides released from the stack. The radiological impact of this alternative pathway was evaluated according to all potential modes of exposure as shown in the next section.

3.0 Evaluation of Radiological and Environmental Impact

The radiological impact of the cooling tower sludge disposal to onsite personnel was evaluated by considering the following potential modes of exposure: 1) external exposure from standing on the ground above the disposal site, 2) internal exposure from the inhalation of resuspended radionuclides, 3) internal exposure from the ingestion of food grown on the disposal site, and 4) internal exposure from drinking potentially contaminated groundwater.

The most plausible mode of radiation exposure is the external exposure caused by persons working above the contaminated sludge. Calculation results and assumptions used in the evaluation from external exposure are shown in Table 2. The annual exposure to an individual from external exposure is conservatively estimated to be less than a tenth of a millirem after the first year of sludge disposal. This annual dose would then be expected to level off at about two-tenths of a millirem based on verified Microshield calculations of exposure rate versus increasing sludge depth due to continued sludge disposal. The calculations are conservative in that most of the estimated 100 hours per year that employees may work in the landfill will be in a location away from the sludge.

The second most plausible mode of radiation exposure is internal exposure resulting from the inhalation of resuspended contaminated sludge. Calculation results and assumptions used in the evaluation are shown in Table 3. The annual exposure to an individual from the inhalation of airborne sludge is conservatively estimated to be less than four-hundredths of a millirem. In the exposure evaluation, dose factors for the highest exposed adult organ were taken into account for a worker inhaling at a moderate rate of 20 liters per minute for 100 hours per year occupancy time in the landfill.

Internal exposure from the ingestion of food grown on the disposal site is considered unlikely as crop production is not anticipated for future land use on this property.

Internal exposure from the consumption of potentially contaminated groundwater is estimated to be minimal. There are no wells drawing from the unconfined aquifer downgradient of the disposal site. There are two wells in use at the Supply System WNP-1 site about 7000 ft. east of the disposal location. However, these wells are 372 ft. and 465 ft. deep, and, based on stratigraphy and water quality data, appear to draw from a semi-confined aquifer in the Ringold conglomerates and the upper fractured basalt flow. If it were assumed that all the radioactivity reached the groundwater beneath the disposal site, the radionuclide concentrations at the WNP-1 wells would be reduced to a small fraction of their maximum permissible concentration (MPC) value by radioactive decay and sorption (Table 4). There would be additional reduction due to dispersion in the aquifer.

The nonradiological environmental impact of cooling tower sludge disposal is negligible. The disposal does not involve the disturbance of new ground nor does it represent new land use. The area has been previously excavated for borrow material and backfilled with native soils and construction debris. The cooling tower sludge is composed mostly of river sediment and windblown silt and is not a concern with respect to hazardous waste regulation (see 40CFR261.6(a)(d)(iv)).

4.0 Disposal Analysis

The radionuclides contained in the cooling tower sludge are of environmental origin and, as such are not licensed material as defined in 10 CFR 20. Accordingly, the provisions of 10 CFR 20 do not apply to this material. Instead, the requirements of 40 CFR 190 that outline permissible exposures to members of the public from the nuclear fuel cycle, are applicable. Therefore, detection levels must be sensitive enough to meet the requirements of 40 CFR 190. Note that the Supply System does not consider radionuclides originating from Department of Energy activities on the Hanford Reservation for compliance with 40 CFR 190. These radionuclides, however, have been included in the analysis to demonstrate that the cumulative radionuclide impact is still negligible.

As shown in the radiological impacts section, the most plausible and limiting form of exposure is from external exposure. Accordingly, the limiting criterion for whole body exposure from 40 CFR 190 is 25 mrem/yr. From Tables 1 and 2, it is shown that the radionuclide mixture of 1.207 pCi/g contained in the sludge produces an annual dose of 0.097 mrem. Taking Microshield calculations into account (infinite slab source) for the buildup of sludge and self attenuation produces a maximum annual dose of 0.19 mrem. Equating this to a specific activity that would produce an annual dose of 25 mrem yields:

$$25 \text{ mrem/yr} \times 1.207 \text{ pCi/g}/0.19 \text{ mrem/yr} = 159 \text{ pCi/g}$$

Thus, 159 pCi/g represents the limiting specific activity to ensure the annual dose of 25 mrem was not exceeded. Assuming that the relative amounts of the radionuclides do not change significantly and that Co-60 accounts for greater than 50% of the external exposure, the specific activity of Co-60 that equates to an annual dose of 25 mrem is:

$$159 \text{ pCi/g} \times 0.36 \text{ pCi/g}/1.207 \text{ pCi/g} = 47.6 \text{ pCi/g Co-60}$$

To ensure compliance with 40 CFR 190, the survey technique used for monitoring the cooling tower sludge must be sensitive enough to detect 47.6 pCi/g of the limiting radionuclide, Co-60. Therefore, by setting the lower limit of detection (LLD) to 47.6 pCi/g of Co-60 and assuming the radionuclide mix does not significantly change, the count time for a 450 ml marinelli sludge sample is calculated as follows:

$$LLD = (4.65*Sb)/(E*V*2.22\ dpm/pCi*Y*exp-\lambda\Delta t)$$

where: Sb = std deviation of bkg count rate $(Rb/t)^{1/2}$
E = counting efficiency
V = sample size in grams
Y = fractional yield
Δt = time elapsed between sample collection and counting

$$47.6\ pCi/g = (4.65*Sb)/(0.0028*380g*2.22dpm/pCi*1*1)$$

Rearranging and solving for Sb:

$$Sb = (47.6pCi/g*0.0028*380g*2.22dpm/pCi)/(4.65) = 24.2$$

Solving for count time:

$$24.2 = (Rb/t)^{1/2}$$

$$t = Rb/(24.2)^2 = 1\ cpm/(24.2/m)^2 = 1.7E-3\ min$$

Thus, with the above counter specifics, a count time of five minutes would be more than adequate to ensure the provisions of 40 CFR 190 are met. Should the activity be greater than or equal to that specified, then the cooling tower sludge disposal should be reevaluated.

TABLE 1

Cooling Tower Sludge Data and Radioactivity Content Calculations

A. Estimated Annual Volume

$$6\ \frac{\text{cooling}}{\text{towers}} \times 2\ \frac{\text{truck loads}}{\text{tower}} \times 2\ \frac{\text{cleanouts}}{\text{yr}} \times 3000\ \frac{\text{gallons}}{\text{truckload}} \times 3785\ \frac{\text{cm}^3}{\text{gallons}} \times 0.19\ \frac{\text{solid}}{\text{fraction}} = 5.2\text{E}+7\ \frac{\text{cm}^3}{\text{yr}}$$

B. Estimated Annual Mass

$$5.2\text{E}+7\ \frac{\text{cm}^3}{\text{yr}} \times 0.85\ \frac{\text{g}}{\text{cm}^3} = 4.4\text{E}+7\ \frac{\text{g}}{\text{yr}}$$

C. Estimated Activities

Radionuclide	Half-Life (yrs)	Highest Avg. Activity (pCi/g)	Total Activity per Year (μCi)	Activity at End* of Forthieth Year (μCi)
Mn-54	0.855	5.7E-2	2.5	3.1
Co-60	5.271	3.6E-1	16	1.2E+2
Zn-65	0.67	1.6E-1	7.0	7.0
Cs-134	2.065	2.0E-1	8.8	26
Cs-137	30	4.3E-1	19	5.0E+2
			5.3E+1	6.6E+2

$$^{*}\ \text{Activity}\ (\mu\text{Ci}) \doteq \frac{P}{\lambda}\left(1 - e^{-\lambda t}\right)$$

Where: $P = \mu\text{Ci/yr}$
λ = decay constant
t = 40 yr

TABLE 2

Estimated Annual External Exposure To An Individual
From Standing Above The Contaminated Cooling Tower Sludge

Radionuclide	Avg Surface Dep. (pCi/m2) [a]	External Dose Fac. (mrem/hr/pCi/m2) [b]	Dose (mrem) [c]
Mn-54	4.9E+3	5.8E-9	2.8E-3
Co-60	3.1E+4	1.7E-8	5.3E-2
Zn-65	1.4E+4	4.0E-9	5.6E-3
Cs-134	1.7E+4	1.2E-8	2.0E-2
Cs-137	3.7E+4	4.2E-9	1.6E-2
Total			9.7E-2

a. The average surface deposition was estimated by assuming that all of the radioactivity in the contaminated sludge was deposited on the top 10 cm surface and that the average concentrations of radionuclides were the same as the measured concentrations.

b. External dose factors were taken from Table E-6 of Reg. Guide 1.109, Rev. 1.

c. Annual dose was based on an occupancy of 100 hours per year.

Table 3

Estimated Annual Internal Exposures
From Inhalation Of Contaminated Sludge

Radionuclides	Avg Surface Dep. (pCi/m2)	Inhal. Dose Factor (mrem/pCi)[a]	Target Organ	Dose (mrem)[b]
Mn-54	4.9E+3	1.75E-4	lung	1.1E-3
Co-60	3.1E+4	7.46E-4	lung	2.8E-2
Zn-65	1.4E+4	1.08E-4	lung	1.8E-3
Cs-134	1.7E+4	1.06E-4	liver	2.2E-3
Cs-137	3.7E+4	7.76E-5	liver	3.4E-3

a. Inhalation dose factors for the highest adult organ were taken from Table E-7 of Reg. Guide 1.109, Rev. 1.

b. Annual doses were calculated using a resuspension factor of 1E-5/m and an inhalation rate of 1.2E+2 m3/yr based on 100 hours occupancy. The resuspension factor was taken from Appendix C of LA-4558-MS, Surface Contamination: Decision Levels.

TABLE 4

Estimated Groundwater Concentration
Of Radionuclides From Cooling Tower Sludge

Radionuclide	Total Activity Per Yr (uCi)	MPC[a] (uCi/ml)	Estimated[b] Concentration (uCi/ml)
Mn-54	2.5	1E-4	1.7E-12
Co-60	16	3E-5	1.1E-11
Zn-65	7.0	2E-4	4.7E-12
Cs-134	8.8	9E-6	0.0
Cs-137	19	2E-5	2.2E-14

a. Maximum permissible concentrations for water per 10 CFR 20 Appendix B, Table II, Column 2.

b. Estimated groundwater concentration due to radioactive decay and sorption per WNP-2 FSAR Section 2.4.13.3.

ORIGINAL

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

TECHNICAL EVALUATION REQUEST

TER NO. 88-0157-0

PTL NO.

PROBLEM IDENTIFICATION/PROPOSED SOLUTION

EPN	SYSTEM
	Non-Radioactive Drains/Storm Drain System

Water containing low levels of radioactivity continues to be released to the storm drain evaporation/percolation pond northeast of WNP-2. Identified radionuclides are characteristic of reactor coolant and may be indicative of unidentified leakage paths between radioactive and non-radioactive systems.

ORIGINATOR	DATE	SUPERVISOR	DATE
G. V. Oldfield	4/29/88		5-3-88

EVALUATION/RECOMMENDATION

EVALUATION SUMMARY

RECOMMENDED ACTION

☐ PROCEDURE REVISION ☐ MAINTENANCE ☐ MODIFICATION ☐ NONE ☐ OTHER

BENEFIT FROM ACTION

EVALUATOR	DATE	SUPERVISOR	DATE

APPROVAL

APPROVED ACTION

RESPONSIBLE DEPARTMENT

	PLANT TECHNICAL MANAGER	DATE
PRC REVIEW REQUIRED ☐		
PLANT MGR. APPVL. REQ'D ☐	PLANT MANAGER	DATE

CLOSURE

IMPLEMENTING DOCUMENT	RESPONSIBLE MANAGER	DATE

968-20941 (6/86)

DIC 1819

ORIGINAL

WASHINGTON PUBLIC POWER
SUPPLY SYSTEM

TECHNICAL EVALUATION REQUEST

TER NO.	QUALITY CLASS	SAFETY RELATED	PTL NO.
88-0157-0		❑ YES ❑ NO	22464

EPN	SYSTEM NO.	SYSTEM NAME
		NON RADIOACTIVE / STORM DRAIN SYSTEM

PROBLEM IDENTIFICATION/PROPOSED SOLUTION

PROBLEM/SOLUTION

Water containing low levels of radioactivity continues to be released to the storm drain evaporation/percolation pond northeast of WNP-2. Identified radionuclides are characteristic of reactor coolant and may be indicative of unidentified leakage paths between radioactive and non-radioactive systems.

ORIGINATOR	DATE	SUPERVISOR	DATE
927K G.V. Oldfield (see attached)		Graybeal (see attached)	

EVALUATION/RECOMMENDATION

EVALUATION SUMMARY IT WAS THOUGHT THAT THE RADIOACTIVITY WAS COMING FROM THE FDR SUMP PIPING CROSS CONNECT. TWO CHECK VALVES WERE INSTALLED, FDR-V-34 & 35, TO PREVENT BACK FLOW FROM THE FDR PIPING. IT SEEMS SOME TRACES OF RADIOACTIVITY ARE STILL BEING RELEASED TO THE STORM DRAIN POND.

RECOMMENDED ACTION A THOROUGH INVESTIGATION SHOULD BE MADE BY ENGINEERING TO DETERMINE THE PATH OF THE RADIOACTIVITY TO THE STORM DRAIN SYSTEM. CORRECTIVE ACTIONS SHOULD THEN BE INITIATED TO ELIMINATE THIS RADIOACTIVE RELEASE.

❑ PROCEDURE REVISION ❑ MAINTENANCE ❑ MODIFICATION ❑ NONE ❑ OTHER

BENEFIT FROM ACTION

ELIMINATION OF RADIOACTIVE RELEASES TO THE STORM DRAIN

EVALUATOR	DATE	SUPERVISOR	DATE
N. PIKE	8-9-89	BF Peck	8-23-89

APPROVAL

APPROVED ACTION

GENERATION ENGINEERING	DATE	RESPONSIBLE DEPARTMENT	
PROJECT ENGINEER	DATE	SUPERVISOR	DATE
PRC REVIEW REQUIRED ❑ YES ❑ NO	PRC APPROVAL ❑ YES ❑ NO	PLANT TECHNICAL MANAGER	DATE

CLOSURE

IMPLEMENTING DOCUMENT	RESPONSIBLE MANAGER	DATE

968-20941 R1 (11/88)

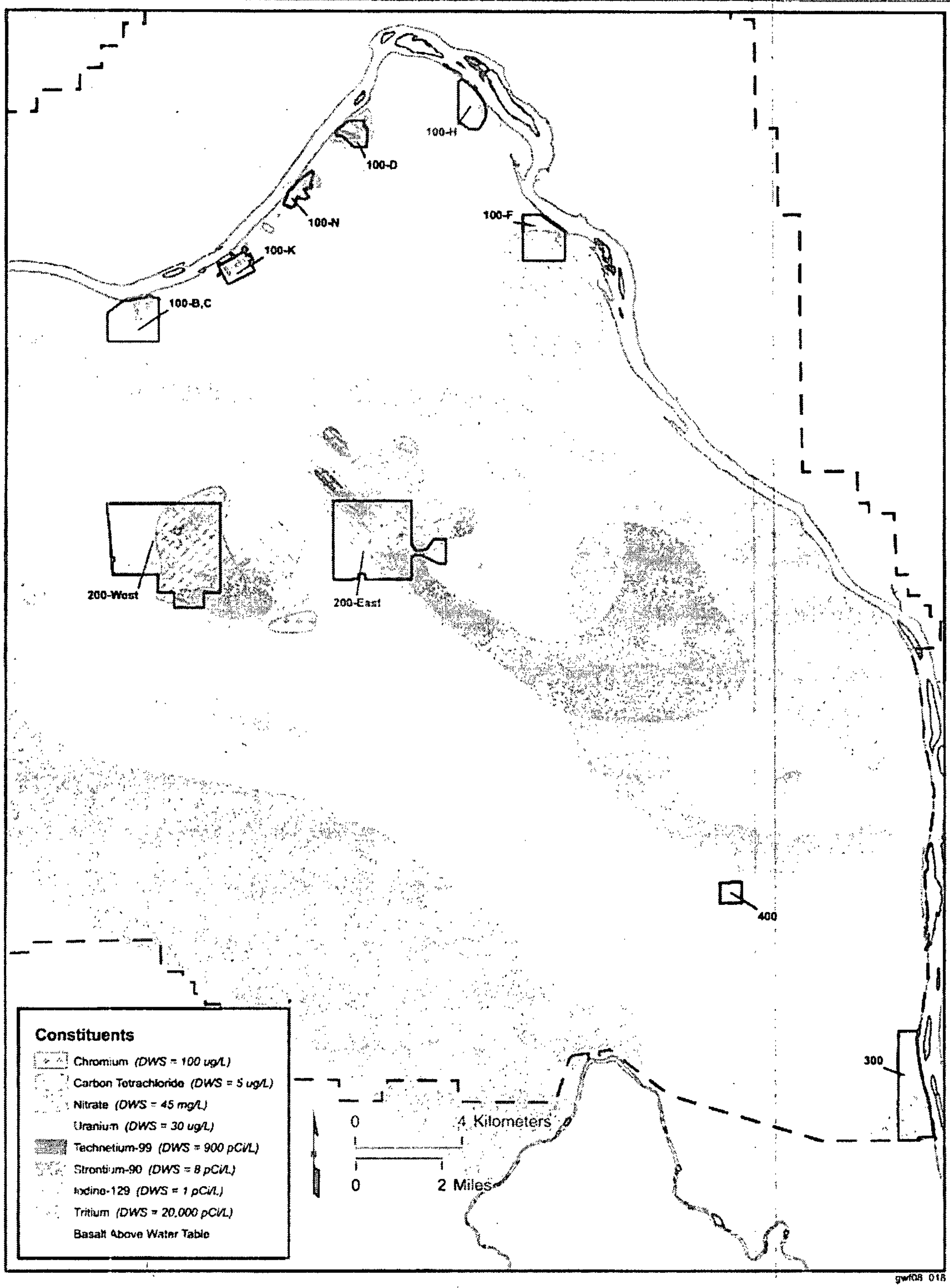


Figure 10.7.4. Major Contaminant Plumes in Hanford Site Groundwater at Concentrations Above Drinking Water Standards During 2008 (DOE/RL-2008-66, Rev. 0)

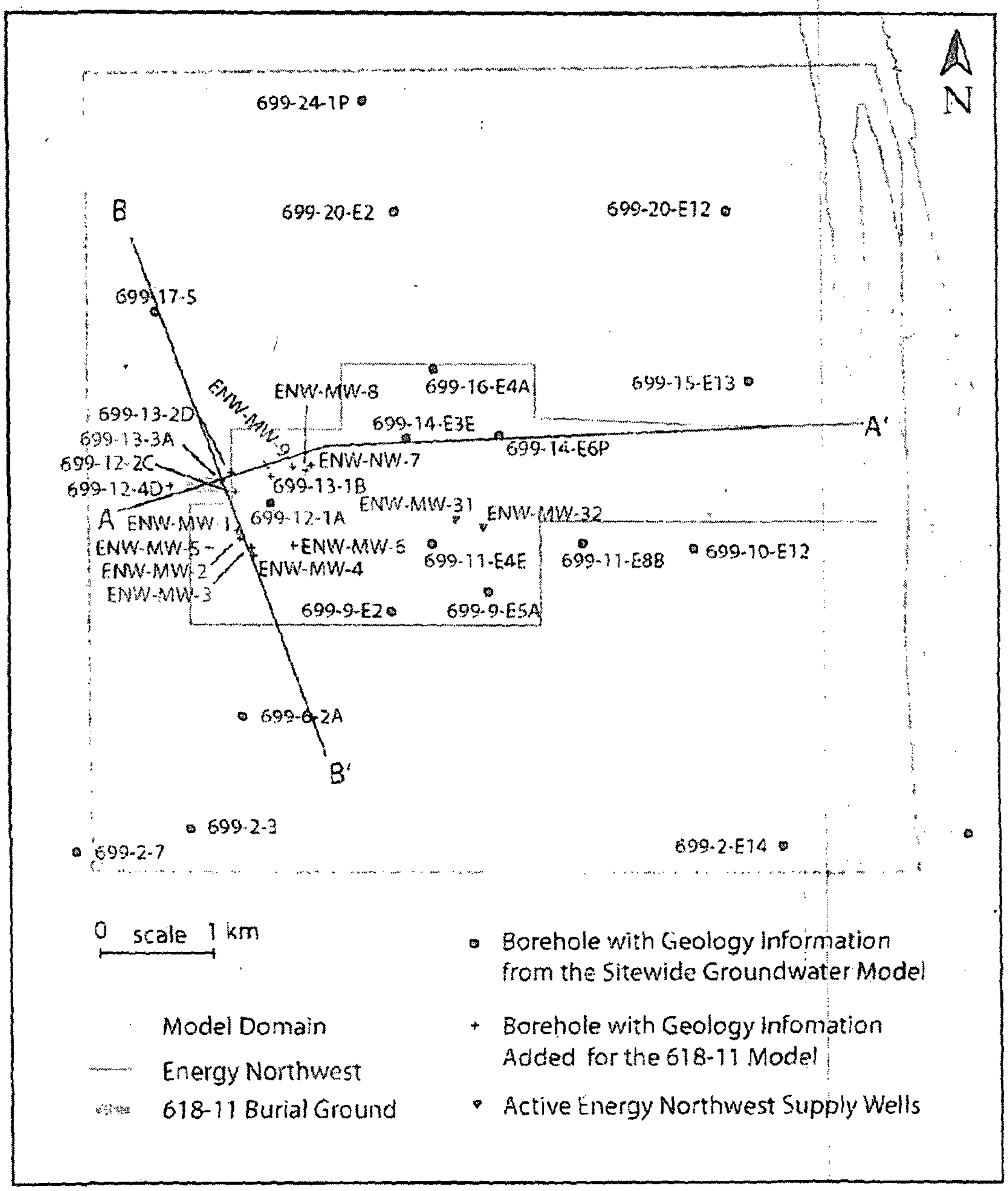


FIGURE 4-10.LINES OF CROSS-SECTIONS AND LOCATIONS OF BOREHOLES USED TO DEFINE HYDROGEOLOGIC CONCEPTUAL MODEL (VERMEUL ET AL. 2005).

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DIC 2601.1

Contamination Event Report No. 98-001

Storm Drain Pond Post 1994
Columbia Generating Station

December 11, 2007

Contamination Event Report

No. 98-001
No. 01-001
No. 01-002
No. 03-001
No. 03-002
No. 03-003
No. 05-001

Summary

The following report summarizes information regarding potential release of radioactivity or detection of elevated radioactivity levels in the Storm Drain Pond (SDP) in accordance with 10 CFR 50.75(g). The documentation of several of the events (98-001, 01-001, 01-002, 03-002, 03-003) provided below indicates no contamination was released to the SDP. No dose analysis is necessary for the events described as no actual release of contamination to the SDP occurred, hence no significant contamination remains after decontamination efforts. The purpose of the report is to consolidate the data concerning each event and to clearly document the events as outlined in 10CFR50.75(g) due to the potential release of radioactive material. Each event was evaluated on a case by case basis and the SDP is monitored under the station's routine Radiological Environmental Monitoring Program (REMP).

Event Description & Location

CER 98-001 (PER 298-0783)
A valve in the Fire Protection System broke resulting in the flooding of the northeast reactor building stairwell on June 17, 1998. Water from the northeast reactor building stairwell was pumped to the Storm Drain Pond at 15:00 after isotopic analysis of a sample taken at 14:15 indicated no radionuclides were present in the water. A second grab sample taken at 15:20 indicated a Cobalt-60 level of 5.2E-08 microcurie per cubic centimeter. The pumping of the water from the stairwell to the SDP was discontinued at 16:20. A final sample of the water that was pumped was taken at 16:34 with the results of this sample indicating no Cobalt-60. A composite sampler located at the Storm Drain Pond was started at 15:00 and discontinued at 17:15. A 171 milliliter sample was analyzed with no radionuclides being detected. Approximately 17,000 gallons of water was discharged to the SDP from the northeast reactor building stairwell.

CER 01-001 (PER 201-1233)
A small amount of potentially contaminated water may have been introduced to the Storm Drain system when the Fire Protection System (FP-SYS-W21) was drained on June 11, 2001 to the Storm Drain connection and out through the C100 door. Two red rubber hoses water hoses from the Tool Crib were used to drain the water from drain valve 21/6 to the storm drain connection via a system strainer on the Radwaste 437' elevation. Approximately 100 gallons of water was released to the storm drain and out the C100 door. Following the system drain, the red rubber hoses were removed and 2.5" fire protection hoses were connected to the system strainer and the system was flushed at 500 gallons per minute for seven minutes. The Fire Protection System Engineer collected a sample of the water and scale from the strainer catch bowl due to the reddish color suspecting it was attributed to Microbiological Influenced Corrosion. The Fire Protection System Engineer wanted to have the sample analyzed at the environmental lab. An isotopic analysis by the station Chemistry laboratory indicated the presence of Cobalt-60 and Chromium-51 among other radionuclides.

The source of the contamination was traced to the rubber hoses used to drain the system. The initial level of contamination in the hoses is unknown. The flow proportional sampler that normally monitors the storm drain discharge was inoperable due to all of the sample bottles being full. As an alternative, a sample of sediment was taken from the discharge area on June 13, 2001 and a follow-up water sample was collected on June 14, 2001. These samples cannot be directly related to this event due to the multiple plant sources that discharge to this point. However, they do provide an indication of whether this is a reportable contamination event. The sediment sample was found to contain 1.24E-7 microcurie per milliliter Cobalt-60 (124 picocuries per kilogram wet). The follow-up water sample was analyzed and found not to contain any detectable radionuclides.

CER 01-002 (PER 201-1381)
Approximately 2.5 gallons of potentially contaminated water was poured down a sink drain in the 487' elevation of the Radwaste Building in Room C-312 which is connected to the Storm Drain system on June 22, 2001. The water that poured down the sink was used to wash the contractor's tools and half masks following an asbestos removal job in the 487' Radwaste Chemistry Laboratory. Two additional buckets of water used on the same job were sampled and analysis indicated no radioactivity. Analysis of swipes taken from the laborers sink and drain also indicated no radioactivity. No contamination was found during the tile removal in the Chemistry laboratory and tile in known contaminated areas in the laboratory was not allowed to be taken up.

CER 03-001 (PER 203-0856)
The analytical results for the Storm Drain outfall composite sample for January 2003 indicated a Tritium level of 1.23±0.03 E+04 picocuries per liter. This level was the highest level observed since 1994. The Offsite Dose Calculation Manual acknowledges that tritiated water may be released into the environment. Section 3.1 of the ODCM states: "Tritium in the form of tritiated water vapor is released to the environment through monitored/sampled pathways. Under certain meteorological conditions, the tritiated water vapor may condense onto surfaces such as rooftops and exterior walls. Subsequently, this condensed, recaptured tritiated water may be carried with precipitation into the Storm Drain Pond (SDP) which serves as a collection point for rainfall on plant roofs. Influent to the SDP is continuously sampled and periodically analyzed for tritium content."

Contamination Event Report
No. 98-001
No. 01-001
No. 01-002
No. 03-001
No. 03-002
No. 03-003
No. 05-001

CER 03-002 (PER 203-2356)
Routine sampling of the Plant Demineralized Water System for radioactivity revealed that radioactivity had been introduced into the water system. Samples taken on June 4, 2003 had no indication of radioactivity above MDA levels. The following table provides information with regard to the samples taken between June 11, 2003 and June 12, 2003.

Sample Location	441' Turbine Bldg.	548'Reactor Bldg.	487' Radwaste Bldg.
Sample Date/Time	June 11,2003 20:15	June 11,2003 21:50	June 12,2003 02:05
Radionuclide	microcurie per milliliter	microcurie per milliliter	microcurie per milliliter
Cobalt-58	3.48E-8	–	2.06E-8
Cobalt-60	7.04E-8	3.23E-7	6.48E-8
Cesium-137	5.24E-8	–	4.13E-8
Manganese-54	3.12E-8	–	–
Zinc-65	2.44E-7	1.08E-7	1.90E-7
Tritium	1.52E-4	9.8E-5	1.99E-4

Leakage from pumps and the Deminerilized Water Storage Tank overflow may go to the Storm Drain Pond. However, there was no documentation indicating the Storm Drain Pond received any contaminated water from this event.

Corrective actions included identification of the source of the contamination and flushing of the Demineralized Water System to return it to a non-radioactive system.

CER 03-003 (PER 203-3885)
Analysis of the initial sample of the WOA drain basin identified a tritium concentration of 1.05E-05 microcurie per milliliter and the analysis of the backup sample found 1.11E-5 microcurie per milliliter. The WOA airwash was secured for cold weather operations and Chemistry was requested to sample the drain basin to determine if Operations could release the water to the storm drain pond. The laborers were requested to pump the screenwash basin water into drums for processing in radwaste. Discussions with Operations identified that although the system was in service, it had not operated for some time due to cold ambient temperatures. Therefore, the water had been sitting in the basin with no make-up or overflow. Samples of the inlet air to the fans indicted the presence of tritium which indicates the plant was probably recycling air from the Turbine Exhaust Air (TEA) discharge that is know to contain tritium. The contact of the TEA discharge with the stagnant water in the basin most likely resulted in equilibrium of the tritium activity between the air and the water.

Contamination Event Report
No. 98-001
No. 01-001
No. 01-002
No. 03-001
No. 03-002
No. 03-003
No. 05-001

No tritium was found in the analysis of the Storm Drain Pond composite sample and drain line sample which indicates the system did not discharge to the pond.

CER 05-001 (Condition Report 205-08789 (Plant Tracking Log # 235297))
Environmental Services reported increased Cobalt-60 levels of 19.9 picocuries per liter from the composite sampler located at the Storm Drain Pond (REMP Station 101). The evaluation provided for this Condition Report provided information with regard to the plant effluents and the precipitation records from Hanford to explain the increased activity level detected in the composite sample.

The following is an excerpt of the information provided the 'Current Status' tab of Plant Tracking Log # 235297:

"Hanford Met Tower precipitation records and plant particulate and iodine effluent results are tabulated below:

Month	Inches of Rainfall	Curies of Particulates/Iodines*
Jan	0.93	3.98e-6
Feb	0.04	8.74e-6
Mar	0.31	7.33E-6
Apr	0.26	1.45E-4
May	0.79	1.21E-4
Jun	0.06	2.37E-4
Jul	0.09	2.33E-5
Aug	0.06	2.08E-4
Sep	0.66	2.84E-4
Oct	0.29	2.21E-5

*Half lives >8 days

During the early part of the summer dry season (May 6th to July 2nd), refueling maintenance activity generated some particulate effluents. Following startup on July 2, 2005, an RWCU system leak also was generating particulate effluents. The first significant rainfall following these releases probably washed particulates that had settled on building roofs to the storm drain pond. As stated above, this is anticipated by plant design and the storm pond is monitored and managed in accordance with 10CFR50.75(g).

The Storm Pond is managed in accordance with 10CFR50.75(g). A flow proportional sampling system is installed at the storm drain discharge into the storm pond (evaporation basin) and the aliquots analyzed monthly. No change to this sampling frequency is recommended."

Contamination Event Report
No. 98-001
No. 01-001
No. 01-002
No. 03-001
No. 03-002
No. 03-003
No. 05-001

The detected activity in the composite sample was below the reporting level of 300 picocuries per liter specified in Table 6.3.1-2 of the Offsite Dose Calculation Manual.

The Columbia Generating Station 2005 Annual Radiological Environmental Operating Report provides the following information with regards to the samples taken at the Storm Drain Pond in 2005:

"5.9.1 Storm Drain Pond (Station 101)
The storm drain pond is located approximately 1500 feet northeast of the CGS. Water is sent to the pond through an 18-inch diameter pipe that discharges into a 300-foot long earthen channel that leads to a 100-foot diameter pond. The pond is a shallow, unlined percolation/evaporation basin. Water at the storm drain outfall is sampled using a flow proportional automatic sampler to collect monthly composite samples. Samples were analyzed for tritium, gross beta, and gamma emitting radionuclides. Tritium was detected in just over half of the outfall water samples during 2005. The tritium concentrations were consistent with the levels that have been seen in previous years. In the sample from May, a higher than average gross beta result was measured. The concentration was reported at 38.3 picocuries per liter; this result was not supported by the gamma analysis results. All other beta measurements at Station 101 in 2005 were within the normal range. The September sample contained Cobalt-60 at a concentration of 18.4 picocuries per liter. This value was within the range for Cobalt-60 values measured previously, but Cobalt-60 had not been seen at this station for several years. No other gamma emitting radionuclides of interest were measured at Station 101 in 2005."

Location:
The storm drain pond is located within the controlled area boundary (a 1.2 mile radius surrounding the plant). Storm water was released at a point approximately 1500 feet northeast of the plant. The water is released through an eighteen inch diameter pipe at a concrete outfall into an earthen channel approximately 300 feet in length. The channel empties into a circular unlined pond area that is approximately 100 feet in diameter.

Radiological Information
The following documents provide information with regard to the radiological information for each event.

1. Problem Evaluation Request, PER No. 298-0783, Isotopic Analysis of Discharge to Storm Drain Indicates Some Cobalt-60 Present, June 17, 1998.
2. Problem Evaluation Request, PER No. 201-1233, Potentially Contaminated Water From Red-Rubber Water Hoses Inadvertently Released Into the Storm Drain System, June 12, 2001.
3. Problem Evaluation Request, PER No. 201-1381, Potentially Contaminated Water Poured Down A Drain Which Goes to the Storm Drain System, June 22, 2001.
4. Problem Evaluation Request, PER No. 203-0856, Tritium Levels in January Composite Sample of Storm Drain Outfall Water Elevated, March 18, 2003.

Contamination Event Report
No. 98-001
No. 01-001
No. 01-002
No. 03-001
No. 03-002
No. 03-003
No. 05-001

5. Condition Report 205-08789 (Plant Tracking Log # 235297), Increase Cobalt-60 was observed at the Storm Pond discharge during October, November 11, 2005.

CER 98-001 (PER 298-0783)
The activity levels indicated for this event was that the second grab sample taken at 15:20 indicated a Cobalt-60 level of 5.2E-08 µCi/cc. However, the initial grab sample, the composite sample and a third sample indicated no detectable activity.

CER 01-001 (PER 201-1233)
The composite sampler was not operable at the time of this event. A sample of sediment was taken from the discharge area on June 13, 2001 and a follow-up water sample was collected on June 14, 2001. These samples cannot be directly related to this event due to the multiple plant sources that discharge to this point. However, they do provide an indication of whether this is a reportable contamination event. The sediment sample was found to contain 1.24E-7 microcurie per milliliter Cobalt-60 (124 picocuries per kilogram wet). The follow-up water sample was analyzed and found not to contain any detectable radionuclides.

CER 01-002 (PER 201-1381)
A sample of the water disposed down the drain was not available for analysis. However, two additional buckets of water used on the same job were sampled and analysis indicated no radioactivity. Analysis of swipes taken from the laborers sink and drain also indicated no radioactivity. No contamination was found during the tile removal in the Chemistry laboratory and tile in known contaminated areas in the laboratory was not allowed to be taken up.

CER 03-001 (PER 203-0856)
The analytical results for the Storm Drain outfall composite sample for January 2003 indicated a Tritium level of 1.23±0.03 E+04 picocuries per liter.

CER 03-002 (PER 203-2356)
The following table provides information with regard to the samples taken between 6/11/03 and 6/12/03.

Sample Location	441' Turbine Bldg.	548'Reactor Bldg.	487' Radwaste Bldg.
Sample Date/Time	June 11,2003 20:15	June 11,2003 21:50	June 12,2003 02:05
Radionuclide	microcurie per milliliter	microcurie per milliliter	microcurie per milliliter
Cobalt-58	3.48E-8	–	2.06E-8
Cobalt-60	7.04E-8	3.23E-7	6.48E-8
Cesium-137	5.24E-8	–	4.13E-8
Manganese-54	3.12E-8	–	–
Zinc-65	2.44E-7	1.08E-7	1.90E-7
Tritium	1.52E-4	9.8E-5	1.99E-4

Contamination Event Report
No. 98-001
No. 01-001
No. 01-002
No. 03-001
No. 03-002
No. 03-003
No. 05-001

Leakage from pumps and the Deminerilized Water Storage Tank overflow may go to the Storm Drain Pond. However, there was no documentation indicating the Storm Drain Pond received any contaminated water from this event.

CER 03-003 (PER 203-3885)
Analysis of the initial sample of the Radwaste Outside Air (WOA) drain basin identified a tritium concentration of 1.05E-05 μCi/ml and the analysis of the backup sample found 1.11E-5 microcurie per milliliter.

No tritium was found in the analysis of the Storm Drain Pond composite sample and drain line sample which indicates the system did not discharge to the pond.

CER 05-001 (Condition Report 205-08789 (Plant Tracking Log # 235297))
Environmental Services reported increased Cobalt-60 levels of 19.9 picocuries per liter from the composite sampler located at the Storm Drain Pond (REMP Station 101). Tritium was detected in just over half of the outfall water samples during 2005. The tritium concentrations were consistent with the levels that have been seen in previous years. In the sample from May, a higher than average gross beta result was measured. The concentration was reported at 38.3 picocuries per liter; this result was not supported by the gamma analysis results. All other beta measurements at Station 101 in 2005 were within the normal range. The September sample contained Cobalt-60 at a concentration of 18.4 picocuries per liter. This value was within the range for Cobalt-60 values measured previously, but Cobalt-60 had not been seen at this station for several years.

References

1. Problem Evaluation Request, PER No. 298-0783, Isotopic Analysis of Discharge to Storm Drain Indicates Some Cobalt-60 Present, June 17, 1998.
2. Problem Evaluation Request, PER No. 201-1233, Potentially Contaminated Water From Red-Rubber Water Hoses Inadvertently Released Into the Storm Drain System, June 12, 2001.
3. Problem Evaluation Request, PER No. 201-1381, Potentially Contaminated Water Poured Down A Drain Which Goes to the Storm Drain System, June 22, 2001.
4. Problem Evaluation Request, PER No. 203-0856, Tritium Levels in January Composite Sample of Storm Drain Outfall Water Elevated, March 18, 2003.
5. Condition Report 205-08789 (Plant Tracking Log # 235297), Increase Cobalt-60 was observed at the Storm Pond discharge during October, November 11, 2005.
6. Columbia Generating Station 2005 Annual Environmental Operating Report.
7. Energy Northwest Columbia Generating Station Offsite Dose Calculation Manual

Records

Contamination Event Report
No. 98-001
No. 01-001
No. 01-002
No. 03-001
No. 03-002
No. 03-003
No. 05-001

1. Problem Evaluation Request, PER No. 298-0783, Isotopic Analysis of Discharge to Storm Drain Indicates Some Cobalt-60 Present, June 17, 1998.
2. Problem Evaluation Request, PER No. 01-1233, Potentially Contaminated Water From Red-Rubber Water Hoses Inadvertently Released Into the Storm Drain System, June 12, 2001.
3. Problem Evaluation Request, PER No. 201-1381, Potentially Contaminated Water Poured Down A Drain Which Goes to the Storm Drain System, June 22, 2001.
4. Problem Evaluation Request, PER No. 203-0856, Tritium Levels in January Composite Sample of Storm Drain Outfall Water Elevated, March 18, 2003.
5. Condition Report 205-08789 (Plant Tracking Log # 235297), Increase Cobalt-60 was observed at the Storm Pond discharge during October, November 11, 2005.
6. Map of Storm Drain Pond location (ST101) from 2005 Annual Radiological Environmental Operating Report.

Prepared by: , CHP Date: 12/11/07
R.C. Winslow

Reviewed by: Date: 12/11/07
M.W. Davis

Approved by: Date: 12/12/07
M.J. Shymanski, RPM

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PROBLEM EVALUATION REQUEST

PER No. 298-0783

System Number	MEL EPN	Discovery Date / Time
		06/17/98 22:34

ISOTOPIC ANALYSIS OF DISCHARGE TO STORM DRAIN INDICATES SOME CO-60 PRESENT

Problem:

Description of Condition: On 6/17/98 at 15:00 water from NE Reactor Building Stairwell was pumped to Storm Drain Pond (ST 101) after isotopic analysis indicated no radionuclides (sample taken at 14:15). Another grab sample was taken at 15:20. Results indicated Co-60 level of 5.2 E-08 uCi/cc. Pumping to the Storm Drain Pond was discontinued at 16:20. A final sample was taken from the water that was pumped at 16:34. The results of this sample showed no Co-60 present. A Composite Sampler located at the Storm Drain Pond was started at 15:00 and discontinued at 17:15. A 171 ml sample was analyzed and no Co-60 or other isotopes were detected. Approximately 17,000 gallons of water was discharged to the Storm Drain Pond. The water was Fire Protection water that flooded the stairwell after a valve broke.

Initial Operability Assessment: N/A

Requirement Not Complied With: PPM 12.5.28, PPM 1.11.12

Immediate Corrective Actions Taken: Release to Storm Drain Pond discontinued and rerouted water to Sump T-4.

Is This Condition Significant?: No.

Additional Information: Initial review by Chemistry of reportability per 10CFR20 indicates that reportable limit is 20 times 3E-06 (6E-05) uCi/cc of Co-60. The sample analyses conducted indicated that the maximum concentration of Co-60 during the discharge was 5.2E-08 uCi/cc, well below the reportability level. Licensing should review this initial review.

Originator Name / Mail Drop or Extension	Reviewer / Date - Time	Quality Identified	
HANSON, JC 927C	BRUCE, STU 06/18/98 02:57	YES ☐ NO ☒	Response Required ☐ Evaluation Number ______
Originator Signature / Date Signed: YES ☒ NO ☐ 06/17/98	Reviewer Comments		

OPERATIONS REVIEWER

OPERABILITY DETERMINATION			REPORTABILITY
Component: ☐ Operable ☐ Operable but degraded or non-conforming ☐ Not Operable ☒ N/A	System/Structure: ☐ Operable ☐ Operable but degraded or non-conforming ☐ Not Operable ☒ N/A	☐ YES ☒ NO Perform Operability / Functionality Determination per 1.3.66 Assigned To: ______	☒ Non Reportable ☐ Potentially Reportable ☐ Reportable Requirement: ______ ☐ Potential Tech. Spec. Violation

Comments:

Operations Reviewer Signature / Date / Time
BAIRD, ML 06/18/98 03:46

ASSIGNMENT

Resolution Categories	Cause Determination	Reactor Startup	Significant PER
☒ (A) Resolve Deficiency using PER Resolution Form ☐ (B) Trend ☐ Human Performance Related ☐ Generic Considerations	☐ Root Cause ☐ Apparent Cause ☐ Evaluate Only	☐ Forced ☐ Refueling Year ☒ No	☐ YES ☒ NO (Justify below)

Comments:

Assigned Dispositioning Manager	Dispositioning Organization
HANSON, JC	CHEMISTRY
Assigned Dispositioner	PER Program Reviewer Signature / Date
NIELSON, HL	LEON, C 06/18/98

PER CLOSURE

PER Coordinator (Print) / Signature / Date	Transmitted To Plant Files (Print) / Signature / Date

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PER RESOLUTION

PER No. 298-0783 REV No. 0
Quality Assessments Initiated ☐ Yes

Operability / Functionality Determination ☐ Yes	☒ NA
Permanent Equipment Disposition Classifications ☐ Permanent Accept-As-Is ☐ Permanent Repair ☐ Rework	☒ NA
Equipment Classification: Quality Class: ☐ 1 ☐ A ☐ 2 ☐ G ☐ Safety Related ☐ ASME	☒ NA
Previous problems or generic impact discussed ☐ Yes	☐ NA

Significant: ☐ Yes ☒ No | Number of interim Corrective Actions: 0 | Number of permanent Corrective Actions: 2

Cause Determination Codes

☐ No Cause Necessary ☐ Unknown (UNKN), Justify in comments ☒ Assumed Risk (AR01), Justify in comments

DESCRIPTION	ORG	PROC	KEY	O&P	HE/IA	GEMS

Comments:

A) Precise Statement of Problem: Based on the analysis result of one sample of water being discharged from the NE Reactor Building stairwell to the storm drain, there was an apparent discharge of detectable levels of Co-60.

B) Event Cause and/or Contributing Cause(s): The very low detection levels established for discharge to the Storm Drain pond produces a potential for detection of radioactivity that is not representative of the water being discharged. There are several mechanisms which may cause this including statistical counting errors, contamination in the detection system, contamination in the sampling equipment, and contamination introduced into the sample during sample preparation for counting. This is an assumed risk built into the detection levels for free-release.

During this discharge there were three samples collected at the plant (per PPM 12.5.28 an initial free release is required prior to discharge) and a flow proportional composite sampler was operating at the outfall to the Storm Drain pond.

Analysis of the first and third samples collected at the plant, and of the composite sample collected at the outfall, did not identify any radioactive contamination. Analysis of the second sample collected at the plant identified very low level contamination.

Based on the results of the three samples that did not identify contamination, we believe that the radioactivity detected in the second sample was not representative of the water being discharged. We have not been able to identify the mechanism that resulted in the contamination of the second sample but due to the initial and final free release sample and composite sample showing no detectable Co-60, the second sample did not represent the released water. The risk that samples would periodically indicate the presence of contamination when none may be present was assumed when the REMP level LLDÆs were accepted as our detection limits.

C) Discussion of Similar Previous Problems and Corrective Actions: In 1992-1993 there were several PERÆs and regulatory actions concerning radioactive discharges to the Storm Drain pond. Refer to LER 92-042 and NOV 92-035. As a result of these problems we obtained a change to our NPDES permit, (PTL 112149), and committed to using the REMP LLD values for analysis of discharges to the pond. (1993 SALP response, GO2-93-125)

In addition, we identified that tritium and particulate material which plates out on the outside of the buildings is a source of contamination which also goes to the Storm Drain pond. This could not be prevented, so we identified this fact in the ODCM and in our NPDES permit.

Approvals For Permanent Disposition

PER Dispositioner	*ALEXANDER, AL*	*07/01/98*
Dispositioning Manager	*HANSON, JC*	*07/02/98*

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PER RESOLUTION

PER No. 298-0783 REV No. 0
Quality Assessments Initiated ☐ Yes

Since the corrective actions for non radioactive discharges were implemented in 1993 we have not released any liquid with detectable contamination to the storm drain pond.

D) Generic Impact, Potential For Similar Deficiencies: As discussed above, the potential for a positive result that is not representative of the water to be discharged is inherent at the very low detection level we have established for free release. Normally we have the time to evaluate the potential source for any contamination identified, and to resample or reanalyze, as appropriate.

The need to discharge this water promptly in order to prevent damage to an important plant safety system eliminated the time normally available for evaluation of the analysis. Discharge of water under normal circumstances is not subject to similar problems. PPMs 12.2.14 and 12.5.28 establish free release criteria to prevent the release of radioactive liquids to non-designated areas.

Response to 50-397/9816-08 and 50-397/9816-06
Free Release Samples
All free release grab samples that were collected and used for decisions for discharge of the water to the storm drain were 1 liter in volume as is required by applicable plant procedures. A 1 liter volume is adequate to reach the established LLD value of 1.5E-08 mCi/cc at the WNP-2 Chemistry laboratory.
The sampling methodology employed after the decision to discharge was to continue to collect periodic grab samples during discharge. All of these grab samples were of 1 liter in volume, and were adequate for the purpose of continued monitoring of the discharge to the established levels. (50-397/9816-08)
Composite Sample
The composite sampler at the outfall to the storm drain pond is not designed for, and was not used for any decision relating to the initiation, continuation, or termination of the discharge. We chose to use the composite sampler to obtain a flow proportional sample of the entire discharge for verification of our analyses. For this incident, we wanted to sample only from the event itself. When setting up the program, all that was known was that the expected volume to be sampled was in excess of 100,000 gallons. It was decided to set the sampling rate to 10ml per 1000 gallons because it was felt that this would allow the sampler to sample through the event while collecting a volume in excess of 1 liter. When the discharge was terminated prior to the expected volume only 171 ml had been accumulated in the sampler. After the release was terminated this volume was collected from the composite sampler and analyzed for radioactivity at the WNP-2 Chemistry laboratory. Due to the small sample size we were unable to achieve a 1.5E-08 mCi/cc LLD, but no radioactivity was detected. The sample was then shipped to our offsite laboratory which was capable of the required LLD on a sample of this volume. The offsite laboratory did not detect any radioactivity. (50-397/9816-06)
A description of the composite sampler and its normal method of operation is attached.

American Sigma 800SL Normal Operation and Use

The composite sampler is an American Sigma 800SL sampler. This sampler contains eight 950ml bottles. The sampler samples at a rate selected by the user into one bottle, sampling at the selected rate until that bottle is full, at which time the sample arm moves to the next bottle. This continues until all eight bottles are full, at which time the program terminates.
The 171ml sampled is a reflection of the rate selected (10ml/1000 gallons) and the volume of water pumped to the storm drain pond (16,200 gallons).
The sampler is normally set to sample at 35ml/1000 gallons during normal flows. This is used because under normal conditions, it will fill the eight bottles in 5 to 7 days, at which time the bottles are changed out and the full sample bottles are brought back to the Environmental lab, composited into one 1 liter bottle for gamma analysis and one 100 ml bottle for tritium analysis and sent to the contractor lab. To get the most accurate program into the sampler, 3 things should be known: 1) Volume to be sampled; 2) flow rate and; 3) duration of flow. Normally, the sampler runs continuously, with a variable flow rate of 1 to 1000 gpm. For this incident, we wanted to sample only from the event itself. When setting up the program, all that was known

was that the probable volume to be sampled was in excess of 100,000 gallons. It was decided to take 10ml samples because it was felt that this would allow the sampler to sample through the event without the program terminating.

The requirement for composite sampler operation is NPDES Permit No. WA 002513 1, S2, Part D on page 10. The whole requirement is as follows: "Permittee shall monitor effluent to outfall 002, unlined pond, for tritium. Monitoring shall be continuous using a flow proportional composite sampler. In the event of sampling equipment failure the Permittee shall follow appropriate facility procedures and practices for sampling. this may include nonroutine grab samples and grab sample compositing. The results shall be reported annually in the Radiological Environmental Monitoring Program report." The settings are at REMP discretion.

The first thing to understand is that the water does not flow through the sampler, but rather through a flume that allows the ultrasonic flowmeter to measure the volume. The flow meter is set to send a pulse to the sampler every 1000 gallons. The sampler itself is set (normally) to take a 35ml sample every pulse. During 1997, the average flow to the pond was approximately 36,000 gpd.

During most batch releases the sampler is left in the flow proportional mode. There are times when, for the non-radiological analysis required by the NPDES permit, that a 24 hour composite sample be taken. During these times, another program, based on time, is used. This program takes 35ml approximately every 8 minutes. Otherwise, the sampler program stays flow proportional as most releases to the storm drain are either high flow/short duration (800-1000 gpm for 30 minutes) or low-medium flow/long duration (200-300 gpm for 2 or 3 hours). The sampler is checked by computer for flow activity (via modem) daily and visited at least weekly.

INFORMATION ONLY

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CORRECTIVE ACTION PLAN
PERMANENT Corrective Action

PER No. 298-0783

ACTION NO		RESPONSIBLE NAME	MAIL DROP	ORG	SCHEDULED	RXSU	Operability / Functionality Determination Related
1	Individual	ALEXANDER, AL	PE12	52830	07/10/98	☐ FORCED	☐
REV. NO: 0	Manager	BENNETT, DA	PE12	52830		☐ REFUEL ☒ NO	

Corrective Action Description: (If Corrective Action is a Work Order, does the work order need only Approval ☐ or Completion ☐ to close the action)

Analyze composite sample to REMP LLD value of 1.5E-08 uCi/ml Co-60.

ACTION: Attach a copy of the offsite analysis result to this CAP for documentation.

APPROVALS FOR CORRECTIVE ACTION

Corrective Action addresses PER: Cause ☐ ________ Generic Impact ☐ N/A ☒

Close Interim Corrective Action #: upon completion of this Corrective Action.

Approval for assignment by Dispositioning Manager: *HANSON, JC* *07/02/98*

Corrective Action Comments:

The composite sample was analyzed by an offsite lab capable of measuring to REMP LLD's. The results of this analysis did not identify contamination in the sample.
7/6/98 pending backup to close (mlp)
7/7/98 received backup (mlp)

Approval for closure by Dispositioning Manager: *HANSON, JC* *07/02/98*

ENERGY NORTHWEST
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PROBLEM EVALUATION REQUEST

PER No. **201-1233**

System Number	MEL EPN	Discovery Date / Time
		06/12/01 08:00

POTENTIALLY CONTAMINATED WATER FROM RED-RUBBER WATER HOSES INADVERTENTLY RELEASED INTO THE STORM DRAIN SYSTEM

Problem:

Description of Condition: During a drain down of fire protection system FP-SYS-W21 on 06/11/2001, two red rubber water hoses from the Tool Crib were used to drain the water from drain valve 21/6 to the storm drain connection via a system strainer on RW 437 and one red rubber hose was used to drain water from main drain valve out of the C100 door. The fire protection (FP) system was drained with about 100 gallons being released both to the storm drain and out of the C100 door. Following the system drain, the red rubber hoses were removed, 2.5" fire protection hoses were connected to the system strainer, and the system was flushed for seven minutes at 500 gpm. Following this flush, the FP System Engineer collected a sample of the water and scale from the strainer catch bowl due to reddish color, suspecting it was attributed to Microbiological Influenced Corrosion (MIC). A second flush of the system was performed at the same flow and time interval. The water in the strainer bowl was clear following the second flush and the system was closed. The FP system engineer wanted further analysis of the samples at the environmental lab suspecting MIC issues. He first was required to place the samples in the AAP SAM-9 for release from the RCA. However, the water sample alarmed the SAM-9 monitor and as a result, both samples were taken to the Chem Lab on 487' RW for an isotopic analysis. The results of the sample were communicated to the FP System Engineer on 06/12/2001 at 0800 hrs and indicated the presence of cobalt-60 and chromium-51 among other radionuclides.

The system drain down was not pressurized and it is believed that the initial water running through the red hoses from drain valve 21/6, through the strainer, resulted in a deposition of material into the strainer catch bowl, effectively a dead spot in the system. The system flush used the same setup as the system drain except the red rubber hoses were replaced with 2.5 inch FP hoses. Due to the strainer design, it is not believed that the subsequent system flushes of 500 gpm could adequately mix with the residue located in the strainer catch bowl where the identified samples were taken. For this reason, it is believed that the red rubber hoses were the reason the system samples were identified with radionuclides.

Initial Operability Assessment: Not Applicable. The Fire Protection (FP) system inspection and flushing was completed and Wet System 21 was put back in service.

Requirement Not Satisfied: Free release of potentially contaminated water to the environment. Inadequate identification of contaminated red rubber hoses.

Immediate Corrective Actions Taken:
1. Following the flush of the WET 21 system, all of the FP 2+" hoses, fittings, and strainer used in the flushing procedure were surveyed by RP personnel and were free released from the RCA.
2. The FP system drain used three red rubber water hoses from the tool crib prior to the flushing. Hose WH-430 was used on the main drain valve and was used to drain Wet System 21 low point which consisted of about 100 gallons of fire protection water that was diverted through door C100 and outside to the concrete and ground by LSA Pad. It was only used for draining of system. The portion of the hose that extending out of the RCA was surveyed by RP personnel and released out of the RCA. A follow-up survey of the concrete resulted in no detectable smearable contamination. There was no increase as a result of direct frisk of the concrete, however, there are higher background levels in the vicinity of the LSA pad. Sprinkler fitter personnel did not witness any discolored water being discharged during the drain down of the system. This hose was surveyed on 6/12/01 and it alarmed the SAM-9 bag monitor of a high contamination alarm (about 51,000 dpm). RP personnel did not identify any smearable contamination but did find about 100 ccpm direct frisk on the outside of the hose. A section of this hose has been cut and an isotopic analysis is being performed to determine a qualitative analysis of activity.

3. Red rubber hose WH-482 was used as part of the drain down connection that ran from drain valve 21/6 and into the storm drain system. It was only used for the draining of the system. A survey of this hose following performance of WET system 21 drain/flush did not identify any fixed or smearable contamination on accessible areas. A hose section is being analyzed by Chemistry for potential radioactivity.

4. The third hose had no identifiable label and as a result, it is difficult to ascertain which hose it was. However, RP, is performing an isotopic on hoses which they identified as radioactive during yesterday's evaluation of clean hoses in the tool crib. On 6/13/01, RP personnel surveyed two of the hoses identified as radioactive and found one with 35k dpm/100cm2 direct frisk and 1k dpm/100cm2 smearable contamination inside the hose and the second hose was about 10K dpm/100cm2 direct frisk and 2k dpm/100cm2 smearable contamination inside. However the latter hose also had red residue inside of it. Both hoses are being analyzed at this time. .It is suspected that one of these hoses will likely have similar activity of that which was found in samples taken during WET system 21 flush.

5. HP surveyed the connection to the storm drain following this incident and found no smearable contamination

6. HP directed the FP craft to obtain new red rubber hose for future system test and draining, and to maintain positive control over the new hose.

7. REMP sampling personnel were directed to obtain samples from the storm drain pond and have them analyzed for radionuclides.

Inappropriate Action: Unidentified contaminated hose issued for use in a non-contaminated system. This released potentially

PER CLOSURE

PER Coordinator (Print) / Signature / Date	Transmitted To Plant Files (Print) / Signature / Date

ENERGY NORTHWEST
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PROBLEM EVALUATION REQUEST

PER No. **201-1233**

System Number	MEL EPN	Discovery Date / Time
		06/12/01 08:00

contaminated the water being drained into the storm drain system.

Additional Information: The fire protection system internal inspection is being done per PPM 15.3.15. Work Order 01018897. System Wet 21 was targeted for flushing by the FP System Engineer. The FP system was drained through the red rubber hoses and flushing connections were installed at about 1300 hrs on 06/11/2001. The flushing connections do not use red rubber water hose, but rather uses 2+ inch fire hose. The FP system was then flushed at a rate of approx. 500 gpm for 7 minutes. The residual water in the flushing strainer catch bowl was of a color not normally found in the FP system (which has its source at the CW Basin). The water was a dull red color, similar to red oxide primer. For this reason, the FP System Engineer obtained sterile sample bottles and collected a sample of the water, and of the small amount of scale left in the strainer, suspecting a Microbiology problem may exist in the system. The system was then flushed again at about 1500 hrs at the same rate as above. The strainer bowl was filled with clear water at this point. The water samples for MIC are normally transported to the PSF for analysis in the lab. The water sample alarmed the SAM-9 monitor on the way out of the Plant. The samples were then taken to the Chem Lab on 487' RW and counted. Reference Chemistry samples 01-1795 and 01-1796. System Engineer alerted HP to the potential problem and investigation of the source of the contamination continued with HP support.

Originator Name / Mail Drop or Extension	Reviewer / Date - Time	Quality Identified	
PETERSON, JE **PE27**	**BORLAND, IM** **06/13/01 15:39**	YES ☐ NO ☒	Response Required ☐ Evaluation Number ______

Originator Signature / Date	Reviewer Comments
Signed: YES ☒ NO ☐ **06/12/01**	**In addition HP personnel at both RCA access points have been instructed to increase the rigor of surveys of any red hoses used by workers to drain clean systems or to ensure the workers use a new hose. These actions will stay in place until a more reliable system of hose control is implemented.**

OPERATIONS REVIEWER

OPERABILITY DETERMINATION			REPORTABILITY
Component: ☐ Operable ☐ Operable but degraded or non-conforming ☐ Not Operable ☒ N/A	System/Structure: ☐ Operable ☐ Operable but degraded or non-conforming ☐ Not Operable ☒ N/A	☐ YES Perform Operability / ☒ NO Functionality Determination per 1.3.66 Assigned To: ______	☐ Non Reportable ☒ Potentially Reportable ☐ Reportable Requirement: ______ ☐ Potential Tech. Spec. Violation

Comments:

Operations Reviewer Signature / Date / Time
ROCKEY, HD **06/13/01** **16:37**

ASSIGNMENT

Resolution Categories	Cause Determination	Reactor Startup	Significant PER
☒ (A) Resolve Deficiency using PER Resolution Form ☐ (B) Trend ☐ Human Performance Related ☐ Generic Considerations	☐ Root Cause ☒ Apparent Cause ☐ Evaluate Only	☐ Forced ☐ Refueling Year ☒ No	☐ YES ☒ NO (Justify below)

Comments:
per D Bennett this is not GP001............tea.

Assigned Dispositioning Manager	Dispositioning Organization
WOOD, SD	**CHEMISTRY**
Assigned Dispositioner	**PER Program Reviewer Signature / Date**
BENNETT, DA	**LEON, C** **06/15/01**

ENERGY NORTHWEST
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PER RESOLUTION

PER No. 201-1233 REV No. 0
Quality Assessments Initiated ☐ Yes

Operability / Functionality Determination ☐ Yes	☒ NA
Permanent Equipment Disposition Classifications ☐ Permanent Accept-As-Is ☐ Permanent Repair ☐ Rework	☒ NA
Equipment Classification: Quality Class: ☐ 1 ☐ A ☐ 2 ☐ G ☐ Safety Related ☐ ASME	☒ NA
Previous problems or generic impact discussed ☐ Yes	☒ NA

Significant: ☐ Yes ☒ No | Number of interim Corrective Actions: 0 | Number of permanent Corrective Actions: 0

Cause Determination Codes

☐ No Cause Necessary ☐ Unknown (UNKN), Justify in comments ☐ Assumed Risk (AR01), Justify in comments

DESCRIPTION	ORG	PROC	KEY	O&P	HE/IA	GEMS
Inappropriate Action: Potential release of radioactive liquid	RP	CE	HK	OP-2		

Comments:

Problem Statement:
A small amount of potentially contaminated water may have been inadvertently introduced into the storm drain system. This PER was written to address the potential release and reportability issue only. PER 201-1251 was written to address the "clean hose" issue.

During an inspection and flushing of fire protection system FP-SYS-W21 on 6/11/01, two rubber water hoses checked out from the tool crib were used to gravity drain the water from the system (via drain valve 21/6). The water was drained to the storm drain connection via a strainer connection on RW 437. Following the draining of the system, the rubber hose was removed and replaced with the fire hoses and the system was flushed with approximately 3000 gallons of water. After the flush the FP engineer collected a sample of the water and the captured scale from the strainer. An isotopic analysis of the sample indicated the presence of Cobalt-60 and other radionuclides.

The source of the contamination was traced to the rubber hoses used to drain the system. Numerous "clean" hoses from the tool crib were discovered with contamination when surveyed (see PER 201-1251). The hoses involved in this event were reported not to contain excess water from a previous job (i.e., water did not run out of them when laid out for use).

Although the initial level of contamination inside the hoses is unknown, it is possible that a small amount of contamination was introduced into the storm drain system piping. Additional sampling was undertaken in order to verify whether any significant contamination reached the storm drain pond (SDP).

Extent of Condition and Safety Significance:
Under normal circumstances a flow proportional automatic sampler operated by the REMP program continuously monitors the storm drain pond discharge. However, the sampler was inoperable at the time of the event because all of the sample bottles were full and the machine had shut itself off. As an alternative, a sample of sediment was taken from the discharge area on June 13 and a follow-up water sample was collected on June 14. These confirmatory samples cannot be directly related to subject PER event because of the multiple plant sources that discharge to this point. They do however, provide an indication of a reportable contamination event which is the subject of this evaluation.

Sample Evaluation

The sediment sample taken June 13 from the pond outfall area was analyzed in the plant chemistry lab and was found to contain 1.24E-7 uCi/ml Co-60 (124 pCi/kg wet; sample number 01-1819.An1). This concentration is less than the Washington Department of Health (WDOH) investigation levels of 2500 pCi/kg for storm drain

Approvals For Permanent Disposition

PER Dispositioner	*BENNETT, DA*	*07/03/01*
Dispositioning Manager	*WOOD, SD*	*07/03/01*

ENERGY NORTHWEST People·Vision·Solutions

PER RESOLUTION

PER No. 201-1233 REV No. 0
Quality Assessments Initiated ☐ Yes

sediment, and is less than the historical average of the SDP ditch sediment since 1996 (380 pCi/kg dry). For comparison, river sediment data for Co-60 has a mean of 35.1 pCi/kg (with range of 1.4 to 129 pCi/kg). A follow-up water sample taken on June 14 was analyzed and found not to contain any detectable radionuclides (sample 01-1856.An1).

Reportability

The circumstances of this event were compared to the State (WDOH) "investigation" limits, the reporting requirements of the station NPDES permit (condition S1, no limits, defers to NRC), and the provisions of 10 CFR 50.73. 10 CFR 50.73(a)(2)(viii)(B) states that a liquid effluent release is reportable (1 hour average) when it exceeds 20 times the applicable concentrations specified in Appendix B to Part 20, Table 2, Column 2 at the point of entry into the receiving waters. For this case, the reportable concentration for Co-60 (6E-5 uCi/ml) was much higher than that detected in the sample.

The concentration of Co-60 in the sediment sample is within the range of expected values for the storm drain pond, less than the value set by the state for additional evaluation, and much less than the requirements of 10 CFR 50.73(a)(2)(viii)(B). It is therefore concluded that the subject PER event did not result in a detectable increase in Co-60 at the pond.

Remedial Corrective Action:
Determination of reportability was completed.

Apparent Cause:
The apparent caused of this event was "Inadequate program monitoring", OP-2, in that the clean hose program failed to prevent this occurrence.

Additional Corrective Action (if required):

To be addressed by PER 201-1251

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PROBLEM EVALUATION REQUEST

PER No. **201-1381**

System Number	MEL EPN	Discovery Date / Time
		06/22/01 12:00

POTIENTIALLY CONTAMINATED WATER POURED DOWN A DRAIN WHICH GOES TO THE STORM DRAIN SYSTEM

Problem:

Description of Condition: At approximately 12:00 on 6/22/01 a site contractor poured approximately 2.5 gallons of potientially contaminated water down a sink drain in the 487"RW laborers closet, room C-312 and door C325. The drain is posted that it goes to the storm drains and marked "No Radioactive Materials" and " Do Not Pour Liquid in This Drain".

Initial Operability Assessment: Not applicable

Requirement Not Satisfied: Free release of potientially contaminated water to the environment.

Immediate Corrective Actions Taken: 1.Following the identification that one of three, five gallon buckets with wash water was missing, Chemistry Technicians questioned the site contrator personnel as to the were abouts of the third bucket and restated that the remaining two buckets were not to be disposed of, that Chemistry personnel would get rid of the remaining wash water for them.
2. The drain that the wash water was poured into was identified.
3. Samples of the remaining two buckets were taken and counted for activity at environmental release limits.
4. Swipes of the sink and sink drain were taken for counting to environmental release limits.
5. PER was to be generated to document the occurrance

Inappropriate Action: Potientially contaminated water poured down a drain that was clearly marked to prevent such an action and the individuals were instructed before hand not to dispose of the wash water, that Chemistry personnel would take care of it.

Additional Information: The wash water was generated by the washing of the contractor's tools and half masks, following the asbestos removal job, in the 487' RW chemistry Laboratory.

The water samples taken of the two remaining buckets had no activity identified.
The swipes taken from the Laborers Sink and Drain also had no activity identified.
During the tile removal in the 487' RW Chemistry laboratory no contamination was found.
The tile in the known contaminated areas of the laboratory was not allowed to be taken up.

An observation of the posting at the sink is that the one good sign is partially hidden by the faucets and a piece of tygon hose and a more visible sign above the sink is in a state of bad repair.

Originator Name / Mail Drop or Extension	Reviewer / Date - Time	Quality Identified	
MAYNE, LL PE12	LOOKER, JR 06/23/01 07:05	YES ☐ NO ☒	Response Required ☐ Evaluation Number ______
Originator Signature / Date Signed: YES ☒ NO ☐ 06/23/01	Reviewer Comments Recommend this PER be assigned to Site Facilities since the asbestos contractor worked for Site Facilities.		

OPERATIONS REVIEWER

OPERABILITY DETERMINATION			REPORTABILITY
Component: ☐ Operable ☐ Operable but degraded or non-conforming ☐ Not Operable ☒ N/A	System/Structure: ☐ Operable ☐ Operable but degraded or non-conforming ☐ Not Operable ☒ N/A	☐ YES Perform Operability / ☒ NO Functionality Determination per 1.3.66 Assigned To: ______	☐ Non Reportable ☒ Potentially Reportable ☐ Reportable Requirement: OTHER: SEE BELOW ☒ Potential Tech. Spec. Violation

Comments:
TS 5.5.4

Operations Reviewer Signature / Date / Time
MUTH, JJ 06/23/01 17:57

PER CLOSURE

PER Coordinator (Print) / Signature / Date	Transmitted To Plant Files (Print) / Signature / Date

ENERGY NORTHWEST People·Vision·Solutions	PROBLEM EVALUATION REQUEST	PER No. 201-1381

System Number	MEL EPN	Discovery Date / Time
		06/22/01 12:00

ASSIGNMENT

Resolution Categories	Cause Determination	Reactor Startup	Significant PER
[X] (A) Resolve Deficiency using PER Resolution Form [ ] (B) Trend [X] Human Performance Related [ ] Generic Considerations	[ ] Root Cause [X] Apparent Cause [ ] Evaluate Only	[ ] Forced [ ] Refueling Year [X] No	[ ] YES [X] NO (Justify below)

Comments:

Assigned Dispositioning Manager	Dispositioning Organization
CULVER, DW	**FACILITIES**
Assigned Dispositioner	PER Program Reviewer Signature / Date
JUMP, R	**ALTON, TE** 06/25/01

INFORMATION ONLY

ENERGY NORTHWEST
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PER RESOLUTION

PER No. 201-1381 REV No. 0
Quality Assessments Initiated ☐ Yes

Operability / Functionality Determination ☐ Yes ☒ NA

Permanent Equipment Disposition Classifications ☒ NA
☐ Permanent Accept-As-Is ☐ Permanent Repair ☐ Rework

Equipment Classification: Quality Class: ☐ 1 ☐ A ☐ 2 ☐ G ☐ Safety Related ☐ ASME ☒ NA

Previous problems or generic impact discussed ☐ Yes ☒ NA

Significant: ☐ Yes ☒ No | Number of interim Corrective Actions: 0 | Number of permanent Corrective Actions: 0

Cause Determination Codes

☐ No Cause Necessary ☐ Unknown (UNKN), Justify in comments ☐ Assumed Risk (AR01), Justify in comments

DESCRIPTION	ORG	PROC	KEY	O&P	HE/IA	GEMS
Inappropriate Action: Vender contractor personnel poured potentially contaminated liquid down sink which is tied to the storm drain system.	VEN	CM	VA	O-5	MJ-5	RB

Comments:

Problem Statement: At approximately 12:00 on 6/22/01 a site contractor poured approximately 2.5 gallons of potientially contaminated water down a sink drain in the 487' RW laborers closet, room C-312 and door C325. The drain is posted that it goes to the storm drains and is marked "No Radioactive Materials" and " Do Not Pour Liquid in This Drain".

Extent of Condition and Safety Significance: None

Remedial Corrective Action: The drain that the wash water was poured into was identified, the remaining wash water was tested for activity at environmental release limits, and swipe samples were taken at sink and drain locations and counted to environmental release limits. A REPLACEMENT SIGN WAS INSTALLED ABOVE THE SINK TO REPLACE THE SIGN THAT WAS IN DISREPAIR.

Apparent Cause: The contractor mis-understood the instructions given by Chemistry personnel during the pre-job briefing. In addition, one of the signs stating "DO NOT POUR LIQUID IN THIS DRAIN" was hard to see, and the other sign was old and unreadable.

Additional Corrective Action (if required): NONE REQUIRED

Approvals For Permanent Disposition

PER Dispositioner	*JUMP, R*	*07/19/01*
Dispositioning Manager	*CULVER, DW*	*07/26/01*

ENERGY NORTHWEST
People·Vision·Solutions

PROBLEM EVALUATION REQUEST

PER No. 203-0856

System Number	MEL EPN	Discovery Date / Time
		03/18/03 09:30

TRITIUM LEVELS IN JANUARY COMPOSITE SAMPLE OF STORM DRAIN OUTFALL WATER ELEVATED

Problem:

Description of Condition: Tritium results received from the analytical contract lab for the REMP showed that the level for tritium in the January composite sample for the storm drain outfall water was 1.23+-0.03E+04 picocuries per liter. This is the highest level observed since 1994.

Initial Operability Assessment: Problem does not affect the safe operation of the plant.

Requirement Not Satisfied: None; release of tritiated water to the storm drain is acknowledged in ODCM section 3.1.

Immediate Corrective Actions Taken: Contacted Environmental Services supervision and Regulatory personnel about abnormal levels. Contacted effluent specialist in Chemistry and asked for review of effluents during the period in question. Contacted Teledyne Brown Engineering to have them perform a confirmatory analysis and also to expedite analysis on the February sample.

Inappropriate Action: NONE

Additional Information: Samples are collected by a composite sampler sampling in a flow proportional mode. The sampler is programmed to collect an approximate 25-ml sample at 1000-gallon intervals. The composite period for this monthly sample was 01/02/03 to 02/04/03.

Originator Name / Mail Drop or Extension	Reviewer / Date - Time	Quality Identified	
MCDONALD, JE 1025	NORTHSTROM, TE 03/18/03 14:11	YES ☐ NO ☒	Response Required ☐ Evaluation Number ______
Originator Signature / Date Signed: YES ☒ NO ☐ 03/18/03	Reviewer Comments		

OPERATIONS REVIEWER

OPERABILITY DETERMINATION			REPORTABILITY
Component: ☐ Operable ☐ Operable but degraded or non-conforming ☐ Not Operable ☒ N/A	System/Structure: ☐ Operable ☐ Operable but degraded or non-conforming ☐ Not Operable ☒ N/A	☐ YES Perform Operability / ☒ NO Functionality Determination per 1.3.66 Assigned To: ______	☒ Non Reportable ☐ Potentially Reportable ☐ Reportable Requirement: ______ ☐ Potential Tech. Spec. Violation

Comments:

Operations Reviewer Signature / Date / Time

BAIRD, ML 03/18/03 17:20

ASSIGNMENT

Resolution Categories	Cause Determination	Reactor Startup	Significant PER
☐ (A) Resolve Deficiency using PER Resolution Form ☒ (B) Trend ☐ Human Performance Related ☐ Generic Considerations	☐ Root Cause ☐ Apparent Cause ☐ Evaluate Only	☐ Forced ☐ Refueling Year ☒ No	☐ YES ☒ NO (Justify below)

Comments:

additional information recieved 03/20/2003............lap

The above referenced PER should be classified as a trend PER because the storm drain outfall is acknowledged in the Offsite Dose Calculation Manual (ODCM) as a point in which tritiated water may be released into the environment. Section 3.1 (page 30) of the ODCM states:

Tritium in the form of tritiated water vapor is released to the environment through monitored/sampled effluent pathways. Under certain meteorological conditions, the tritiated water vapor may condense onto surfaces such as rooftops and exterior walls. Subsequently, this condensed, recaptured tritiated water may be carried with precipitation into the Storm Drain Pond (SDP) which serves as a collection point for rainfall on plant roofs. Influent to the SDP is continuously sampled and periodically analyzed for tritium content.

PER CLOSURE

PER Coordinator (Print) / Signature / Date	Transmitted To Plant Files (Print) / Signature / Date

ENERGY NORTHWEST People·Vision·Solutions

PROBLEM EVALUATION REQUEST

PER No. 203-0856		
System Number	MEL EPN	Discovery Date / Time 03/18/03 09:30

TE Northstrom

Assigned Dispositioning Manager **NORTHSTROM, TE**	Dispositioning Organization **ENVIRONMENTAL SERVICES**
Assigned Dispositioner **MCDONALD, JE**	PER Program Reviewer Signature / Date **PRITCHARD, LA** 03/20/03

ENERGY NORTHWEST People·Vision·Solutions	PROBLEM EVALUATION REQUEST	PER No. 203-2356

System Number	MEL EPN	Discovery Date / Time
060.0 - DEMINERALIZED WATER STORAGE AND		06/12/03 01:55

RADIOACTIVE CONTAMINATION FOUND IN THE DEMINERALIZED WATER SYTEM IN THE REACTOR, TURBINE AND RADWASTE BUILDINGS AND DEMINERALIZED WATER STORA

Problem:

Description of Condition: Routine sampling of the Plant Demineralized Water System for radioactivity revealed that radioactivity had been introduced into the water system.

The Demineralizer Water System is normally sampled for radioactivity weekly. The samples taken on 6/4/03 had no indication of radioactivity above MDA levels.

The weekly samples started on 6/11/03 and finished on 6/12/03, were taken from the same locations as on 6/4/03.

The first sample was collected at 2015 on 6/11/03 (441' TG by zinc inject skid)
The second sample was collected at 2150 on 6/11/03 (548' RX by SLC Tank which was an alternate sample point because the normal point was in the contaminated zone on 501 RX)
The third sample was collected at 0205 on 6/12/03 (487' RW demin. water in lab).

First sample: 441' TG Activity levels above MDA were;
Co58 3.48 E-8 uc/ml
Co60 7.04 E-8 uc/ml
Cs137 5.24 E-8 uc/ml
Mn54 3.12 E-8 uc/ml
Zn65 2.44 E-7 uc/ml
Tritium 1.52 E-4 uc/ml

Second sample: 548' RX Activity levels above MDA were;
Co60 3.23 E-7 uc/ml
Zn65 1.08 E-7 uc/ml
Tritium 9.8 E-5 uc/ml

Third sample: 487' RW Activity levels above MDA were;
Co58 2.06 E-8 uc/ml
Co60 6.48 E-8 uc/ml
Cs137 4.13 E-8 uc/ml
Zn65 1.90 E-7 uc/ml
Tritium 1.99 E-4 uc/ml

Initial Operability Assessment: NA This is a radioactive contamination issue of a system normally maintained free of contamination, which is the primary source of water to already contaminated SSC systems.
This additional contamination added at levels of magnitude below those already present in the SSC systems would imply no impact.

Requirement Not Satisfied: Efforts to maintain the Plant Demineralized Water System at below MDA levels failed. This could be an impact to systems that use demineralized water and are maintained as non-radioactive.

Immediate Corrective Actions Taken: Backup samples were taken and analysed, with the results almost identical to the original samples. In particular the tritium results were very close to the original, which is a very good indicator because it is not impacted by corrosion products and collection issues such as flow velocity.

The Demineralized Water System was secured until the condition of the Demineralized Water Storage Tank (DWST) could be determined.

The DWST was sampled and found to contain similar radioactivity previously identified;
6/12/03 at 03:45
Co60 4.0 E-8 uc/ml
Cs137 2.03 e-8 uc/ml
Zn65 3.7 E-8 uc/ml
Tritium 4.46 E-4 uc/ml

Supervision notified and an investigation initiated to try and find the source of the radioactivity which from the activity identified indicates reactor coolant.
This investigation included Chemistry, Operations, Engineering, Outage Management and Maintenance.

Efforts to recover the system were intiated by the System Engineer and Chemistry, with and under the guidance of Operations. A Troubleshooting Plan was in place by 1600 on 6/12/03 and preparations to recover the DWST and Turbine Building distribution system, which support Stator Cooling Water and Aux. Boiler feed, were under way.

PER CLOSURE

PER Coordinator (Print) / Signature / Date	Transmitted To Plant Files (Print) / Signature / Date

ENERGY NORTHWEST People·Vision·Solutions	PROBLEM EVALUATION REQUEST	PER No. 203-2356

System Number	MEL EPN	Discovery Date / Time
060.0 - DEMINERALIZED WATER STORAGE AND		06/12/03 01:55

Inappropriate Action: The cause of the radioactive contamination is not known. The investigation is under way to try and determine how the contamination occurred.

Additional Information:

PASS System is Not believed to be a possible source as in the past because of in place modifications that have isolated the system from direct contact with Demin. Water.

One hose was found going into the wetwell for use by the divers.

Hoses were checked that had been used to supply water to the RWCU System during restoration with no indication.

Hose near the fuel pool scupper tank, used for filling, was not installed.

A recheck of the demineralized water system on 487' RW taken @ 1043 and the activity showed no indication of increasing or decreasing. The source input is believed to no longer be connected to the demin. water system.

Originator Name / Mail Drop or Extension	Reviewer / Date - Time	Quality Identified	
MAYNE, LL PE12	BENNETT, DA 06/12/03 17:45	YES ☐ NO ☒	Response Required ☐ Evaluation Number ____
Originator Signature / Date Signed: YES ☒ NO ☐ 06/12/03	Reviewer Comments		

OPERATIONS REVIEWER

OPERABILITY DETERMINATION			REPORTABILITY
Component: ☐ Operable ☐ Operable but degraded or non-conforming ☐ Not Operable ☒ N/A	System/Structure: ☐ Operable ☐ Operable but degraded or non-conforming ☐ Not Operable ☒ N/A	☐ YES Perform Operability / ☒ NO Functionality Determination per 1.3.66 Assigned To: ____	☒ Non Reportable ☐ Potentially Reportable ☐ Reportable Requirement: ____ ☐ Potential Tech. Spec. Violation

Comments:

Operations Reviewer Signature / Date / Time		
GREEN, WR	06/12/03	19:03

ASSIGNMENT

Resolution Categories	Cause Determination	Reactor Startup	Significant PER
☒ (A) Resolve Deficiency using PER Resolution Form ☐ (B) Trend ☐ Human Performance Related ☐ Generic Considerations	☐ Root Cause ☐ Apparent Cause ☒ Evaluate Only	☐ Forced ☐ Refueling Year ☒ No	☐ YES ☒ NO (Justify below)

Comments:

Assigned Dispositioning Manager	Dispositioning Organization
BENNETT, DA	CHEMISTRY
Assigned Dispositioner	**PER Program Reviewer Signature / Date**
MAYNE, LL	ALTON, TE 06/13/03

ENERGY NORTHWEST
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PER RESOLUTION

PER No. 203-2356 REV No. 0

Quality Assessments Initiated ☐ Yes

Operability / Functionality Determination ☐ Yes	☒ NA
Permanent Equipment Disposition Classifications ☐ Permanent Accept-As-Is ☐ Permanent Repair ☐ Rework	☒ NA
Equipment Classification: Quality Class: ☐ 1 ☐ A ☐ 2 ☐ G ☐ Safety Related ☐ ASME	☒ NA
Previous problems or generic impact discussed ☒ Yes	☐ NA

Significant: ☐ Yes ☒ No | Number of interim Corrective Actions: 0 | Number of permanent Corrective Actions: 3

Cause Determination Codes

☐ No Cause Necessary ☒ Unknown (UNKN), Justify in comments ☐ Assumed Risk (AR01), Justify in comments

DESCRIPTION	ORG	PROC	KEY	O&P	HE/IA	GEMS
Inappropriate Action: Cause of the radioactive contamination is not known. The contamination occurred during a finite time period and when discovered the source was no longer introducing radioactivity into the demineralized water system.	CHM	PP	CE			

Comments:

Problem Statement: Routine sampling of the Demineralized Water System for radioactivity revealed that radioactivity had been introduced into the system. The system is maintained at below MDA levels because the system feeds systems that are controlled as non-radioactive.

The Demineralized Water System is normally sampled for radioactivity weekly. The samples taken on 6/4/03 had no indication of radioactivity above MDA levels. The weekly samples taken on 6/11/03 and finished counting on 6/12/03 were taken from the same sample points as on 6/4/03 and radioactivity was detected in all three samples. The Demineralized Water Storage Tank (DWST) was sampled following the identification of positive radioactivity and similar radioactivity, to that in the distribution systems of the reactor building, turbine building and the radwaste building was found.

Remedial Corrective Action: Chemistry Supervision was notified and an investigation to try and find the source of the radioactivity was initiated. Because of the tritium levels identified, reactor coolant is suspected. It would be hard to contaminate the demineralized water system to 1.5 to 2.0 e-4 uc/ml tritium from any other source. The investigation included individuals from Chemistry, Operations, System Engineering, Outage Management and Maintenance.

No direct source could be found during the investigation and because of no increasing trend in radioactivity levels it was determined that the source most likely had terminated. The PASS System, the source of past contaminations and the reason routine sampling is conducted on a weekly basis, was ruled out as a source of this contamination because of plant modifications that isolated the PASS system from the Demineralized Water System.

System Engineering, with the help of Operations, developed a trouble shooting plan to recover the DWST and the Turbine Building demineralized water distribution system in support of the completion of the R-16 outage. This trouble shooting plan called Phase One has been completed. A Phase Two plan is in place awaiting available volume in the plant water inventory to conduct the flushing as indicated in the plan. Chemistry will have a CAP 1 to completed the flush as directed by the trouble shooting plan as soon as possible. The goal being to return the demineralized water system to no detectable activity above MDA. Should additional flushing be required, outside of Phase Two, to remove the contamination the Demineralized Water System Engineer should be contacted to develope a Phase Three trouble shooting plan under an additional CAP for this PER.

The usual sample points for the Turbine building and the Radwaste Building are less than MDA on 7/3/03 and the reactor Building is still indicating positive tritium values.

System engineering, for the Feed and Condensate system and the Condensate Storage Tanks (CSTS), will

Approvals For Permanent Disposition

PER Dispositioner	*MAYNE, LL*	*07/09/03*
Dispositioning Manager	*BENNETT, DA*	*07/09/03*

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PER RESOLUTION

PER No. 203-2356 REV No. 0
Quality Assessments Initiated ☐ Yes

have a CAP 2 to investigate possible connections between the Demineralized Water System and Feed, Condensate and CSTS. This may help to idenitify the source or give indication of lineups that could cause a similar event in the future.

Operations is taking a CAP3 to evaluate potiental sources and lineups that could impact the Demineralized Water System. This should include but is not limited to problems with the demineralized water system if the transfer pump is stopped because of a power outage, connections between CSTs and the demineralized Water Storage Tank, potiential for LLRT to cross connect systems , and hose use by other departments during an outage. Also in the CAP will be an evaluation as to whether the securing of the Demineralized Water sytem until a sample could determine the condition of the water in the tank, could have resulted in the contamination of the DWST from the distribution headers.

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CORRECTIVE ACTION PLAN
PERMANENT Corrective Action

PER No. 203-2356

ACTION NO		RESPONSIBLE NAME	MAIL DROP	ORG	SCHEDULED	RXSU	Operability / Functionality Determination Related
1	Individual	LOOKER, JR	927C	52810	09/30/03	☐ FORCED ☐ REFUEL ☒ NO	☐
REV. NO: 0	Manager	WOOD, SD	927C	52800			

Corrective Action Description: (If Corrective Action is a Work Order, does the work order need only Approval ☐ or Completion ☐ to close the action)

Complete the Trouble Shooting Plan, designated as Phase Two, for returning the demineralized water system in the Turbine Building, Reactor Building and the Radwaste Building to below MDA levels of radioactivity. If necessary generate a CAP for the Demineralized Water System Engineer to develop a Phase Three trouble shooting plan if areas outside Phase Two are idientified as problem areas during the flushing process.

APPROVALS FOR CORRECTIVE ACTION

Corrective Action addresses PER: Cause ☐ ________ Generic Impact ☐ N/A ☐

Close Interim Corrective Action #: upon completion of this Corrective Action.

Approval for assignment by Dispositioning Manager: *BENNETT, DA* *07/09/03*

Corrective Action Comments:

Phase 2 of the trouble shooting plan for flushing the contaminated demineralized water system was completed on 8/5/03. The contaminated portions of the system were flushed to <MDA levels. Development and initiation of a phase 3 section of the plan was not required. RL 8/13/03.

08/13/03 Need copy of trouble shooting plan to close. (smt)

09/10/03 Received backup documentation and closed. (smt)

Approval for closure by Dispositioning Manager: *BENNETT, DA* *08/13/03*

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CORRECTIVE ACTION PLAN
PERMANENT Corrective Action

PER No. 203-2356

ACTION NO		RESPONSIBLE NAME	MAIL DROP	ORG	SCHEDULED	RXSU	Operability / Functionality Determination Related
2	Individual	HUMMER, MM	PE24	54230	09/30/03	☐ FORCED	☐
REV. NO: 0	Manager	TWOMEY, JD	909S	54230		☐ REFUEL ☒ NO	

Corrective Action Description: (If Corrective Action is a Work Order, does the work order need only Approval ☐ or Completion ☐ to close the action)

Evaluate possible connections between the Demineralized Water System and the Feed, Condensate and CSTs. This is to identify possible sources of the contamination to the Demineraized Water System and give an indication of valve lineups that could cause a similar event in the future.

APPROVALS FOR CORRECTIVE ACTION

Corrective Action addresses PER: Cause ☐ ________ Generic Impact ☐ N/A ☐

Close Interim Corrective Action #: upon completion of this Corrective Action.

Approval for assignment by Dispositioning Manager: *BENNETT, DA* *07/09/03*

Corrective Action Comments:

A review of the cross connects between condensate, CST, and Demin Water found two potential paths.

There are various hose connections in the DW system that could be a source of cross contamination. The hose connections should be controlled by backflow preventers and by procedure.

The other potential leak path is from the condensate supply pumps, COND-P-3, 4, or 5; through open or leaking COND-FCV-45, 41, or 43; leak through normally shut COND-V-12A and/or 12B; through DW-P-1B and/or 1A only if they are secured; through the isolation valves for DW-P-1B and/or 1A; and finally into the DW-TK-1. There is defense in depth in that it is unlikely that all these conditions would be met. So, while this is a potential path it isn't a very credible path.

A search of Passport did not find any WR's/WO's that indicate the valves are leaking.

10/02/03 closed. (smt)

Approval for closure by Dispositioning Manager: *BENNETT, DA* *09/30/03*

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CORRECTIVE ACTION PLAN
PERMANENT Corrective Action

PER No. 203-2356

ACTION NO		RESPONSIBLE NAME	MAIL DROP	ORG	SCHEDULED	RXSU	Operability / Functionality Determination Related
3	Individual	JERROW, SR	9270	52220	09/30/03	☐ FORCED	☐
REV. NO: 0	Manager	FELDMAN, DS	9270	52220		☐ REFUEL	
						☒ NO	

Corrective Action Description: (If Corrective Action is a Work Order, does the work order need only Approval ☐ or Completion ☐ to close the action)

Evaluate potiential sources and valve lineups that could impact the Demineralized Water System. This should include but is not limited to problems with the demineralized water system if the transfer pump is stopped because of a power outage, connections between the CSTS and the demineralized water system, potential for LLRT to cross connect systems and hose use by other departments at the plant that could cause a cross connect. Additionally, the demineralized water system was secured, until the condition of the DWST could be determined, evaluate whether this could have caused the contamination of the tank by the demineralized water distribution system.

APPROVALS FOR CORRECTIVE ACTION

Corrective Action addresses PER: Cause ☐ ________ Generic Impact ☐ N/A ☐

Close Interim Corrective Action #: upon completion of this Corrective Action.

Approval for assignment by Dispositioning Manager: *BENNETT, DA* *07/09/03*

Corrective Action Comments:

Following the contamination of the DWST, Operations directed Equipment Operators to search the plant for possible sources of contamination. Two evolutions were identified as taking place near the time frame of contamination of the tank.

The first evolution was a fill and vent of RWCU by the LLRT group. This evolution was ruled out as possible source of the contamination. The fill hose used was still in the area with a check valve installed and no contamination was found in the hose.

The second evolution was ECCS screen cleaning by the divers in the wetwell. No check valve was installed on the hose and the hose was contaminated (the hose was found hooked up and routed into the wetwell water). If the DWST transfer pumps were turned off with this hose routed from a DW hose bib to the wetwell, a direct path exists to siphon water back to the DWST via the SCW skid recirc line. There are no check valves to block this path. During this same time frame, DWST transfer pumps were powered down to support bus outage work. This evolution has been identified as likely cause of DWST contamination.

07/15/03 closed. (smt)

Approval for closure by Dispositioning Manager: *BENNETT, DA* *07/10/03*

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PROBLEM EVALUATION REQUEST

PER No. **203-3885**

System Number	MEL EPN	Discovery Date / Time
		10/28/03 12:56

TRITIUM DETECTED IN THE WOA AIR WASH WATER

Problem:

Description of Condition: WOA airwash was secured for cold weather ops and Chemistry was requested to sample the WOA drain basin so that Operations could release that water to the storm drain system. The initial sample for tritium showed a concentration of 1.05E-5 uCi/ml and the backup sample showed a tritium concentration of 1.11E-5 uCi/ml. Free release criteria for tritium is LT 3.00E-6 uCi/ml.

Initial Operability Assessment: N/A. The screen wash system is not a Technical Specification, ODCM, Safety Related, or Augmented Quality System, Structure, or Component.

This may be reportable. Operations needs to determine if screenwash water was released to the storm drain system when the system was drained down, i.e. did the basin overflow.

Requirement Not Satisfied: Possible release of radioactive liquid to the storm drain system.

Immediate Corrective Actions Taken: WOA screenwash is potable water. A potable water sample was collected for tritium analysis and the result was LT 3.00E-6.
Chemistry set up sampling apparatus to collect an air sample in the WOA plenum.
OPS was requested to contact the laborers and pump the screenwash basin water into drums.
Environmental Services was requested to collect samples from the storm drain pond composite sampler.
Regulatory Affairs was notified.

Inappropriate Action: None

Additional Information: Possible sources of the tritium contamination could be leaking steam coils or the introduction of tritiated air from the reactor or turbine building exhausts.

Originator Name / Mail Drop or Extension	Reviewer / Date - Time	Quality Identified	
LOOKER, JR 927C	BENNETT, DA 10/28/03 14:07	YES ☐ NO ☒	Response Required ☐ Evaluation Number ____
Originator Signature / Date Signed: YES ☒ NO ☐ 10/28/03	Reviewer Comments Should be assigned to Bennett/Madden		

OPERATIONS REVIEWER

OPERABILITY DETERMINATION			REPORTABILITY
Component: ☐ Operable ☐ Operable but degraded or non-conforming ☐ Not Operable ☒ N/A	System/Structure: ☐ Operable ☐ Operable but degraded or non-conforming ☐ Not Operable ☒ N/A	☐ YES Perform Operability / ☒ NO Functionality Determination per 1.3.66 Assigned To:____	☒ Non Reportable ☐ Potentially Reportable ☐ Reportable Requirement: 10CFR50.73(a)(2)(viii) ☐ Potential Tech. Spec. Violation

Comments:
Reportability changed to Non-Reportable based in information recieved 10/29/03......lap
As we discussed, please change the subject PER to "non-reportable." This change is justified because the reporting criteria referenced in the PER (10 CFR 50.73(a)(2)(viii)) specifically excludes tritium from the list of radionuclides to be reported. Also, since this is not an RPER, please close the related PTL (206540) to perform a reportability eval.
Thanks, Fred Schill

Operations Reviewer Signature / Date / Time
GREEN, WR 10/28/03 14:53

ASSIGNMENT

Resolution Categories	Cause Determination	Reactor Startup	Significant PER
☒ (A) Resolve Deficiency using PER Resolution Form ☐ (B) Trend ☐ Human Performance Related ☐ Generic Considerations	☐ Root Cause ☐ Apparent Cause ☒ Evaluate Only	☐ Forced ☐ Refueling Year ☒ No	☐ YES ☒ NO (Justify below)

Comments:

PER CLOSURE

PER Coordinator (Print) / Signature / Date	Transmitted To Plant Files (Print) / Signature / Date

ENERGY NORTHWEST People·Vision·Solutions	PROBLEM EVALUATION REQUEST	PER No. 203-3885

System Number	MEL EPN	Discovery Date / Time
		10/28/03 12:56

Assigned Dispositioning Manager	Dispositioning Organization
BENNETT, DA	**CHEMISTRY**
Assigned Dispositioner	PER Program Reviewer Signature / Date
MADDEN, CR	**PRITCHARD, LA** 10/29/03

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PER RESOLUTION

PER No. 203-3885 REV No. 0
Quality Assessments Initiated ☐ Yes

Operability / Functionality Determination ☐ Yes	☒ NA
Permanent Equipment Disposition Classifications ☐ Permanent Accept-As-Is ☐ Permanent Repair ☐ Rework	☒ NA
Equipment Classification: Quality Class: ☐ 1 ☐ A ☐ 2 ☐ G ☐ Safety Related ☐ ASME	☒ NA
Previous problems or generic impact discussed ☐ Yes	☒ NA

Significant: ☐ Yes ☒ No | Number of interim Corrective Actions: 0 | Number of permanent Corrective Actions: 0

Cause Determination Codes

☒ No Cause Necessary ☐ Unknown (UNKN), Justify in comments ☐ Assumed Risk (AR01), Justify in comments

DESCRIPTION	ORG	PROC	KEY	O&P	HE/IA	GEMS
Inappropriate Action: None identified	CHM	RM	MT			

Comments:

Problem Statement: WOA airwash basin was found to contain tritium.

When the airwash basin was sampled for free release it had detectable tritium. Discussion with Ops indicates that although the system was in service it had not operated for some time due to ambient temperatures. Therefore the water had been sitting in the basin with no make-up or overflow. The inlet air to the fans was sampled and indicated detectable tritium also. This indicates that we had probabaly been re-cycling air from the TEA discharge that is known to contain tritium. It's contact with the stagnant water in the WOA basin most likely caused the water to come to equilbrium with the air.

Remedial Corrective Action: Sampled the storm drain pond composite sampler and drain line and analyzed for tritium. No detectable tritium was found. This indicates that the system did not discharge to the pond recently.

Laborers barreled the water in the basin and took it to radwaste.
Ops caution tagged the drain valve for the WOA airwash basin to require sampling before opening the valve.
No further actions are required.

Approvals For Permanent Disposition

PER Dispositioner	*MADDEN, CR*	*11/06/03*
Dispositioning Manager	*BENNETT, DA*	*11/06/03*

ENERGY NORTHWEST People·Vision·Solutions	Condition Report	CR #: 2-05-08789

Creator: **MADDEN, CLAY R** Extension: **4460** Org. Code: **52830** Date/Time: **11/10/2005 /15:16**

Facility: **Columbia Generating Station**

Primary Area This Issue Impacts: **Environmental Issue**
Secondary Area(s) This Issue Impacts: **Chemistry Issue**

Do you believe this issue affects the Operation of this facility, may similarly affect other Structures, Systems or Components (SSCs), or is reportable to the NRC or other organization?: **NO**

Do You Believe This Issue is: **I Don't Know**

☐ Operability
☐ Reportability Requirement:
Comments / Assessment:

☒ Not An Equipment Issue
☐ The Equipment Part Number (EPN) Is: Safety Related: YES ☐ NO ☒
☐ I Don't Know The EPN, Short Description:
☐ I Don't Know

Condition Summary Statement:
Increased Co-60 was observed at the Storm Pond discharge during October.

Detailed Description:
Environmental Services reported increased Co-60 in samples taken at the Storm Pond. The levels (<20 pCi/L) were reported to be less than the threshold for reporting (300 pCi/L iaw ODCM RFO 6.3.1 Table 6.3.1-2).

Recommend a Category C to Bennett/Madden

Any Actions That Have Been Taken To Address This Issue:
I have contacted Environmental Services and requested more detailed information about this increase to allow comparison with meteorological conditions and plant events. Some minor increases are anticipated due to recent seasonal rainfall. I have also asked Regulatory Affairs to review state and federal commitments with respect to the storm pond's 50.75(g) status.

Category Determination:	Minor Condition Assign.	
☐ CAT A - Root Cause ☐ CAT B - Apparent Cause ☒ CAT C - Minor Condition ☐ CAT D - No Further Action Req. (Explain Below)	**PTL**	PER Assignment: PER Number: Disp. Manager: Org.: Dispositioner: CAT C Assignment: PTL Number:A **235297** Responsible Manager: **BENNETT, DA** Org.:52830 Responsible Individual: **MADDEN, CR** Org.:52830 Scheduled Completion Date: **11/24/05**

Operations Comments:
The following has been evaluated during the review of this CR per SWP-CAP-01:

Operability: This issue is not Technical Specification, LCS, ODCM, Safety Related, or Augmented Quality System, Structure, or Component (SSC) related. This issue does not affect implementation of Station Blackout or Control Room evacuation requirements and does not affect assessment of Emergency Action Levels or Emergency Operating Procedures.

Reportability: This CR does not meet the criteria of PPM 1.10.1 for reportability based on the levels being lower than the limits. Follow up reportability may be required however.

FAO/OD: NA

Extent of Condition: NA

Industrial Safety: NA

Immediate OPS Review By: **ROCKEY, HD** Date/Time: **11/10/05 /17:06**

Reviewer Comments: Reactor Startup:
Outage (Year):

Review Completed By: **PRITCHARD, LA** Date/Time: **11/14/05 /12:51**

Codes: **I/CHM** **RAD** **CONTAM** **ENVIRON** **REPORT** **D/CHM** **CRGED**

DIC 1803.5

CR 2-05-08789 observed Co-60 at 19.9 pCi/L at the storm pond (REMP Station 101). "The results for the September composite water sample (the collection period was from 9-7-05 through 10-4-05) at station 101 contained Co-60 at a concentration of 19.9 pCi/L. [Based on the Hanford Met Tower data, during this period, there was 0.71" of rainfall.] The results from both the prior sampling period (8-2-05 to 9-7-05) [0.06" of rainfall] and the following sampling period (10-4-05 to 11-2-05) [0.24" of rainfall] showed that Co-60 was below the MDA (the associated MDAs were 3.43 pCi/L and 2.80 pCi/L respectively). The last time that there was a positive Co-60 result in this sample was in December of 2000." The REMP sample results will be included in the annual REMP report. No PTL is necessary for this as these results are already included based on ODCM Chapter 5.0, Table 5-1, and RFO 6.3.1.

Hanford Met Tower precipitation records and plant particulate and iodine effluent results are tabulated below:

Month	Inches of Rainfall	Curies of Particulates/Iodines*
Jan	0.93	3.98e-6
Feb	0.04	8.74e-6
Mar	0.31	7.33E-6
Apr	0.26	1.45E-4
May	0.79	1.21E-4
Jun	0.06	2.37E-4
Jul	0.09	2.33E-5
Aug	0.06	2.08E-4
Sep	0.66	2.84E-4
Oct	0.29	2.21E-5

*Half lives > 8 days

During the early part of the summer dry season (May 6th to July 2nd), refueling maintenance activity generated some particulate effluents. Following startup on 7/2/05, an RWCU system leak also was generating particulate effluents. The first significant rainfall following these releases probably washed particulates that had settled on building roofs to the storm drain pond. As stated above, this is anticipated by plant design and the storm pond is monitored and managed iaw 10CFR50.75(g).

The Storm Pond is managed iaw 10CFR50.75(g). A flow proportional sampling system is installed at the storm drain discharge into the storm pond (evaporation basin) and the aliquots analyzed monthly. No change to this sampling frequency is recommended.

It is understood by Washington State Department of Health and EFSEC that seasonal rain can result in very low level radioactive material reaching the storm pond and parking lot drains from gaseous effluent washout & rainout as well as from the washing of particulates that have settled out on the roofs of buildings and on the grounds surrounding CGS.

CR 2-05-08754 was written in the same time period:

DETAILED DESCRIPTION OF CONDITION: OSP-COLDWEATHER-OPS directs Operations to contact chemistry to sample the airwash basin for free release prior to draining the basin to the storm drains. Upon entering the ROA unit, the operator noted the basin had already drained. The apparent cause was due to low outside air temperature causing the automatic basin drain valve to open draining the basin to the storm drains to prevent freezing. A procedure note indicates that a potential exists for an unmonitored release if a door inside the Reactor building, which is on the suction side of the ROA duct, is left open. Under these conditions it is possible for contamination to accumulate in the air wash water. PER 292-0081 and 298-1646 describe similar issues.

IMMEDIATE ACTIONS TAKEN: Contacted HP to perform contamination survey of the drained airwash basin: No contamination was detected.

ANALYSIS: There are two ways by which small amounts of radioactive material can become entrained in intake air wash a) building wake effects which can result in gaseous effluents re-entering the HVAC system at the intake structure, and b) leaving manways (doors) to the intake air structures open which can result in radioactive materials in the air wash system. Administrative controls were put in place as a result of PER 292-0081 to limit this later input. It is possible that building wake effects could have resulted in some particulate activity entering the ROA intake structure and becoming entrained in the airwash. A similar release at similar concentrations occured in the 2002-2003 time frame and no activity was seen at the Storm Pond. So, although this pathway is a possibility, it is not a significant one.

*****************************PER 298-1646******************************

Description of Condition: During a tagout, equipment operators determined that an unmonitored flow path exists from the common discharge header for ROA-P-1A and ROA-P-1B to the reactor roof drain system through 3/4" line containing ROA-V-60 and a flow element ROA-FI-1 to the roof drain system. During operation of the air washer unit there is a steady flow of 4 GPM through this path to the floor drain.

*********************292-0081*****************************

There is an unmonitored potential for radiological release point from the radiological controlled area (RCA) via various unmarked drains. (DG building, plant roof) QA walkdown generated per. Need to consider labeling of these drains. No previous per generated. Agreement between HP/CHEM and QA is to label drains. Maintenance to take the lead on establishing a program and implementing. Ops to upgrade PPM to eliminate practice of recirc air back to radwaste HVAC.

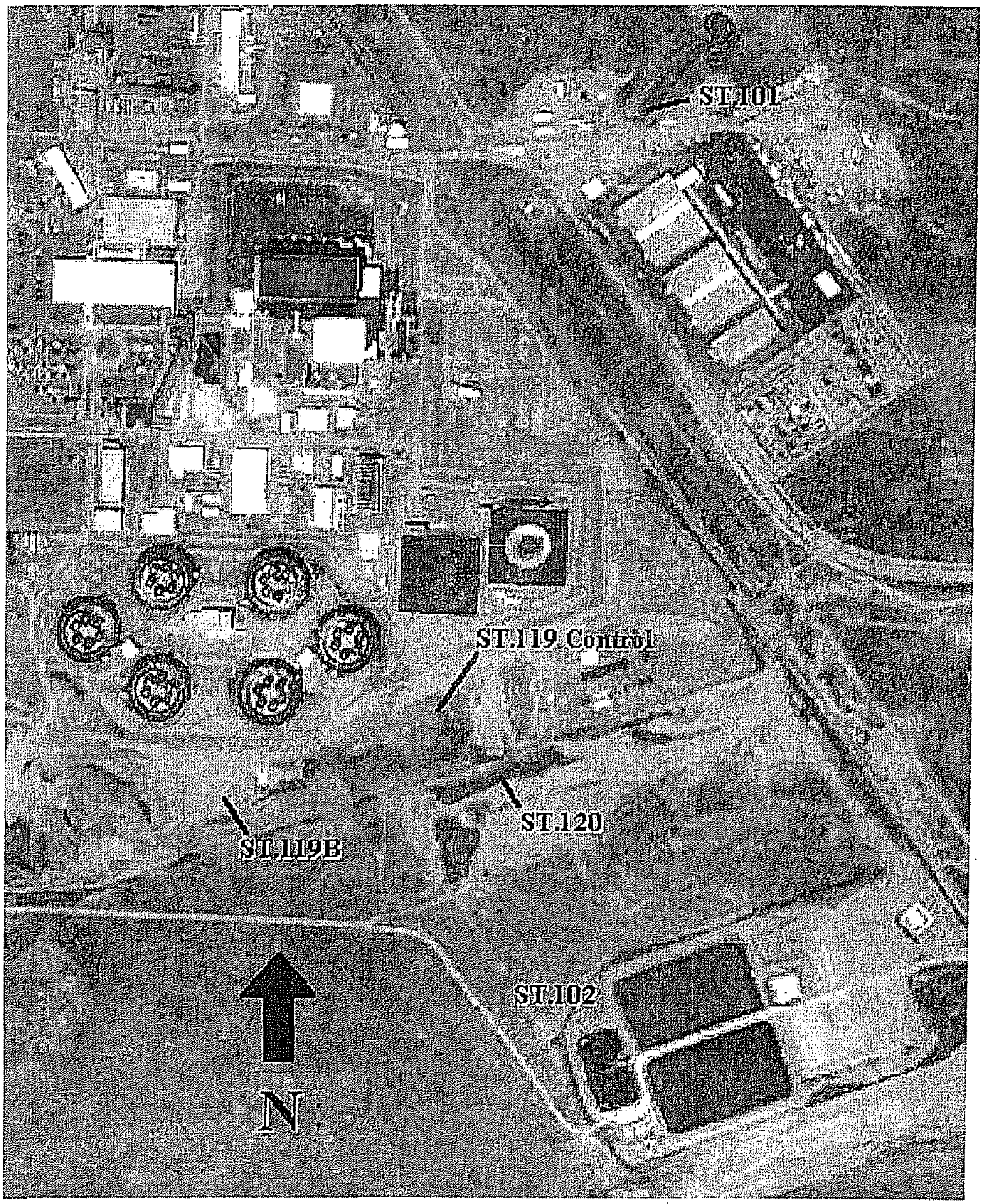

FIGURE 4-3 REMP NEAR PLANT SAMPLING LOCATIONS
STATION 102A (APPROXIMATELY 0.25 MI SOUTH). STATION 102 IN PICTURE IS BOTH 102B, 102D AND 102G.

	Well ID	Sample Date/Time	Results	Units
Tritium	699-2-3	02/14/1962 0:00	1000	pCi/L
Tritium	699-2-3	03/01/1962 0:00	1000	pCi/L
Tritium	699-2-3	05/08/1962 0:00	1000	pCi/L
Tritium	699-2-3	05/15/1962 0:00	1000	pCi/L
Tritium	699-2-3	07/31/1962 0:00	1000	pCi/L
Tritium	699-2-3	08/07/1962 0:00	1000	pCi/L
Tritium	699-2-3	10/25/1962 0:00	1000	pCi/L
Tritium	699-2-3	10/30/1962 0:00	1000	pCi/L
Tritium	699-2-3	01/16/1963 0:00	1000	pCi/L
Tritium	699-2-3	02/13/1963 0:00	40000	pCi/L
Tritium	699-2-3	04/10/1963 0:00	1000	pCi/L
Tritium	699-2-3	05/23/1963 0:00	1000	pCi/L
Tritium	699-2-3	06/12/1963 0:00	1000	pCi/L
Tritium	699-2-3	12/07/1965 0:00	2900	pCi/L
Tritium	699-2-3	12/08/1965 0:00	2900	pCi/L
Tritium	699-2-3	10/05/1966 0:00	2200	pCi/L
Tritium	699-2-3	12/20/1966 0:00	3400	pCi/L
Tritium	699-2-3	03/20/1967 0:00	2300	pCi/L
Tritium	699-2-3	06/08/1967 0:00	2500	pCi/L
Tritium	699-2-3	06/09/1967 0:00	2400	pCi/L
Tritium	699-2-3	09/12/1967 0:00	2500	pCi/L
Tritium	699-2-3	12/07/1967 0:00	1700	pCi/L
Tritium	699-2-3	02/06/1969 0:00	870	pCi/L
Tritium	699-2-3	05/19/1969 0:00	2200	pCi/L
Tritium	699-2-3	07/18/1969 0:00	2100	pCi/L
Tritium	699-2-3	05/03/1971 0:00	13000	pCi/L
Tritium	699-2-3	06/29/1971 0:00	13000	pCi/L
Tritium	699-2-3	10/13/1971 0:00	15000	pCi/L
Tritium	699-2-3	02/01/1972 0:00	17000	pCi/L
Tritium	699-2-3	06/06/1972 0:00	18000	pCi/L
Tritium	699-2-3	07/17/1972 0:00	18000	pCi/L
Tritium	699-2-3	08/07/1972 0:00	21000	pCi/L
Tritium	699-2-3	09/09/1972 0:00	21000	pCi/L
Tritium	699-2-3	09/19/1972 0:00	21000	pCi/L
Tritium	699-2-3	10/03/1972 0:00	20000	pCi/L
Tritium	699-2-3	04/06/1973 0:00	24000	pCi/L
Tritium	699-2-3	06/04/1973 0:00	29000	pCi/L
Tritium	699-2-3	07/30/1973 0:00	42000	pCi/L
Tritium	699-2-3	11/07/1973 0:00	44000	pCi/L
Tritium	699-2-3	11/26/1973 0:00	46000	pCi/L
Tritium	699-2-3	01/29/1974 0:00	47000	pCi/L
Tritium	699-2-3	04/01/1974 0:00	46000	pCi/L
Tritium	699-2-3	07/29/1974 0:00	49000	pCi/L
Tritium	699-2-3	09/30/1974 0:00	62000	pCi/L
Tritium	699-2-3	01/21/1975 0:00	670000	pCi/L
Tritium	699-2-3	04/17/1975 0:00	56000	pCi/L
Tritium	699-2-3	07/28/1975 0:00	59000	pCi/L
Tritium	699-2-3	09/29/1975 0:00	64000	pCi/L
Tritium	699-2-3	01/26/1976 0:00	72000	pCi/L
Tritium	699-2-3	04/05/1976 0:00	82000	pCi/L
Tritium	699-2-3	08/03/1976 0:00	82000	pCi/L

Tritium	699-2-3	01/04/1977 0:00	83000 pCi/L
Tritium	699-2-3	03/03/1977 0:00	82000 pCi/L
Tritium	699-2-3	07/27/1977 0:00	88000 pCi/L
Tritium	699-2-3	01/06/1978 0:00	97000 pCi/L
Tritium	699-2-3	01/26/1978 0:00	98000 pCi/L
Tritium	699-2-3	03/01/1978 0:00	120000 pCi/L
Tritium	699-2-3	03/21/1978 0:00	110000 pCi/L
Tritium	699-2-3	04/24/1978 0:00	93000 pCi/L
Tritium	699-2-3	05/16/1978 0:00	100000 pCi/L
Tritium	699-2-3	06/19/1978 0:00	100000 pCi/L
Tritium	699-2-3	07/11/1978 0:00	110000 pCi/L
Tritium	699-2-3	08/11/1978 0:00	110000 pCi/L
Tritium	699-2-3	10/02/1978 0:00	110000 pCi/L
Tritium	699-2-3	11/08/1978 0:00	100000 pCi/L
Tritium	699-2-3	01/08/1979 0:00	110000 pCi/L
Tritium	699-2-3	01/22/1979 0:00	110000 pCi/L
Tritium	699-2-3	02/22/1979 0:00	110000 pCi/L
Tritium	699-2-3	03/27/1979 0:00	110000 pCi/L
Tritium	699-2-3	05/16/1979 0:00	120000 pCi/L
Tritium	699-2-3	06/11/1979 0:00	110000 pCi/L
Tritium	699-2-3	07/11/1979 0:00	120000 pCi/L
Tritium	699-2-3	08/06/1979 0:00	110000 pCi/L
Tritium	699-2-3	09/05/1979 0:00	120000 pCi/L
Tritium	699-2-3	10/10/1979 0:00	120000 pCi/L
Tritium	699-2-3	11/07/1979 0:00	120000 pCi/L
Tritium	699-2-3	01/03/1980 0:00	120000 pCi/L
Tritium	699-2-3	01/30/1980 0:00	130000 pCi/L
Tritium	699-2-3	02/28/1980 0:00	130000 pCi/L
Tritium	699-2-3	03/24/1980 0:00	120000 pCi/L
Tritium	699-2-3	04/14/1980 0:00	110000 pCi/L
Tritium	699-2-3	05/13/1980 0:00	110000 pCi/L
Tritium	699-2-3	06/10/1980 0:00	110000 pCi/L
Tritium	699-2-3	07/08/1980 0:00	110000 pCi/L
Tritium	699-2-3	08/13/1980 0:00	110000 pCi/L
Tritium	699-2-3	09/04/1980 0:00	110000 pCi/L
Tritium	699-2-3	09/30/1980 0:00	110000 pCi/L
Tritium	699-2-3	11/11/1980 0:00	120000 pCi/L
Tritium	699-2-3	01/05/1981 0:00	120000 pCi/L
Tritium	699-2-3	01/29/1981 0:00	120000 pCi/L
Tritium	699-2-3	02/18/1981 0:00	120000 pCi/L
Tritium	699-2-3	03/17/1981 0:00	110000 pCi/L
Tritium	699-2-3	05/06/1981 0:00	110000 pCi/L
Tritium	699-2-3	05/14/1981 0:00	110000 pCi/L
Tritium	699-2-3	06/15/1981 0:00	120000 pCi/L
Tritium	699-2-3	07/20/1981 0:00	120000 pCi/L
Tritium	699-2-3	08/24/1981 0:00	120000 pCi/L
Tritium	699-2-3	09/01/1981 0:00	120000 pCi/L
Tritium	699-2-3	09/28/1981 0:00	120000 pCi/L
Tritium	699-2-3	10/29/1981 0:00	120000 pCi/L
Tritium	699-2-3	01/04/1982 0:00	110000 pCi/L
Tritium	699-2-3	02/03/1982 0:00	120000 pCi/L
Tritium	699-2-3	02/17/1982 0:00	120000 pCi/L

Tritium	699-2-3	03/29/1982 0:00	120000	pCi/L
Tritium	699-2-3	04/14/1982 0:00	120000	pCi/L
Tritium	699-2-3	05/10/1982 0:00	120000	pCi/L
Tritium	699-2-3	06/17/1982 0:00	120000	pCi/L
Tritium	699-2-3	07/07/1982 0:00	120000	pCi/L
Tritium	699-2-3	08/02/1982 0:00	120000	pCi/L
Tritium	699-2-3	09/07/1982 0:00	120000	pCi/L
Tritium	699-2-3	09/27/1982 0:00	120000	pCi/L
Tritium	699-2-3	12/13/1982 0:00	120000	pCi/L
Tritium	699-2-3	01/31/1983 0:00	120000	pCi/L
Tritium	699-2-3	02/14/1983 0:00	120000	pCi/L
Tritium	699-2-3	03/23/1983 0:00	120000	pCi/L
Tritium	699-2-3	04/18/1983 0:00	120000	pCi/L
Tritium	699-2-3	05/11/1983 0:00	120000	pCi/L
Tritium	699-2-3	06/06/1983 0:00	120000	pCi/L
Tritium	699-2-3	07/12/1983 0:00	120000	pCi/L
Tritium	699-2-3	08/22/1983 0:00	120000	pCi/L
Tritium	699-2-3	09/08/1983 0:00	110000	pCi/L
Tritium	699-2-3	09/30/1983 0:00	120000	pCi/L
Tritium	699-2-3	12/19/1983 0:00	130000	pCi/L
Tritium	699-2-3	01/20/1984 0:00	120000	pCi/L
Tritium	699-2-3	02/28/1984 0:00	110000	pCi/L
Tritium	699-2-3	03/16/1984 0:00	110000	pCi/L
Tritium	699-2-3	04/18/1984 0:00	120000	pCi/L
Tritium	699-2-3	05/10/1984 0:00	120000	pCi/L
Tritium	699-2-3	06/15/1984 0:00	120000	pCi/L
Tritium	699-2-3	07/17/1984 0:00	120000	pCi/L
Tritium	699-2-3	08/10/1984 0:00	120000	pCi/L
Tritium	699-2-3	09/11/1984 0:00	120000	pCi/L
Tritium	699-2-3	10/08/1984 0:00	110000	pCi/L
Tritium	699-2-3	11/19/1984 0:00	120000	pCi/L
Tritium	699-2-3	12/13/1984 0:00	120000	pCi/L
Tritium	699-2-3	01/11/1985 0:00	120000	pCi/L
Tritium	699-2-3	02/08/1985 0:00	120000	pCi/L
Tritium	699-2-3	03/18/1985 0:00	120000	pCi/L
Tritium	699-2-3	04/08/1985 0:00	120000	pCi/L
Tritium	699-2-3	05/28/1985 0:00	110000	pCi/L
Tritium	699-2-3	06/12/1985 0:00	110000	pCi/L
Tritium	699-2-3	08/15/1985 0:00	120000	pCi/L
Tritium	699-2-3	08/30/1985 0:00	110000	pCi/L
Tritium	699-2-3	09/07/1985 0:00	110000	pCi/L
Tritium	699-2-3	10/15/1985 0:00	110000	pCi/L
Tritium	699-2-3	11/05/1985 0:00	110000	pCi/L
Tritium	699-2-3	12/13/1985 0:00	110000	pCi/L
Tritium	699-2-3	01/07/1986 0:00	110000	pCi/L
Tritium	699-2-3	02/04/1986 0:00	110000	pCi/L
Tritium	699-2-3	03/06/1986 0:00	210	pCi/L
Tritium	699-2-3	04/03/1986 0:00	110000	pCi/L
Tritium	699-2-3	05/06/1986 0:00	100000	pCi/L
Tritium	699-2-3	06/02/1986 0:00	110000	pCi/L
Tritium	699-2-3	06/30/1986 0:00	110000	pCi/L
Tritium	699-2-3	08/04/1986 0:00	108000	pCi/L

Tritium	699-2-3	09/08/1986 0:00	110000 pCi/L
Tritium	699-2-3	10/07/1986 0:00	106000 pCi/L
Tritium	699-2-3	11/03/1986 0:00	106000 pCi/L
Tritium	699-2-3	11/18/1986 0:00	106000 pCi/L
Tritium	699-2-3	12/01/1986 0:00	108000 pCi/L
Tritium	699-2-3	01/26/1987 0:00	107000 pCi/L
Tritium	699-2-3	06/03/1987 0:00	103000 pCi/L
Tritium	699-2-3	09/09/1987 0:00	107000 pCi/L
Tritium	699-2-3	10/25/1987 0:00	108000 pCi/L
Tritium	699-2-3	01/22/1988 0:00	104000 pCi/L
Tritium	699-2-3	04/08/1988 0:00	104000 pCi/L
Tritium	699-2-3	07/18/1988 0:00	108000 pCi/L
Tritium	699-2-3	10/18/1988 0:00	104000 pCi/L
Tritium	699-2-3	04/14/1989 0:00	104000 pCi/L
Tritium	699-2-3	11/07/1989 0:00	104000 pCi/L
Tritium	699-2-3	07/29/1991 11:35	97500 pCi/L
Tritium	699-2-3	01/23/1992 8:30	97600 pCi/L
Tritium	699-2-3	01/23/1992 8:30	98500 pCi/L
Tritium	699-2-3	02/06/1992 11:00	94700 pCi/L
Tritium	699-2-3	04/30/1992 10:15	101000 pCi/L
Tritium	699-2-3	08/12/1992 10:32	94300 pCi/L
Tritium	699-2-3	12/01/1992 8:00	97800 pCi/L
Tritium	699-2-3	02/02/1993 11:30	91900 pCi/L
Tritium	699-2-3	05/06/1993 11:15	96900 pCi/L
Tritium	699-2-3	08/19/1993 11:25	94200 pCi/L
Tritium	699-2-3	11/15/1993 9:00	88100 pCi/L
Tritium	699-2-3	02/23/1994 10:45	90800 pCi/L
Tritium	699-2-3	06/01/1994 11:15	92200 pCi/L
Tritium	699-2-3	09/08/1994 17:00	87400 pCi/L
Tritium	699-2-3	12/12/1994 10:36	87800 pCi/L
Tritium	699-2-3	03/23/1995 11:52	87500 pCi/L
Tritium	699-2-3	04/06/1995 10:30	87600 pCi/L
Tritium	699-2-3	06/22/1995 12:34	87400 pCi/L
Tritium	699-2-3	09/25/1995 12:27	88300 pCi/L
Tritium	699-2-3	09/25/1995 12:27	86200 pCi/L
Tritium	699-2-3	12/18/1995 10:35	81145 pCi/L
Tritium	699-2-3	03/18/1996 10:12	86565 pCi/L
Tritium	699-2-3	06/26/1996 11:58	76061 pCi/L
Tritium	699-2-3	09/18/1996 11:39	83205 pCi/L
Tritium	699-2-3	07/26/2001 8:32	57600 pCi/L
Tritium	699-2-3	07/27/2004 10:27	47400 pCi/L
Tritium	699-2-3	10/02/2007 11:24	39000 pCi/L
Tritium	699-2-7	03/03/1986 0:00	16000 pCi/L
Tritium	699-2-7	06/24/1986 0:00	13000 pCi/L
Tritium	699-2-7	08/13/1986 0:00	12900 pCi/L
Tritium	699-2-7	11/07/1986 0:00	12100 pCi/L
Tritium	699-2-7	01/26/1987 0:00	6790 pCi/L
Tritium	699-2-7	05/31/1987 0:00	10900 pCi/L
Tritium	699-2-7	07/24/1987 0:00	10700 pCi/L
Tritium	699-2-7	10/21/1987 0:00	13300 pCi/L
Tritium	699-2-7	01/27/1988 0:00	13300 pCi/L

Tritium	699-2-7	01/30/1989 0:00	12300 pCi/L
Tritium	699-2-7	04/13/1990 0:00	14300 pCi/L
Tritium	699-2-7	03/21/1991 8:25	11900 pCi/L
Tritium	699-2-7	12/18/1991 13:33	12300 pCi/L
Tritium	699-2-7	12/18/1991 13:33	12200 pCi/L
Tritium	699-2-7	02/07/1992 9:12	11700 pCi/L
Tritium	699-2-7	04/30/1992 8:28	13100 pCi/L
Tritium	699-2-7	08/18/1992 11:00	13500 pCi/L
Tritium	699-2-7	12/03/1992 9:05	13100 pCi/L
Tritium	699-2-7	02/02/1993 9:15	14100 pCi/L
Tritium	699-2-7	05/14/1993 9:00	14500 pCi/L
Tritium	699-2-7	08/19/1993 9:20	15100 pCi/L
Tritium	699-2-7	11/18/1993 10:46	15100 pCi/L
Tritium	699-2-7	02/25/1994 9:07	15100 pCi/L
Tritium	699-2-7	06/01/1994 9:00	15600 pCi/L
Tritium	699-2-7	09/08/1994 17:00	14100 pCi/L
Tritium	699-2-7	01/03/1995 10:32	15500 pCi/L
Tritium	699-2-7	03/23/1995 11:38	15500 pCi/L
Tritium	699-2-7	04/21/1995 8:30	14800 pCi/L
Tritium	699-2-7	06/27/1995 9:25	15400 pCi/L
Tritium	699-2-7	09/25/1995 11:23	16900 pCi/L
Tritium	699-2-7	12/18/1995 11:30	15336 pCi/L
Tritium	699-2-7	03/18/1996 11:10	15951 pCi/L
Tritium	699-2-7	06/26/1996 10:50	14531 pCi/L
Tritium	699-2-7	09/19/1996 10:34	17356 pCi/L
Tritium	699-2-7	04/17/1997 13:51	16100 pCi/L
Tritium	699-2-7	07/21/1997 11:37	15000 pCi/L
Tritium	699-2-7	10/20/1997 14:00	16200 pCi/L
Tritium	699-2-7	07/15/1998 11:57	17200 pCi/L
Tritium	699-2-7	10/08/1998 12:53	16800 pCi/L
Tritium	699-2-7	11/11/1999 13:32	15300 pCi/L
Tritium	699-2-7	10/27/2000 10:14	14800 pCi/L
Tritium	699-2-7	10/25/2001 12:24	14000 pCi/L
Tritium	699-2-7	10/22/2002 10:55	13500 pCi/L
Tritium	699-2-7	10/28/2003 9:36	13400 pCi/L
Tritium	699-2-7	10/14/2004 12:28	11100 pCi/L
Tritium	699-2-7	10/14/2004 12:28	10900 pCi/L
Tritium	699-2-7	10/27/2005 11:54	14200 pCi/L
Tritium	699-2-7	11/06/2006 11:46	12200 pCi/L
Tritium	699-2-7	10/31/2007 13:17	11000 pCi/L
Tritium	699-2-7	11/03/2008 13:06	9800 pCi/L
Tritium	699-9-E2	01/15/1963 0:00	1000 pCi/L
Tritium	699-9-E2	02/12/1963 0:00	1000 pCi/L
Tritium	699-9-E2	03/12/1963 0:00	1000 pCi/L
Tritium	699-9-E2	04/09/1963 0:00	1000 pCi/L
Tritium	699-9-E2	05/21/1963 0:00	1000 pCi/L
Tritium	699-9-E2	12/09/1965 0:00	2900 pCi/L
Tritium	699-9-E2	12/10/1965 0:00	2300 pCi/L
Tritium	699-9-E2	10/05/1966 0:00	2200 pCi/L
Tritium	699-9-E2	12/20/1966 0:00	8000 pCi/L
Tritium	699-9-E2	09/13/1967 0:00	1900 pCi/L

Tritium	699-9-E2	02/07/1969 0:00	490	pCi/L
Tritium	699-9-E2	05/20/1969 0:00	1200	pCi/L
Tritium	699-9-E2	01/19/1971 0:00	520	pCi/L
Tritium	699-9-E2	05/12/1971 0:00	580	pCi/L
Tritium	699-9-E2	07/15/1971 0:00	560	pCi/L
Tritium	699-9-E2	11/01/1971 0:00	530	pCi/L
Tritium	699-9-E2	01/07/1972 0:00	520	pCi/L
Tritium	699-9-E2	05/08/1972 0:00	510	pCi/L
Tritium	699-9-E2	07/17/1972 0:00	530	pCi/L
Tritium	699-9-E2	09/21/1972 0:00	540	pCi/L
Tritium	699-9-E2	03/06/1973 0:00	660	pCi/L
Tritium	699-9-E2	05/01/1973 0:00	850	pCi/L
Tritium	699-9-E2	06/21/1973 0:00	720	pCi/L
Tritium	699-9-E2	08/01/1973 0:00	480	pCi/L
Tritium	699-9-E2	10/02/1973 0:00	780	pCi/L
Tritium	699-9-E2	11/07/1973 0:00	840	pCi/L
Tritium	699-9-E2	02/04/1974 0:00	1500	pCi/L
Tritium	699-9-E2	04/04/1974 0:00	800	pCi/L
Tritium	699-9-E2	08/01/1974 0:00	430	pCi/L
Tritium	699-9-E2	01/21/1975 0:00	970	pCi/L
Tritium	699-9-E2	04/02/1975 0:00	540	pCi/L
Tritium	699-9-E2	07/31/1975 0:00	730	pCi/L
Tritium	699-9-E2	10/02/1975 0:00	1200	pCi/L
Tritium	699-9-E2	01/28/1976 0:00	1000	pCi/L
Tritium	699-9-E2	03/31/1976 0:00	800	pCi/L
Tritium	699-9-E2	08/02/1976 0:00	3400	pCi/L
Tritium	699-9-E2	10/05/1976 0:00	1300	pCi/L
Tritium	699-9-E2	01/05/1977 0:00	790	pCi/L
Tritium	699-9-E2	03/29/1977 0:00	760	pCi/L
Tritium	699-9-E2	06/27/1977 0:00	770	pCi/L
Tritium	699-9-E2	10/11/1977 0:00	910	pCi/L
Tritium	699-9-E2	01/12/1978 0:00	1200	pCi/L
Tritium	699-9-E2	03/28/1978 0:00	2300	pCi/L
Tritium	699-9-E2	06/16/1978 0:00	970	pCi/L
Tritium	699-9-E2	09/13/1978 0:00	860	pCi/L
Tritium	699-9-E2	01/15/1979 0:00	1300	pCi/L
Tritium	699-9-E2	03/20/1979 0:00	1400	pCi/L
Tritium	699-9-E2	06/28/1979 0:00	420	pCi/L
Tritium	699-9-E2	07/31/1979 0:00	420000	pCi/L
Tritium	699-9-E2	07/31/1979 0:00	510	pCi/L
Tritium	699-9-E2	09/06/1979 0:00	510	pCi/L
Tritium	699-9-E2	03/24/1980 0:00	620	pCi/L
Tritium	699-9-E2	06/09/1980 0:00	460	pCi/L
Tritium	699-9-E2	01/05/1981 0:00	630	pCi/L
Tritium	699-9-E2	03/25/1981 0:00	460	pCi/L
Tritium	699-9-E2	06/15/1981 0:00	1200	pCi/L
Tritium	699-9-E2	09/10/1981 0:00	550	pCi/L
Tritium	699-9-E2	01/04/1982 0:00	640	pCi/L
Tritium	699-9-E2	03/18/1982 0:00	370	pCi/L
Tritium	699-9-E2	06/17/1982 0:00	630	pCi/L
Tritium	699-9-E2	09/07/1982 0:00	410	pCi/L
Tritium	699-9-E2	12/07/1982 0:00	550	pCi/L

Tritium	699-9-E2	03/24/1983 0:00	-450 pCi/L
Tritium	699-9-E2	06/07/1983 0:00	-110 pCi/L
Tritium	699-9-E2	09/01/1983 0:00	1500 pCi/L
Tritium	699-9-E2	11/19/1983 0:00	58 pCi/L
Tritium	699-9-E2	03/20/1984 0:00	-190 pCi/L
Tritium	699-9-E2	06/27/1984 0:00	150 pCi/L
Tritium	699-9-E2	09/27/1984 0:00	-270 pCi/L
Tritium	699-9-E2	01/31/1985 0:00	15 pCi/L
Tritium	699-9-E2	04/24/1985 0:00	110 pCi/L
Tritium	699-9-E2	06/14/1985 0:00	-240 pCi/L
Tritium	699-9-E2	08/02/1985 0:00	-83 pCi/L
Tritium	699-9-E2	10/17/1985 0:00	-360 pCi/L
Tritium	699-9-E2	02/04/1986 0:00	-310 pCi/L
Tritium	699-9-E2	06/25/1986 0:00	-210 pCi/L
Tritium	699-9-E2	08/14/1986 0:00	340 pCi/L
Tritium	699-9-E2	11/11/1986 0:00	290 pCi/L
Tritium	699-9-E2	01/26/1987 0:00	143 pCi/L
Tritium	699-9-E2	06/08/1987 0:00	148 pCi/L
Tritium	699-9-E2	08/24/1987 0:00	210 pCi/L
Tritium	699-9-E2	10/27/1987 0:00	710 pCi/L
Tritium	699-9-E2	06/20/1994 9:00	1220 pCi/L
Tritium	699-9-E2	06/04/1996 9:00	1709.6 pCi/L
Tritium	699-9-E2	12/16/1996 12:10	1260 pCi/L
Tritium	699-9-E2	12/22/1997 10:17	2150 pCi/L
Tritium	699-9-E2	02/10/2000 12:15	1750 pCi/L
Tritium	699-9-E2	09/05/2000 12:07	2720 pCi/L
Tritium	699-9-E2	11/28/2000 10:48	2750 pCi/L
Tritium	699-9-E2	12/01/2003 9:26	2010 pCi/L
Tritium	699-9-E2	07/25/2007 11:08	1800 pCi/L
Tritium	699-10-E12	01/16/1963 0:00	20000 pCi/L
Tritium	699-10-E12	02/13/1963 0:00	1000 pCi/L
Tritium	699-10-E12	04/10/1963 0:00	1000 pCi/L
Tritium	699-10-E12	05/23/1963 0:00	1000 pCi/L
Tritium	699-10-E12	06/12/1963 0:00	1000 pCi/L
Tritium	699-10-E12	10/05/1966 0:00	1800 pCi/L
Tritium	699-10-E12	12/20/1966 0:00	2000 pCi/L
Tritium	699-10-E12	06/06/1967 0:00	2100 pCi/L
Tritium	699-10-E12	06/06/1967 0:00	3200 pCi/L
Tritium	699-10-E12	09/11/1967 0:00	3400 pCi/L
Tritium	699-10-E12	12/05/1967 0:00	2100 pCi/L
Tritium	699-10-E12	02/13/1969 0:00	500 pCi/L
Tritium	699-10-E12	05/15/1969 0:00	510 pCi/L
Tritium	699-10-E12	07/17/1969 0:00	530 pCi/L
Tritium	699-10-E12	01/25/1971 0:00	470 pCi/L
Tritium	699-10-E12	07/06/1971 0:00	720 pCi/L
Tritium	699-10-E12	11/01/1971 0:00	860 pCi/L
Tritium	699-10-E12	01/07/1972 0:00	520 pCi/L
Tritium	699-10-E12	10/29/1973 0:00	520 pCi/L
Tritium	699-10-E12	04/29/1974 0:00	500 pCi/L
Tritium	699-10-E12	10/29/1974 0:00	500 pCi/L
Tritium	699-10-E12	04/28/1975 0:00	480 pCi/L

Tritium	699-10-E12	11/04/1975 0:00	1000	pCi/L
Tritium	699-10-E12	01/12/1978 0:00	1300	pCi/L
Tritium	699-10-E12	03/28/1978 0:00	1500	pCi/L
Tritium	699-10-E12	06/16/1978 0:00	1500	pCi/L
Tritium	699-10-E12	09/15/1978 0:00	1100	pCi/L
Tritium	699-10-E12	01/15/1979 0:00	1300	pCi/L
Tritium	699-10-E12	03/20/1979 0:00	900	pCi/L
Tritium	699-10-E12	06/11/1979 0:00	1900	pCi/L
Tritium	699-10-E12	09/06/1979 0:00	2200	pCi/L
Tritium	699-10-E12	01/03/1980 0:00	4400	pCi/L
Tritium	699-10-E12	03/18/1980 0:00	3100	pCi/L
Tritium	699-10-E12	06/09/1980 0:00	3700	pCi/L
Tritium	699-10-E12	09/17/1980 0:00	4700	pCi/L
Tritium	699-10-E12	12/31/1980 0:00	3600	pCi/L
Tritium	699-10-E12	03/30/1981 0:00	4500	pCi/L
Tritium	699-10-E12	06/15/1981 0:00	5500	pCi/L
Tritium	699-10-E12	09/10/1981 0:00	4800	pCi/L
Tritium	699-10-E12	01/04/1982 0:00	5500	pCi/L
Tritium	699-10-E12	03/18/1982 0:00	5900	pCi/L
Tritium	699-10-E12	06/11/1982 0:00	5400	pCi/L
Tritium	699-10-E12	09/02/1982 0:00	34000	pCi/L
Tritium	699-10-E12	12/06/1982 0:00	1200	pCi/L
Tritium	699-10-E12	03/25/1983 0:00	8200	pCi/L
Tritium	699-10-E12	06/07/1983 0:00	8500	pCi/L
Tritium	699-10-E12	09/01/1983 0:00	8600	pCi/L
Tritium	699-10-E12	11/21/1983 0:00	23000	pCi/L
Tritium	699-10-E12	03/22/1984 0:00	9600	pCi/L
Tritium	699-10-E12	06/27/1984 0:00	11000	pCi/L
Tritium	699-10-E12	10/16/1984 0:00	11000	pCi/L
Tritium	699-10-E12	02/04/1985 0:00	11000	pCi/L
Tritium	699-10-E12	07/02/1985 0:00	11000	pCi/L
Tritium	699-10-E12	11/04/1985 0:00	12000	pCi/L
Tritium	699-10-E12	11/10/1985 0:00	12000	pCi/L
Tritium	699-10-E12	03/03/1986 0:00	12000	pCi/L
Tritium	699-10-E12	08/06/1986 0:00	12900	pCi/L
Tritium	699-10-E12	11/12/1986 0:00	13900	pCi/L
Tritium	699-10-E12	01/26/1987 0:00	13500	pCi/L
Tritium	699-10-E12	06/03/1987 0:00	14500	pCi/L
Tritium	699-10-E12	07/29/1987 0:00	15500	pCi/L
Tritium	699-10-E12	10/27/1987 0:00	16800	pCi/L
Tritium	699-10-E12	02/10/1988 0:00	17000	pCi/L
Tritium	699-10-E12	04/28/1988 0:00	17500	pCi/L
Tritium	699-10-E12	08/25/1988 0:00	19100	pCi/L
Tritium	699-10-E12	10/24/1988 0:00	20400	pCi/L
Tritium	699-10-E12	04/24/1989 0:00	22600	pCi/L
Tritium	699-10-E12	10/19/1989 0:00	23400	pCi/L
Tritium	699-10-E12	12/07/1990 10:49	22300	pCi/L
Tritium	699-10-E12	12/09/1991 9:20	24400	pCi/L
Tritium	699-10-E12	04/03/1992 11:00	25800	pCi/L
Tritium	699-10-E12	01/28/1993 8:30	28800	pCi/L
Tritium	699-10-E12	09/17/1994 8:15	28900	pCi/L
Tritium	699-10-E12	08/31/1995 10:50	31200	pCi/L

Tritium	699-10-E12	08/02/1996 9:00	25764 pCi/L
Tritium	699-10-E12	08/25/1997 13:50	22000 pCi/L
Tritium	699-10-E12	09/23/1998 12:19	24400 pCi/L
Tritium	699-10-E12	09/30/1999 11:18	25200 pCi/L
Tritium	699-10-E12	02/08/2000 13:01	23200 pCi/L
Tritium	699-10-E12	05/17/2000 10:08	25100 pCi/L
Tritium	699-10-E12	09/01/2000 11:26	24300 pCi/L
Tritium	699-10-E12	02/26/2002 11:23	24000 pCi/L
Tritium	699-10-E12	01/06/2003 10:59	20600 pCi/L
Tritium	699-10-E12	02/02/2004 12:56	18000 pCi/L
Tritium	699-10-E12	01/11/2005 12:35	15200 pCi/L
Tritium	699-10-E12	02/10/2006 11:02	16500 pCi/L
Tritium	699-10-E12	01/30/2007 12:02	14000 pCi/L
Tritium	699-10-E12	05/07/2008 12:39	13000 pCi/L
Tritium	699-10-E12P	03/14/1967 0:00	1600 pCi/L
Tritium	699-10-E12P	06/09/1967 0:00	2800 pCi/L
Tritium	699-10-E12P	12/05/1967 0:00	2100 pCi/L
Tritium	699-10-E12P	01/09/1968 0:00	1800 pCi/L
Tritium	699-10-E12P	03/27/1968 0:00	1900 pCi/L
Tritium	699-10-E12P	11/05/1968 0:00	820 pCi/L
Tritium	699-10-E12P	02/13/1969 0:00	500 pCi/L
Tritium	699-10-E12P	05/15/1969 0:00	660 pCi/L
Tritium	699-10-E12P	07/17/1969 0:00	530 pCi/L
Tritium	699-10-E12P	03/03/1970 0:00	560 pCi/L
Tritium	699-10-E12P	01/25/1971 0:00	470 pCi/L
Tritium	699-10-E12P	07/06/1971 0:00	720 pCi/L
Tritium	699-10-E12P	11/01/1971 0:00	860 pCi/L
Tritium	699-10-E12P	01/06/1972 0:00	520 pCi/L
Tritium	699-10-E12P	01/07/1972 0:00	520 pCi/L
Tritium	699-10-E12P	10/29/1973 0:00	520 pCi/L
Tritium	699-10-E12P	04/29/1974 0:00	500 pCi/L
Tritium	699-10-E12P	10/28/1974 0:00	500 pCi/L
Tritium	699-10-E12P	10/29/1974 0:00	500 pCi/L
Tritium	699-10-E12P	04/28/1975 0:00	480 pCi/L
Tritium	699-10-E12P	11/04/1975 0:00	1000 pCi/L
Tritium	699-10-E12Q	12/05/1967 0:00	2100 pCi/L
Tritium	699-10-E12Q	01/09/1968 0:00	1800 pCi/L
Tritium	699-10-E12Q	03/27/1968 0:00	1900 pCi/L
Tritium	699-10-E12Q	08/12/1968 0:00	1300 pCi/L
Tritium	699-10-E12Q	11/05/1968 0:00	960 pCi/L
Tritium	699-10-E12Q	02/13/1969 0:00	500 pCi/L
Tritium	699-10-E12Q	05/15/1969 0:00	620 pCi/L
Tritium	699-10-E12Q	07/17/1969 0:00	530 pCi/L
Tritium	699-10-E12R	01/09/1968 0:00	1800 pCi/L
Tritium	699-10-E12R	03/27/1968 0:00	3700 pCi/L
Tritium	699-10-E12R	08/12/1968 0:00	1400 pCi/L
Tritium	699-10-E12R	11/05/1968 0:00	820 pCi/L
Tritium	699-10-E12R	02/13/1969 0:00	500 pCi/L
Tritium	699-10-E12R	05/15/1969 0:00	540 pCi/L
Tritium	699-10-E12R	07/17/1969 0:00	530 pCi/L
Tritium	699-12-2C	07/24/2002 12:24	287000 pCi/L

Tritium	699-12-2C	10/01/2002 10:00	313000 pCi/L
Tritium	699-12-2C	01/07/2003 9:36	294000 pCi/L
Tritium	699-12-2C	03/25/2003 11:13	320000 pCi/L
Tritium	699-12-2C	06/26/2003 11:58	346000 pCi/L
Tritium	699-12-2C	09/18/2003 12:47	309000 pCi/L
Tritium	699-12-2C	12/30/2003 10:17	353000 pCi/L
Tritium	699-12-2C	03/11/2004 9:46	324000 pCi/L
Tritium	699-12-2C	06/29/2004 12:55	363000 pCi/L
Tritium	699-12-2C	09/17/2004 9:45	368000 pCi/L
Tritium	699-12-2C	12/27/2004 12:40	310000 pCi/L
Tritium	699-12-2C	03/22/2005 9:39	360000 pCi/L
Tritium	699-12-2C	06/23/2005 9:23	375000 pCi/L
Tritium	699-12-2C	09/26/2005 12:01	409000 pCi/L
Tritium	699-12-2C	01/03/2006 12:23	398000 pCi/L
Tritium	699-12-2C	01/03/2006 12:23	393000 pCi/L
Tritium	699-12-2C	03/17/2006 9:57	398000 pCi/L
Tritium	699-12-2C	07/06/2006 9:55	358000 pCi/L
Tritium	699-12-2C	12/13/2006 9:03	342000 pCi/L
Tritium	699-12-2C	01/02/2007 10:37	321000 pCi/L
Tritium	699-12-2C	04/26/2007 8:52	304000 pCi/L
Tritium	699-12-2C	07/20/2007 12:32	294000 pCi/L
Tritium	699-12-2C	09/27/2007 10:18	240000 pCi/L
Tritium	699-12-2C	01/18/2008 11:41	220000 pCi/L
Tritium	699-12-2C	03/16/2008 8:38	210000 pCi/L
Tritium	699-12-2C	08/26/2008 11:34	170000 pCi/L
Tritium	699-12-2C	09/28/2008 10:56	170000 pCi/L
Tritium	699-12-4D	11/27/1984 0:00	670 pCi/L
Tritium	699-12-4D	01/21/1985 0:00	6090 pCi/L
Tritium	699-12-4D	04/24/1985 0:00	362 pCi/L
Tritium	699-12-4D	11/11/1985 0:00	311 pCi/L
Tritium	699-12-4D	11/12/1985 0:00	231 pCi/L
Tritium	699-12-4D	02/07/2000 13:35	1850 pCi/L
Tritium	699-12-4D	08/29/2000 12:17	2220 pCi/L
Tritium	699-12-4D	06/14/2001 12:47	2010 pCi/L
Tritium	699-12-4D	07/20/2004 10:46	1870 pCi/L
Tritium	699-12-4D	12/22/2005 10:01	1690 pCi/L
Tritium	699-12-4D	02/14/2007 10:50	1480 pCi/L
Tritium	699-12-4D	06/05/2007 9:32	1500 pCi/L
Tritium	699-12-4D	03/07/2008 10:02	1400 pCi/L
Tritium	699-13-0A	09/15/2001 15:45	21600 pCi/L
Tritium	699-13-0A	09/15/2001 15:45	21400 pCi/L
Tritium	699-13-0A	07/24/2002 11:24	35500 pCi/L
Tritium	699-13-0A	10/01/2002 11:51	35100 pCi/L
Tritium	699-13-0A	01/06/2003 11:49	36400 pCi/L
Tritium	699-13-0A	03/24/2003 10:36	30200 pCi/L
Tritium	699-13-0A	06/23/2003 9:35	30300 pCi/L
Tritium	699-13-0A	09/17/2003 11:20	29500 pCi/L
Tritium	699-13-0A	12/30/2003 12:30	30200 pCi/L
Tritium	699-13-0A	03/10/2004 11:41	31700 pCi/L
Tritium	699-13-0A	06/25/2004 9:07	35000 pCi/L

Tritium	699-13-0A	09/17/2004 10:38	33800 pCi/L
Tritium	699-13-0A	12/27/2004 11:05	26700 pCi/L
Tritium	699-13-0A	03/23/2005 11:01	29700 pCi/L
Tritium	699-13-0A	06/23/2005 12:09	41400 pCi/L
Tritium	699-13-0A	09/26/2005 13:27	46700 pCi/L
Tritium	699-13-0A	01/04/2006 12:07	48800 pCi/L
Tritium	699-13-0A	03/17/2006 11:16	49100 pCi/L
Tritium	699-13-0A	06/28/2006 10:38	39100 pCi/L
Tritium	699-13-0A	11/02/2006 13:53	44600 pCi/L
Tritium	699-13-0A	01/02/2007 12:36	44200 pCi/L
Tritium	699-13-0A	04/26/2007 9:42	52000 pCi/L
Tritium	699-13-0A	07/20/2007 11:49	54600 pCi/L
Tritium	699-13-0A	09/16/2007 11:43	52000 pCi/L
Tritium	699-13-0A	01/17/2008 11:17	53000 pCi/L
Tritium	699-13-1	08/01/1973 0:00	100000 pCi/L
Tritium	699-13-1	02/04/1974 0:00	250000 pCi/L
Tritium	699-13-1	04/05/1974 0:00	300000 pCi/L
Tritium	699-13-1A	06/21/1973 0:00	88000 pCi/L
Tritium	699-13-1A	11/06/1973 0:00	150000 pCi/L
Tritium	699-13-1A	11/07/1973 0:00	160000 pCi/L
Tritium	699-13-1A	11/28/1973 0:00	43000 pCi/L
Tritium	699-13-1A	12/13/1973 0:00	160000 pCi/L
Tritium	699-13-1A	12/19/1973 0:00	130000 pCi/L
Tritium	699-13-1A	01/29/1974 0:00	270000 pCi/L
Tritium	699-13-1A	01/31/1974 0:00	280000 pCi/L
Tritium	699-13-1A	02/04/1974 0:00	14000 pCi/L
Tritium	699-13-1A	02/05/1974 0:00	290000 pCi/L
Tritium	699-13-1A	02/07/1974 0:00	60000 pCi/L
Tritium	699-13-1A	02/12/1974 0:00	57000 pCi/L
Tritium	699-13-1A	02/14/1974 0:00	260000 pCi/L
Tritium	699-13-1A	04/05/1974 0:00	300000 pCi/L
Tritium	699-13-1A	08/01/1974 0:00	320000 pCi/L
Tritium	699-13-1A	10/02/1974 0:00	390000 pCi/L
Tritium	699-13-1A	01/29/1975 0:00	390000 pCi/L
Tritium	699-13-1A	04/02/1975 0:00	94000 pCi/L
Tritium	699-13-1A	08/01/1975 0:00	53000 pCi/L
Tritium	699-13-1A	10/02/1975 0:00	56000 pCi/L
Tritium	699-13-1A	01/28/1976 0:00	15000 pCi/L
Tritium	699-13-1A	03/31/1976 0:00	8800 pCi/L
Tritium	699-13-1A	08/02/1976 0:00	69000 pCi/L
Tritium	699-13-1A	09/27/1976 0:00	63000 pCi/L
Tritium	699-13-1A	03/02/1977 0:00	180000 pCi/L
Tritium	699-13-1A	03/28/1977 0:00	200000 pCi/L
Tritium	699-13-1A	06/28/1977 0:00	200000 pCi/L
Tritium	699-13-1A	09/28/1977 0:00	84000 pCi/L
Tritium	699-13-1A	01/13/1978 0:00	390000 pCi/L
Tritium	699-13-1A	03/30/1978 0:00	12000 pCi/L
Tritium	699-13-1A	04/19/1978 0:00	120000 pCi/L
Tritium	699-13-1A	06/21/1978 0:00	1100000 pCi/L
Tritium	699-13-1A	09/13/1978 0:00	680000 pCi/L

Tritium	699-13-1A	01/15/1979 0:00	410000 pCi/L
Tritium	699-13-1A	03/20/1979 0:00	1400000 pCi/L
Tritium	699-13-1A	03/24/1980 0:00	69000 pCi/L
Tritium	699-13-1A	06/09/1980 0:00	33000 pCi/L
Tritium	699-13-1A	09/17/1980 0:00	790000 pCi/L
Tritium	699-13-1A	01/05/1981 0:00	36000 pCi/L
Tritium	699-13-1A	06/15/1981 0:00	15000 pCi/L
Tritium	699-13-1A	02/08/2000 10:14	23300 pCi/L
Tritium	699-13-1A	08/31/2000 10:28	12000 pCi/L
Tritium	699-13-1A	06/28/2001 11:15	16400 pCi/L
Tritium	699-13-1A	11/17/2004 9:55	139000 pCi/L
Tritium	699-13-1A	06/27/2007 10:50	110000 pCi/L

Tritium	699-13-1B	06/21/1973 0:00	9100 pCi/L
Tritium	699-13-1B	08/01/1973 0:00	100000 pCi/L
Tritium	699-13-1B	11/28/1973 0:00	620 pCi/L
Tritium	699-13-1B	12/13/1973 0:00	30000 pCi/L
Tritium	699-13-1B	12/19/1973 0:00	31000 pCi/L
Tritium	699-13-1B	01/29/1974 0:00	16000 pCi/L
Tritium	699-13-1B	01/31/1974 0:00	18000 pCi/L
Tritium	699-13-1B	02/04/1974 0:00	14000 pCi/L
Tritium	699-13-1B	02/05/1974 0:00	19000 pCi/L
Tritium	699-13-1B	02/07/1974 0:00	20000 pCi/L
Tritium	699-13-1B	02/12/1974 0:00	21000 pCi/L
Tritium	699-13-1B	02/14/1974 0:00	15000 pCi/L
Tritium	699-13-1B	04/05/1974 0:00	20000 pCi/L
Tritium	699-13-1B	08/01/1974 0:00	15000 pCi/L
Tritium	699-13-1B	10/02/1974 0:00	18000 pCi/L
Tritium	699-13-1B	01/29/1975 0:00	28000 pCi/L
Tritium	699-13-1B	04/02/1975 0:00	26000 pCi/L
Tritium	699-13-1B	08/01/1975 0:00	32000 pCi/L
Tritium	699-13-1B	10/02/1975 0:00	74000 pCi/L
Tritium	699-13-1B	01/28/1976 0:00	66000 pCi/L
Tritium	699-13-1B	03/31/1976 0:00	86000 pCi/L
Tritium	699-13-1B	08/02/1976 0:00	60000 pCi/L
Tritium	699-13-1B	09/27/1976 0:00	48000 pCi/L
Tritium	699-13-1B	03/02/1977 0:00	160000 pCi/L
Tritium	699-13-1B	03/28/1977 0:00	70000 pCi/L
Tritium	699-13-1B	06/28/1977 0:00	42000 pCi/L
Tritium	699-13-1B	09/28/1977 0:00	270000 pCi/L
Tritium	699-13-1B	01/13/1978 0:00	100000 pCi/L
Tritium	699-13-1B	03/30/1978 0:00	430000 pCi/L
Tritium	699-13-1B	06/21/1978 0:00	140000 pCi/L
Tritium	699-13-1B	09/13/1978 0:00	270000 pCi/L
Tritium	699-13-1B	01/15/1979 0:00	400000 pCi/L
Tritium	699-13-1B	03/20/1979 0:00	610000 pCi/L
Tritium	699-13-1B	06/28/1979 0:00	180000 pCi/L
Tritium	699-13-1B	01/03/1980 0:00	1300 pCi/L
Tritium	699-13-1B	03/24/1980 0:00	620 pCi/L
Tritium	699-13-1B	06/09/1980 0:00	700 pCi/L
Tritium	699-13-1B	09/17/1980 0:00	750 pCi/L
Tritium	699-13-1B	01/05/1981 0:00	390 pCi/L

Tritium	699-13-1B	03/31/1981 0:00	660 pCi/L
Tritium	699-13-1B	06/15/1981 0:00	560 pCi/L
Tritium	699-13-1B	02/08/2000 11:57	300 pCi/L
Tritium	699-13-1B	08/31/2000 10:04	32400 pCi/L
Tritium	699-13-1C	01/13/1980 0:00	620 pCi/L
Tritium	699-13-1C	03/24/1980 0:00	670 pCi/L
Tritium	699-13-1C	06/09/1980 0:00	440 pCi/L
Tritium	699-13-1C	09/17/1980 0:00	480 pCi/L
Tritium	699-13-1C	01/05/1981 0:00	470 pCi/L
Tritium	699-13-1C	03/31/1981 0:00	470 pCi/L
Tritium	699-13-1C	06/15/1981 0:00	590 pCi/L
Tritium	699-13-1C	09/10/1981 0:00	320 pCi/L
Tritium	699-13-1C	01/04/1982 0:00	630 pCi/L
Tritium	699-13-1C	02/22/1982 0:00	410 pCi/L
Tritium	699-13-1C	05/10/1982 0:00	300 pCi/L
Tritium	699-13-1C	08/02/1982 0:00	650 pCi/L
Tritium	699-13-1C	12/02/1982 0:00	400 pCi/L
Tritium	699-13-1C	02/14/1983 0:00	800 pCi/L
Tritium	699-13-1C	05/09/1983 0:00	-510 pCi/L
Tritium	699-13-1C	08/08/1983 0:00	-140 pCi/L
Tritium	699-13-1C	11/08/1983 0:00	390 pCi/L
Tritium	699-13-1C	02/28/1984 0:00	8.4 pCi/L
Tritium	699-13-1C	06/05/1984 0:00	490 pCi/L
Tritium	699-13-1C	04/17/1986 0:00	-330 pCi/L
Tritium	699-13-1C	05/20/1992 8:30	-45.09 pCi/L
Tritium	699-13-1C	11/23/1992 12:00	188 pCi/L
Tritium	699-13-1C	07/09/1993 8:00	57.15 pCi/L
Tritium	699-13-1C	11/30/1994 14:10	770 pCi/L
Tritium	699-13-1C	10/06/1995 9:46	-4.6 pCi/L
Tritium	699-13-1C	02/08/2000 13:00	110 pCi/L
Tritium	699-13-1C	06/28/2001 10:13	25.2 pCi/L
Tritium	699-13-1C	10/27/2003 11:01	31.6 pCi/L
Tritium	699-13-1C	12/13/2006 8:25	-31 pCi/L
Tritium	699-13-1C	11/16/2008 10:01	91 pCi/L
Tritium	699-13-1D	08/25/2001 11:05	110000 pCi/L
Tritium	699-13-1D	08/25/2001 11:05	115000 pCi/L
Tritium	699-13-1D	09/24/2001 7:35	116000 pCi/L
Tritium	699-13-1E	07/24/2002 10:36	116000 pCi/L
Tritium	699-13-1E	10/01/2002 11:15	123000 pCi/L
Tritium	699-13-1E	01/06/2003 11:00	137000 pCi/L
Tritium	699-13-1E	03/24/2003 11:14	143000 pCi/L
Tritium	699-13-1E	06/23/2003 10:31	167000 pCi/L
Tritium	699-13-1E	06/23/2003 10:31	170000 pCi/L
Tritium	699-13-1E	09/17/2003 10:35	168000 pCi/L
Tritium	699-13-1E	12/30/2003 11:29	183000 pCi/L
Tritium	699-13-1E	12/30/2003 11:29	184000 pCi/L
Tritium	699-13-1E	03/10/2004 12:24	168000 pCi/L
Tritium	699-13-1E	06/25/2004 10:12	152000 pCi/L
Tritium	699-13-1E	09/16/2004 9:22	171000 pCi/L

Tritium	699-13-1E	12/27/2004 11:48	179000 pCi/L
Tritium	699-13-1E	03/23/2005 9:28	175000 pCi/L
Tritium	699-13-1E	06/23/2005 11:14	239000 pCi/L
Tritium	699-13-1E	09/26/2005 12:43	283000 pCi/L
Tritium	699-13-1E	01/12/2006 12:57	306000 pCi/L
Tritium	699-13-1E	03/17/2006 10:36	232000 pCi/L
Tritium	699-13-1E	11/02/2006 13:16	203000 pCi/L
Tritium	699-13-1E	11/06/2006 10:41	197000 pCi/L
Tritium	699-13-1E	02/20/2007 11:25	223000 pCi/L
Tritium	699-13-1E	04/26/2007 9:17	209000 pCi/L
Tritium	699-13-1E	06/27/2007 13:14	215000 pCi/L
Tritium	699-13-1E	09/16/2007 11:02	210000 pCi/L
Tritium	699-13-1E	01/17/2008 10:03	200000 pCi/L
Tritium	699-13-2C	08/31/2001 11:10	196000 pCi/L
Tritium	699-13-2D	08/30/2001 13:10	690000 pCi/L
Tritium	699-13-2D	09/06/2001 11:34	634000 pCi/L
Tritium	699-13-2D	09/06/2001 11:34	684000 pCi/L
Tritium	699-13-2D	09/07/2001 11:30	1390000 pCi/L
Tritium	699-13-2D	09/07/2001 11:30	1330000 pCi/L
Tritium	699-13-2D	09/08/2001 17:10	1390000 pCi/L
Tritium	699-13-2D	09/08/2001 17:10	1300000 pCi/L
Tritium	699-13-2D	09/11/2001 8:30	503000 pCi/L
Tritium	699-13-2D	09/11/2001 8:30	510000 pCi/L
Tritium	699-13-2D	07/24/2002 9:34	597000 pCi/L
Tritium	699-13-2D	10/01/2002 10:38	639000 pCi/L
Tritium	699-13-2D	01/06/2003 13:06	587000 pCi/L
Tritium	699-13-2D	03/24/2003 12:39	558000 pCi/L
Tritium	699-13-2D	06/26/2003 11:12	509000 pCi/L
Tritium	699-13-2D	09/17/2003 9:49	490000 pCi/L
Tritium	699-13-2D	12/30/2003 9:23	468000 pCi/L
Tritium	699-13-2D	03/08/2004 11:49	439000 pCi/L
Tritium	699-13-2D	07/12/2004 10:24	480000 pCi/L
Tritium	699-13-2D	09/16/2004 11:01	502000 pCi/L
Tritium	699-13-2D	12/28/2004 10:26	428000 pCi/L
Tritium	699-13-2D	03/21/2005 13:21	528000 pCi/L
Tritium	699-13-2D	06/23/2005 10:21	591000 pCi/L
Tritium	699-13-2D	09/26/2005 11:20	677000 pCi/L
Tritium	699-13-2D	01/04/2006 10:56	659000 pCi/L
Tritium	699-13-2D	03/17/2006 9:13	590000 pCi/L
Tritium	699-13-2D	07/06/2006 10:46	529000 pCi/L
Tritium	699-13-2D	07/06/2006 10:46	534000 pCi/L
Tritium	699-13-2D	11/02/2006 14:39	524000 pCi/L
Tritium	699-13-2D	01/02/2007 11:34	490000 pCi/L
Tritium	699-13-2D	04/26/2007 10:12	408000 pCi/L
Tritium	699-13-2D	06/27/2007 12:30	453000 pCi/L
Tritium	699-13-2D	09/16/2007 12:34	410000 pCi/L
Tritium	699-13-2D	01/18/2008 10:58	370000 pCi/L
Tritium	699-13-2D	03/16/2008 10:28	370000 pCi/L
Tritium	699-13-2D	08/26/2008 10:34	340000 pCi/L
Tritium	699-13-2D	09/28/2008 9:59	340000 pCi/L

Tritium	699-13-3A	01/25/1999 10:22	1860000 pCi/L
Tritium	699-13-3A	01/27/2000 10:43	8140000 pCi/L
Tritium	699-13-3A	02/07/2000 11:25	7410000 pCi/L
Tritium	699-13-3A	02/07/2000 11:25	7230000 pCi/L
Tritium	699-13-3A	02/07/2000 11:25	6890000 pCi/L
Tritium	699-13-3A	08/29/2000 10:36	8380000 pCi/L
Tritium	699-13-3A	08/29/2000 10:36	7510000 pCi/L
Tritium	699-13-3A	08/29/2000 10:36	6720000 pCi/L
Tritium	699-13-3A	09/26/2000 1:30	6300000 pCi/L
Tritium	699-13-3A	09/26/2000 1:30	5880000 pCi/L
Tritium	699-13-3A	09/26/2000 11:11	6160000 pCi/L
Tritium	699-13-3A	09/26/2000 11:11	6560000 pCi/L
Tritium	699-13-3A	09/26/2000 11:30	6200000 pCi/L
Tritium	699-13-3A	09/26/2000 11:30	6540000 pCi/L
Tritium	699-13-3A	09/26/2000 13:20	6010000 pCi/L
Tritium	699-13-3A	09/26/2000 13:20	6380000 pCi/L
Tritium	699-13-3A	09/26/2000 13:30	6840000 pCi/L
Tritium	699-13-3A	09/26/2000 13:30	6540000 pCi/L
Tritium	699-13-3A	09/26/2000 13:30	6090000 pCi/L
Tritium	699-13-3A	09/26/2000 13:45	6980000 pCi/L
Tritium	699-13-3A	09/26/2000 13:45	7040000 pCi/L
Tritium	699-13-3A	09/26/2000 14:00	5690000 pCi/L
Tritium	699-13-3A	09/26/2000 14:00	5770000 pCi/L
Tritium	699-13-3A	09/26/2000 14:15	6210000 pCi/L
Tritium	699-13-3A	09/26/2000 14:15	6450000 pCi/L
Tritium	699-13-3A	10/04/2000 11:11	6810000 pCi/L
Tritium	699-13-3A	10/04/2000 11:11	7050000 pCi/L
Tritium	699-13-3A	10/04/2000 11:11	8370000 pCi/L
Tritium	699-13-3A	10/30/2000 12:19	6980000 pCi/L
Tritium	699-13-3A	01/25/2001 11:11	5290000 pCi/L
Tritium	699-13-3A	01/16/2002 10:18	4230000 pCi/L
Tritium	699-13-3A	08/21/2002 10:36	3830000 pCi/L
Tritium	699-13-3A	10/07/2002 9:36	3670000 pCi/L
Tritium	699-13-3A	01/06/2003 9:59	3610000 pCi/L
Tritium	699-13-3A	01/06/2003 9:59	3620000 pCi/L
Tritium	699-13-3A	03/25/2003 12:12	3360000 pCi/L
Tritium	699-13-3A	07/21/2003 10:21	2830000 pCi/L
Tritium	699-13-3A	09/17/2003 9:04	2410000 pCi/L
Tritium	699-13-3A	01/22/2004 9:37	2320000 pCi/L
Tritium	699-13-3A	03/08/2004 10:49	2150000 pCi/L
Tritium	699-13-3A	03/08/2004 10:49	1890000 pCi/L
Tritium	699-13-3A	07/12/2004 9:17	2230000 pCi/L
Tritium	699-13-3A	09/16/2004 10:00	1970000 pCi/L
Tritium	699-13-3A	12/27/2004 10:13	1470000 pCi/L
Tritium	699-13-3A	03/21/2005 12:09	1650000 pCi/L
Tritium	699-13-3A	06/27/2005 10:00	1590000 pCi/L
Tritium	699-13-3A	09/26/2005 10:35	1600000 pCi/L
Tritium	699-13-3A	01/04/2006 9:35	1470000 pCi/L
Tritium	699-13-3A	05/23/2006 10:17	1070000 pCi/L
Tritium	699-13-3A	06/28/2006 9:56	996000 pCi/L
Tritium	699-13-3A	11/06/2006 10:01	1040000 pCi/L

Tritium	699-13-3A	01/02/2007 9:42	940000 pCi/L
Tritium	699-13-3A	05/14/2007 10:00	1060000 pCi/L
Tritium	699-13-3A	06/27/2007 11:47	1020000 pCi/L
Tritium	699-13-3A	09/16/2007 13:10	850000 pCi/L
Tritium	699-13-3A	01/18/2008 10:08	940000 pCi/L
Tritium	699-13-3A	03/16/2008 9:32	880000 pCi/L
Tritium	699-13-3A	03/16/2008 9:32	880000 pCi/L
Tritium	699-13-3A	08/26/2008 9:16	610000 pCi/L
Tritium	699-13-3A	09/28/2008 9:20	780000 pCi/L
Tritium	699-14-E6P	12/20/1966 0:00	2100 pCi/L
Tritium	699-14-E6P	06/06/1967 0:00	3200 pCi/L
Tritium	699-14-E6P	07/28/1967 0:00	2400 pCi/L
Tritium	699-14-E6P	02/17/1969 0:00	720 pCi/L
Tritium	699-14-E6P	05/15/1969 0:00	790 pCi/L
Tritium	699-14-E6P	07/17/1969 0:00	710 pCi/L
Tritium	699-14-E6P	10/31/1974 0:00	500 pCi/L
Tritium	699-14-E6P	01/03/1975 0:00	600 pCi/L
Tritium	699-14-E6P	05/01/1975 0:00	500 pCi/L
Tritium	699-14-E6P	07/01/1975 0:00	480 pCi/L
Tritium	699-14-E6P	11/04/1975 0:00	1100 pCi/L
Tritium	699-14-E6P	01/05/1976 0:00	930 pCi/L
Tritium	699-14-E6P	05/03/1976 0:00	870 pCi/L
Tritium	699-14-E6P	06/28/1976 0:00	580 pCi/L
Tritium	699-14-E6P	10/05/1976 0:00	840 pCi/L
Tritium	699-14-E6P	01/05/1977 0:00	580 pCi/L
Tritium	699-14-E6P	03/29/1977 0:00	1400 pCi/L
Tritium	699-14-E6P	06/27/1977 0:00	1200 pCi/L
Tritium	699-14-E6P	09/30/1977 0:00	870 pCi/L
Tritium	699-14-E6P	02/03/1978 0:00	820 pCi/L
Tritium	699-14-E6P	03/28/1978 0:00	1400 pCi/L
Tritium	699-14-E6P	06/16/1978 0:00	1200 pCi/L
Tritium	699-14-E6P	09/13/1978 0:00	1500 pCi/L
Tritium	699-14-E6P	06/14/1979 0:00	390 pCi/L
Tritium	699-14-E6P	09/18/1979 0:00	810 pCi/L
Tritium	699-14-E6P	01/15/1980 0:00	660 pCi/L
Tritium	699-14-E6P	03/18/1980 0:00	700 pCi/L
Tritium	699-14-E6P	06/23/1980 0:00	650 pCi/L
Tritium	699-14-E6P	09/19/1980 0:00	420 pCi/L
Tritium	699-14-E6P	01/13/1981 0:00	580 pCi/L
Tritium	699-14-E6P	03/30/1981 0:00	570 pCi/L
Tritium	699-14-E6P	06/11/1981 0:00	530 pCi/L
Tritium	699-14-E6P	09/09/1981 0:00	370 pCi/L
Tritium	699-14-E6P	02/03/1982 0:00	400 pCi/L
Tritium	699-14-E6S	02/17/1969 0:00	820 pCi/L
Tritium	699-14-E6S	05/15/1969 0:00	540 pCi/L
Tritium	699-14-E6S	07/18/1969 0:00	550 pCi/L
Tritium	699-14-E6S	06/21/1973 0:00	750 pCi/L
Tritium	699-14-E6S	10/31/1974 0:00	500 pCi/L
Tritium	699-14-E6S	01/03/1975 0:00	1000 pCi/L
Tritium	699-14-E6S	05/01/1975 0:00	830 pCi/L

Tritium	699-14-E6S	07/01/1975 0:00	480	pCi/L
Tritium	699-14-E6S	11/04/1975 0:00	1500	pCi/L
Tritium	699-14-E6S	01/05/1976 0:00	1000	pCi/L
Tritium	699-14-E6S	05/03/1976 0:00	1000	pCi/L
Tritium	699-14-E6S	06/28/1976 0:00	850	pCi/L
Tritium	699-14-E6S	10/05/1976 0:00	1300	pCi/L
Tritium	699-14-E6S	01/05/1977 0:00	520	pCi/L
Tritium	699-14-E6S	03/29/1977 0:00	1300	pCi/L
Tritium	699-14-E6S	06/27/1977 0:00	1600	pCi/L
Tritium	699-14-E6S	09/30/1977 0:00	1400	pCi/L
Tritium	699-14-E6S	02/03/1978 0:00	1100	pCi/L
Tritium	699-14-E6S	03/28/1978 0:00	1300	pCi/L
Tritium	699-14-E6S	06/16/1978 0:00	820	pCi/L
Tritium	699-14-E6S	09/13/1978 0:00	820	pCi/L
Tritium	699-14-E6S	06/14/1979 0:00	460	pCi/L
Tritium	699-14-E6S	09/18/1979 0:00	660	pCi/L
Tritium	699-14-E6S	01/15/1980 0:00	740	pCi/L
Tritium	699-14-E6S	06/23/1980 0:00	490	pCi/L
Tritium	699-14-E6S	09/19/1980 0:00	570	pCi/L
Tritium	699-14-E6S	01/13/1981 0:00	560	pCi/L
Tritium	699-14-E6S	03/30/1981 0:00	450	pCi/L
Tritium	699-14-E6S	06/14/1995 10:08	-0.43	pCi/L
Tritium	699-14-E6T	12/20/1966 0:00	4100	pCi/L
Tritium	699-14-E6T	06/09/1967 0:00	2400	pCi/L
Tritium	699-14-E6T	07/28/1967 0:00	2400	pCi/L
Tritium	699-14-E6T	09/11/1967 0:00	3500	pCi/L
Tritium	699-14-E6T	02/17/1969 0:00	560	pCi/L
Tritium	699-14-E6T	05/15/1969 0:00	540	pCi/L
Tritium	699-14-E6T	07/18/1969 0:00	510	pCi/L
Tritium	699-14-E6T	06/21/1973 0:00	830	pCi/L
Tritium	699-14-E6T	07/02/1973 0:00	470	pCi/L
Tritium	699-14-E6T	10/29/1973 0:00	520	pCi/L
Tritium	699-14-E6T	01/14/1974 0:00	1000	pCi/L
Tritium	699-14-E6T	04/29/1974 0:00	500	pCi/L
Tritium	699-14-E6T	07/01/1974 0:00	570	pCi/L
Tritium	699-14-E6T	02/03/1978 0:00	3900	pCi/L
Tritium	699-14-E6T	06/21/1978 0:00	5900	pCi/L
Tritium	699-14-E6T	09/29/1978 0:00	17000	pCi/L
Tritium	699-14-E6T	06/14/1979 0:00	15000	pCi/L
Tritium	699-14-E6T	03/18/1980 0:00	21000	pCi/L
Tritium	699-14-E6T	06/23/1980 0:00	22000	pCi/L
Tritium	699-14-E6T	09/19/1980 0:00	22000	pCi/L
Tritium	699-14-E6T	01/13/1981 0:00	23000	pCi/L
Tritium	699-14-E6T	03/30/1981 0:00	21000	pCi/L
Tritium	699-14-E6T	06/11/1981 0:00	25000	pCi/L
Tritium	699-14-E6T	09/09/1981 0:00	20000	pCi/L
Tritium	699-14-E6T	02/03/1982 0:00	27000	pCi/L
Tritium	699-14-E6T	03/26/1982 0:00	29000	pCi/L
Tritium	699-14-E6T	12/02/1982 0:00	18000	pCi/L
Tritium	699-14-E6T	03/24/1983 0:00	31000	pCi/L
Tritium	699-14-E6T	06/10/1983 0:00	31000	pCi/L

Tritium	699-14-E6T	09/12/1983 0:00	30000	pCi/L
Tritium	699-14-E6T	01/06/1984 0:00	34000	pCi/L
Tritium	699-14-E6T	09/30/1984 0:00	38000	pCi/L
Tritium	699-14-E6T	03/25/1985 0:00	39000	pCi/L
Tritium	699-14-E6T	06/10/1985 0:00	37000	pCi/L
Tritium	699-14-E6T	09/07/1985 0:00	39000	pCi/L
Tritium	699-14-E6T	02/28/1986 0:00	40000	pCi/L
Tritium	699-14-E6T	09/30/1986 0:00	41300	pCi/L
Tritium	699-14-E6T	04/26/1987 0:00	41800	pCi/L
Tritium	699-14-E6T	10/25/1987 0:00	47600	pCi/L
Tritium	699-14-E6T	01/25/1988 0:00	51800	pCi/L

Tritium	699-17-5	01/09/1962 0:00	780000	pCi/L
Tritium	699-17-5	02/06/1962 0:00	1000	pCi/L
Tritium	699-17-5	03/07/1962 0:00	1000	pCi/L
Tritium	699-17-5	04/03/1962 0:00	1000	pCi/L
Tritium	699-17-5	05/29/1962 0:00	1000	pCi/L
Tritium	699-17-5	06/26/1962 0:00	1000	pCi/L
Tritium	699-17-5	07/24/1962 0:00	1000	pCi/L
Tritium	699-17-5	08/21/1962 0:00	1000	pCi/L
Tritium	699-17-5	09/18/1962 0:00	50000	pCi/L
Tritium	699-17-5	11/13/1962 0:00	1000	pCi/L
Tritium	699-17-5	12/11/1962 0:00	1000	pCi/L
Tritium	699-17-5	01/15/1963 0:00	20000	pCi/L
Tritium	699-17-5	02/12/1963 0:00	1000	pCi/L
Tritium	699-17-5	03/12/1963 0:00	1000	pCi/L
Tritium	699-17-5	04/09/1963 0:00	1000	pCi/L
Tritium	699-17-5	05/21/1963 0:00	1000	pCi/L
Tritium	699-17-5	10/16/1963 0:00	1000	pCi/L
Tritium	699-17-5	12/08/1965 0:00	2900	pCi/L
Tritium	699-17-5	12/09/1965 0:00	2300	pCi/L
Tritium	699-17-5	09/13/1967 0:00	2000	pCi/L
Tritium	699-17-5	02/07/1969 0:00	490	pCi/L
Tritium	699-17-5	05/20/1969 0:00	780	pCi/L
Tritium	699-17-5	07/14/1969 0:00	520	pCi/L
Tritium	699-17-5	01/12/1971 0:00	480	pCi/L
Tritium	699-17-5	05/05/1971 0:00	590	pCi/L
Tritium	699-17-5	07/13/1971 0:00	650	pCi/L
Tritium	699-17-5	11/01/1971 0:00	780	pCi/L
Tritium	699-17-5	01/07/1972 0:00	520	pCi/L
Tritium	699-17-5	05/08/1972 0:00	510	pCi/L
Tritium	699-17-5	07/17/1972 0:00	610	pCi/L
Tritium	699-17-5	09/21/1972 0:00	720	pCi/L
Tritium	699-17-5	03/06/1973 0:00	480	pCi/L
Tritium	699-17-5	04/06/1973 0:00	540	pCi/L
Tritium	699-17-5	05/01/1973 0:00	500	pCi/L
Tritium	699-17-5	06/21/1973 0:00	640	pCi/L
Tritium	699-17-5	07/02/1973 0:00	470	pCi/L
Tritium	699-17-5	08/27/1973 0:00	650	pCi/L
Tritium	699-17-5	10/29/1973 0:00	47000	pCi/L
Tritium	699-17-5	11/07/1973 0:00	3200	pCi/L
Tritium	699-17-5	01/10/1974 0:00	800	pCi/L

Tritium	699-17-5	01/14/1974 0:00	510 pCi/L
Tritium	699-17-5	02/26/1974 0:00	850 pCi/L
Tritium	699-17-5	04/29/1974 0:00	500 pCi/L
Tritium	699-17-5	07/01/1974 0:00	810 pCi/L
Tritium	699-17-5	08/30/1974 0:00	430 pCi/L
Tritium	699-17-5	10/29/1974 0:00	520 pCi/L
Tritium	699-17-5	12/30/1974 0:00	530 pCi/L
Tritium	699-17-5	02/25/1975 0:00	1100 pCi/L
Tritium	699-17-5	04/28/1975 0:00	480 pCi/L
Tritium	699-17-5	06/30/1975 0:00	950 pCi/L
Tritium	699-17-5	08/25/1975 0:00	4400 pCi/L
Tritium	699-17-5	10/27/1975 0:00	1100 pCi/L
Tritium	699-17-5	12/29/1975 0:00	520 pCi/L
Tritium	699-17-5	02/24/1976 0:00	560 pCi/L
Tritium	699-17-5	04/26/1976 0:00	740 pCi/L
Tritium	699-17-5	06/28/1976 0:00	790 pCi/L
Tritium	699-17-5	09/01/1976 0:00	820 pCi/L
Tritium	699-17-5	10/05/1976 0:00	610 pCi/L
Tritium	699-17-5	01/05/1977 0:00	770 pCi/L
Tritium	699-17-5	03/29/1977 0:00	1300 pCi/L
Tritium	699-17-5	06/27/1977 0:00	1100 pCi/L
Tritium	699-17-5	10/11/1977 0:00	900 pCi/L
Tritium	699-17-5	01/13/1978 0:00	1000 pCi/L
Tritium	699-17-5	06/16/1978 0:00	1100 pCi/L
Tritium	699-17-5	09/15/1978 0:00	1700 pCi/L
Tritium	699-17-5	01/16/1979 0:00	820 pCi/L
Tritium	699-17-5	03/22/1979 0:00	1200 pCi/L
Tritium	699-17-5	06/14/1979 0:00	550 pCi/L
Tritium	699-17-5	09/12/1979 0:00	1100 pCi/L
Tritium	699-17-5	01/03/1980 0:00	570 pCi/L
Tritium	699-17-5	03/24/1980 0:00	480 pCi/L
Tritium	699-17-5	06/12/1980 0:00	500 pCi/L
Tritium	699-17-5	09/17/1980 0:00	750 pCi/L
Tritium	699-17-5	01/05/1981 0:00	520 pCi/L
Tritium	699-17-5	03/25/1981 0:00	450 pCi/L
Tritium	699-17-5	06/15/1981 0:00	780 pCi/L
Tritium	699-17-5	09/10/1981 0:00	360 pCi/L
Tritium	699-17-5	01/04/1982 0:00	500 pCi/L
Tritium	699-17-5	03/18/1982 0:00	1600 pCi/L
Tritium	699-17-5	06/17/1982 0:00	560 pCi/L
Tritium	699-17-5	09/07/1982 0:00	370 pCi/L
Tritium	699-17-5	12/07/1982 0:00	390 pCi/L
Tritium	699-17-5	03/23/1983 0:00	-42 pCi/L
Tritium	699-17-5	06/07/1983 0:00	210 pCi/L
Tritium	699-17-5	09/01/1983 0:00	1500 pCi/L
Tritium	699-17-5	11/21/1983 0:00	240 pCi/L
Tritium	699-17-5	03/20/1984 0:00	-220 pCi/L
Tritium	699-17-5	06/21/1984 0:00	83 pCi/L
Tritium	699-17-5	09/27/1984 0:00	-300 pCi/L
Tritium	699-17-5	02/04/1985 0:00	-200 pCi/L
Tritium	699-17-5	04/24/1985 0:00	50 pCi/L
Tritium	699-17-5	06/14/1985 0:00	-410 pCi/L

Tritium	699-17-5	08/02/1985 0:00	-270 pCi/L
Tritium	699-17-5	11/10/1985 0:00	-260 pCi/L
Tritium	699-17-5	02/04/1986 0:00	64 pCi/L
Tritium	699-17-5	06/24/1986 0:00	-300 pCi/L
Tritium	699-17-5	07/28/1986 0:00	-50 pCi/L
Tritium	699-17-5	11/07/1986 0:00	-360 pCi/L
Tritium	699-17-5	02/27/1987 0:00	241 pCi/L
Tritium	699-17-5	06/03/1987 0:00	107 pCi/L
Tritium	699-17-5	08/19/1987 0:00	77.5 pCi/L
Tritium	699-17-5	10/21/1987 0:00	194 pCi/L
Tritium	699-17-5	01/21/1988 0:00	29 pCi/L
Tritium	699-17-5	02/03/1989 0:00	-95.1 pCi/L
Tritium	699-17-5	04/14/1989 0:00	127 pCi/L
Tritium	699-17-5	10/19/1989 0:00	43.1 pCi/L
Tritium	699-17-5	02/15/1990 0:00	186 pCi/L
Tritium	699-17-5	08/16/1990 9:00	777 pCi/L
Tritium	699-17-5	10/18/1990 10:40	188 pCi/L
Tritium	699-17-5	01/16/1991 8:56	44.29 pCi/L
Tritium	699-17-5	03/28/1991 8:45	224 pCi/L
Tritium	699-17-5	06/20/1991 12:30	-55.7 pCi/L
Tritium	699-17-5	09/11/1991 8:00	97.59 pCi/L
Tritium	699-17-5	12/04/1991 8:20	35.09 pCi/L
Tritium	699-17-5	02/19/1992 8:50	66 pCi/L
Tritium	699-17-5	05/11/1992 9:00	136 pCi/L
Tritium	699-17-5	08/17/1992 8:46	298 pCi/L
Tritium	699-17-5	11/17/1992 8:22	159 pCi/L
Tritium	699-17-5	03/11/1993 9:00	58.7 pCi/L
Tritium	699-17-5	08/19/1993 8:10	4.63 pCi/L
Tritium	699-17-5	02/15/1994 8:15	151 pCi/L
Tritium	699-17-5	08/30/1994 8:45	-10.3 pCi/L
Tritium	699-17-5	02/22/1995 9:00	140 pCi/L
Tritium	699-17-5	04/08/1996 8:45	1520 pCi/L
Tritium	699-17-5	06/26/1997 12:55	306 pCi/L
Tritium	699-17-5	06/22/1998 9:01	247 pCi/L
Tritium	699-17-5	06/22/1998 9:01	212 pCi/L
Tritium	699-17-5	02/07/2000 12:23	81.5 pCi/L
Tritium	699-17-5	08/30/2000 11:54	335 pCi/L
Tritium	699-17-5	08/24/2001 10:49	418 pCi/L
Tritium	699-17-5	08/31/2004 9:41	783 pCi/L

Tritium	699-20-E12	05/23/1963 0:00	1000 pCi/L
Tritium	699-20-E12	05/29/1963 0:00	1000 pCi/L
Tritium	699-20-E12	06/12/1963 0:00	1000 pCi/L
Tritium	699-20-E12	10/05/1966 0:00	2200 pCi/L
Tritium	699-20-E12	12/20/1966 0:00	2000 pCi/L
Tritium	699-20-E12	06/09/1967 0:00	2400 pCi/L
Tritium	699-20-E12	09/11/1967 0:00	3300 pCi/L
Tritium	699-20-E12	12/05/1967 0:00	2100 pCi/L
Tritium	699-20-E12	02/17/1969 0:00	860 pCi/L
Tritium	699-20-E12	05/15/1969 0:00	540 pCi/L
Tritium	699-20-E12	07/18/1969 0:00	1500 pCi/L
Tritium	699-20-E12	01/12/1971 0:00	810 pCi/L

Tritium	699-20-E12	01/26/1971 0:00	140 pCi/L
Tritium	699-20-E12	05/05/1971 0:00	690 pCi/L
Tritium	699-20-E12	07/13/1971 0:00	560 pCi/L
Tritium	699-20-E12	04/13/1973 0:00	540 pCi/L
Tritium	699-20-E12	05/17/1973 0:00	720 pCi/L
Tritium	699-20-E12	07/03/1973 0:00	600 pCi/L
Tritium	699-20-E12	01/18/1974 0:00	560 pCi/L
Tritium	699-20-E12	07/11/1974 0:00	500 pCi/L
Tritium	699-20-E12	01/30/1975 0:00	1500 pCi/L
Tritium	699-20-E12	10/05/1976 0:00	990 pCi/L
Tritium	699-20-E12	01/05/1977 0:00	2700 pCi/L
Tritium	699-20-E12	03/29/1977 0:00	1100 pCi/L
Tritium	699-20-E12	06/27/1977 0:00	1200 pCi/L
Tritium	699-20-E12	09/30/1977 0:00	740 pCi/L
Tritium	699-20-E12	03/28/1978 0:00	980 pCi/L
Tritium	699-20-E12	06/16/1978 0:00	760 pCi/L
Tritium	699-20-E12	09/13/1978 0:00	1400 pCi/L
Tritium	699-20-E12	06/14/1979 0:00	460 pCi/L
Tritium	699-20-E12	09/06/1979 0:00	780 pCi/L
Tritium	699-20-E12	01/03/1980 0:00	650 pCi/L
Tritium	699-20-E12	03/18/1980 0:00	710 pCi/L
Tritium	699-20-E12	06/09/1980 0:00	560 pCi/L
Tritium	699-20-E12	09/19/1980 0:00	410 pCi/L
Tritium	699-20-E12	01/13/1981 0:00	540 pCi/L
Tritium	699-20-E12	03/30/1981 0:00	410 pCi/L
Tritium	699-20-E12	06/11/1981 0:00	1100 pCi/L
Tritium	699-20-E12	09/09/1981 0:00	720 pCi/L
Tritium	699-20-E12	01/04/1982 0:00	410 pCi/L
Tritium	699-20-E12	06/09/1982 0:00	300 pCi/L
Tritium	699-20-E12	12/06/1982 0:00	390 pCi/L
Tritium	699-20-E12	06/07/1983 0:00	-300 pCi/L
Tritium	699-20-E12	09/12/1983 0:00	540 pCi/L
Tritium	699-20-E12	03/25/1985 0:00	99 pCi/L
Tritium	699-20-E12	02/28/1986 0:00	220 pCi/L
Tritium	699-20-E12	06/25/1986 0:00	12000 pCi/L
Tritium	699-20-E12	08/26/1986 0:00	60 pCi/L
Tritium	699-20-E12	11/12/1986 0:00	743 pCi/L
Tritium	699-20-E12	02/27/1987 0:00	546 pCi/L
Tritium	699-20-E12	06/03/1987 0:00	648 pCi/L
Tritium	699-20-E12	08/19/1987 0:00	657 pCi/L
Tritium	699-20-E12	10/25/1987 0:00	142 pCi/L
Tritium	699-20-E12	01/25/1988 0:00	967 pCi/L
Tritium	699-20-E12	06/17/1988 0:00	1390 pCi/L
Tritium	699-20-E12	07/19/1988 0:00	-50.7 pCi/L
Tritium	699-20-E12	10/31/1988 0:00	2500 pCi/L
Tritium	699-20-E12	04/06/1989 0:00	2360 pCi/L
Tritium	699-20-E12	10/26/1989 0:00	3610 pCi/L
Tritium	699-20-E12	12/16/1991 11:30	5900 pCi/L
Tritium	699-20-E12	03/12/1992 12:30	6810 pCi/L
Tritium	699-20-E12	07/15/1993 8:15	10600 pCi/L
Tritium	699-20-E12	03/02/1994 8:55	10700 pCi/L
Tritium	699-20-E12	08/31/1995 11:30	12500 pCi/L

Tritium	699-20-E12	02/14/1996 10:30	12110 pCi/L
Tritium	699-20-E12O	09/30/1999 12:27	3280 pCi/L
Tritium	699-20-E12O	05/18/2000 11:17	5590 pCi/L
Tritium	699-20-E12O	06/21/2001 9:51	9520 pCi/L
Tritium	699-20-E12O	12/12/2001 13:18	13100 pCi/L
Tritium	699-20-E12O	01/13/2003 11:26	13900 pCi/L
Tritium	699-20-E12O	05/25/2004 11:08	12100 pCi/L
Tritium	699-20-E12O	07/05/2005 10:10	8540 pCi/L
Tritium	699-20-E12O	02/27/2006 10:21	6700 pCi/L
Tritium	699-20-E12O	02/12/2007 10:41	3320 pCi/L
Tritium	699-20-E12O	03/07/2008 11:47	2000 pCi/L
Tritium	699-20-E12O	11/14/2008 11:18	1700 pCi/L
Tritium	699-20-E12P	03/14/1967 0:00	1600 pCi/L
Tritium	699-20-E12P	06/09/1967 0:00	2400 pCi/L
Tritium	699-20-E12P	12/05/1967 0:00	2100 pCi/L
Tritium	699-20-E12P	01/09/1968 0:00	1800 pCi/L
Tritium	699-20-E12P	03/27/1968 0:00	1900 pCi/L
Tritium	699-20-E12P	08/12/1968 0:00	1000 pCi/L
Tritium	699-20-E12P	11/05/1968 0:00	820 pCi/L
Tritium	699-20-E12P	02/17/1969 0:00	860 pCi/L
Tritium	699-20-E12P	05/15/1969 0:00	660 pCi/L
Tritium	699-20-E12P	07/18/1969 0:00	710 pCi/L
Tritium	699-20-E12P	10/29/1969 0:00	520 pCi/L
Tritium	699-20-E12P	03/03/1970 0:00	560 pCi/L
Tritium	699-20-E12P	07/27/1970 0:00	470 pCi/L
Tritium	699-20-E12P	01/26/1971 0:00	1400 pCi/L
Tritium	699-20-E12P	07/06/1971 0:00	550 pCi/L
Tritium	699-20-E12P	10/15/1971 0:00	980 pCi/L
Tritium	699-20-E12P	05/17/1973 0:00	720 pCi/L
Tritium	699-20-E12P	07/03/1973 0:00	600 pCi/L
Tritium	699-20-E12P	01/18/1974 0:00	560 pCi/L
Tritium	699-20-E12P	07/11/1974 0:00	500 pCi/L
Tritium	699-20-E12P	10/05/1974 0:00	1200 pCi/L
Tritium	699-20-E12P	10/05/1976 0:00	1200 pCi/L
Tritium	699-20-E12P	01/05/1977 0:00	820 pCi/L
Tritium	699-20-E12P	01/13/1977 0:00	820 pCi/L
Tritium	699-20-E12P	03/29/1977 0:00	1200 pCi/L
Tritium	699-20-E12P	06/27/1977 0:00	750 pCi/L
Tritium	699-20-E12P	09/30/1977 0:00	830 pCi/L
Tritium	699-20-E12P	02/03/1978 0:00	1200 pCi/L
Tritium	699-20-E12P	03/28/1978 0:00	1600 pCi/L
Tritium	699-20-E12P	06/16/1978 0:00	730 pCi/L
Tritium	699-20-E12P	09/13/1978 0:00	840 pCi/L
Tritium	699-20-E12P	06/14/1979 0:00	500 pCi/L
Tritium	699-20-E12P	09/06/1979 0:00	440 pCi/L
Tritium	699-20-E12P	01/03/1980 0:00	820 pCi/L
Tritium	699-20-E12P	03/18/1980 0:00	740 pCi/L
Tritium	699-20-E12P	06/09/1980 0:00	880 pCi/L
Tritium	699-20-E12P	09/19/1980 0:00	540 pCi/L
Tritium	699-20-E12P	01/13/1981 0:00	480 pCi/L
Tritium	699-20-E12P	06/11/1981 0:00	8700 pCi/L
Tritium	699-20-E12P	09/09/1981 0:00	600 pCi/L

Tritium	699-20-E12P	01/04/1982 0:00	440	pCi/L
Tritium	699-20-E12P	03/18/1982 0:00	370	pCi/L
Tritium	699-20-E12P	06/09/1982 0:00	300	pCi/L
Tritium	699-20-E12P	12/06/1982 0:00	390	pCi/L
Tritium	699-20-E12P	03/24/1983 0:00	-490	pCi/L
Tritium	699-20-E12P	06/07/1983 0:00	-98	pCi/L
Tritium	699-20-E12P	09/12/1983 0:00	310	pCi/L
Tritium	699-20-E12P	11/21/1983 0:00	220	pCi/L
Tritium	699-20-E12P	03/30/1984 0:00	-150	pCi/L
Tritium	699-20-E12P	06/28/1984 0:00	-140	pCi/L
Tritium	699-20-E12P	09/30/1984 0:00	-280	pCi/L
Tritium	699-20-E12P	03/25/1985 0:00	-250	pCi/L
Tritium	699-20-E12P	06/10/1985 0:00	19	pCi/L
Tritium	699-20-E12P	09/07/1985 0:00	330	pCi/L
Tritium	699-20-E12P	02/28/1986 0:00	260	pCi/L
Tritium	699-20-E12P	08/26/1986 0:00	-250	pCi/L
Tritium	699-20-E12P	04/26/1987 0:00	253	pCi/L
Tritium	699-20-E12P	09/17/1987 0:00	59.1	pCi/L
Tritium	699-20-E12P	01/25/1988 0:00	76.3	pCi/L
Tritium	699-20-E12P	08/03/1988 0:00	-172	pCi/L
Tritium	699-20-E12P	03/24/1989 0:00	-127	pCi/L
Tritium	699-20-E12P	12/16/1991 11:45	182	pCi/L
Tritium	699-20-E12P	05/07/1992 7:50	-51.5	pCi/L
Tritium	699-20-E12P	12/22/1992 9:30	9300	pCi/L
Tritium	699-20-E12P	05/07/1993 8:00	67.4	pCi/L
Tritium	699-20-E12P	07/15/1993 8:45	115	pCi/L
Tritium	699-20-E12P	03/02/1994 9:00	-70.2	pCi/L
Tritium	699-20-E12P	10/24/1995 12:30	-50.66	pCi/L
Tritium	699-20-E12P	02/14/1996 10:45	-61.96	pCi/L
Tritium	699-20-E12Q	12/05/1967 0:00	2100	pCi/L
Tritium	699-20-E12Q	01/09/1968 0:00	1800	pCi/L
Tritium	699-20-E12Q	03/27/1968 0:00	1900	pCi/L
Tritium	699-20-E12Q	08/12/1968 0:00	1300	pCi/L
Tritium	699-20-E12Q	11/05/1968 0:00	2900	pCi/L
Tritium	699-20-E12Q	02/17/1969 0:00	720	pCi/L
Tritium	699-20-E12Q	05/15/1969 0:00	660	pCi/L
Tritium	699-20-E12Q	07/18/1969 0:00	630	pCi/L
Tritium	699-20-E12R	12/05/1967 0:00	2100	pCi/L
Tritium	699-20-E12R	01/09/1968 0:00	1800	pCi/L
Tritium	699-20-E12R	03/27/1968 0:00	4100	pCi/L
Tritium	699-20-E12R	08/12/1968 0:00	1000	pCi/L
Tritium	699-20-E12R	02/17/1969 0:00	660	pCi/L
Tritium	699-20-E12R	05/15/1969 0:00	620	pCi/L
Tritium	699-20-E12R	07/18/1969 0:00	670	pCi/L
Tritium	699-20-E12S	09/30/1997 13:58	-107	pCi/L
Tritium	699-20-E12S	09/29/1998 10:16	169	pCi/L
Tritium	699-20-E12S	01/20/2006 11:00	-38.8	pCi/L
Tritium	699-20-E12S	02/12/2007 11:30	-86.2	pCi/L
Tritium	699-24-1P	02/17/1969 0:00	510	pCi/L
Tritium	699-24-1P	05/15/1969 0:00	540	pCi/L
Tritium	699-24-1P	07/11/1969 0:00	520	pCi/L

Tritium	699-24-1P	01/25/1971 0:00	470	pCi/L
Tritium	699-24-1P	07/06/1971 0:00	550	pCi/L
Tritium	699-24-1P	10/15/1971 0:00	980	pCi/L
Tritium	699-24-1P	06/13/1972 0:00	520	pCi/L
Tritium	699-24-1P	05/17/1973 0:00	660	pCi/L
Tritium	699-24-1P	07/03/1973 0:00	750	pCi/L
Tritium	699-24-1P	01/18/1974 0:00	560	pCi/L
Tritium	699-24-1P	07/11/1974 0:00	500	pCi/L
Tritium	699-24-1P	10/05/1976 0:00	850	pCi/L
Tritium	699-24-1P	01/05/1977 0:00	890	pCi/L
Tritium	699-24-1P	03/29/1977 0:00	1500	pCi/L
Tritium	699-24-1P	06/27/1977 0:00	1700	pCi/L
Tritium	699-24-1P	09/30/1977 0:00	950	pCi/L
Tritium	699-24-1P	02/03/1978 0:00	1300	pCi/L
Tritium	699-24-1P	03/28/1978 0:00	850	pCi/L
Tritium	699-24-1P	06/16/1978 0:00	1100	pCi/L
Tritium	699-24-1P	09/13/1978 0:00	1400	pCi/L
Tritium	699-24-1P	06/14/1979 0:00	640	pCi/L
Tritium	699-24-1P	09/19/1979 0:00	760	pCi/L
Tritium	699-24-1P	01/17/1980 0:00	590	pCi/L
Tritium	699-24-1P	03/27/1980 0:00	690	pCi/L
Tritium	699-24-1P	06/11/1980 0:00	530	pCi/L
Tritium	699-24-1P	09/19/1980 0:00	440	pCi/L
Tritium	699-24-1P	01/13/1981 0:00	400	pCi/L
Tritium	699-24-1P	03/30/1981 0:00	380	pCi/L
Tritium	699-24-1P	06/12/1981 0:00	640	pCi/L
Tritium	699-24-1P	09/09/1981 0:00	510	pCi/L
Tritium	699-24-1P	02/03/1982 0:00	480	pCi/L
Tritium	699-24-1P	03/23/1982 0:00	370	pCi/L
Tritium	699-24-1P	09/07/1982 0:00	370	pCi/L
Tritium	699-24-1P	12/02/1982 0:00	400	pCi/L
Tritium	699-24-1P	03/24/1983 0:00	-12	pCi/L
Tritium	699-24-1P	06/10/1983 0:00	170	pCi/L
Tritium	699-24-1P	09/13/1983 0:00	690	pCi/L
Tritium	699-24-1P	01/06/1984 0:00	-330	pCi/L
Tritium	699-24-1P	03/30/1984 0:00	-120	pCi/L
Tritium	699-24-1P	06/22/1984 0:00	-330	pCi/L
Tritium	699-24-1P	09/30/1984 0:00	-280	pCi/L
Tritium	699-24-1P	03/25/1985 0:00	-290	pCi/L
Tritium	699-24-1P	06/10/1985 0:00	150	pCi/L
Tritium	699-24-1P	09/07/1985 0:00	170	pCi/L
Tritium	699-24-1P	02/28/1986 0:00	-260	pCi/L
Tritium	699-24-1P	08/26/1986 0:00	-130	pCi/L
Tritium	699-24-1P	09/09/1986 0:00	28.3	pCi/L
Tritium	699-24-1P	04/26/1987 0:00	269	pCi/L
Tritium	699-24-1P	09/17/1987 0:00	44.1	pCi/L
Tritium	699-24-1P	01/25/1988 0:00	389	pCi/L
Tritium	699-24-1P	08/03/1988 0:00	232	pCi/L
Tritium	699-24-1P	03/24/1989 0:00	-113	pCi/L
Tritium	699-24-1P	05/07/1992 9:30	-6.19	pCi/L
Tritium	699-24-1P	11/13/1992 8:30	-1230	pCi/L
Tritium	699-24-1P	07/08/1993 9:00	0.22	pCi/L

Tritium	699-24-1P	09/30/1994 9:45	65 pCi/L
Tritium	699-24-1P	03/23/1995 9:30	2.05 pCi/L
Tritium	699-24-1P	09/16/1996 10:00	25.07 pCi/L
Tritium	699-24-1P	11/01/2001 12:58	11.5 pCi/L
Tritium	699-24-1P	10/28/2005 11:30	11.2 pCi/L
Tritium	699-24-1P	07/06/2006 8:40	113 pCi/L
Tritium	699-24-1P	11/09/2008 10:53	21 pCi/L
Tritium	C3252	08/27/2001 15:00	2430 pCi/L
Tritium	C3252	08/27/2001 15:00	2150 pCi/L
Tritium	C3252	08/27/2001 15:00	2770 pCi/L
Tritium	C3252	08/27/2001 15:00	2400 pCi/L
Tritium	C3255	09/14/2001 9:22	913 pCi/L
Tritium	C3255	09/14/2001 9:22	1040 pCi/L
Tritium	C3264	10/09/2000 8:45	6510 pCi/L
Tritium	C3264	10/09/2000 8:45	6510 pCi/L
Tritium	C3265	10/13/2000 13:20	1500000 pCi/L
Tritium	C3265	10/13/2000 13:20	1450000 pCi/L
Tritium	C3265	10/13/2000 13:20	1530000 pCi/L
Tritium	C3265	10/13/2000 13:20	1550000 pCi/L

DECOMMISSIONING RECORDKEEPING LOG

Event Report Number (YY-XXX)	Prepared by	Date	Location	Event Description
92-001(1)	R. Winslow	11/14/07	Storm Drain Pond	Tritium discharged to the Storm Drain Pond from 1984 – 1992 via T-1, T02, & T-3 sumps.
92-002(1) (combined with 92-001)	R. Winslow	11/14/07	Storm Drain Pond	Contaminated sumps containing measurable gamma-emitting isotopes were routed to Turbine Bldg sumps and discharged to the Strom Drain Pond.
92-003(1)	R. Winslow	11/14/07	Sewage Treatment Plant	Sewage Treatment Plant contaminated via a cross-connection from FFTF.
92-004(1)	R. Winslow	12/6/07	Cooling Tower sludge disposal site	Sludge removed from Cooling Towers contains low levels of radioactivity.
93-001(1)	R. Winslow	12/6/07	Spray Pond sediment disposal sites	Contaminated sediment from cleanout of the SW Spray Ponds in 1989 and 1991 was placed in disposal trenches south of the Protected Area.
98-001	R. Winslow	12/12/07	Storm Drain Pond	PER 298-0783: Isotopic analysis of discharge to storm drain indicates some Co-60 present
00-001(2) (combined with 98-001)	N/A	N/A	Storm Drain Pond	PER 200-1826: Co-60 found in liquid nitrate waste. These wastes typically are drained to the Storm Drain Pond. Determined to be cross-contamination of sample container, and not a radioactive discharge to the SDP.
01-001(2) (combined with 98-001)	R. Winslow	12/12/07	Storm Drain Pond	PER 201-1381: Potentially contaminated water poured down drain to Storm Drain Pond
01-002(2) (combined with 98-001)	R. Winslow	12/12/07	Storm Drain Pond	PER 201-1233: Water drained to Storm Drain Pond using potentially contaminated hoses
03-001 (combined with 98-001)	R. Winslow	12/12/07	Storm Drain Pond	PER 203-0856: Tritium levels in January composite sample of storm drain outfall water elevated.
03-002(2) (combined with 98-001)	R. Winslow	12/12/07	Storm Drain Pond	PER 203-2356: Radioactive water found in demineralized water system including DWST. Leakage from pumps and DWST overflow goes to the Storm Drain Pond. (Note there were multiple PERs - documenting multiple contamination events.)

DECOMMISSIONING RECORDKEEPING LOG

03-003[2] (combined with 98-001)	R. Winslow	12/12/07	Storm Drain Pond	PER 203-3885: Tritium detected in the WOA air wash water. This drains to the Storm Drain Pond.
05-001 (combined with 98-001)	R. Winslow	12/12/07	Storm Drain Pond	CR 2-05-08789: Increased Co-60 was observed at the Storm Pond discharge during October.
06-001	M. McLain	06/14/06	CW Blowdown (CBD) Line	Soil samples indicate Co-60 and Cs-137 along pipe with higher levels indicated in valve box 12. Contamination in CBD valve boxes re-mediated (reference AR-OER 53852).

[1]Reference GO2-06-100, COLUMBIA GENERATING STATION, DOCKET NO. 50-397, GROUNDWATER PROTECTION – DATA COLLECTION QUESTIONNAIRE
[2]Reference PTL 244301, REVIEW SITE OPERATING HISTORY FOR EVIDENCE OF PAST SPILLS AND LEAKS TO THE ENVIRONMENT

Date	ODCM 31 pCi/L	ODCM 32 pCi/L	ODCM 52 pCi/L	MW-1 pCi/L	MW-2 pCi/L	MW-3 pCi/L	MW-4 pCi/L	MW-5 pCi/L	MW-6 pCi/L	MW-7 pCi/L	MW-8 pCi/L	MW-9 pCi/L	MW-10 pCi/L	MW-11 pCi/L	MW-12 pCi/L	MW-13
01/08/1980			270 ± 120													
03/04/1980			330 ± 190													
07/08/1980			90 ± 90													
10/01/1980			<110													
01/05/1981			520 ± 190													
03/30/1981			230 ± 170													
07/14/1981			360 ± 220													
09/14/1981			<10													
10/13/1981			280 ± 160													
01/05/1982			190 ± 180													
03/25/1982	230	<230														
03/30/1982			200 ± 130													
06/17/1982	700	<700														
07/06/1982			<150													
09/09/1982	1300	<1300														
10/05/1982			<260													
12/27/1982	440	<440														
02/22/1983			<210													
03/14/1983	300	<300														
04/05/1983			290 ± 210													
06/10/1983	2600															
06/14/1983		1400 ± 300														
09/14/1983	300	<300														
09/27/1983			330 ± 210													
12/14/1983	<300	<300														
09/13/1984	38.9 ± 227	(-32.4) ± 225	324 ± 236													
12/19/1984	261 ± 287	198 ± 285	(-516) + 232													
03/20/1985	95.8 + 213	213 ± 217	213 ± 217													
06/24/1985	(-190) ± 272	(-165) ± 272	(-82.1) ± 275													
09/18/1985	87.9 ± 275	0.279 ± 273	289 ± 283													
12/18/1985	178 ± 220	(-63.1) ± 211	48.7 ± 215													
03/19/1986	(-24.7) ± 209	109 ± 215	200 ± 218													
06/18/1986	88.0 ± 79.0	130 ± 80.0	47.0 ± 82.0													
09/23/1986	4.10 ± 78.3	54.0 ± 61.6	220 ± 80.0													
12/17/1986	34.0 ± 85.3	100 ± 73.5	94.0 ± 85.1													
03/18/1987	190 ± 125	10 ± 117	2.3 ± 106													
06/09/1987	160 ± 90	51 ± 101	40 ± 104													
09/16/1987	(-21) ± 1.13	(-120) ± 80	250 ± 80													
12/16/1987	42 ± 92.1	83 ± 81.1	230 ± 100													
03/16/1988	(-12) ± 75.8	120 ± 60	280 ± 110													
06/15/1988	140 ± 80	220 ± 100	190 ± 100													
09/15/1988	23 ± 66	39 ± 67	85 ± 85													
12/14/1988	(-69) ± 131	10 ± 111	21 ± 89													
03/15/1989	50 ± 99	62 ± 82	90 ± 77													
06/13/1989	(-43) ± 97		50 ± 92													
07/28/1989		*(-50) ± 89*														
09/13/1989	(-130) ± 90	31 ± 92	39 ± 98													
12/06/1989	110 ± 80	52 ± 86	(-40) ± 94													
03/13/1990	16 ± 120	(-67) ± 83	70 ± 100													

06/14/1990	(-1.9) ± 100	(-53) ± 150	(-32) ± 77								
09/12/1990	150 ± 120	(-100) ± 90	31 ± 90								
12/05/1990	(-17) ± 84	28 ± 150	220 ± 110								
03/13/1991	0.59 ± 72	(-93) ± 76	81 ± 71								
06/16/1991	(-29) ± 82	7.9 ± 110	110 ± 70								
09/04/1991	(-1.4) ± 95	(-3.4) ± 79	86 ± 76								
12/03/1991	(-8.0) ± 94	(-36) ± 93	(-17) ± 98								
03/03/1992	(-100) ± 110	(-69) ± 75	57 ± 77								
06/02/1992	(-220) ± 73	(-140) ± 14	77 ± 97								
09/01/1992	(-2.0) ± 98	(-69) ± 91	9.4 ± 94								
12/02/1992	(-28) ± 69	(-42) ± 68	64 ± 73								
03/03/1993	(-10) ± 72	(-29) ± 74	45 ± 77								
06/02/1993	36 ± 115	(-32) ± 113	60 ± 116								
09/01/1993	(-47) ± 96.2	(-69) ± 95.2	(-100) ± 93.6								
12/01/1993	38 ± 98.5	20 ± 97.6	(-110) ± 99.2								
03/02/1994	-43	-4.7	12								
06/01/1994	-43	-77	65								
08/31/1994	28	26	160								
12/06/1994	-20	-40	-7.5								
03/01/1995	(-20) ± 95.5	(-64) ± 98.9	(28) ± 95.1								
05/08/1996						790 ± 54		19000 ± 400			
05/10/1995							9000 ± 400	12000 ± 1000			
05/11/1995						750 ± 170					
05/12/1995				2300 ± 200	2200 ± 200						
06/06/1995	(-9.7) ± 121	(-270) ± 106									
09/06/1995	170 ± 110	51 ± 105	130 ± 100								
12/05/1995	61 ± 96.4	75 ± 92	140 ± 95.2								
03/05/1996	(-65) ± 98	(-96) ± 96.2	15 ± 10.9								
06/04/1996	(-120) ± 91.5	(-76) ± 94.1	37 ± 104								
09/04/1996	(-59) ± 99	(-68) ± 98.5	(-79) ± 97.8								
12/03/1996	51 ± 108	(-51) ± 102	45 ± 115								
03/04/1997	(-180) ± 121	(-100) ± 126	17 ± 126								
06/04/1997		(-29) ± 136	(-90) ± 14.6								
09/03/1997		45 ± 109	0 ± 107								
12/02/1997	(-65) ± 156	(-290) ± 141	(-330) ± 138								
02/10/1998									<300	<300	2200
03/03/1998	(-4.7) ± 84.6	(-47) ± 82.1	47 ± 87.4								
05/12/1998									180	210	1700
06/03/1998	(-9.5) ± 87.4	(-43) ± 85.6	36 ± 89.8								
08/18/1998									<200	<200	1600
09/02/1998	160 ± 90	50 ± 81.2	190 ± 90								
11/10/1998									<200	<200	1600
12/01/1998	39 ± 104	62 ± 105	90 ± 106								
03/02/1999	100 ± 101	61 ± 99.1	180 ± 100								
06/02/1999	67 ± 97.8	53 ± 97.3	57 ± 97.5								
09/01/1999	(-140) ± 94.3	(-49) ± 98.1	(39) ± 98.5								
12/01/1999	26 ± 98.9	31 ± 99.1	100 ± 102								
03/01/2000	(-69) ± 100	(-71) ± 100	(-26) ± 100								
06/07/2000	(-76) ± 100	(-4.7) ± 100	(-4.7) ± 100								
09/06/2000	(-280) ± 62	(-240) ± 63	(-280) ± 65								

12/05/2000	43 ± 91	47 ± 91	3.3 ± 89										
03/06/2001	(-470) ± 194	(-600) ± 180	(-490) ± 189										
06/05/2001	(-31) ± 62.4	(-16) ± 62.7	(-14) ± 68.1										
09/05/2001	(-31) ± 58.8	(-48) ± 57.9	0 ± 60.4										
12/04/2001	(-30) ± 57.5	(-20) ± 58.1	(-46) ± 60.5										
03/05/2002	34.3 ± 61.6	11.3 ± 59.8	81.1 ± 62.4										
06/04/2002	(-11.1) ± 60.1	13.3 ± 60.7	58 ± 62.6										
09/04/2002	82.5 ± 79.6	36.5 ± 80.7	58.4 ± 81.3										
12/03/2002	(-90.5) ± 147	(-83.2) ± 163	9.48 ± 172										
03/04/2003	(-96.4) ± 107	(-31.7) ± 111	28.2 ±109										
06/03/2003	(-24.9) ± 113	(-75.5) ± 112	(-75.5) ± 112										
09/03/2003	(-132) ± 113	(-49.4) ± 115	9.77 ± 147										
12/02/2003	5.19 ± 111	99.5 ± 113	(-211) ± 149										
03/02/2004	2.56 ± 101	98.5 ± 105	(-960) ± 293										
06/02/2004	(-157) ± 116	74.0 ± 125	(-159) ± 105										
09/01/2004	(-4.12) ± 92	(-43.8) ± 87.4	4.05 ± 90.6										
12/01/2004	48.8 ± 106	49.0 ± 106	563 ± 134										
03/01/2005	(-43.2) ± 116	24.5 ± 119	(-26.9) ± 116										
06/01/2005	(-96.0) ± 128	(-258) ± 123	(-972) ± 102										
09/07/2005	(-63.0) ± (-241)	(-73.0 ± (-235)	10.2 ± 35.7										
12/05/2005	(-24.4) ± 87.8	(-39.8) ± 87.1	39.6 ± 91.4										
03/01/2006	(-104) ± 1310	(-26.8) ± 1330	(-78.5) ± 1320										
06/05/2006	181 ± 72.9	133 ± 71.6	137 ± 72.6										
09/06/2006	66.2 ± 65.5	46.7 ± 65.4	116 ± 66.4										
12/04/2006	(-60.0) ± 1230	32.7 ± 93.6	76.4 ± 94.8										
01/24/2007							237 ± 139	396 ± 144	605 ± 151				
03/05/2007	(-43.9_ ± 128	(-22.5) ± 132	(-5.63) ± 143										
06/04/2007	87.8 ± 136	(-28.7) ± 128	11.8 ± 130										
09/05/2007	(-3.38) ± 127	(-34.9) ± 124	11.8 ± 128										
11/28/2007				840 ± 119	16800 ± 321	4560 ± 186	131 ± 101	2320 ± 150					
12/03/2007	(-135) ± 94.2	(-150) ± 93.2	397 ± 109										
03/03/2008	(-6.19) ± 85.7	(-16.3) ± 98.3	(-29.8) ± 94.7										
06/02/2008	(-14.1) ± 98.9	(-136) ± 97.2	(-45) ± 100										
07/23/2008				1340 ± 130	17400 ± 327	5140 ± 196	360 ± 105	1190 ± 127	377 ± 106				
09/03/2008	73.8 ± 97.3	1.69 ± 91.5	189 ± 100										
10/22/2008				1260 ± 124	16700 ± 318	5050 ± 192	194 ± 97.4	1570 ± 131	339 ± 102				
11/19/2008										420 ± 102	1100 ± 118	773 ± 112	11000
12/01/2008	27.6 ± 91.8	16.9 ± 89.7	34.3 ± 96.4										
01/21/2009				1140 ± 121	17000 ± 319	5370 ± 195	353 ± 102	926 ± 116	445 ± 104				
01/28/2009										441 ± 104	884 ± 115	743 ± 112	11000
04/22/2009										519 ± 106	787 ± 112	780 ± 112	11700
04/27/2009				1410 ± 125	17000 ± 322	5230 ± 196	1950 ± 136	735 ± 110	330 ± 99				
07/22/2009				1240 ± 124	16600 ± 317	5010 ± 191	16.3 ± 89	2600 ± 152	269 ± 101				
07/29/2009										527 ± 103	962 ± 114	764 ± 110	11400
08/31/2009	(-23.6) ± 99.4	(-58.6) ± 93.1	(-125) ± 91.8										
10/26/2009										453 ± 104	983 ± 121	813 ± 114	11900
10/27/2009				1310 ± 126	16600 ± 323	5170 ± 196	131 ± 95.2	927 ± 117	386 ± 102				
11/30/2009	188 ± 97.8	89.0 ± 94.2	161 ± 96.9										
01/21/2010										516 ± 109	731 ± 114	691 ± 111	12000
01/25/2010				1250 ± 127	17000 ± 324	5260 ± 197	189 ± 99.6	148 ± 99.6	298 ± 103				

06/14/1990	(-1.9) ± 100	(-53) ± 150	(-32) ± 77								
09/12/1990	150 ± 120	(-100) ± 90	31 ± 90								
12/05/1990	(-17) ± 84	28 ± 150	220 ± 110								
03/13/1991	0.59 ± 72	(-93) ± 76	81 ± 71								
06/16/1991	(-29) ± 82	7.9 ± 110	110 ± 70								
09/04/1991	(-1.4) ± 95	(-3.4) ± 79	86 ± 76								
12/03/1991	(-8.0) ± 94	(-36) ± 93	(-17) ± 98								
03/03/1992	(-100) ± 110	(-69) ± 75	57 ± 77								
06/02/1992	(-220) ± 73	(-140) ± 14	77 ± 97								
09/01/1992	(-2.0) ± 98	(-69) ± 91	9.4 ± 94								
12/02/1992	(-28) ± 69	(-42) ± 68	64 ± 73								
03/03/1993	(-10) ± 72	(-29) ± 74	45 ± 77								
06/02/1993	36 ± 115	(-32) ± 113	60 ± 116								
09/01/1993	(-47) ± 96.2	(-69) ± 95.2	(-100) ± 93.6								
12/01/1993	38 ± 98.5	20 ± 97.6	(-110) ± 99.2								
03/02/1994	-43	-4.7	12								
06/01/1994	-43	-77	65								
08/31/1994	28	26	160								
12/06/1994	-20	-40	-7.5								
03/01/1995	(-20) ± 95.5	(-64) ± 98.9	(28) ± 95.1								
05/08/1996						790 ± 54		19000 ± 400			
05/10/1995							9000 ± 400	12000 ± 1000			
05/11/1995						750 ± 170					
05/12/1995				2300 ± 200	2200 ± 200						
06/06/1995	(-9.7) ± 121	(-270) ± 106									
09/06/1995	170 ± 110	51 ± 105	130 ± 100								
12/05/1995	61 ± 96.4	75 ± 92	140 ± 95.2								
03/05/1996	(-65) ± 98	(-96) ± 96.2	15 ± 10.9								
06/04/1996	(-120) ± 91.5	(-76) ± 94.1	37 ± 104								
09/04/1996	(-59) ± 99	(-68) ± 98.5	(-79) ± 97.8								
12/03/1996	51 ± 108	(-51) ± 102	45 ± 115								
03/04/1997	(-180) ± 121	(-100) ± 126	17 ± 126								
06/04/1997		(-29) ± 136	(-90) ± 14.6								
09/03/1997		45 ± 109	0 ± 107								
12/02/1997	(-65) ± 156	(-290) ± 141	(-330) ± 138								
02/10/1998									<300	<300	2200
03/03/1998	(-4.7) ± 84.6	(-47) ± 82.1	47 ± 87.4								
05/12/1998									180	210	1700
06/03/1998	(-9.5) ± 87.4	(-43) ± 85.6	36 ± 89.8								
08/18/1998									<200	<200	1600
09/02/1998	160 ± 90	50 ± 81.2	190 ± 90								
11/10/1998									<200	<200	1600
12/01/1998	39 ± 104	62 ± 105	90 ± 106								
03/02/1999	100 ± 101	61 ± 99.1	180 ± 100								
06/02/1999	67 ± 97.8	53 ± 97.3	57 ± 97.5								
09/01/1999	(-140) ± 94.3	(-49) ± 98.1	(39) ± 98.5								
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06/05/2001	(-31) ± 62.4	(-16) ± 62.7	(-14) ± 68.1										
09/05/2001	(-31) ± 58.8	(-48) ± 57.9	0 ± 60.4										
12/04/2001	(-30) ± 57.5	(-20) ± 58.1	(-46) ± 60.5										
03/05/2002	34.3 ± 61.6	11.3 ± 59.8	81.1 ± 62.4										
06/04/2002	(-11.1) ± 60.1	13.3 ± 60.7	58 ± 62.6										
09/04/2002	82.5 ± 79.6	36.5 ± 80.7	58.4 ± 81.3										
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03/04/2003	(-96.4) ± 107	(-31.7) ± 111	28.2 ±109										
06/03/2003	(-24.9) ± 113	(-75.5) ± 112	(-75.5) ± 112										
09/03/2003	(-132) ± 113	(-49.4) ± 115	9.77 ± 147										
12/02/2003	5.19 ± 111	99.5 ± 113	(-211) ± 149										
03/02/2004	2.56 ± 101	98.5 ± 105	(-960) ± 293										
06/02/2004	(-157) ± 116	74.0 ± 125	(-159) ± 105										
09/01/2004	(-4.12) ± 92	(-43.8) ± 87.4	4.05 ± 90.6										
12/01/2004	48.8 ± 106	49.0 ± 106	563 ± 134										
03/01/2005	(-43.2) ± 116	24.5 ± 119	(-26.9) ± 116										
06/01/2005	(-96.0) ± 128	(-258) ± 123	(-972) ± 102										
09/07/2005	(-63.0) ± (-241)	(-73.0 ± (-235)	10.2 ± 35.7										
12/05/2005	(-24.4) ± 87.8	(-39.8) ± 87.1	39.6 ± 91.4										
03/01/2006	(-104) ± 1310	(-26.8) ± 1330	(-78.5) ± 1320										
06/05/2006	181 ± 72.9	133 ± 71.6	137 ± 72.6										
09/06/2006	66.2 ± 65.5	46.7 ± 65.4	116 ± 66.4										
12/04/2006	(-60.0) ± 1230	32.7 ± 93.6	76.4 ± 94.8										
01/24/2007							237 ± 139	396 ± 144	605 ± 151				
03/05/2007	(-43.9_ ± 128	(-22.5) ± 132	(-5.63) ± 143										
06/04/2007	87.8 ± 136	(-28.7) ± 128	11.8 ± 130										
09/05/2007	(-3.38) ± 127	(-34.9) ± 124	11.8 ± 128										
11/28/2007				840 ± 119	16800 ± 321	4560 ± 186	131 ± 101	2320 ± 150					
12/03/2007	(-135) ± 94.2	(-150) ± 93.2	397 ± 109										
03/03/2008	(-6.19) ± 85.7	(-16.3) ± 98.3	(-29.8) ± 94.7										
06/02/2008	(-14.1) ± 98.9	(-136) ± 97.2	(-45) ± 100										
07/23/2008				1340 ± 130	17400 ± 327	5140 ± 196	360 ± 105	1190 ± 127	377 ± 106				
09/03/2008	73.8 ± 97.3	1.69 ± 91.5	189 ± 100										
10/22/2008				1260 ± 124	16700 ± 318	5050 ± 192	194 ± 97.4	1570 ± 131	339 ± 102				
11/19/2008										420 ± 102	1100 ± 118	773 ± 112	11000
12/01/2008	27.6 ± 91.8	16.9 ± 89.7	34.3 ± 96.4										
01/21/2009				1140 ± 121	17000 ± 319	5370 ± 195	353 ± 102	926 ± 116	445 ± 104				
01/28/2009										441 ± 104	884 ± 115	743 ± 112	11000
04/22/2009										519 ± 106	787 ± 112	780 ± 112	11700
04/27/2009				1410 ± 125	17000 ± 322	5230 ± 196	1950 ± 136	735 ± 110	330 ± 99				
07/22/2009				1240 ± 124	16600 ± 317	5010 ± 191	16.3 ± 89	2600 ± 152	269 ± 101				
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08/31/2009	(-23.6) ± 99.4	(-58.6) ± 93.1	(-125) ± 91.8										
10/26/2009										453 ± 104	983 ± 121	813 ± 114	11900
10/27/2009				1310 ± 126	16600 ± 323	5170 ± 196	131 ± 95.2	927 ± 117	386 ± 102				
11/30/2009	188 ± 97.8	89.0 ± 94.2	161 ± 96.9										
01/21/2010										516 ± 109	731 ± 114	691 ± 111	12000
01/25/2010				1250 ± 127	17000 ± 324	5260 ± 197	189 ± 99.6	148 ± 99.6	298 ± 103				

Date	ODCM 31 pCi/L	ODCM 32 pCi/L	ODCM 52 pCi/L	MW-1 pCi/L	MW-2 pCi/L	MW-3 pCi/L	MW-4 pCi/L	MW-5 pCi/L	MW-6 pCi/L	MW-7 pCi/L	MW-8 pCi/L	MW-9 pCi/L	MW-10 pCi/L	MW-11 pCi/L	MW-12 pCi/L	MW-13
01/08/1980			270 ± 120													
03/04/1980			330 ± 190													
07/08/1980			90 ± 90													
10/01/1980			<110													
01/05/1981			520 ± 190													
03/30/1981			230 ± 170													
07/14/1981			360 ± 220													
09/14/1981			<10													
10/13/1981			280 ± 160													
01/05/1982			190 ± 180													
03/25/1982	230	<230														
03/30/1982			200 ± 130													
06/17/1982	700	<700														
07/06/1982			<150													
09/09/1982	1300	<1300														
10/05/1982			<260													
12/27/1982	440	<440														
02/22/1983			<210													
03/14/1983	300	<300														
04/05/1983			290 ± 210													
06/10/1983	2600															
06/14/1983		1400 ± 300														
09/14/1983	300	<300														
09/27/1983			330 ± 210													
12/14/1983	<300	<300														
09/13/1984	38.9 ± 227	(-32.4) ± 225	324 ± 236													
12/19/1984	261 ± 287	198 ± 285	(-516) + 232													
03/20/1985	95.8 + 213	213 ± 217	213 ± 217													
06/24/1985	(-190) ± 272	(-165) ± 272	(-82.1) ± 275													
09/18/1985	87.9 ± 275	0.279 ± 273	289 ± 283													
12/18/1985	178 ± 220	(-63.1) ± 211	48.7 ± 215													
03/19/1986	(-24.7) ± 209	109 ± 215	200 ± 218													
06/18/1986	88.0 ± 79.0	130 ± 80.0	47.0 ± 82.0													
09/23/1986	4.10 ± 78.3	54.0 ± 61.6	220 ± 80.0													
12/17/1986	34.0 ± 85.3	100 ± 73.5	94.0 ± 85.1													
03/18/1987	190 ± 125	10 ± 117	2.3 ± 106													
06/09/1987	160 ± 90	51 ± 101	40 ± 104													
09/16/1987	(-21) ± 1.13	(-120) ± 80	250 ± 80													
12/16/1987	42 ± 92.1	83 ± 81.1	230 ± 100													
03/16/1988	(-12) ± 75.8	120 ± 60	280 ± 110													
06/15/1988	140 ± 80	220 ± 100	190 ± 100													
09/15/1988	23 ± 66	39 ± 67	85 ± 85													
12/14/1988	(-69) ± 131	10 ± 111	21 ± 89													
03/15/1989	50 ± 99	62 ± 82	90 ± 77													
06/13/1989	(-43) ± 97		50 ± 92													
07/28/1989		(-50) ± 89														
09/13/1989	(-130) ± 90	31 ± 92	39 ± 98													
12/06/1989	110 ± 80	52 ± 86	(-40) ± 94													
03/13/1990	16 ± 120	(-67) ± 83	70 ± 100													

Date	ODCM 31 pCi/L	ODCM 32 pCi/L	ODCM 52 pCi/L	MW-1 pCi/L	MW-2 pCi/L	MW-3 pCi/L	MW-4 pCi/L	MW-5 pCi/L	MW-6 pCi/L	MW-7 pCi/L	MW-8 pCi/L	MW-9 pCi/L	MW-10 pCi/L	MW-11 pCi/L	MW-12 pCi/L	MW-13 pCi/L	MW-14 pCi/L
01/08/1980			270 ± 120														
03/04/1980			330 ± 190														
07/08/1980			90 ± 90														
10/01/1980			<110														
01/05/1981			520 ± 190														
03/30/1981			230 ± 170														
07/14/1981			360 ± 220														
09/14/1981			<10														
10/13/1981			280 ± 160														
01/05/1982			190 ± 180														
03/25/1982	230	<230															
03/30/1982			200 ± 130														
06/17/1982	700	<700															
07/06/1982			<150														
09/09/1982	1300	<1300															
10/05/1982			<260														
12/27/1982	440	<440															
02/22/1983			<210														
03/14/1983	300	<300															
04/05/1983			290 ± 210														
06/10/1983	2600																
06/14/1983		1400 ± 300															
09/14/1983	300	<300															
09/27/1983			330 ± 210														
12/14/1983	<300	<300															
09/13/1984	38.9 ± 227	(-32.4) ± 225	324 ± 236														
12/19/1984	261 ± 287	198 ± 285	(-516) + 232														
03/20/1985	95.8 + 213	213 ± 217	213 ± 217														
06/24/1985	(-190) ± 272	(-165) ± 272	(-82.1) ± 275														
09/18/1985	87.9 ± 275	0.279 ± 273	289 ± 283														
12/18/1985	178 ± 220	(-63.1) ± 211	48.7 ± 215														
03/19/1986	(-24.7) ± 209	109 ± 215	200 ± 218														
06/18/1986	88.0 ± 79.0	130 ± 80.0	47.0 ± 82.0														
09/23/1986	4.10 ± 78.3	54.0 ± 61.6	220 ± 80.0														
12/17/1986	34.0 ± 85.3	100 ± 73.5	94.0 ± 85.1														
03/18/1987	190 ± 125	10 ± 117	2.3 ± 106														
06/09/1987	160 ± 90	51 ± 101	40 ± 104														
09/16/1987	(-21) ± 1.13	(-120) ± 80	250 ± 80														
12/16/1987	42 ± 92.1	83 ± 81.1	230 ± 100														
03/16/1988	(-12) ± 75.8	120 ± 60	280 ± 110														
06/15/1988	140 ± 80	220 ± 100	190 ± 100														
09/15/1988	23 ± 66	39 ± 67	85 ± 85														
12/14/1988	(-69) ± 131	10 ± 111	21 ± 89														
03/15/1989	50 ± 99	62 ± 82	90 ± 77														
06/13/1989	(-43) ± 97		50 ± 92														
07/28/1989		(-50) ± 89															
09/13/1989	(-130) ± 90	31 ± 92	39 ± 98														
12/06/1989	110 ± 80	52 ± 86	(-40) ± 94														
03/13/1990	16 ± 120	(-67) ± 83	70 ± 100														

12/05/2000	43 ± 91	47 ± 91	3.3 ± 89											
03/06/2001	(-470) ± 194	(-600) ± 180	(-490) ± 189											
06/05/2001	(-31) ± 62.4	(-16) ± 62.7	(-14) ± 68.1											
09/05/2001	(-31) ± 58.8	(-48) ± 57.9	0 ± 60.4											
12/04/2001	(-30) ± 57.5	(-20) ± 58.1	(-46) ± 60.5											
03/05/2002	34.3 ± 61.6	11.3 ± 59.8	81.1 ± 62.4											
06/04/2002	(-11.1) ± 60.1	13.3 ± 60.7	58 ± 62.6											
09/04/2002	82.5 ± 79.6	36.5 ± 80.7	58.4 ± 81.3											
12/03/2002	(-90.5) ± 147	(-83.2) ± 163	9.48 ± 172											
03/04/2003	(-96.4) ± 107	(-31.7) ± 111	28.2 ± 109											
06/03/2003	(-24.9) ± 113	(-75.5) ± 112	(-75.5) ± 112											
09/03/2003	(-132) ± 113	(-49.4) ± 115	9.77 ± 147											
12/02/2003	5.19 ± 111	99.5 ± 113	(-211) ± 149											
03/02/2004	2.56 ± 101	98.5 ± 105	(-960) ± 293											
06/02/2004	(-157) ± 116	74.0 ± 125	(-159) ± 105											
09/01/2004	(-4.12) ± 92	(-43.8) ± 87.4	4.05 ± 90.6											
12/01/2004	48.8 ± 106	49.0 ± 106	563 ± 134											
03/01/2005	(-43.2) ± 116	24.5 ± 119	(-26.9) ± 116											
06/01/2005	(-96.0) ± 128	(-258) ± 123	(-972) ± 102											
09/07/2005	(-63.0) ± (-241)	(-73.0 ± (-235)	10.2 ± 35.7											
12/05/2005	(-24.4) ± 87.8	(-39.8) ± 87.1	39.6 ± 91.4											
03/01/2006	(-104) ± 1310	(-26.8) ± 1330	(-78.5) ± 1320											
06/05/2006	181 ± 72.9	133 ± 71.6	137 ± 72.6											
09/06/2006	66.2 ± 65.5	46.7 ± 65.4	116 ± 66.4											
12/04/2006	(-60.0) ± 1230	32.7 ± 93.6	76.4 ± 94.8											
01/24/2007							237 ± 139	396 ± 144	605 ± 151					
03/05/2007	(-43.9 ± 128	(-22.5) ± 132	(-5.63) ± 143											
06/04/2007	87.8 ± 136	(-28.7) ± 128	11.8 ± 130											
09/05/2007	(-3.38) ± 127	(-34.9) ± 124	11.8 ± 128											
11/28/2007				840 ± 119	16800 ± 321	4560 ± 186	131 ± 101	2320 ± 150						
12/03/2007	(-135) ± 94.2	(-150) ± 93.2	397 ± 109											
03/03/2008	(-6.19) ± 85.7	(-16.3) ± 98.3	(-29.8) ± 94.7											
06/02/2008	(-14.1) ± 98.9	(-136) ± 97.2	(-45) ± 100											
07/23/2008				1340 ± 130	17400 ± 327	5140 ± 196	360 ± 105	1190 ± 127	377 ± 106					
09/03/2008	73.8 ± 97.3	1.69 ± 91.5	189 ± 100											
10/22/2008				1260 ± 124	16700 ± 318	5050 ± 192	194 ± 97.4	1570 ± 131	339 ± 102					
11/19/2008										420 ± 102	1100 ± 118	773 ± 112	11000 ± 263	396 ± 103
12/01/2008	27.6 ± 91.8	16.9 ± 89.7	34.3 ± 96.4											
01/21/2009				1140 ± 121	17000 ± 319	5370 ± 195	353 ± 102	926 ± 116	445 ± 104					
01/28/2009										441 ± 104	884 ± 115	743 ± 112	11000 ± 263	416 ± 104
04/22/2009										519 ± 106	787 ± 112	780 ± 112	11700 ± 270	318 ± 100
04/27/2009				1410 ± 125	17000 ± 322	5230 ± 196	1950 ± 136	735 ± 110	330 ± 99					
07/22/2009				1240 ± 124	16600 ± 317	5010 ± 191	16.3 ± 89	2600 ± 152	269 ± 101					
07/29/2009										527 ± 103	962 ± 114	764 ± 110	11400 ± 264	329 ± 98
08/31/2009	(-23.6) ± 99.4	(-58.6) ± 93.1	(-125) ± 91.8											
10/26/2009										453 ± 104	983 ± 121	813 ± 114	11900 ± 279	782 ± 113
10/27/2009				1310 ± 126	16600 ± 323	5170 ± 196	131 ± 95.2	927 ± 117	386 ± 102					
11/30/2009	188 ± 97.8	89.0 ± 94.2	161 ± 96.9											
01/21/2010										516 ± 109	731 ± 114	691 ± 111	12000 ± 278	461 ± 107
01/25/2010				1250 ± 127	17000 ± 324	5260 ± 197	189 ± 99.6	148 ± 99.6	298 ± 103					

06/14/1990	(-1.9) ± 100	(-53) ± 150	(-32) ± 77								
09/12/1990	150 ± 120	(-100) ± 90	31 ± 90								
12/05/1990	(-17) ± 84	28 ± 150	220 ± 110								
03/13/1991	0.59 ± 72	(-93) ± 76	81 ± 71								
06/16/1991	(-29) ± 82	7.9 ± 110	110 ± 70								
09/04/1991	(-1.4) ± 95	(-3.4) ± 79	86 ± 76								
12/03/1991	(-8.0) ± 94	(-36) ± 93	(-17) ± 98								
03/03/1992	(-100) ± 110	(-69) ± 75	57 ± 77								
06/02/1992	(-220) ± 73	(-140) ± 14	77 ± 97								
09/01/1992	(-2.0) ± 98	(-69) ± 91	9.4 ± 94								
12/02/1992	(-28) ± 69	(-42) ± 68	64 ± 73								
03/03/1993	(-10) ± 72	(-29) ± 74	45 ± 77								
06/02/1993	36 ± 115	(-32) ± 113	60 ± 116								
09/01/1993	(-47) ± 96.2	(-69) ± 95.2	(-100) ± 93.6								
12/01/1993	38 ± 98.5	20 ± 97.6	(-110) ± 99.2								
03/02/1994	-43	-4.7	12								
06/01/1994	-43	-77	65								
08/31/1994	28	26	160								
12/06/1994	-20	-40	-7.5								
03/01/1995	(-20) ± 95.5	(-64) ± 98.9	(28) ± 95.1								
05/08/1996						790 ± 54		19000 ± 400			
05/10/1995							9000 ± 400	12000 ± 1000			
05/11/1995						750 ± 170					
05/12/1995				2300 ± 200	2200 ± 200						
06/06/1995	(-9.7) ± 121	(-270) ± 106									
09/06/1995	170 ± 110	51 ± 105	130 ± 100								
12/05/1995	61 ± 96.4	75 ± 92	140 ± 95.2								
03/05/1996	(-65) ± 98	(-96) ± 96.2	15 ± 10.9								
06/04/1996	(-120) ± 91.5	(-76) ± 94.1	37 ± 104								
09/04/1996	(-59) ± 99	(-68) ± 98.5	(-79) ± 97.8								
12/03/1996	51 ± 108	(-51) ± 102	45 ± 115								
03/04/1997	(-180) ± 121	(-100) ± 126	17 ± 126								
06/04/1997		(-29) ± 136	(-90) ± 14.6								
09/03/1997		45 ± 109	0 ± 107								
12/02/1997	(-65) ± 156	(-290) ± 141	(-330) ± 138								
02/10/1998									<300	<300	2200
03/03/1998	(-4.7) ± 84.6	(-47) ± 82.1	47 ± 87.4								
05/12/1998									180	210	1700
06/03/1998	(-9.5) ± 87.4	(-43) ± 85.6	36 ± 89.8								
08/18/1998									<200	<200	1600
09/02/1998	160 ± 90	50 ± 81.2	190 ± 90								
11/10/1998									<200	<200	1600
12/01/1998	39 ± 104	62 ± 105	90 ± 106								
03/02/1999	100 ± 101	61 ± 99.1	180 ± 100								
06/02/1999	67 ± 97.8	53 ± 97.3	57 ± 97.5								
09/01/1999	(-140) ± 94.3	(-49) ± 98.1	(39) ± 98.5								
12/01/1999	26 ± 98.9	31 ± 99.1	100 ± 102								
03/01/2000	(-69) ± 100	(-71) ± 100	(-26) ± 100								
06/07/2000	(-76) ± 100	(-4.7) ± 100	(-4.7) ± 100								
09/06/2000	(-280) ± 62	(-240) ± 63	(-280) ± 65								

ENERGY NORTHWEST
COLUMBIA GENERATING STATION
SITE-WIDE PROCEDURES

SWP-ENG-04

SWP-ENG-04

Effective Date: 04/03/08

DIC # 1308.1

PCN # (If applicable) N/A

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All review and approval signatures are documented on the Procedure Revision Form

Procedure Revision Synopsis

New procedure that will be used as guidance to the Buried Piping Integrity Program Manager.

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1.0 PURPOSE

This procedure describes the implementation of the Buried Piping Integrity program. This procedure details: the piping to be inspected, the roles of all affected organizations, the inspection frequency, guideline of ultrasonic thickness techniques, and other inspection methods. This program is not an ASME Code required program, however, inspections may be performed on ASME piping systems.

The Program goals are to maintain piping integrity of the various sections of piping currently installed below ground through inspections and trending. Other significant goals of the Program are to: maintain plant operability and functionality, provide nuclear and personnel safety and reducing operating costs. The program objective is to identify for repair or replacement piping degraded by environmental and chemical factors prior to reaching the design minimum wall thickness.

The Buried Piping Program is an organizational integrated program that will inspect sections of underground piping as well as monitor soil chemistry and water chemistry to identify ground environmental concerns. The plant systems inspected will be determined by safety impact, radioactive impact, and the consequences of a leak. The priority index for each susceptible line is maintained in the Buried Piping Integrity Program Notebook.

2.0 RESPONSIBILITIES

2.1 Program Manager

- Monitoring Program Health and updating program health reports.
- Manage the Buried Piping Integrity Program.
- Evaluate buried piping inspection results.
- Initiating Work Requests (WR) and Work Orders (WO) as necessary (inspections, exams, repairs, etc.).
- Evaluating buried piping failures and non-conforming conditions.
- Budgeting appropriately based on the needs of the program.
- Participate in Industry Activities (OE, User Groups, etc.)

2.2 System Engineering

- Assisting program manager in determining areas to inspect piping.
- Drive and track repair/replacement work.
- Maintain Cathodic Protection Program.

2.3 Environmental Services

- Assisting program manager in determining areas to inspect piping based on environmental conditions.
- Assist Chemistry with Groundwater Protection Program, as needed.

2.4 Radiological Services

- Provide assistance, as needed, for the Buried Piping Integrity Program.
- Support Chemistry and Environmental Services, as needed.
- Assess the radiological impact of the spread of contamination due to buried piping failures.

2.5 Chemistry

- Assisting program manager in determining areas to inspect piping that has possible corrosion due to chemistry factors
- Assist Environmental Services, as needed.
- Manage the Groundwater Protection Program.
- Maintain effective water chemistry to minimize corrosion.

3.0 PROCEDURE

3.1 Susceptibility Analysis

3.1.1 System Screening

The Program identifies all piping systems that are buried. The susceptibility analysis reviewed all systems and eliminated those that do not have buried piping (see Attachment 8.1).

Potable Water is not included in the Buried Piping Program due to a majority of the piping being PVC and no strategy / risk based approach can be developed to inspect the pipe.

3.1.2 Line Screening and Susceptible Lines

Systems that have buried piping were broken down by line number and line size. Then each line was identified as buried or not. Those lines that were identified as buried are considered susceptible and included in Attachment 8.2.

Each susceptible line has: design and operating temperature, design and operating pressure, line material, coating information, design wall thickness, cathodic protection information, line description, and associated drawings.

3.1.3 Susceptibility Ranking

a. Radiological Systems

Each susceptible line is ranked in the Priority Index table per the guidance of EPRI (see Reference 7.3). Each line ranking is determined by the line History, Condition, Design, Inventory, Hazard, Mobility and Post Release Detection. Those lines with the highest priority ranking will typically be inspected before those with a lower priority.

b. Non-Radiological Systems

Systems that do not carry radiological material are ranked and prioritized separately (see Priority Index within Buried Piping Program Notebook). Non-radiological systems are ranked based on line History, Condition, Operations Risk and Safety Risk.

3.2 Inspection/Examination Location Identification

3.2.1 Locations selected for inspection/examination will be based on the priority ranking given to each line by the Priority Index. Each location will be identified by the line size and line number (if necessary drawing numbers will be identified).

3.2.2 Inspections/Examinations will be performed as needed and per the guidance of the Buried Piping Integrity Program.

3.3 Deliverables

3.3.1 Inspections

Piping will be inspected in the Buried Piping Integrity Program by visual inspection (internal and/or external), guided wave examination, and/or UT examination. Examination surfaces will include a visual inspection of the exposed pipe. Visual surface inspections should note pipe and coating (if applicable) condition. Buried piping will need to be accessed through a manhole or by excavating.

Guided wave testing may require minimum excavating of buried piping. Locations will be selected based on excavation difficulties (plant procedures, tearing up asphalt, damaging nearby piping or underground electrical lines) and which locations allow an examination of the most pipe (number of 45° or 90° bends in pipe and surrounding underground materials limit guided wave exams). When a buried pipe is exposed it may require removal of corrosion, protective wrapping or coatings to perform guided wave inspections of the pipe. Above ground piping may require the removal of insulation. Pipe condition should be noted prior to examination (coating and/or pipe condition).

Ultrasonic examinations will be performed as a check to the guided wave results. Ultrasonics will be used at locations where the guided wave results show a flaw. Excavation will be required on buried piping with significant signs of degradation and/or per the guidance of Section 3.4.1. Procedure 8.3.63 (Procedure for Monitoring Pipe Wall Thinning) will be used for conducting UT examinations.

3.3.2 Inspection/Examination Evaluations

Guided Wave Examination Evaluations will be performed by a vendor.

UT Exams and Visual Inspections will be evaluated by NDE and the Buried Piping Program Manager.

3.3.3 Final Inspection/Examination Reports

a. Inspection/Examination reports will be issued in a timely manner and loaded on the Buried Piping Integrity Team Site.

b. Reports will include photographs and documentation indicating the location of the inspection/examination.

3.3.4 Other Inspections and Trending

a. Cavitation Monitoring ? Monitored and/or trended by the responsible system engineer.

b. Corrosion Coupons ? Monitored and trended by the corrosion engineer.

c. Cathodic Protection ? Monitored by the cathodic protection engineer and utilized by the Buried Piping Program Manager in the Susceptibility Analysis.

3.4 Acceptance Criteria

Inspection and Examination results will be evaluated per the guidance in this section. Any non-conformances will be documented per the Corrective Action Program.

3.4.1 G-Scan

a. Examinations with an indication of greater than 30% nominal wall loss will be forwarded to Design Engineering for further evaluation and trended (per the corrective action program).

Indications of greater than 30% should be verified with a UT examination within 2 years.

b. Examinations with indications of less than 30% nominal wall loss will be trended (per the corrective action program) and planned for future inspections.

3.4.2 Ultrasonic Examination

a. Examined component has an estimated remaining life of at least 2 years.

b. Any component with 2 years or less of predicted service life will be planned for repair or replacement.

3.4.3 Visual Inspection

a. Inspection shows no signs of corrosion or coating deficiencies.

b. If pitting or corrosion is observed: pit depth, extent of corrosion, and significance of corrosion will be documented.

4.0 DOCUMENTATION

4.1 Program Notebook

4.1.1 The Program Notebook is maintained by the Program Manager and updated as applicable.

4.1.2 Program Notebook follows the guidance of ENG-PRG-01.

4.2 Program Health Report

4.2.1 Program Health Report is updated quarterly by the Program Manager.

4.2.2 Program Health Report follows the guidance of ENG-PRG-01.

4.2.3 Program Health Reports are posted and/or stored where accessible for review (e.g., on a web page).

5.0 RECORDS

5.1 Records will be kept on the Buried Piping Integrity team site and/or maintained by the Buried Piping Program Manager.

5.2 Records pertaining to 10CFR 50.75 will be maintained per reference 2.13.

6.0 DEFINITIONS

6.1 Condition, C_L: The priority factor that is a relative measure of the current physical condition of a System, Structure or Component (SSC). An evaluation of potential ongoing releases, conducted, in accordance with Section 3.2.3 of Reference 7.3, should determine the age of the SSC, its current physical condition, its maintenance history, and the results of any leak testing or other method for verifying SSC integrity (see Reference 7.3 Appendix C for details).

6.2 Consequence Priority Factors: The significance of a groundwater contamination and the average of four Priority Factors (HC, IC, MC and PC).

6.3 Design, D_L: The priority factor that is a relative indicator that an SSC or work practice will result in soil or groundwater contamination in the event of a spill or leak (see Reference 7.3 Appendix C for details).

6.4 G-Scan / Guided Wave: G-Scan Technique utilizes torsional waves that are computer generated at frequencies of 16 to 55 KHz. The G-Scan system is a low frequency ultrasonic guided wave technique developed for the rapid survey of pipe to detect corrosion. Guided Wave results are informational only and must be verified by local UT exams.

6.5 Hazard, H_C: The priority factor that is a relative measure of the radionuclide's dose hazard, with tritium having the lowest value of 1. Values will be based on Relative Dose (RD) values obtained from Table C-1 of Reference 7.3 (see Reference 7.3 Appendix C for details).

6.6 History, H_L: The priority factor that is a relative measure of whether an unanalyzed pathway to the environment has been created, an SSC has leaked, or a work practice has resulted in a spill of radioactive material to the environment (see Reference 7.3 Appendix C for details).

6.7 Inventory, I_C: The priority factor that is a relative measure of the total radioactivity content of the liquid source. It may relate to total volume, flow rate and/or liquid radionuclide concentration.

6.8 Likelihood Priority Factors: The chance that an SSC or work practice will cause groundwater contamination and the average of three Priority Factors (H_L, C_L, and D_L or O_L).

6.9 Mobility, M_C: The priority factor that is a relative measure of the partitioning of a radionuclide between soil and groundwater within an aquifer and the mobility of the constituent in groundwater. Value may be determined using Table C-2 of Reference 7.3 (see Reference 7.3 Appendix C for details).

6.10 Operations Risk, O_L: This factor is a relative indicator of the economic significance and risk of the plant being required to react (down-power or scram) due to a leak in the SSC (see Buried Piping Program Notebook for more details).

6.11 Post-Release Detection, P_C: The priority factor that is a relative measure of the ability to detect and react to a leak or spill (see Reference 7.3 Appendix C for details).

6.12 Priority Factor: Coefficient value used to determine the Priority Index for an SSC.

6.13 Priority Index (PI): A measure of an SSC or work practices potential for contaminating groundwater. The PI is calculated by multiplying the Likelihood, Consequence and 11.11 (constant, per Reference 7.3 App. C). Constant ensures maximum PI of 100. The Priority Index is an attachment of the Buried Piping Program Notebook.

6.14 Safety Risk, S: The priority factor that is a relative measure representing the nuclear safety significance of the SSC to ensure safe plant shutdown in the event of an accident (see Buried Piping Program Notebook for more details).

6.15 Ultrasonic Testing (UT): UT uses ultrasonic pulse-waves to measure the wall thickness of a pipe. Typically wall thickness measurements are taken from the outside surface of the pipe. UT techniques can only be performed where you have access to the pipes outer surface (buried piping will have to be excavated). UT can be performed on pipe with corrosion resistant coatings on the outer surface. UT techniques are considered acceptable for both ASME and non-ASME piping systems.

6.16 Visual Inspection: The visual inspection will look for pitting, corrosion, cracks, or possible fluid that has leaked out of the pipe.

7.0 REFERENCES

7.1 PPM 8.3.63, Procedure for Monitoring Pipe Wall Thinning

7.2 NEI 07-07, Industry Ground Water Protection Initiative ? Final Guidance Document, Nuclear Energy Institute

7.3 1015118, Groundwater Protection Guidelines for Nuclear Power Plants, Electric Power and Research Institute

7.4 ANI Nuclear Liability Insurance Guideline 07-01, Potential for Unmonitored and unplanned Off-Site Releases of Radioactive Material, American Nuclear Insurers

7.5 EPT-04, Service Water Reliability, INPO

7.6 Service Water Reliability Program, Appendix 2

7.7 1011730, Groundwater Monitoring Guidance for Nuclear Power Plants, EPRI

7.8 1011905, Cathodic Protection System Application and Maintenance Guide, EPRI

7.9 1013468, Condition Assessment of Large-Diameter Buried Piping: Phase 3 - Field Trial

7.10 1006616, Life Cycle Management Planning Sourcebooks - Volume 2: Buried Large-Diameter Piping

7.11 PPM 1.10.1, Notifications and Reportable Events

7.12 PPM 1.11.1, Radiological Environmental Monitoring Program (REMP) Implementation Procedure

7.13 PPM 1.11.18, Record Keeping for Decommissioning Planning

7.14 PPM 16.12.5, Preparation of Radioactive Effluent Release Reports

7.15 SI-G-Scan-100, G-Scan Piping Inspection General Procedure

8.0 ATTACHMENTS

8.1 System Screening Analysis

8.2 Susceptibility Analysis

SYSTEM SCREENING ANALYSIS

SYSTEM TITLE	Buried Piping	Contains Liquid[1]	Plant Risk[1]	Exclusion Comment
APPENDIX R POST-FIRE SAFE SHUTDOWN ANALYSIS	No	N/A	N/A	Not Buried
ASD INVERTERS AND CONTROL POWER	No	N/A	N/A	Not Buried
ASME SECTION I REPAIR/REPLACEMENT PROGRAM	No	N/A	N/A	Not Buried
ASME SECTION REPAIR/REPLACEMENT PROGRAM	No	N/A	N/A	Not Buried
ASME SECTION VIII REPAIR/REPLACEMENT PROGRAM	No	N/A	N/A	Not Buried
ASME SECTION XI REPAIR/REPLACEMENT	No	N/A	N/A	Not Buried
ASME VESSEL INSPECTION PROGRAM	No	N/A	N/A	Not Buried
ELEC SEPARATION	No	N/A	N/A	Not Buried
FLOW ACCELERATED CORROSION (FAC)	No	N/A	N/A	Not Buried
FIRE PROTECTION PROGRAM	No	N/A	N/A	Not Buried
NDE	No	N/A	N/A	Not Buried
WELDING	No	N/A	N/A	Not Buried
EMERGENCY LIGHTING	No	N/A	N/A	Not Buried
500/25 KV AC DISTRIBUTION	No	N/A	N/A	Not Buried
230/115 KV AC DISTRIBUTION	No	N/A	N/A	Not Buried
VITAL INSTRUMENT POWER SUPPLY	No	N/A	N/A	Not Buried
480 V AC DISTRIBUTION	No	N/A	N/A	Not Buried
120 V AC DISTRIBUTION	No	N/A	N/A	Not Buried
6.9 KV AC DISTRIBUTION	No	N/A	N/A	Not Buried
INTEGRATED TESTING	No	N/A	N/A	Not Buried
4160 V DISTRIBUTION	No	N/A	N/A	Not Buried
AUTOMATIC DEPRESSURIZATION SYSTEM	Yes	No	N/A	Not Liquid
ANNUNCIATOR SYSTEM	No	N/A	N/A	Not Buried
AVG POWER RANGE MONITOR / OSCILLATION POWER RANGE MONITOR	No	N/A	N/A	Not Buried
CONDENSER AIR REMOVAL	No	N/A	N/A	Not Buried
AREA RAD MONITORING	No	N/A	N/A	Not Buried

SYSTEM TITLE	Buried Piping	Contains Liquid[1]	Plant Risk[1]	Exclusion Comment
AUXILLIARY STEAM	No	N/A	N/A	Not Buried
RRC ADJUSTABLE SPEED DRIVES	No	N/A	N/A	Not Buried
EXTRACTION STEAM	No	N/A	N/A	Not Buried
PROCESS COMPUTER	No	N/A	N/A	Not Buried
CONT ATMOSPHERE CONTROL	No	N/A	N/A	Not Buried
CONTROL & SERVICE AIR	Yes	No	N/A	Not Liquid
CONTAINMENT EXHAUST PURGE	No	N/A	N/A	Not Buried
CONTAINMENT INSTRUMENT AIR	No	N/A	N/A	Not Buried
CONTAINMENT ATMOSPHERE MONITORING	No	N/A	N/A	Not Buried
CONTAINMENT NITROGEN	No	N/A	N/A	Not Buried
CONDENSATE	Yes	Yes	Yes	Required
CATHODIC PROTECTION	Yes	No	N/A	Not Liquid
CIRCULATING WATER H&V	No	N/A	N/A	Not Buried
COND FILTER DEMIN	No	N/A	N/A	Not Buried
CONTROL, CABLE RM H&V	No	N/A	N/A	Not Buried
PRIMARY CONT. COOLING	No	N/A	N/A	Not Buried
CONTROL ROD DRIVE	No	N/A	N/A	Not Buried
CONTAINMENT SUPPLY PURGE	No	N/A	N/A	Not Buried
COND STORAGE & TRANSFER	Yes	Yes	Yes	Required
COOLING TOWER H&V	No	N/A	N/A	Not Buried
CONTAINMENT VACUUM BREAKERS	No	N/A	N/A	Not Buried
CIRCULATING WATER SYS	Yes	Yes	Yes	Required
DC POWER DISTRIBUTION	No	N/A	N/A	Not Buried
DIGITAL ELECTRO-HYDRAULICS (ELECTRONICS)	No	N/A	N/A	Not Buried
DIGITAL ELECTRO-HYDRAULICS (HYDRAULICS)	No	N/A	N/A	Not Buried
DIESEL GENERATOR BLDG H&V	No	N/A	N/A	Not Buried
DEMINERALIZED WATER	Yes	Yes	Yes	Required
NON-RADIOACTIVE DRAINS	Yes	Yes	Yes	Required
LIQUID WASTE PROCESSING	Yes	Yes	Yes	Required
EXCITER/VOLT REG.	No	N/A	N/A	Not Buried
FACILITIES	No	N/A	N/A	Not Buried

Attachment 8.1, System Screening Analysis

SYSTEM TITLE	Buried Piping	Contains Liquid[1]	Plant Risk[1]	Exclusion Comment
FIRE PROTECTION (ACTIVE SYSTEMS)	Yes	Yes	Yes	Required
FIRE PROTECTION (PASSIVE SYSTEMS)	No	N/A	N/A	Not Buried
FUEL POOL COOLING	No	N/A	N/A	Not Buried
MAIN GENERATOR COMPONENTS	No	N/A	N/A	Not Buried
MAIN GENERATOR	No	N/A	N/A	Not Buried
GUARDHOUSE H&V	No	N/A	N/A	Not Buried
MAIN GEN HYDROGEN	No	N/A	N/A	Not Buried
HEATER, VENTS & DRAINS	No	N/A	N/A	Not Buried
HIGH PRESSURE CORE SPRAY	Yes	Yes	Yes	Required
HPCS STANDBY AC PWR SPPLY	No	N/A	N/A	Not Buried
HYDROGEN STORAGE & SUPPLY FACILITY	No	N/A	N/A	Not Buried
HEAT TRACE/FREEZE PROTECTION	No	N/A	N/A	Not Buried
HYDROGEN WATER CHEMISTRY	Yes	Yes	Yes	Required
ISOPHASE BUS DUCT COOLING	No	N/A	N/A	Not Buried
INTERMEDIATE RANGE MONITOR	No	N/A	N/A	Not Buried
INDEPENDENT SPENT FUEL STORAGE INSTALLATION	No	N/A	N/A	Not Buried
JET PUMP INST	No	N/A	N/A	Not Buried
LEAK DETECTION	No	N/A	N/A	Not Buried
MAIN TURBINE LO	No	N/A	N/A	Not Buried
LOW PRESSURE CORE SPRAY	Yes	Yes	Yes	Required
MISCELLANEOUS EQUIPMENT	No	N/A	N/A	Not Buried
MET SYSTEM	No	N/A	N/A	Not Buried
MAKEUP WATER H&V	No	N/A	N/A	Not Buried
MAIN STEAM BOP	No	N/A	N/A	Not Buried
MAIN STEAM NSSS	No	N/A	N/A	Not Buried
MAIN STEAM LEAKAGE CONTROL	No	N/A	N/A	Not Buried
CRANES & HOISTS	No	N/A	N/A	Not Buried
CHEM WASTE PROCESSING	No	N/A	N/A	Not Buried
NUCLEAR BOILER INSTRUMENTATION	No	N/A	N/A	Not Buried
NS SERVICE EQUIPMENT	No	N/A	N/A	Not Buried
OFF-GAS PROCESSING	No	N/A	N/A	Not Buried
OFF-GAS VAULT HVAC	No	N/A	N/A	Not Buried

SYSTEM TITLE	Buried Piping	Contains Liquid[1]	Plant Risk[1]	Exclusion Comment
OSCILLATION POWER RANGE MONITOR	No	N/A	N/A	Not Buried
FACILITIES/PRIMARY CONTAINMENT	No	N/A	N/A	Not Buried
PLANT COMMUNICATIONS	No	N/A	N/A	Not Buried
KAMAN (CMS, FD, TEA, TSW, WEA, WOA)	No	N/A	N/A	Not Buried
GE (AR, CBD, FDR. MS, OG, RCC, REA, SW)	No	N/A	N/A	Not Buried
NMC (RRA, TRA, WRA)	No	N/A	N/A	Not Buried
MISC. (TSC, WMA)	No	N/A	N/A	Not Buried
SANITARY INSIDE POWER BLOCK	Yes	Yes	No	Not a Risk to Plant Operations
PROCESS SAMPLING RADIOACTIVE	No	N/A	N/A	Not Buried
PENETRATION SEALS TRACKING	No	N/A	N/A	Not Buried
POTABLE WATER	Yes	Yes	Yes	Not Required[2]
SOLID WASTE PROCESSING	Yes	Yes	Yes	Required
ROD BLOCK MONITOR	No	N/A	N/A	Not Buried
RX BLDG CLOSED COOLING	No	N/A	N/A	Not Buried
RX CORE ISOLATION COOLING	No	N/A	N/A	Not Buried
RADIOACTIVE SUMPS/DRAINS	Yes	Yes	Yes	Required
REACTOR CORE ISOLATION COOLING	No	N/A	N/A	Not Buried
RX FEEDWATER SYSTEM INSTRUMENTS	No	N/A	N/A	Not Buried
REACTOR FEEDWATER SYS (MECHANICAL)	No	N/A	N/A	Not Buried
RX BUILDING HVAC	No	N/A	N/A	Not Buried
RESIDUAL HEAT REMOVAL	No	N/A	N/A	Not Buried
REACTOR BUILDING	No	N/A	N/A	Not Buried
REACTOR MANUAL CONTROL SYSTEM	No	N/A	N/A	Not Buried
REACTOR PROTECTION SYS	No	N/A	N/A	Not Buried
REACTOR PRESSURE VESSEL	No	N/A	N/A	Not Buried
REACTOR RECIRCULATION	No	N/A	N/A	Not Buried
REMOTE SHUTDOWN	No	N/A	N/A	Not Buried
REACTOR WATER CLEAN UP	No	N/A	N/A	Not Buried
ROD WORTH MINIMIZER	No	N/A	N/A	Not Buried
STANDBY AC POWER SUPPLY	No	N/A	N/A	Not Buried

Attachment 8.1, System Screening Analysis

SYSTEM TITLE	Buried Piping	Contains Liquid[1]	Plant Risk[1]	Exclusion Comment
STANDBY AC POWER/EMERGENCY	No	N/A	N/A	Not Buried
SUPERVISORY CONTROL	No	N/A	N/A	Not Buried
STATOR COOLING WATER	No	N/A	N/A	Not Buried
SECURITY	No	N/A	N/A	Not Buried
SEISMIC MONITORING	No	N/A	N/A	Not Buried
STANDBY GAS TREATMENT	No	N/A	N/A	Not Buried
SERVICE BUILDING H&V	No	N/A	N/A	Not Buried
STANDBY LIQUID CONTROL	No	N/A	N/A	Not Buried
SEAL OIL	No	N/A	N/A	Not Buried
SW PUMPHOUSE H&V	No	N/A	N/A	Not Buried
SOURCE RANGE MONITOR	No	N/A	N/A	Not Buried
SRV VALVE INSTRUMENTATION	No	N/A	N/A	Not Buried
SEALING STEAM	No	N/A	N/A	Not Buried
STACK MONITOR	No	N/A	N/A	Not Buried
STANDBY SERVICE WATER	Yes	Yes	Yes	Required
TDAS	No	N/A	N/A	Not Buried
TURBINE BLDG H&V	No	N/A	N/A	Not Buried
TRANSVERSING INCORE PROBE	No	N/A	N/A	Not Buried
TOWER MAKEUP	Yes	Yes	N/A	Required
TURBINE OIL PURIFICATION & TRANSFER	No	N/A	N/A	Not Buried
TSC	No	N/A	N/A	Not Buried
TURBINE SUPERVISORY INSTRUMENT	No	N/A	N/A	Not Buried
PLANT SERVICE WATER	Yes	Yes	N/A	Required
MAIN TURBINE	No	N/A	N/A	Not Buried
RADWASTE BLDG HVAC	No	N/A	N/A	Not Buried
MAKEUP WATER TREATMENT	No	N/A	N/A	Not Buried
ALTERNATE REMOTE SHUTDOWN/REMOTE SHUTDOWN	No	N/A	N/A	Not Buried
ISI	No	N/A	N/A	Not Buried
MOV	No	N/A	N/A	Not Buried
IST	No	N/A	N/A	Not Buried
EQUIPMENT QUALIFICATION	No	N/A	N/A	Not Buried
HEAT EXCHANGER INTEGRITY	No	N/A	N/A	Not Buried

Attachment 8.1, System Screening Analysis

SYSTEM TITLE	Buried Piping	Contains Liquid[1]	Plant Risk[1]	Exclusion Comment
BWRVIP	No	N/A	N/A	Not Buried
REACTOR VESSEL SURVEILANCE	No	N/A	N/A	Not Buried
MAINTENANCE RULE	No	N/A	N/A	Not Buried
THERMAL PERFORMANCE	No	N/A	N/A	Not Buried
MOTORS	No	N/A	N/A	Not Buried
CHECK VALVES	No	N/A	N/A	Not Buried
RELIEF VALVES	No	N/A	N/A	Not Buried
OIL ANALYSIS	No	N/A	N/A	Not Buried
BREAKERS	No	N/A	N/A	Not Buried
VIBRATION	No	N/A	N/A	Not Buried
THERMOGRAPHY	No	N/A	N/A	Not Buried
PUMPS	No	N/A	N/A	Not Buried
RELAYS	No	N/A	N/A	Not Buried
SNUBBERS	No	N/A	N/A	Not Buried
LLRT/ILRT	No	N/A	N/A	Not Buried
AOV	No	N/A	N/A	Not Buried
RIGGING DESIGN ENGINEER (PPM 10.4.12)	No	N/A	N/A	Not Buried
RIGGING SYSTEM ENGINEER (PPM 10.4.12)	No	N/A	N/A	Not Buried

Notes:
1. N/A if system already meets at least one inclusion or exclusion criteria.
2. Potable Water is not included in the program to the inability to strategically inspect and trend PVC pipe.

SUSCEPTIBILITY ANALYSIS

Line Number	ASME	Exclusion Criteria: Buried In Dirt (X if yes)	Buried In Concrete (X if yes)	Coated (Y/N)	Cathodic Protection (Y/N)	Pipe Material	Wall Thickness / Min Wall	Drawing Ref.	Exclusion Comment	Operating Press (Psig)	Operating Temp (Deg F)	Design Press (Psig)	Design Temp (Deg F)	Line Description	Radiological (Y/N)	Line Included in Buried Piping Integrity Program
Main Condensate	*all of these pipelines are either from design spec. 15B.1 or design spec. 1 (ASME)															
COND(1)-1									Not Buried	2.4" Hg Abs	115	30" Hg Vac* to 50 psig	125	Condensate Pumps COND-P-1A, 1B &1C Suction from COND-HX-9A, 9B & 9C	N	N
COND(2)-1									Not Buried	160	115	250	125	Condensate Pumps COND-P-1A, 1B &1C Discharge to COND-HX-7, COND-HX-8A & 8B, and OG-HX-2	N	N
COND(3)-1									Not Buried	92/112**	115	250	125	Condensate Booster Pumps COND-P-2A, 2B & 2C Suction from Condensate Demineralizer System	N	N
COND(4)-3									Not Buried	539	116	775	150	Condensate Booster Pumps COND-P-2A, 2B & 2C Discharge pumps to COND-HX-1	N	N

COND(4)-3									Not Buried	524	164	775	200	Condensate Booster Pumps COND-P-2A, 2B & 2C to Discharge COND-HX-1 to COND-HX-2	N	N
COND(4)-3									Not Buried	523	199	775	250	Condensate Booster Pumps COND-P-2A, 2B & 2C Discharge COND-HX-2 to COND-HX-3	N	N
COND(4)-3									Not Buried	499	252	775	310	Condensate Booster Pumps COND-P-2A, 2B & 2C Discharge COND-HX-3 to COND-HX-4	N	N
COND(4)-3									Not Buried	482	286	775	340	Condensate Booster Pumps COND-P-2A, 2B & 2C Discharge COND-HX-4 to COND-HX-5	N	N
COND(4)-3									Not Buried	471	366	775	420	Condensate Booster Pumps COND-P-2A, 2B & 2C Pump Discharge COND-HX-5 to RFW-P-1A & 1B	N	N
COND(4)-4									Not Buried	428	362	1950	450	COND-V-400 to COND-V-401	N	N
COND(5)-3									Not Buried	471	366	775	420	To Steam Evaporator SS-EV-1A & 1B	N	N
COND(5)-2									Not Buried	185	381	300	420	Steam Evaporators SS-EV-1A & 1B to COND-HX-9	N	N
COND(5)-3									Not Buried	471	366	775	420	COND(4)-3 to COND(5)-2	N	N

COND(6)-1									Not Buried	112	115	30" Hg Vac to 250 psig	125	COND(3)-1 to COND-HX-9	N	N
16"COND(7)-1		X				ASTM A106 Gr. B	0.375	215-08,663; 215-00,484; COND-344-5.10H; COND-344-11.14; E599	Required	112/2.4" Hg Abs	115	30" Hg Vac to 250 psig	125	From COND-V-10A&B on CSTs to COND-V-17 TG Building. Hotwell makeup.	N	Y
COND(8)-1									Not Buried	2.4" Hg Abs	115	30" Hg Vac to 250 psig	125	Condensate Pumps COND-P-1A, 1B & 1C Vent to Main Condenser COND-HX-9	N	N
COND(9)-1									Not Buried	112	115	250	125	Seal Water to Condensate Pumps COND-P-1A, 1B & 1C	N	N
COND(100)-1									Not Buried	2.4" Hg Abs	116	30" Hg Vac to 50 psig	125	Condensate Booster Pumps COND-P-2A, 2B & 2C Recirculation	N	N
COND(100)-3									Not Buried	539	116	775	125	Condensate Booster Pumps COND-P-2A, 2B & 2C Recirculation	N	N
COND(101)-3									Not Buried	539	116	775	125	Turbine Exhaust Spray to HP Turbine Preseparator Drain Tank HD-TK-1A &1B	N	N
COND(102)-3									Not Buried	471	366	775	420	Startup Bypass, COND(4)-3 to COND(102)-4	N	N
COND(102)-4									Not Buried	1205	368	1950	420	Startup Bypass, COND(102)-3 to RFW(1)-4	N	N

COND(103)-1									Not Buried	218	368	250	420	Reactor Feedwater Pumps RFW-P-1A & 1B Seal Water After Isolation Valve COND-V-621A & 621B	N	N
COND(103)-3									Not Buried	486	368	775	420	Reactor Feedwater Pumps RFW-P-1A & 1B Seal Water to Isolation Valve COND-V-621A & 621B	N	N
COND(103)-3									Not Buried	438	120	775	125	COND(4)-3 Seal Water to Reactor Feedwater Pumps RFW-P-1A & 1B	N	N
COND(104)-3									Not Buried	539	116	775	125	to Main Condenser COND-HX-9 Fog Nozzles	N	N
COND(105)-1									Not Buried	112	115	250	125	Start-up Crossover to Auxiliary Condensate	N	N
COND(10-19), (21-24), (26), (31), (34),(38), (61), (63), (70-75), (99), (150-153),(155-157), (253)-1									Not Buried	100	100	150	150		N	N
COND(25)-1									Not Buried	100	100	150	150	Precoat Rm Supply Header	N	N
COND(27)-1									Not Buried	100	100	150	150	Radwaste Bldg Supply Header	N	N
COND(28)-1									Not Buried	100	115	150	150	Backwash Supply to CF System	N	N

COND(29)-1									Not Buried	100	100	150	150	to Fuel Pool Supply & CF-TK-17	N	N
COND(30)-1									Not Buried	100	115	150	150	COND-P-3 & 4 Pressurization Supply	N	N
COND(32)-1									Not Buried	100	100	150	150	to Waste Precoat CF-TK-3	N	N
COND(33)-1									Not Buried	100	I00	150	150	to Waste Filter Aid CF-TK-7	N	N
COND(35)-1									Not Buried	100	100	150	150	to Resin CF-TK-34	N	N
COND(36)-1									Not Buried	100	100	150	150	Centrifuge Supply PWR-FU-94B	N	N
COND(37)-1									Not Buried	100	100	150	150	to Solid Radwaste Handling System (COND-V-301 Deactivated)	N	N
COND(39)-1									Not Buried	100	100	150	150	to Decon Sol AS-EV-1A (Not Operational)	N	N
COND(40)-1									Not Buried	100	I00	150	150	to COND-TK-1A & 1B	N	N
14"COND(40)-1S		X				ASTM-A312 Type 304	schd 10S	M527-1; 215-00,811; 215-00,488	Required	100	140	150	150	From various sources of 'cleaned' water to COND-TK-1A & 1B	Y	Y
COND(41)-1									Not Buried	100	100	150	150	Supply Header to RHR	N	N
COND(42)-1									Not Buried	100	100	150	150	Supply Header to RHR	N	N
COND(43)-1									Not Buried	100	100	150	150	Supply Header to HPCS	N	N
COND(44)-1									Not Buried	100	100	150	150	Condensate Supply Header to RHR	N	N
COND(45)-1									Not Buried	100	100	150	150	Condensate Supply Header Service Box Valves	N	N

COND(46)-1									Not Buried	100	100	150	150	Condensate Supply Header Service Box Valves	N	N
COND(47)-1									Not Buried	100	100	150	150	Condensate Supply Header to Reactor Building	N	N
COND(48)-1									Not Buried	100	100	150	150	Supply Header to RHR	N	N
COND(49)-1									Not Buried	100	100	150	150	Supply Header to RHR	N	N
COND(50)-1									Not Buried	112	115	150	150	Condensate from OG System to COND-HX-9	N	N
COND(60)-1									Not Buried	100	100	150	150	Condensate Storage Tank Via COND(20)-1 to Pressure Switch HPCS-PS-3	N	N
COND(60)-1S									Not Buried	100	140	150	150	Trap Backwash Condensate Supply to RWCU	N	N
COND(60)-1S									Not Buried	100	140	150	150	to Condensate Storage Tank	N	N
COND(62)-1									Not Buried	100	100	150	150	Return from RCIC-V-59	N	N
COND(64)-1									Not Buried	100	100	150	150	from COND-P-4	N	N
COND(64)-1S									Not Buried	100	140	150	150	to Condensate Storage Tank	N	N
COND(65)-1									Not Buried	100	100	150	150	from COND-P-5	N	N
COND(66)-1									Not Buried	100	100	150	150	from COND-P-3	N	N
COND(66)-1S									Not Buried	100	140	150	150	to Condensate Storage Tank	N	N
COND(71)-1S									Not Buried	100	128/145	150	150	from FPC-V-138 to Condensate Storage Tank	N	N
COND(72)-1S									Not Buried	100	140	150	150	Waste Sample Pump EDR-V-14B to COND(40)-1S	N	N

COND(73)-1S									Not Buried	100	140	150	150	Waste Sample Pump EDR-V-14A to COND(40)-1S	N	N
COND(74)-1S									Not Buried	100	140	150	150	Floor Drain Sample Pump FDR-P-21 to COND(40)-1S	N	N
COND(75)-1S									Not Buried	100	140	150	150	MWR-V-569 to COND(40)-1S	N	N
COND(76)-1									Not Buried	100	100	150	150	Condensate Flushing Supply	N	N
COND(77)-1									Not Buried	100	100	150	150	Condensate to RHR(3)-1 Loop C	N	N
COND(78)-1									Not Buried	100	100	150	150	Condensate to FPC-TK-1B	N	N
4"COND(80)-1		X		Y		A106 Gr. B	0.237	COND-075-14.20; COND-348-5.10; COND-348-11.17H; COND-348-1.4	Required	100	100	150	150	From COND-V-11A&B to make up to CRD Sys. (CRD-V-18)	N	Y
COND(80)-1									Not Buried	100	100	150	150	Condensate Supply to CRD-1 System	N	N
COND(81)-1									Not Buried	112	115	210	125	COND-DM-1A Precoat Feed Backwash Return & Influent	N	N
COND(82)-1									Not Buried	112	115	210	125	COND-DM-1B Precoat Feed Backwash Return & Influent	N	N
COND(83)-1									Not Buried	112	115	210	125	COND-DM-1C Precoat Feed Backwash Return & Influent	N	N
COND(84)-1									Not Buried	112	115	210	125	COND-DM-1D Precoat Feed Backwash Return & Influent	N	N

COND(85)-1									Not Buried	112	115	210	125	COND-DM-1E Precoat Feed Backwash Return & Influent	N	N
COND(86)-1									Not Buried	112	115	210	125	COND-DM-1F Precoat Feed Backwash Return & Influent	N	N
COND(87)-1									Not Buried	100	100	150	150	DW(3)-1S to Condensate Storage Tank	N	N
COND(88)-1									Not Buried	112	115	150	150	Seal Water & Backwash Supply to CPR-P-22	N	N
COND(89)-1									Not Buried	100	100	150	150	Radwaste Bldg Condensate Supply Header	N	N
COND(90)-1									Not Buried	112	115	150	150	Backwash Supply to CPR-TK-92A & 92B Bubbler Tube	N	N
COND(91)-1									Not Buried	88/108	115	210	125	COND-DM-1A Effluent & COND-RST-1A Drain	N	N
COND(92)-1									Not Buried	88/108	115	210	125	COND-DM-1B Effluent & COND-RST-1B Drain	N	N
COND(93)-1									Not Buried	88/108	115	210	125	COND-DM-1C Effluent & COND-RST-1C Drain	N	N
COND(94)-1									Not Buried	88/108	115	210	125	COND-DM-1D Effluent & COND-RST-1D Drain	N	N
COND(95)-1									Not Buried	88/108	115	210	125	COND-DM-1E Effluent & COND-RST-1E Drain	N	N

COND(96)-1									Not Buried	88/108	115	210	125	COND-DM-1F Effluent & COND-RST-1F Drain	N	N
COND(97)-1									Not Buried	112	115	250	125	COND-DM-1A thru 1F Bypass	N	N
COND(106)-1									Not Buried	112	115	250	125	Seal Water to Pumped Drain Pumps	N	N
COND(155)-1S									Not Buried	100	90/120	150	150	From HPCS-V-11 to Storage Tanks TK-1A & 1B	N	N
COND(255)-1									Not Buried	92/112*	115	250	125	CRD Water Supply from 36" COND(3)-1 to Condensate Booster Pumps & COND-V-672 & COND-V-674	N	N
COND(255)-1									Not Buried	92/112 *	115	150	125	CRD Water Supply from COND-V-672 & COND-V-674 to 4" COND(80)-1	N	N
COND(211)-1									Not Buried	92/112 *	115	210	125	from Effluent COND(91)-1 thru COND-P-10A to Influent COND(81)-1	N	N
COND(212)-1									Not Buried	92/112 *	115	210	125	from Effluent COND(92)-1 thru COND-P-10B to Influent COND(82)-1	N	N
COND(213)-1									Not Buried	92/112 *	115	210	125	from Effluent COND(93)-1 thru COND-P-10C to Influent COND(83)-1	N	N
COND(214)-1									Not Buried	92/112 *	115	210	125	from Effluent COND(94)-1 thru COND-P-10D to Influent COND(84)-1	N	N

COND(215)-1									Not Buried	92/112 *	115	210	125	from Effluent COND(95)-1 thru COND-P-10E to Influent COND(85)-1	N	N
COND(216)-1									Not Buried	92/112 *	115	210	125	from Effluent COND(96)-1 thru COND-P-10F to Influent COND(86)-1	N	N
COND(221)-1									Not Buried	155	115	210	125	from CF(31)-1 & COND-V-210A to COND(91)-1	N	N
COND(222)-1									Not Buried	155	115	210	125	from CF(32)-1 & COND-V-210B to COND(92)-1	N	N
COND(223)-1									Not Buried	155	115	210	125	from CF(33)-l & COND-V-210c to COND(93)-1	N	N
COND(224)-1									Not Buried	155	115	210	125	from CF(94)-1 & COND-V-210D to COND(94)-1	N	N
COND(225)-1									Not Buried	155	115	210	125	from CF(35)-1 & COND-V-210E to COND(95)-1	N	N
COND(226)-1									Not Buried	155	115	210	125	from CF(36)-1 & COND-V-210F to COND(96)-1	N	N
COND(231)-1									Not Buried	145	100	210	125	Backwash Air Supply to COND-DM-1A	N	N
COND(232)-1									Not Buried	145	100	210	125	Backwash Air Supply to COND-DM-1B	N	N
COND(233)-1									Not Buried	145	I00	210	125	Backwash Air Supply to COND-DM-1C	N	N
COND(234)-1									Not Buried	145	100	210	125	Backwash Air Supply to COND-DM-1D	N	N
COND(235)-1									Not Buried	145	100	210	125	Backwash Air Supply to COND-DM-1E	N	N

COND(236)-1									Not Buried	145	100	210	125	Backwash Air Supply to COND-DM-1F	N	N
COND(241)-1									Not Buried	92/112 *	115	210	125	COND-DM-1A to MWR System	N	N
COND(242)-1									Not Buried	92/112 *	115	210	125	COND-DM-1B to MWR System	N	N
COND(243)-1									Not Buried	92/112 *	115	210	125	COND-DM-1C to MWR System	N	N
COND(244)-1									Not Buried	92/112 *	115	210	125	COND-DM-1D to MWR System	N	N
COND(245)-1									Not Buried	92/112 *	115	210	125	COND-DM-1E to MWR System	N	N
COND(246)-1									Not Buried	92/112 *	115	210	125	COND-DM-1F to MWR System	N	N
COND(247)-1									Not Buried	155	115	210	125	MWR System to COND-DM-1A	N	N
COND(248)-1									Not Buried	155	115	210	125	MWR System to COND-DM-1B	N	N
COND(249)-1									Not Buried	155	115	210	125	MWR System to COND-DM-1C	N	N
COND(250)-1									Not Buried	155	115	210	125	MWR System to COND-DM-1D	N	N
COND(251)-1									Not Buried	155	115	210	125	MWR System to COND-DM-1E	N	N
COND(252)-1									Not Buried	155	115	210	125	MWR System to COND-DM-1F	N	N
COND(260-262)-1									Not Buried	50	140	150	150	Hot Water Supply to Solid Radwaste System	N	N
COND(60)-1									Not Buried	18	100	20	150	Condensate Storage Tank Via COND(20)-1 to Pressure Switch HPCS-PS-3	N	N
COND(62)-3									Not Buried	1100	120	1420	150	RWCU "A" Resin Trap Flush Supply from COND-V-1080	N	N
24"COND(20)-1	×	X		Y		ASME SA106 Gr. B	0.375	M200-132, 132A, & 133	Required	100	100	150	150	From COND-V-9A&B to GSB for RHR flushing,	N	Y

Attachment 8.2, Susceptibility Analysis

														HPCS, and RCIC. Goes through a 28" culvert.		
COND (20), (67-69), (79), (98), (154)	X								Not Buried	100	100	150	150		N	N
COND(98)-1	X								Not Buried	12	100	20	150	Isolable Instrument Lines to HPC-LS-1A, B and RCIC-LS-15A, B	N	N
Circ. Water *all of these pipelines are from design spec. 15B.1																
CW(1)-1		X		Y		A283 Gr. C	0.500	M507-1, C533	Required	35	87	60	110	Circulating Water Pump Discharge to Main Condenser COND-HX-9	N	Y
CW(2)-1		X		Y		A283 Gr. C	0.500	M507-1, C533	Required	25	109	60	110	Circulating Water Return to the Cooling Towers from Main Condenser COND-HX-9	N	Y
CW(3)-1		X		Y		A283 Gr. C	0.500	M507-1, C533	Required					From Each Cooling Tower to the Circ. Water Basin	N	Y
1"CW(4)-1		X		Y		ASTM A106 Gr. B	0.179	M507-1	Required	35	87	60	110	Circulating Water to Chlorinators	N	Y
6"CW(4)-1		X		Y		ASTM A106 Gr. B	0.280	M507-1	Required	35	87	60	110	Circulating Water to Chlorinators	N	Y
18"CW(5)-1		X		Y		ASTM A106 Gr. B	0.375	M507-1	Required	35	108	60	110	Standby Service Water Return to Cooling Towers	N	Y
24"CW(5)-1		X		Y		ASTM A106 Gr. B	0.375	M507-1	Required	35	108	60	110	Standby Service Water Return to Cooling Towers	N	Y
84"CW(6)-1		X		Y		A283 Gr. C	0.500	M507-1, C533	Required					Cooling Tower Bypass Energy Disapator Line	N	Y
72"CW(6)-1		X		Y		A283 Gr. C	0.500	M507-1, C533	Required					Cooling Tower Bypass Energy Disapator Line	N	Y

48"CW(6)-1		X		Y		A283 Gr. C	0.625	M507-1, C533	Required					Cooling Tower Bypass Energy Disapator Line	N	Y
CW(7)-1									Not Buried	35	87	60	110	Circulating Water Pump Priming Line	N	N
CW(8)-1									Not Buried	35	87	60	110	Circulating Water to Residual Chlorine Analyzer CL-XAY-2	N	N
CW(9)-1									Not Buried	77	87	100	110	Circulating Water to Corrosion and Bio-Fouling Monitors (PVC)	N	N
Circ. Water Blowdown *all of these pipelines are from design spec. 15B.1																
CBD(1)-1 (30" & 36")		X		Y	N	CS	0.375	M741	Required	35	87	60	110	Blowdown to river. (AED MEC M741-743 & AED ARC C536-537)	N	Y
CBD(1)-1 (18", 20", & 24")		X		Y	N	CS	0.375	C538	Required	35	87	60	110	Blowdown to river. (AED ARC C538)	N	Y
CBD(70)-1		X		Y	N	CS	0.406	M741	Required	35	87	60	110	Crossover from CBD(1)-1 to Spray Pond B	N	Y
Diesel Oil																
3"DO(9)-1		X		Y		ASTM SA-106 Gr. B	0.216	M512-4 & M741-2	Required	Atmospheric	Ambient	12	120	Loop from DO-TK-1A, B, & 2 to the Filter Polisher Skid and back to the storage tanks. Buried pipe both to and from storage tanks.	N	Y
3"&2"DO(56)-1		X		Y		ASTM SA-106 Gr. B	schd 40	M512-4 & M741-2	Required	25	Ambient	100	120	From DO-TK-3A, B,& C to DO-TK-1A, B, & 2.	N	Y
1-1/2"DO(1)-1		X		Y		ASTM SA-106	0.145	M512-4 & M741-2	questionable what	25	Ambient	100	120	From DO-P-1A & B to day	N	Y

						Gr. B			sections are buried.					tanks.		
1-1/2"DO(5)-1		X		Y		ASTM SA-106 Gr. B	0.145	M512-4 & M741-2	questionable what sections are buried.	25	Ambient	100	120	From DO-P-2 to DO-TK-3C.	N	Y
Demineralized Water *all of these pipelines are from design spec. 15B.1																
6"DW(3)-1S		X				ASTM A312 TP 304	10S	DW-1279-1; DW-458-1.2; DW-458-1.2H; DW-458-3	Required	115	100	150	150	Make up to CST's from demin water	N	Y
DW(ALL)-1S									Not Buried	115	100	150	150		N	N
DW(ALL)-2S									Not Buried	200	388	250	410		N	N
DW(ALL)-3S									Not Buried	115	100	1250	280		N	N
Roof Drains																
10"RD(3)-1		X						M540 (B/12) & M741 (C15)	Required					RW roof drain line to storm sewer manhole S4.	N	Y
8"RD(3)-1		X						M741 (C15)	Required					RW roof drain line to storm sewer manhole S4.	N	Y
6"RD(21)-1		X						M741 (E15)	Required					RW roof drain line to storm sewer manhole S4.	N	Y
6"RD(2?)-1		X						M741 (E15)	Required					RW roof drain line to storm sewer manhole S4.	N	Y
6"RD(1)-1		X						M740 (B9)	Required					TG roof drain line to storm sewer manhole S10.	N	Y
8"RD(1)-1		X						M740 (D9)	Required					TG roof drain line to storm sewer manhole S10.	N	Y
6"RD(1)-1		X						M740 (E9)	Required					TG roof drain line to storm sewer manhole S10.	N	Y
8"RD(4)-1		X						M740 (G8)	Required					GSB roof drain	N	Y

														line to storm sewer manhole S4.		
6"RD(4)-1		X						M740 (G7)	Required					GSB roof drain line to storm sewer manhole S4.	N	Y
10"RD(1)-1		X						M740 (G6)	Required					GSB roof drain line to storm sewer manhole S4.	N	Y
6"RD(2)-1		X						M740 (G6)	Required					GSB roof drain line to storm sewer manhole S4.	N	Y
6"RD(2)-1		X						M740 (G5)	Required					GSB roof drain line to storm sewer manhole S4.	N	Y
EDR/FDR & ED/FD																
4"FD(7)-1		X				ASTM A106 Gr. B	0.216	M741-1	Required	43	140	150	180	Discharge water from RadWaste to the river. Ties into CBD.	Y	Y
3"FDR(52)-1		X				ASTM A106 Gr. B	0.216	2-206-04,296,3; FD433-1.3; M781	Required	80	120	150	150	From floor drains of the CST pit to either sump T-4 in the TG, or to the storm drain. (FDR-V-24&25)	Y	Y
FDR-SUMP-R1			X			Lined with 304 SS	0.313	M539, S701, S702, S754	Required	---	---	---	---	Rx building sump 1.	Y	Y
3"FDR(52)-1			X			ASTM A106 Gr. B	0.216	M539, S701, S702, S754	Required	80	120	150	150	Input line into FDR-SUMP-R1.	Y	Y
6"FDR(43)-1			X			ASTM A106 Gr. B	0.280	M539, S701, S702, S754	Required	80	120	150	150	Riser input line into FDR-SUMP-R1.	Y	Y
FDR-SUMP-R2			X			Lined with 304 SS	0.313	M539, S701, S702, S754	Required	---	---	---	---	Rx building sump 2.	Y	Y
3"FDR(52)-1			X			ASTM A106 Gr.	0.216	M539, S701,	Required	80	120	150	150	Input line into FDR-SUMP-R2.	Y	Y

						B		S702, S754								
6"FDR(42)-1			X			ASTM A106 Gr. B	0.280	M539, S701, S702, S754	Required	80	120	150	150	Riser input line into FDR-SUMP-R2.	Y	Y
FDR-SUMP-R3			X			Lined with 304 SS	0.313	M539, S701, S702, S754	Required	---	---	---	---	Rx building sump 3.	Y	Y
3"FDR(52)-1			X			ASTM A106 Gr. B	0.216	M539, S701, S702, S754	Required	80	120	150	150	Input line into FDR-SUMP-R3.	Y	Y
6"FDR(45)-1			X			ASTM A106 Gr. B	0.280	M539, S701, S702, S754	Required	80	120	150	150	Riser input line into FDR-SUMP-R3.	Y	Y
FDR-SUMP-R4			X			Lined with 304 SS	0.313	M539, S701, S702, S754	Required	---	---	---	---	Rx building sump 4.	Y	Y
3"FDR(52)-1			X			ASTM A106 Gr. B	0.216	M539, S701, S702, S754	Required	80	120	150	150	Input line into FDR-SUMP-R4.	Y	Y
6"FDR(44)-1			X			ASTM A106 Gr. B	0.280	M539, S701, S702, S754	Required	80	120	150	150	Riser input line into FDR-SUMP-R4.	Y	Y
EDR-SUMP-R5			X			Lined with 304 SS	0.313	M539, S701, S702, S754	Required	---	---	---	---	Rx building sump 5.	Y	Y
6"EDR(50)-1			X			ASTM A106 Gr. B	0.280	M539, S701, S702, S754	Required	80	120	150	150	Input line into EDR-SUMP-R5.	Y	Y
6"EDR(46)-1			X			ASTM A106 Gr. B	0.280	M539, S701, S702, S754	Required	80	120	150	150	Riser input into EDR-SUMP-R5.	Y	Y
FDR-SUMP-W1			X			Lined with 304 ss	0.313	M540, S900, S905, S658	Required	---	---	---	---	RW building sump 1.	Y	Y
4" & 6"FDR(52)-1			X			ASTM A106 Gr. B	Schd 40	M540, S900, S905, S658	Required	80	120	150	150	Input line into FDR-SUMP-W1.	Y	Y
6"FD(63)-1			X			ASTM A106 Gr. B	0.432	M540, S900, S905, S658	Required	?	?	?	?	Riser input line into FDR-SUMP-W1.	Y	Y
FDR-SUMP-W2			X			Lined with 304 SS	0.313	M540, S900, S905, S658	Required	---	---	---	---	RW building sump 2.	Y	Y
6" & 8"FDR(52)-1			X			ASTM A106 Gr.	Schd 40	M540, S900,	Required	80	120	150	150	Input line into FDR-SUMP-W2.	Y	Y

						B		S905, S658								
6"FDR(63)-1			X			ASTM A106 Gr. B	0.280	M540, S900, S905, S658	Required	80	120	150	150	Riser input line into FDR-SUMP-W2.	Y	Y
EDR-SUMP-W3			X			Lined with 304 SS	0.313	M540, S900, S905, S658	Required	---	---	---	---	RW building sump 3.	Y	Y
6" & 8"EDR(52)-1			X			ASTM A106 Gr. B	Schd 40	M540, S900, S905, S658	Required	80	120	150	150	Input line into EDR-SUMP-W3.	Y	Y
6"EDR(62)-1			X			ASTM A106 Gr. B	0.280	M540, S900, S905, S658	Required	80	120	150	150	Riser input line into EDR-SUMP-W3.	Y	Y
2"EDR(67)-1			X			ASTM A106 Gr. B	0.218	M540, S900, S905, S658	Required	80	120	150	150	EDR-SUMP-W3 to EDR-SUMP-W6 cross tie.	Y	Y
MWR-SUMP-W4			X			Lined with 304 SS	0.313	M540, S900, S905, S658	Required	---	---	---	---	RW building sump 4.	Y	Y
4" & 6"MWR(59)-1S			X			ASME SA312 TP304	Schd 10S	M540, S900, S905, S658	Required	100	140	150	150	Input line into MWR-SUMP-W4.	Y	Y
6"MWR(64)-1S			X			ASME SA312 TP304	Schd 10S	M540, S900, S905, S658	Required	100	140	150	150	Riser input line into MWR-SUMP-W4.	Y	Y
2"MWR(57)-1S			X			ASME SA312 TP304	Schd 10S	M540, S900, S905, S658	Required	100	140	150	150	Input line into MWR-SUMP-W4.	Y	Y
3"FD(5)-1?			X			ASTM A106 Gr. B	0.300	M540 & M825	Required	43	140	150	180	From 4"PSD(3)-1 to	Y	Y
FDR-SUMP-W5			X			Lined with 304 SS	0.313	M540, S900, S905, S658	Required	---	---	---	---	Rw building sump 5.	Y	Y
3"FDR(66)-1			X			ASTM A106 Gr. B	0.216	M540, S900, S905, S658	Required	80	120	150	150	Input line into FDR-SUMP-W5.	Y	Y
6"FDR(64)-1			X			ASTM A106 Gr. B	0.280	M540, S900, S905, S658	Required	80	120	150	150	Riser input line into FDR-SUMP-W5.	Y	Y
3"FDR(76)-1			X			ASTM A106 Gr. B	0.216	M540, S900, S905, S658	Required	80	120	150	150	Overflow line for FDR-SUMP-W5.	Y	Y
3"MWR-1			X			Unknown	Unknown	M540(B9), S900,	Required	100	140	150	150	from SWA-P-1.	Y	Y

								S905, S658								
EDR-SUMP-W6			X			Lined with 304 SS	0.313	M540, S900, S905, S658	Required	---	---	---	---	Rw building sump 6.	Y	Y
FR-SUMP-T1			X			Lined with 304 SS	0.313	M518, S602, S658	Required	---	---	---	---	Tg building sump 1.	Y	Y
3" & 4"FD(1)-1			X			ASTM A106 Gr. B	Schd 80	M518, S602, S658	Required	?	?	?	?	Input lines into FR-SUMP-T1.	Y	Y
6"FD(1)-1			X			ASTM A106 Gr. B	0.432	M518, S602, S658	Required	?	?	?	?	Riser input line into FR-SUMP-T1.	Y	Y
FD-SUMP-T2			X			Lined with 304 SS	0.313	M518, S602, S658	Required	---	---	---	---	Tg building sump 2.	Y	Y
3" & 6"FD(2)-1			X			ASTM A106 Gr. B	Schd 80	M518, S602, S658	Required	?	?	?	?	Input lines into FR-SUMP-T2.	Y	Y
FD-SUMP-T3			X			Lined with 304 SS	0.313	M518, S602, S658	Required	---	---	---	---	Tg building sump 3.	Y	Y
6"FD(3)-1			X			ASTM A106 Gr. B	0.432	M518, S602, S658	Required	?	?	?	?	Input lines into FR-SUMP-T3.	Y	Y
6"ED(3)-1			X			ASTM A106 Gr. B	0.432	M518, S602, S658	Required	?	?	?	?	Input lines into FR-SUMP-T3.	Y	Y
6"FD(3)-1			X			ASTM A106 Gr. B	0.432	M518, S602, S658	Required	?	?	?	?	Riser input line into FR-SUMP-T3.	Y	Y
OIL DRAIN SUMP			X			Unknown	Unknown	M518(F1), S602, S658	Required	?	?	?	?	Oil drain sump.	Y	Y
4"FD(16)-1			X			ASTM A106 Gr. B	0.337	M518, S602, S658	Required	?	?	?	?	Input line into the oil drain sump.	Y	Y
FDR-SUMP-T4			X			Lined with 304 SS	0.313	M538, S602, S658	Required	---	---	---	---	Tg building sump 4.	Y	Y
6"FDR(52)-1			X			ASTM A106 Gr. B	0.280	M538, S602, S658	Required	80	120	150	150	Input line into FDR-SUMP-T4.	Y	Y
6"FDR(61)-1			X			ASTM A106 Gr. B	0.280	M538, S602, S658	Required	80	120	150	150	Riser input line into FDR-SUMP-T4.	Y	Y

Attachment 8.2, Susceptibility Analysis

FDR-SUMP-T5			X			Lined with 304 SS	0.313	M538, *S602, S658*	Required	---	---	---	---	Tg building *sump 5.*	Y	Y
4" & 6"FDR(52)-1			X			ASTM A106 Gr. B	Schd 40	M538, S602, S658	Required	80	120	150	150	Input lines into FDR-SUMP-T5.	Y	Y
6"FDR(62)-1			X			ASTM A106 Gr. B	0.280	M538, S602, S658	Required	80	120	150	150	Riser input line into FDR-SUMP-T5.	Y	Y
EDR-SUMP-T6			X			Lined with 304 SS	0.313	M538, S602, S658	Required	---	---	---	---	Tg building sump 6.	Y	Y
6"EDR(50)-1			X			ASTM A106 Gr. B	0.280	M538, S602, S658	Required	80	120	150	150	Input lines into FDR-SUMP-T6.	Y	Y
6"EDR(60)-1			X			ASTM A106 Gr. B	0.280	M538, S602, S658	Required	80	120	150	150	Riser input line into FDR-SUMP-T6.	Y	Y
EDR-SUMP-T7			X			Lined with 304 SS	0.313	M538, S602, S658	Required	---	---	---	---	Tg building sump 7.	Y	Y
6"EDR(50)-1			X			ASTM A106 Gr. B	0.280	M538, S602, S658	Required	80	120	150	150	Input lines into FDR-SUMP-T7.	Y	Y
6"EDR(61)-1			X			ASTM A106 Gr. B	0.280	M538, S602, S658	Required	80	120	150	150	Riser input line into FDR-SUMP-T7.	Y	Y
FD-SUMP-S1			X			Not lined	---	M518; S684(J13); S633-1(G5)	Required	---	---	---	---	GSB building sump 1.	Y	Y
3", 4", 6", & 8"FD(4)-1			X			ASTM A106 Gr. B	Schd 80	M518; S684(J13); S633-1(G5)	Required	?	?	?	?	*Input lines into* FD-SUMP-S1.	Y	Y
4"FD(9)-1						ASTM A106 Gr. B	0.337	M518; S684(J13); S633-1(G5)		43	140	150	180	FD-P-19A & B discharge line from sump S1 to the storm sewer by 8"RD(4)-1.	Y	N
Tower Makeup	*all of these pipelines are from design spec. 15B.1															
TMU(1)-1 (24")						CS	0.375	M507-1,	Not Buried	90	68	120	68	Cooling Tower Makeup Pump TMU-P-1A, 1B & 1C Discharge	N	N
TMU(1)-1 (36")		X				CS	0.375	M507-1, M741,	Required	90	68	120	68	From TMU-P-1A, B, & C to	N	Y

								M743						Circ. Water Pumphouse		
TMU(1)-1 (42")		X				ASTM A283	0.438	M507-1	Required	90	68	120	68	Discharge header for TMU-P-1A, B, & C.	N	Y
TMU(2)-1 (3/4")						ASTM A106 Gr. B	0.154	M507-1	Not Buried	90	68	120	68	Sample rack	N	N
TMU(2)-1 (1")						ASTM A106 Gr. B	0.179	M507-1	Not Buried	90	68	120	68	TMU(1)-1 to Pump & Motor Bearings	N	N
TMU(3)-1 (14")						CS	0.375	M507-1	Not Buried	90	68	120	68	Cooling Tower Makeup Pump Backwash Discharge to River via TMU(7)-1	N	N
TMU(4)-1 (32")		X				CS	0.375	M507-1, M524-1	Required	90	68	120	68	Cooling Tower Makeup Water to Spray Ponds	N	Y
TMU(5)-1 (6")		X				CS	0.280	M507-1, M910 SH.1,M741, M740	Required	90	68	120	68	Cooling Tower Makeup Water to Water Treatment System	N	Y
TMU(6)-1									Required	90	68	120	68	Cooling Tower Makeup Pump Surge Line	N	N
TMU(7)-1 (36")		X					0.375	M507-1, C870, M660	Required					Intake from river	N	Y
TMU(8)-1 (4")						CS	0.237	M507-1	Not Buried					Air cooling coils	N	N
TMU(9)-1 (1")								M507-1	Not Buried					Bubbler system instrument air	N	N
TMU(10)-1 (1/2")						PVC	0.147	M507-1	Not Buried					TMU air dryer	N	N
Plant Service Water *all of these pipelines are from design spec. 15B.1																
30"TSW(1)-1		X				ASTM A155 C1.1-C50	1/2" to min	M508-1	Required	100	86	200	110	Main Service Water Inlet (Supply)	N	Y
16"TSW(1)-1		X				ASTM A106 Gr. B	0.375	M508-1	Required	100	86	200	110	To TSW-V-224. From temp pump connection from spray pond B.	N	Y

TSW(2)-1									Not Buried	80	111	125	125	Main Service Water Outlet (Return)	N	N
TSW(3)-1									Not Buried	100	86	125	110	to Condensate Pump Motor Coolers TSW-HX-4A, 4B & 4C	N	N
TSW(4)-1									Not Buried	100	86	125	110	to RFW Turbine Oil Coolers TO-HX-2A, 2B, 2C & 2D	N	N
TSW(5)-1									Not Buried	100	86	125	110	TSW(4)-1 to Plate Heat Exchangers CJW-HX-1A& 1B	N	N
TSW(6)-1									Not Buried	l00	86	125	110	to Main Turbine L.O. Coolers TO-HX-1A & 1B	N	N
TSW(8)-1									Not Buried	100	86	125	110	to Generator Hydrogen Coolers TSW-HX-7A, 7B, 7C & 7D	N	N
TSW(9)-1									Not Buried	100	86	125	110	to Exciter Coolers TSW-HX-2A, 2B, 2C & 2D	N	N
TSW(10)-1									Not Buried	100	86	125	110	to Seal Oil Coolers TSW-HX-8 & 9	N	N
TSW(11)-1									Not Buried	100	86	125	110	to Isophase Bus Duct Heat Exchangers TSW-HX-1A & 1B	N	N
TSW(12)-1									Not Buried	100	86	125	110	to Stator Cooling Units Water Heat Exchangers TSW-HX-3A & 3B	N	N
TSW(13)-1									Not Buried	100	86	200	110	to Service Air Compressor SA-C-1 and Dryer	N	N

														SA-DY-1 Skids		
TSW(14)-1									Not Buried	100	86	125	110	to Condensate Booster Pump L.O. Coolers TSW-HX-6A through 6F	N	N
TSW(15)-1									Not Buried	100	86	125	110	to Mechanical Vacuum Pump Seal Water Coolers TSW-HX-10A & 10B	N	N
TSW(16)-1									Not Buried	l00	86	125	110	to Service Building Chiller Condenser SCH-CU-51	N	N
TSW(17)-1									Not Buried	100	86	200	110	to Reactor Building Closed Cooling Water Heat Exchangers RCC-HX-1A, 1B & 1C	N	N
TSW(19)-1									Not Buried	100	86	200	110	to Critical Switchgear Air Handling	N	N
TSW(20)-1									Not Buried	80	111	125	125	Condensate Pump Motor Coolers TSW-HX-4A, 4B & 4C to Outlet Header TSW(2)-1	N	N
TSW(21)-1									Not Buried	80	111	125	125	RFP Lube Oil Coolers TSW-HX-2A, 2B, 2C & 2D Outlet Header TSW(2)-1	N	N
TSW(22)-1									Not Buried	80	111	125	125	Plate Heat Exchangers CJW-HX-1A & 1B to Outlet Header TSW(2)-1	N	N
TSW(23)-1									Not Buried	80	111	125	125	Main Turbine Oil Coolers TO-HX-	N	N

														1A & 1B to Outlet Header TSW(2)-1		
TSW(25)-1									Not Buried	80	111	125	125	Generator Hydrogen Coolers TSW-HX-7A, 7B, 7C & 7D to Outlet Header TSW(2)-l	N	N
TSW(26)-1									Not Buried	80	111	125	125	Exciter Coolers TSW-HX-2A, 2B, 2C & 2D to Outlet Header TSW(2)-1	N	N
TSW(27)-1									Not Buried	80	111	125	125	Seal Oil Coolers TSW-HX-8 & 9 to Outlet Header TSW(2)-1	N	N
TSW(28)-1									Not Buried	80	111	125	125	Isophase Bus Duct Heat Exchangers TSW-HX-1A & 1B to Outlet Header TSW(2)-1	N	N
TSW(29)-1									Not Buried	80	111	125	125	Stator Cooling Water Heater Exchangers TSW-HX-3A & 3B to Outlet Header TSW(2)-1	N	N
TSW(30)-1									Not Buried	80	111	125	125	Condensate Booster Pumps Lube Oil Coolers TSW-HX-6A through 6F to Outlet Header TSW(2)-1	N	N
TSW(31)-1									Not Buried	80	111	125	125	Mechanical Vacuum Pump Seal Water Coolers TSW-HX-10A & 10B	N	N

														to Outlet Header TSW(2)-1		
TSW(32)-1									Not Buried	80	111	125	125	Service Building Chiller Condenser SCH-CU-51 to Outlet Header TSW(2)-1	N	N
TSW(33)-1									Not Buried	80	111	200	125	Reactor Building Closed Cooling Water Heat Exchangers RCC-HX-1A, 1B & 1C to Outlet Header TSW(2)-1	N	N
TSW(34)-1									Not Buried	80	111	200	125	Radwaste Chiller and Service Air Compressor & Dryer Skids to Outlet Header TSW(2)-1	N	N
TSW(35)-1									Not Buried	80	111	200	125	Critical Switchgear Air Handling Units WMA-AH-53A & 53B Communication Equipment Room A.C. Unit WRA-AC-51, Instrument Shop A.C. Unit WRA-AC-52 to Outlet Header TSW(2)-1	N	N
TSW(36)-1									Not Buried	100	86	200	125	to TSW Pump Lube Water Filters to TSW Pumps and Motor Bearing Coolers	N	N
TSW(37)-1									Not Buried	100	86	200	125	to Circulating Water System	N	N

														Fill Line		
TSW(38)-1									Not Buried	100	86	125	125	to Sample Cooler	N	N
TSW(39)-1									Not Buried	80	111	125	125	Sample Cooler to Outlet Header TSW(2)-1	N	N
TSW(40)-1									Not Buried	100	86	200	110	Service Water Pump to CW Lube Water Filters	N	N
TSW(41)-1									Not Buried	55	86	200	110	CW Lube Water Filters to CW Pumps and Motor Bearing Coolers	N	N
TSW(56)-1CU									Not Buried	55	85	125	110	Discharge from TSW Lube Water Filters. From beyond Case Drain and Backwash Valves to Open Discharge	N	N
TSW(42)-1									Not Buried	100	86	200	110	Startup Lube Water for Service Water Pumps TSW-P-1A & 1B from Fire Protection System	N	N
TSW(43)-1									Not Buried	100	86	200	110	Injection Water from Service Water Pumps TSW-P-1A & 1B Discharge to Eductors at Circ. Water Pump CW-P-1A, 1B & 1C Discharge Chambers	N	N
TSW(44)-1									Not Buried	100	86	200	110	to Seal Steam Evaporator Blowdown Coolers SS-HX-1A & 1B	N	N

TSW(45)-1									Not Buried	80	110	200	110	Seal Steam Evaporators Blowdown Coolers SS-HX-1A & 1B to Outlet Header TSW(2)-1	N	N
TSW(46)-1									Not Buried	100	86	200	110	to Decontamination Solution Concentration Evaporator Blowdown Coolers AS-HX-1A & 1B	N	N
TSW(47)-1									Not Buried	80	111	200	125	from Decontamination Solution Concentration Evaporator Blowdown Coolers AS-HX-1A & 1B to Outlet Header TSW(2)-1	N	N
TSW(48)-1									Not Buried	100	86	200	110	to Off Gas Refrigeration Chiller Condensers WRE-CU-7A & 7B	N	N
TSW(49)-1									Not Buried	80	110	200	125	Off Gas Refrigeration Chiller Condensers WRE-CU-7A & 7B to Outlet Header TSW(2)-1	N	N
TSW(61)-1									Not Buried	100	86	200	110	Service Water Pump TSW-P-1A & 1B Discharge to CL-V-17	N	N
TSW(63)-1									Not Buried	100	86	200	110	TSW(17)-1 to	N	N

														Weld Cap		
TSW(64)-1									Not Buried	80	86	200	125	TSW(18)-1 to Weld Cap	N	N
3"TSW(65)-1		X				ASTM A106 Gr. B	0.216	M508-1	Required	100	86	200	125	to Main Guardhouse Air Conditioning Equipment	N	Y
3"TSW(66)-1		X				ASTM A106 Gr. B	0.216	M508-1	Required	100	86	200	125	from Main Guardhouse Air Conditioning Equipment	N	Y
TSW(67)-1									Not Buried	100	86	200	110	Air Vent on TSW-P-1A Discharge to Sump	N	N
TSW(68)-1									Not Buried	100	86	200	110	Air Vent on TSW-P-1B Discharge to Sump	N	N
12"TSW(70)-1		X				ASTM A106 Gr. B	0.375	M508-1	Required	41	86	60	110	Crossover from Standby Service Water Spray Pond "B" to Main Service Water Inlet TSW(1)-1	N	Y
TSW(71)-1									Not Buried	100	86	200	110	TSW(9)-1 to Hydrogen Dryer Cooler H2-HX-1	N	N
TSW(72)-1									Not Buried	80	111	200	125	Hydrogen Dryer Cooler H2-HX-1 to TSW(26)-1	N	N
TSW(73)-1									Not Buried	100	86	200	110	TSW Supply Drain	N	N
TSW(74)-1									Not Buried	80	111	125	125	TSW Return Drain	N	N
Fire Protection																
12"FP(1)-1 C.I.		X		Y		Cast Iron		M515-1 & M932-1	Required	125	85	175	100	Supply lines from FP-P-2A&B to 12"FP(4)-1 C.I.	N	Y
12"FP(4)-1 C.I.		X		Y		Cast Iron		M515-1 & M932-1	Required	125	85	175	100	Supplied from 12"FP(1)-1 and FP-P-110, and supplies plant	N	Y

														and buildings.		
6"FP(5)-1		X		Y		Carbon Steel		M515-1 & M932-1	Required	125	85	175	100	Hydrant lines. (many of these)	N	Y
4"FP(6)-1		X		Y		Carbon Steel		M515-1 & M932-1	Required	125	85	175	100	From 12"FP(6)-1 C.I. to FP-V-328.	N	Y
4"FP(4)-1		X		Y		Carbon Steel		M515-1 & M932-1	Required	125	85	175	100	Supply line to building 5 & 6. From 12"FP(4)-1 C.I.	N	Y
8"FP(5)-1		X		Y		Carbon Steel		M515-1 & M932-1	Required	125	85	175	100	Supply line to Building #8.	N	Y
6"FP(71)-1		X		Y		Carbon Steel		M515-1 & M932-1	Required	125	85	175	100	Supply line to Buildings #13, #47, #64, #65, & #11.	N	Y
8"FP(17)-1 C.I.		X		Y		Cast Iron		M515-1 & M932-1	Required	125	85	175	100	From 12"FP(4)-1 C.I. to FP-V-139 and FP-V-401.	N	Y
12"FP(11)-1 C.I.		X		Y		Cast Iron		M515-1 & M932-1	Required	125	85	175	100	To TG/RW/DG standpipes and sprinkler systems.	N	Y
12"FP(11)-1		X		Y		Carbon Steel		M515-1 & M932-1	Required	125	85	175	100	To TG/RW/DG standpipes and sprinkler systems.	N	Y
12"FP(12)-1 C.I.		X		Y		Cast Iron		M515-1 & M932-1	Required	125	85	175	100	To transformer sprinklers.	N	Y
12"FP(12)-1		X		Y		Carbon Steel		M515-1 & M932-1	Required	125	85	175	100	To transformer sprinklers.	N	Y
12"FP(10)-1 C.I.		X		Y		Cast Iron		M515-1 & M932-1	Required	125	85	175	100	To TG/GSB standpipes and sprikler systems.	N	Y
12"FP(10)-1		X		Y		Carbon Steel		M515-1 & M932-1	Required	125	85	175	100	To TG/GSB standpipes and sprikler systems.	N	Y
10"FP(4)-1 D.I.		X		Y		Ductile Iron		M515-1 & M932-1	Required	125	85	175	100	From FP-P-110 to 12"FP(4)-1 C.I.	N	Y
12"FP(9)-1		X		Y		Carbon Steel		M515-1 & M932-1	Required	125	85	175	100	To TG/GSB standpipes and sprikler systems.	N	Y
12"FP(9)-1 C.I.		X		Y		Cast Iron		M515-1 & M932-1	Required	125	85	175	100	To TG/GSB standpipes and sprikler systems.	N	Y

4"FP(50)-1 C.I.		X		Y		Cast Iron		M515-1 & M932-1	Required	125	85	175	100	To wet system #14, Buiding #62 (Main Guard House).	N	Y
12"FP(8)-1		X		Y		Carbon Steel		M515-1 & M932-1	Required	125	85	175	100	To GSB standpipes and sprinkler systems.	N	Y
12"FP(8)-1 C.I.		X		Y		Cast Iron		M515-1 & M932-1	Required	125	85	175	100	To GSB standpipes and sprinkler systems.	N	Y
12"FP(43)-1 C.I.		X		Y		Cast Iron		M515-1 & M932-1	Required	125	85	175	100	To TG/RW/DG standpipes and sprinkler systems.	N	Y
12"FP(43)-1		X		Y		Carbon Steel		M515-1 & M932-1	Required	125	85	175	100	To TG/RW/DG standpipes and sprinkler systems.	N	Y
8"FP(4)-1 C.I.		X		Y		Cast Iron		M515-1 & M932-1	Required	125	85	175	100	Supply line to Building #88, and HT-1N and HT-1M.	N	Y
8"FP(4)-1		X		Y		Carbon Steel		M515-1 & M932-1	Required	125	85	175	100	Supply line to Building #88, and HT-1N and HT-1M.	N	Y
4"FP(33)-1 C.I.		X		Y		Cast Iron		M515-1 & M932-1	Required	125	85	175	100	To wet system #13 for Building #30.	N	Y
12"FP(6)-1 C.I.		X		Y		Cast Iron		M515-1 & M932-1	Required	125	85	175	100	To RW standpipes and sprinkler systems.	N	Y
12"FP(13)-1 C.I.		X		Y		Cast Iron		M515-1 & M932-1	Required	125	85	175	100	To RW standpipes and sprinkler systems.	N	Y
12" FP(13)-1		X		Y		Carbon Steel		M515-1 & M932-1	Required	125	85	175	100	Supplies DG Building #7.	N	Y
8"FP(13)-1		X		Y		Carbon Steel		M515-1 & M932-1	Required	125	85	175	100	Supplies DG Building #7.	N	Y
12"FP(7)-1 C.I.		X		Y		Cast Iron		M515-1 & M932-1	Required	125	85	175	100	To TG/RW/DG standpipes and	N	Y

														sprinkler systems.		
6"FP(71)-1 D.I.		X		Y		Ductile Iron		M515-1 & M932-1	Required	125	85	175	100	Supply line to Buildings #105, #106, and HT-2W.	N	Y
4"FP(51)-1 C.I.		X		Y		Cast Iron		M515-1 & M932-1	Required	125	85	175	100	To wet system #15 and Buildings #1 and #63	N	Y
8"FP(26)-1		X		Y		Carbon Steel		M515-1 & M932-1	Required	125	85	175	100	Supply to Building #17.	N	Y
8"FP(25)-1		X		Y		Carbon Steel		M573-2	Required	125	85	175	100	Supply line to warehouse Building #80.	N	Y
8"FP(24)-1		X		Y		Carbon Steel		M573-2	Required	125	85	175	100	Supply line to warehouse Building #79.	N	Y
8"FP(23)-1		X		Y		Carbon Steel		M573-2	Required	125	85	175	100	Supply line to warehouse Building #78.	N	Y
8"FP(22)-1		X		Y		Carbon Steel		M573-2	Required	125	85	175	100	Supply line to warehouse Building #77.	N	Y
8"FP(21)-1		X		Y		Carbon Steel		M573-2	Required	125	85	175	100	Supply line to warehouse Building #76.	N	Y
10"FP(17)-1 C.I.		X		Y		Cast Iron		M573-2	Required	125	85	175	100	From 12"FP(4)-1 to many things.	N	Y
12"FP(4)-1		X		Y		Carbon Steel		M573-2	Required	125	85	175	100	Supply to HT-2Q, 2R, 2S, 2T, 2V.	N	Y
6"FP(18)-1		X		Y		Carbon Steel		M573-2	Required	125	85	175	100	Supply to HT-2P.	N	Y
6"FP(?)-1		X		Y		Carbon Steel		M573-2	Required	125	85	175	100	Supply to HT-2U.	N	Y
8"FP(91)-1		X		Y		Carbon Steel		M573-2	Required	125	85	175	100	Supply to wellhouse #2 & a blind flange M573-2 (G/5), Building #40.	N	Y
2"FP(210)-1		X		Y		Carbon Steel		M573-2	Required	125	85	175	100	From FP-TK-110 to FP-LG-110.	N	Y
12"FP(109)-1		X		Y		Carbon Steel		M573-2	Required	125	85	175	100	From PWC-TK-100 to FP-TK-	N	Y

														110		
16"FP(4)-1 D.I.		X		Y		Ductile Iron		M573-2	Required	125	85	175	100	From FP-TK-110 to FP-P-110 &112.	N	Y
6"&8"FP(Kootenai)-1		X		Y		Ductile Iron		359-01,28,1 & see Buried Piping Program FP Drawings	Required					Kootenai building (#34) FP piping loop.	N	Y
Off Gas																
6" OG(6)-2/3		X	X	Y		SA 333 Gr.B		M535-1&2 & 215-00,13927	Required	16	130	350	150	"Hold-up Line" allowing for radiological decay. From TG to TG/RW corridor.	Y	Y
14" OG(6)-2/3		X		Y		SA 333 Gr.B		M535-1&2 & 215-00,13927	Required	16	130	350	150	"Hold-up Line" allowing for radiological decay. From TG/RW corridor through Yard to RW.	Y	Y
Standby Service Water *all of these pipelines are from the M616 document																
20"SW(1)-2 UG	X	X				ASME SA-106 Gr. B	0.375	SW524-1, SW250-1.3, 4.7, 8.16, 17.20, 21.24	Required	216	32-106	309(423 ft)	150	SW A supply line to plant.	N	Y
SW(101)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(11)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(13)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(17)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(19)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(3)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(36)-2									Not Buried	216	32-106	309(423 ft)	150		N	N

SW(41)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(43)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(45)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(5)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(53)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(55)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
2"SW(56)-2	X	X		Y		ASME SA-106 Gr. B	0.218	M524-1	Required	216	32-106	309(423 ft)	150	Drain line from 18IN SW(21)-2 loop A return & 20IN SW(1)-2 loop A supply to storm sewer manhole S4.	N	Y
SW(57)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(60)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(7)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(79)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(83)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(87)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(88)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(9)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(92)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(1)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(15)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
30"SW(35)-2	X	X				ASME SA106 Gr. B	0.375	M524-1, M200-706	Required	216	32-106	309(423 ft)	150	Syphon Line between spray ponds A & B.	N	Y

SW(48)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(10)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(102)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(12)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(14)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(18)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(2)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(20)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(4)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(42)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(44)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(46)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(47)-2									Not Buried	216	32-150	309(423 ft)	150		N	N
SW(6)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(8)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(81)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(85)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(90)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(94)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(16)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
20"SW(2)-2 UG	X	X				ASME SA-106 Gr. B	0.375	M524-2	Required	216	32-106	309(423 ft)	150	Supply from SW-P-1B to SW B loop.	N	Y
2"SW(49)-2	X	X				ASME	0.218	SW-1006-1	Required	216	32-106	309(423	150	Supply to PRA-	N	Y

						SA-106 Gr. B		& 2				ft)		CC-1B.		
SW(121)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(21)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(23)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(25)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(25)-1									Not Buried	100	32-106	150(423 ft)	150		N	N
SW(27)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(28)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(29)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(31)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(33)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(37)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(39)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(50)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(54)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(58)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(63)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(64)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(65)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(80)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(84)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(89)-2									Not Buried	216	32-106	309(423 ft)	150		N	N

SW(93)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(100)-2									Not Buried	216	32-106	309(423 ft)	150	Keep fill piping. Has been deactivated!	N	N
18"SW(21)-2 UG	X	X				ASME SA-106 Gr. B	0.375	SW-296-37.46, 47.53, & 54.57	Required	216	32-106	309(423 ft)	150	Return line to Spray Pond B.	N	Y
18"SW(61)-2	X	X				ASME SA-106 Gr. B	0.375	M524-1 & SW-296-54.57	Required	216	32-106	309(423 ft)	150	CW crossover connection.	N	Y
SW(68)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(122)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(22)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(24)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(25)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(26)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(30)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(32)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(34)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(38)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(40)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(62)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(66)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(67)-2									Not Buried	216	32-150	309(423 ft)	150		N	N
SW(82)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(86)-2									Not Buried	216	32-106	309(423 ft)	150		N	N

SW(91)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(95)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
18"SW(22)-2 UG	X	X				ASME SA-106 Gr. B	0.375	M524-2, SW-295-23.32, 33.38	Required	216	32-106	309(423 ft)	150	Loop B return. Goes into Spray Pond A.	N	Y
SW(22)-1 UG									Not Buried	216	32-106	309(423 ft)	150	We don't think that this line even exists. Maybe a M616 type-o?	N	N
SW(69)-2									Not Buried	216	32-106	309(423 ft)	150		N	N
SW(53)-1									Not Buried	100	32-106	150(423 ft)	150		N	N
2"SW(56)-1	X	X				ASME SA-106 Gr. B	0.218	M524-1	Required	100	32-106	150(423 ft)	150	Drain line from 18IN SW(21)-2 loop A return & 20IN SW(1)-2 loop A supply to storm sewer manhole S4.	N	Y
SW(56)-2	X	X				ASME SA-106 Gr. B		M524-1	Required	216	32-106	309(423 ft)	150	Misc. drain lines. Many of them in the yard.	N	Y
SW(60)-1									Not Buried	100	32-106	150(423 ft)	150		N	N
8"SW(70)-1	X	X				ASME SA-106 Gr. B	0.322	M524-1 & SW-290-1.3	Required	100	32-106	150(423 ft)	150	Supply line to plant from HPCS-P-2 (SW HPCS).	N	Y
SW(72)-1									Not Buried	100	32-106	150(423 ft)	150		N	N
SW(75)-1									Not Buried	100	32-106	150(423 ft)	150		N	N
SW(77)-1									Not Buried	100	32-106	150(423 ft)	150		N	N
SW(53)-1									Not Buried	100	32-106	150(423 ft)	150		N	N
SW(56)-1									Not Buried	100	32-106	150(423 ft)	150		N	N
8"SW(71)-1	X	X				ASME SA-106	0.322	M524-1 & SW-297-	Required	100	32-106	150(423 ft)	150	HPCS SW return from	N	Y

						Gr. B		8.17						plant.		
SW(73)-1									Not Buried	100	32-106	150(423 ft)	150		N	N
SW(76)-1									Not Buried	100	32-106	150(423 ft)	150		N	N
SW(78)-1									Not Buried	100	32-106	150(423 ft)	150		N	N
Hydrogen Water Chemisty (HWC)																
2"HWC(3)-2S		X			Y	ASTM A312 TP304L	0.218	317-00,6233,1; 317-00,6236,1; 317-00,6237,1	Not Used	*	*	300	165	Bulk Oxygen Supply from HSSF to Plant (Spared in Place)	N	Y
2"HWC(1)-2S		X			Y	ASTM A312 TP304L	0.218	317-00,6238,1; 317-00,6242,1; 317-00,6241,1	Required	200	-28 to 55	300	165	Bulk Hydrogen Supply from HSSF to P100 Hydrogen Control Panel	N	Y

Columbia Generating Station
Storm Drain Pond and Groundwater Monitoring

The Storm Drain Pond (SDP) is non-lined surfaces depression that is an NPDES discharge point for Columbia Generating Station. The SDP receives water from the following:

- Yard and roof drains
- Filter backwash from the water treatment facility
- Reverse osmosis reject water from the makeup demineralizer unit
- Service Building drains
- Diesel Building drains
- Air wash drains from the Reactor and Radwaste Buildings
- Flush water from the fire protection system
- Circulating water from Main Condenser Water Boxes during an on-line tube plugging evolution
- Condensate Storage Tank Pit drains (if discharge criteria is met)
- *Initial plant design had several Turbine Building sumps that discharged to the SDP. These were rerouted to Radwaste in 1993.

There have been several instances of in which radioactivity has been inadvertently sent to the storm drain pond. These events are documented in Contamination events 92-001 and 98-001 (see attached reports). The SDP is controlled as a radiological material area and a radiological controlled area.

The water entering the SDP is monitored for flow and is sampled by a composite sampler that is analyzed on a monthly basis. CGS experiences washout of tritium from gaseous building effluents that is detected in the storm water being discharged to the SDP. These results have been reported in the AREOR since 1992 as Station 101.

CGS is located on the Hanford Nuclear Reservation. Large areas of groundwater have been contaminated due to operation of the Department of Energy (DOE) facilities. The groundwater at CGS is contaminated with tritium plumes from two separate DOE sources. The DOE has an extensive groundwater monitoring program (see attached documents). Note – Hanford well 699-13-1C is the same as CGS ODCM Station 52.

Energy Northwest has installed several wells that have been monitored for radioactivity. The CGS ODCM has three drinking water wells (Stations 31, 32 & 52) that have been monitored on a quarterly basis. These wells are all deep wells that draw water from a non-contaminated confined aquifer. Monitoring wells (MW-1, 2, 3, 4 & 5) were installed in 1995 for a landfill study. Monitoring wells (MW-6, 7, 8 & 9) were installed in 1997 for an NPDES study. Monitoring wells (MW-10, 11, 12, 13 & 14) were installed in 2008 as part of the NEI Groundwater Protection Initiative. (See attached documents.)

The groundwater in the vicinity of the SDP is influenced by the Hanford contamination plumes and CGS discharges to the SDP. The tritium levels measured in monitoring wells MW-7, 8 & 9 are lower than other nearby wells. This may be attributed to the large quantity of water discharged to the SDP. CGS discharges approximately 15 million gallons a year to the SDP. This has the effect of either diluting the contamination from the Hanford plumes or diverting the plumes around the SDP.

Attachments

1. Decommissioning Record Keeping Log – 50.75(g) file
2. Contamination Event Report 92-001
3. Contamination Event Report 98-001
4. Hanford Contamination Plumes
5. Hanford nearby well locations
6. Hanford tritium data from wells
7. CGS well locations
8. CGS tritium data from wells

ENERGY NORTHWEST
COLUMBIA GENERATING STATION
SITE-WIDE PROCEDURES

SWP-CHE-01

SWP-CHE-01

Effective Date: 03/17/09

DIC # 1308.1

PCN # (If applicable) N/A

QPR:	Larry	D.	Morrison	2322
	First	MI	Last Name	Ext. #
Sponsor:	Mot	P.	Hedges	8277
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All review and approval signatures are documented on the Procedure Revision Form

Synopsis

2.2 Added Site Conceptual model information
3.1.1 Added a requirement to reevaluate assessment of SSCs if activity is found in a clean system
3.2.3 Included new wells and information about tritium washout
3.2.8 Added section for maintenance of wells
3.2.9 Added step for decommissioning wells
3.2.5 Added requirement to compare analytical results against the ODCM requirements
3.3.6 Added step to evaluate dose impact of a spill in Annual RETS Report
3.5.2 Added new step to coordinate NEI review
3.5.3 Included criteria that may trigger a review of site hydrology
3.5.4 Added new step to evaluate the need to update the FSAR
6.11 Added new reference for Site Hydrogeologic Model
6.12 Added new reference for report on new wells
7.1 Included new wells and modified information in Attachment 7.1

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1.0 PURPOSE

This procedure implements the requirements of the Groundwater Protection Program as required by Nuclear Energy Institute (NEI) 07-07 and American Nuclear Insurance (ANI) Guideline 07-01.

2.0 DISCUSSION

2.1 Background

There have been a number of industry events that have resulted in contamination of groundwater by tritium. In at least one incident the tritium migrated off-site and was detected in a residential drinking water well. While the amount of activity released in these events has been minor and has not resulted in any adverse effects on the health and safety of the public or plant employees, it has created a negative public awareness issue that must be addressed.

The Groundwater Protection Program is a multi-faceted program which includes site characterization, assessment of potential sources, groundwater monitoring, remediation of contaminated areas, recordkeeping, and communication with regulators.

Columbia Generating Station (CGS) is unique in the commercial nuclear power industry in that it is located on the United States Department of Energy (USDOE) Hanford Site. The unconfined aquifer (groundwater) at CGS contains tritium plumes from two different USDOE sources. One of the USDOE sources, the 618-11 burial site, is adjacent to the west side (up gradient) of CGS property.

This Program is intended to ensure that CGS does not contribute to the existing groundwater contamination issue on the USDOE Hanford Site.

2.2 Site Characterization – Geohydrology

The groundwater (unconfined aquifer) at CGS is located at a depth of approximately 60-65 feet below ground level and continues to approximately 250 feet below ground level. The flow of groundwater in the unconfined aquifer is from west to east, emptying into the Columbia River. The CGS buildings are all located above the water table and do not impede the groundwater flow.

Final Safety Analysis Report (FSAR) Section 2.4.13.1 provides a detailed description of groundwater on the CGS site. This information is designated as historical, but is consistent with current information. Additional information for the entire USDOE Hanford Site is available at: http://www.hanford.gov/cp/gpp/library/gwrep07/html/gw07_nav.htm.

Because CGS is located on the USDOE Hanford Site, there are no private residences or irrigation facilities located down gradient of the plant that have the potential to use the groundwater from the unconfined aquifer. There are no drinking water wells, between CGS and the Columbia River, that draw from the unconfined aquifer. The CGS drinking water well (backup only) has a depth 695 feet and is sealed from the unconfined aquifer and draws from confined water in the basalt. The two drinking water wells at WNP-1 are 372 and 465 feet deep and also draw from the confined aquifer.

In 2008, HydroGeophysics, Inc. (HGI) completed a Site Hydrogeologic Conceptual Model for CGS. This model satisfies the requirements of NEI 07-07 and EPRI Report 1015118. Based on the recommendations of this model, five additional groundwater monitoring wells were installed in 2008.

3.0 PROCEDURE

3.1 Assessment of Potential Sources of Leaks or Spills from CGS

3.1.1 CGS systems, structures and components (SSCs) have been evaluated in accordance with the methodology in EPRI Report 1015118, Guideline for Implementing a Groundwater Protection Program at Nuclear Power Plants. The results of this evaluation have been incorporated into SWP-ENG-04. This information will be used to assist in determination for the priority for inspection of piping and components. Additionally, the assessment of SSCs should be reevaluated if activity is found in a clean system.

3.1.2 Work processes at CGS are evaluated in accordance with PPM 1.3.76, Integrated Risk Management. PPM 1.3.76 requires that all work orders be reviewed for risk. Work orders, with an activity that if performed incorrectly, could cause a release or discharge of radioactive material to the environment (e.g., soil, atmosphere, surface water, storm drains) are designated as a high risk evolution. A High Risk Plan is developed and implemented to minimize the potential risk to the environment.

3.2 Groundwater Monitoring

3.2.1 The USDOE Hanford Site has several hundred ground water monitoring wells, with several of these located on or near CGS property. An annual report of the results is published each year. This information can be found at the following website: http://hanford-site.pnl.gov/envreport/

3.2.2 The CGS Radiological Environmental Monitoring Program (REMP) has no requirements to monitor the unconfined aquifer. The REMP monitors the drinking water wells at CGS and WNP-1 on a quarterly basis.

3.2.3 CGS installed a number of groundwater monitoring wells for the unconfined aquifer in the 1990's to allow monitoring of the construction landfill and National Pollutant Discharge Elimination System (NPDES) Outfalls 002 and 003. These wells were only monitored for limited periods of time, but are still available. NPDES Outfall 002 is to an unlined Storm Dain Pond. The discharge to this outfall will routinely show positive results for tritium due to washout of tritium from building gaseous effluent releases. Additional wells have been installed to implement the requirements of the NEI Groundwater Protection Program. These wells are listed in Attachment 7.1.

3.2.4 If a new well(s) is desired, consult with a hydrologist to ensure:

- Proper location, size and depth
- Location of screens
- Wells are constructed in accordance with WAC 173-160

3.2.5 On an annual basis, provide the following information for inclusion into the (REMP):

- Wells or other locations (soil and/or vegetation from contaminated areas) to be sampled
- Frequency for sampling of each well or location
- Parameters for analysis (to be analyzed and compared to the requirements of the ODCM).

3.2.6 The results will be reviewed to determine if additional samples or analysis of additional parameters is required. Abnormal results will be documented in accordance with SWP-CAP-01.

3.2.7 The ground water sampling and analysis results will be included in the annual REMP report.

3.2.8 Groundwater wells should be monitored for problems to determine if maintenance is required. Some parameters of interest are as follows:

- Periodically measure the depth to the groundwater level to ensure that a representative sample is collected.
- Periodically measure the depth of the well to monitor for sediment buildup.
- Inspect the well casing, lid, concrete pad, and guard pipes for structural integrity.
- Excessive turbidity during sample collection may be an indication of problems.

3.2.9 If it is determined that a well is no longer required and will be decommissioned, then refer to the requirements in WAC 173-160.

3.3 Response to a Radioactive Spill or Leak to the Environment

3.3.1 Indication of a potentially radioactive leak or spill to the environment requires entry into ABN-RAD-SPILL, which will direct the initial plant response.

3.3.2 Radiation Protection will assess the personnel dose impact and radiological control requirements.

3.3.3 Spills and leaks are to be documented in accordance with SWP-CAP-01. Information to be collected concerning a spill or leak:

- Date/time (estimated start date if unknown)
- Location
- Volume of liquid leaked or spilled
- Nuclide identification, concentration or total quantity of activity leaked or spilled
- Immediate remediation activities, if applicable
- Potential for activity to reach groundwater

3.3.4 Remediation of each spill or leak must be evaluated on an individual basis to determine the appropriate method. Remediation recommendations should involve input from Radiation Protection, Chemistry and Environmental Services and consider the following:

- Potential for the activity to migrate
- Accessibility of the activity for removal
- Disposal costs
- Refer to Radiation Protection white paper "Low-Level Radioactive Material Control Program" (DIC 2604.1)
- Documentation of the remediation recommendations and activities should be contained in the corrective action for the spill

3.3.5 Refer to PPM 1.11.18 for requirements to document a spill or leak in accordance with 10 CFR 50.75(g).

3.3.6 Evaluate inclusion of the dose impact of the spill in the Annual Radiological Effluent Release Report.

3.4 Communication

3.4.1 Refer to PPM 1.10.1 for voluntary reporting requirements of a spill or leak required by NEI 07-07.

3.4.2 Energy Facility Site Evaluation Council (EFSEC) and the Washington Department of Health are the CGS state regulators having primary responsibility for oversight concerning a spill or leak of contaminated material. Personnel at these agencies should receive routine communications and updates concerning the Groundwater Protection Program.

3.5 Program Oversight

3.5.1 Periodically, at least every 5 years, a self assessment of the Groundwater Protection Program should be performed in accordance with SWP-ASU-02 against all of the requirements of NEI 07-07. The self assessment should also include an independent, knowledgeable individual.

3.5.2 Contact NEI to coordinate the NEI program review in accordance with NEI 07-07.

3.5.3 Periodically, at least every 5 years, review the site hydrology to verify that it is still valid. The following issues should be considered in determining the need to review the site hydrology:

- Substantial on-site construction
- Substantial disturbance of on-site property
- Substantial changes in the use of on-site or nearby off-site water
- Substantial changes in on-site or nearby off-site pumping rates of groundwater

3.5.4 Following completion of any site hydrology study, evaluate the need to update the hydrology information contained in the FSAR.

4.0 DOCUMENTATION

4.1 Analytical results will be documented as part of the REMP

4.2 Spills and leaks will be documented per SWP-CAP-01

4.3 Abnormal analytical results will be documented per SWP-CAP-01

5.0 DEFINITIONS

5.1 Aquifer – A geologic layer that allows water to pass through easily, with all its pores saturated with water.

5.2 Confined Aquifer – Lower layer of groundwater separated by an impermeable layer.

5.3 Groundwater - Any subsurface water, whether in the unsaturated (Vadose) zone or the saturated zone of the earth.

5.4 Licensed Material (10 CFR 20.1003) – Source material, special nuclear material, or byproduct material received, possessed, used, transferred, or disposed of under a general or specific license issued by the Commission.

5.5 Unconfined Aquifer – Upper most layer of groundwater.

5.6 Vadose Zone – The soil or rock between the ground surface and the water table. It usually contains some water, but also contains air.

5.7 Water Table – The top of the saturated zone.

6.0 REFERENCES

6.1 NEI 07-07, Industry Groundwater Protection Initiative – Final Guidance Document

6.2 EPRI Report 1015118, Guideline for Implementing a Groundwater Protection Program at Nuclear Power Plants

6.3 ANI Guideline 07-01, Potential for Unplanned Off-Site Releases of Radioactive Material

6.4 NUREG/CR-6948, Vol. 1, Integrated Ground-Water Monitoring Strategy for NRC-Licensed Facilities and Sites: Logic, Strategic Approach and Discussion

6.5 NRC Information Notice 2006-13 "Ground-Water Contamination due to Undetected Leakage of Radioactive Water"

6.6 NRC Liquid Radioactive Release Lessons Learned Task Force Final Report, September 1, 2006

6.7 SWP-ASU-02, Self Assessment and Benchmark Process

6.8 SWP-CAP-01, Corrective Action Program

6.9 SWP-ENG-04, Buried Piping Integrity Program

6.10 PPM 1.11.18, Record Keeping for Decommissioning Planning

6.11 Site Hydrogeologic Conceptual Model, HGI, June 2008

6.12 Borehole Summary Report, Freestone Environmental Services, January 2009

7.0 ATTACHMENTS

7.1 Columbia Generating Station Groundwater Monitoring Wells

COLUMBIA GENERATING STATION GROUNDWATER MONITORING WELLS

Well No.	GPS Coordinates	Comments
MW-1	N46.46897 W119.33718	Installed 1995 for Landfill monitoring
MW-2	N46.46807 W119.33723	Installed 1995 for Landfill monitoring
MW-3	N46.46735 W119.33598	Installed 1995 for Landfill monitoring
MW-4	N46.46665 W119.33580	Installed 1995 for Landfill monitoring
MW-5	N46.46738 W119.34082	Installed 1995 for Landfill monitoring
MW-6	N46.46749 W119.33118	Installed 1997 for NPDES monitoring
MW-7	N46.47387 W119.32893	Installed 1997 for NPDES monitoring
MW-8	N46.47345 W119.32957	Installed 1997 for NPDES monitoring
MW-9	N46.47379 W119.33105	Installed 1997 for NPDES monitoring
MW-10	N46.47206 W119.33575	Installed 2008 for Groundwater Protection Program
MW-11	N46.47202 W119.33241	Installed 2008 for Groundwater Protection Program
MW-12	N46.47156 W119.33194	Installed 2008 for Groundwater Protection Program
MW-13	N46.46456 W119.33112	Installed 2008 for Groundwater Protection Program
MW-14	N46.46535 W119.32637	Installed 2008 for Groundwater Protection Program

END