Met-Ed / GPU

Metropolitan Edison Company
Post Office Box 480
Middletown, Pennsylvania 17057

Writer's Direct Dial Number

February 23, 1981
LL2-81-0043

TMI Program Office
Attn: Mr. Lake Barrett, Deputy Director
U. S. Nuclear Regulatory Commission
c/o Three Mile Island Nuclear Station
Middletown, Pennsylvania 17057

Dear Sir:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operation License No. DPR-73
Docket No. 50-320
Preliminary Assessment of the Potential Source of Radionuclides
Found in the Ground of Three Mile Island

As requested at our meeting of January 16, 1981, attached is our initial evaluation of increased levels of radionuclides which have been detected in groundwater and soil on the TMI-site since the institution of the groundwater monitoring program. This report identifies potential sources of contamination on site, our preliminary conclusions based on available data, and our plans for continued investigations.

Please note that the attached report is basically a written summary of the information presented on January 16, 1981. The report was prepared prior to receipt yesterday (February 19, 1981) of the January and early February groundwater data showing substantially higher levels of Cesium 137 and Cobalt 60, at Monitoring Well #2, than in any previous results. Based on a cursory review of the new data, the conclusions in the attached report still appear valid. In particular the existence of Cobalt concentrations in the most recent data, again confirm that the Borated Water Storage Tank (BWST) is the dominant (and perhaps only) source of the detected contamination. We are examining the new data now and will report our conclusions as soon as they are available.

Sincerely,

G K Hovey

G. K. Hovey
Vice-President and
Director, TMI-2

A001
1/1

GKH:JJB:djb

cc: B. J. Snyder, Program Director-TMI Program Office

8103020525

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received TMI
2/24

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Purpose

The purpose of this report is to provide a preliminary assessment of the potential sources of radionuclides found in the ground water and soil on the Three Mile Island (TMI) site.

Scope

The assessment made in this report will consider changing plant conditions and ground data since the March 28, 1979 accident. Although this report will consider certain geological characteristics, it will not provide a geological analysis. A geological analysis will be included in a later report. This report is based on data on hand as of January 28, 1981.

Summary of Conclusions

1. The major confirmed source of radionuclides in the ground of TMI is the TMI-2 Borated Water Storage Tank (see Figure 1).

2. There are no indications of leakage from the TMI-2 Containment Building, although that possibility cannot be ruled out entirely. If there is Containment Building leakage, it is a minor contributor to the ground contamination detected to date.

3. Other minor sources of radionuclides exist, including (but not necessarily limited to) near surface effects, such as unidentified spills.

4. The levels of radioactivity found in the ground water and soil of TMI are very low. These levels pose no threat to the health and safety of the public or plant personnel.

5. The Ground Water Monitoring Program should continue at TMI, along with additional assessments as appropriate, based on new data acquired.

Sources of Data

Data used for the purposes of this report were taken from the following sources:

1. Ground Water Monitoring Program

The chronology of the Ground Water Monitoring is shown in Figure 2.

In March and April of 1980, ground water monitoring wells (MW) were installed to provide an early warning system in case of a leak in the TMI Unit Containment Building. After tritium was found in MW No. 2, additional wells, observation wells (OW), were installed in May, 1980 to help assess the tritium condition. Data from all MWs and OWs have been sampled either weekly or bi-weekly, providing a large data base. In early September, 1980, pump tests on MW-2 drew approximately 55,000 gallons of ground water. This extended pump test on MW-2 is believed to have increased the ground water flow to the wells in the area.

2. Isotopic Analysis of In-Plant Water Volumes

Review of the isotopic analysis of water in the Containment Building Sump, the BWST and Auxiliary Building has indicated that activation products, e.g. Co-58 and Co-60, are present in the BWST at elevated levels relative to the very low concentrations of these activation products in the Containment Building and Auxiliary Building.

3. Soil Samples Taken as Part of the Ground Water Monitoring Program, Decontamination Work and Environmental Control

Isotopic analysis of soil samples taken during drilling MWs and OWs, decontamination of the ground at the Unit 2 BWST, and environmental monitoring on TMI have provided information on the location of radionuclides as well as limited data on isotope concentrations as a function of depth in the ground.

4. History of Unit 2 Operations and Conditions

Information on the geological condition of TMI, Unit 2 plant design, history of radioactive water transfers, history of radioactive releases, and conditions in the plant at various times following the accident (e.g., flooded condition in the Unit 2 Containment and Auxiliary Buildings) have been used to assess potential leakage paths.

Potential Sources of Radionuclides in the Ground at TMI

The following are considered to be possible sources of radionuclides in the ground at TMI:

1. Radioactive Fallout or Other Non-TMI Sources
2. Unit 1 - leakage and airborne releases during plant operations over the years.
3. Unit 2 - the following sources from Unit 2 were considered:

   a) Borated Water Storage Tank (BWST) - The BWST has contained radioactive water since immediately after the March 28, 1979 accident. Leakage to the ground from pumps, valves and piping at the BWST has been identified repeatedly since the accident.

b) Auxiliary Building - The March 28, 1979 accident resulted in the contamination of this building. The recent discovery of a contaminated seam between the Auxiliary Building and Control and Service Building has prompted detailed investigations in this area (see references 3, 4 and 5).

c) Containment Building - The Containment Building is flooded to about the 290' elevation with approximately 600,000 gallons of radioactive water.

d) Local Effects - Local spills of radioactive water of contamination at doors could contribute to the presence of radionuclides in the ground.

e) Airborne releases during and immediately after the March 28, 1979 accident and during the Containment Building Purge in the summer of 1980.

f) EPICOR I - This low level radwaste processing system has processed radioactive water from Units 1 and 2. Leakage from this system could contribute to radioactivity in the ground.

g) EPICOR II - This radwaste system was used to process the contaminated water from the Auxiliary Building. Leakage from this system could contribute to radioactivity in the ground.

Trend Identification

1. Soil sample data and ground water monitoring data, Appendix A, suggest more than one source of radioactivity. Data from the Ground Water Monitoring Program, Appendix A, indicates that tritium, H-3 levels around Unit 2 are generally higher than background. The H-3 spikes (distinct increases above normal measured levels) shown during September, 1980, are not thought to be plant related since they show up in all wells including MW-1 located north of Unit 1. Radioactive fallout over the entire region during a given period is a possible cause of these spikes. Also, there may be a correlation between these spikes and changes in the water table or changes in releases from some upstream source.

2. Higher levels of H-3 in the unsaturated soil region at the BWST and also at OWs 138 and 14 on the west side of the plant indicate a source proximate to these two areas.

3. To date, H-3 levels on the east side of the plant near the BWST have indicated a gradually increasing trend (see Appendix A). Other areas have relatively constant H-3 levels. This increasing trend is attributed to a number of possible causes:

a) Leakage of tritiated water from the piping system at the BWST to the ground has been identified. This leakage has not been constant. We may be seeing a period of time when BWST leakage increased. Also, excavation around the BWST area in September, 1980 could have provided a short circuit path to the wells for the tritiated water.

b) Extended MW-2 pump tests during early September, 1980 could have drawn tritiated water to the wells.

3. Cesium, Cs-134, Cs-137, Co-58, Co-60 have been detected on the east side of the plant near the BWST (see References 7, 8 and 9).

Assessment of Potential Sources of Radionuclides Found in the Ground at TMI

1. Radioactive Fallout or Other Non TMI Sources - Ground water monitoring data for September, 1980, Appendix A, indicates soikes in tritium levels in all wells including the control well (MW-1).* Also all wells show some background H-3. This data suggests an overall source to TMI independent of Units 1 and 2. Radioactive fallout could be this overall source. Also, there may be some correlation with ground water levels and/or some source upstream of TMI.

2. Unit 1 - Generally the ground water monitoring data, Appendix A, reveals H-3 levels above background* in all the wells near Unit 2 (see Figure 1). Although there is no proof that these tritium levels originate from Unit 1, it is conceivable that small amounts of leakage and/or airborne releases over the years of Unit 1 operation could have contributed to these levels. This is possible because the island has a hydrological gradient of ground water flow from north to south.

3. Unit 2 - There are several potential sources of radionuclides from Unit 2.

   a) Borated Water Storage Tank (BWST) - the chronology of operations and activities with regard to the BWST is provided in Figure 2.

   On March 30, 1979, the BWST was filled with water from the Unit 1 Spent Fuel Pool. This water contained Co-58 and Co-60 in the range of 10^{-5} to 10^{-4} u Ci/ml. Cs-134 and Cs-137 were also present in the range of 10^{-4} to 10^{-3} u Ci/ml. The H-3 concentration was in the 1×10^{-2} u Ci/ml range.

   Since the accident there have been recurring instances of leakage of BWST water from pumps, valves, and piping at the BWST (see Figure 2).

   * Data from MWs 1 & 15 are taken as background because they are far from the power block. MW-1 is north of Unit 1 and MW-15 is at the south end of TMI.

Although in each case action was taken to capture the leakage and fix the leaks, it is apparent that this was a persistent problem which resulted in deposition of radionuclides into the surrounding soil. Soil samples, Reference 7, taken as part of decontamination done in December, 1979, revealed Co-58, Co-60, Cs-134, and Cs-137 near the ground surface at the BWST.

Between March 29 and April 12, 1980, 332,000 gallons of water were transferred from the BWST to Unit 1. Between April 19 and June 24, 1980, approximately 330,000 gallons of processed water from EPICOR II were transferred to the BWST mixing with 130,000 gallons remaining in the BWST. This mixed water contained: Co-58 and Co-60 at $\sim 1.5 \times 10^{-5}$ u Ci/ml, Cs-134 at $\sim 1.6 \times 10^{-4}$ u Ci/ml, Cs-137 at $\sim 3.6 \times 10^{-4}$ u Ci/ml and H-3 at $\sim 1 \times 10^{-1}$ u Ci/ml.

Soil samples taken at the surface around the BWST in the spring of 1980, References 8 and 9, revealed the presence of Co-58, Co-60, Cs-134 and Cs-137.

In Septemeber, 1980 the area around the BWST was excavated as part of the construction work associated with enclosing the area around the BWST. Soil samples taken in this area aslo revealed the presence of Co-58, Co-60, Cs-134, and Cs-137 (no correlaction of isotope concentration with depth was obtained).

When the data from the above chronology is assessed with the data received from the MWs and OWs near the BWST, it becomes evident that the BWST is a major source of radionuclides in the ground on the east side of Unit 2.

1) Analysis of the BWST water revealed the presence of H-3. H-3 has consistently been found in the ground water monitoring wells and well soil samples near the BWST in concentrations generally higher than in other areas near the plant. This supports the conclusion that the history of leakage from the BWST has contributed to H-3 in the ground water of the adjacent area. Also, the ground water monitoring data shows a correlation of tritium concentration with distance from the BWST, i.e., the closer to the BWST the higher the tritium concentrations (Figure 3).

2) Cs-134 and Cs-137 has been recently detected in MW-2 (see Appendix A). Also, as indicated in the above chronology, Cs-134 and Cs-137 have been found in near surface soil samples. Co-58 and Co-60 have also been found in these soil samples. The presence of Cs and Co in the soil is consistent with the conclusion that leakage from the BWST is the major source of radionuclides in the adjacent area. The fact the Co has not consistently been found in the ground water samples is explained by the general insolubility of Co. It appears that the Co tends to plate out in the soil and therefore has not reached the ground water level.

b) Auxiliary Building - The investigations into the contaminated building seams,(References 3, 4 and 5) have revealed that contamination of the Auxiliary Building as a result of the accident and subsequent decontamination work were the cause of the contaminated seams. Reference 5 indicates that the sampling program performed as part of the investigation showed that the plant water stops have prevented contamination from migrating laterally to the environment. There is no conclusive proof, however, that the water stop which would prevent migration in the vertical direction downward is holding. Therefore, the Auxiliary Building cannot be ruled out as a possible source of radioactive isotopes in the ground water. Current data, however, suggests that leakage from the contaminated seams would be minimal if not non-existent:

1) For leakage to occur from the bottom of the foundation, the lower horizontal water stop would have to be broken. Although this is possible, any crack or break would probably not allow free flow of water.

2) The ground water elevation at TMI ranges from about 285' in the spring, to about 279' in the fall. The level of seam contamination is at the 280'-6" level. From that elevation outleakage can occur only when the ground water level falls below the 280'-6" elevation. Therefore, with this small (maximum of 1'-6") and variable hydraulic driving head, any flow would be expected to be small and intermittent. Rainwater leaking past flashing between buildings could soak the seam. This soaking could increase the driving head for leakage from the Auxiliary Building. However, this would require heavy rainfall and the flow caused by the rain would be short term. If continous heavy rains persisted, the increased tendency for leakage out of the building would be offset to a degree by an increase in the ground water level.

c) Containment Building - The Containment Building is flooded with approximately 600,000 gallons of contaminated water (see Reference 2 for water analysis) up to about the 290' elevation. Therefore, the containment must be treated as a potential source of radioactivity in the ground at TMI. As indicated previously, the Ground Water Monitoring Program was initiated as a early warning system for Containment Building leakage. Data from the Ground Water Monitoring Program and other sources indicates that the Containment Building does not have a prominent leak:

1) Although H-3 and Cs have been found in the ground, there is no correlation of concentration of these isotopes with distance from the Containment Building. (Figure 3)

2) There is a continuing generally good correlation between the quantity of water in the Containment Building (as estimated by building water level) and the in-leakage to that body of water from the Reactor Coolant System (RCS) (as measured by RCS makeup). In other words, there is no indication of significant loss of inventory from the Containment Building

3) The location and distribution of radionuclides found do not support a conclusion that the Containment Building has a prominent leak. Specifically, there seems to be no correlation between measured concentrations of H-3 in the ground water and soil with soil depth or specific area to support a conclusion that the Building is leaking.

Because of the amount of contaminated water in the Containment Building, and its activity, the Containment Building must continue to be considered a potential source. The water level of 290' inside the Containment Building is 5' above the high ground water level. This means that leakage would go out of Containment if a path existed. Although the Containment Building sets on bedrock, fractures in the rock could allow migration of contaminated water.

d) Local Effects - Relatively higher levels of H-3 have been found in the unsaturated (above ground water level) zone on the west side of Unit 2 by OW-13B and OW-14. This suggests a local, near surface source. The H-3 levels found deeper in the unsaturated zone and below the ground water level could be explained by tritiated water percolating down from the surface, although tritiated water moving horizontally with the ground water cannot be discounted for the H-3 found below the ground water level. No specific local source can be identified at this time.

e) Airborne Releases - One hypothesis considered is that H-3 in the water vapor released as part of the discharges from Unit 2 immediately after the accident, and during the Containment Building Purge in the summer of1980, condensed and fell in the vicinity of Unit 2. This would explain the general above background levels of H-3 near Unit 2. Although this is possible for the releases right after the accident, it does not appear probable for the Containment Building Purge because H-3 levels higher than background were measured before the Containment Building Purge. The airborne sources are not considered major sources since the general above background tritium levels are close to background, within 400 pci per liter, i.e., the higher levels of H-3 are found in localized areas which is not characteristic of airborne releases which tend to disperse over general areas.

f) EPICOR I - Near surface soil samples near the low level waste processing system, EPICOR I, revealed Cs-137 and Cs-134 in the 10^4 pCi/Kg range. Although these findings make EPICOR I a potential source of radioactivity in the ground water there is no data to prove that the radionuclides being revealed as part of the Ground Water Monitoring Program originate from EPICOR I.

g) <u>EPICOR II</u> - This radwaste processing system is on the east side of Unit 2 in the area of the BWST. At this point, EPICOR II is not suspected as a source of radionuclides in the ground because the levels of tritium found in the proximate MWs and OWs are generally lower than those in other locations further form the EPICOR II system.

<u>Conclusions</u>:

1. The major confirmed source of radionuclides found in the ground of TMI is the BWST on the east side of Unit 2.

2. There are no indications of leakage from the TMI-2 Containment Building, although that possibility cannot be ruled out entirely. If there is Containment Building leakage, it is a minor contributor to the ground contamination detected to date.

3. Other minor sources of radionuclides exist, including (but not necessarily limited to) near surface effects, such as unidentified spills.

4. The following are potential sources of radionuclides in the ground at TMI. These potential sources cannot currently be substantiated as contributing to the radioactivity in the ground at TMI:

   a) Radioactive fallout or other non-TMI sources
   b) Unit 1
   c) Unit 2

      1) Auxiliary Building
      2) Containment Building
      3) Airborne Releases
      4) EPICOR I
      5) EPICOR II

5. The levels or radioactivity found in the ground water and soil of TMI are very low. These levels pose no threat to the health and safety of the public or plant personnel.

5. The Ground Water Monitoring Program should continue at TMI along with additional assessments as appropriate based on new data acquired.

References

1. GPU Letter No. WER-778, W. E. Riethle to Carlyle Westland, dated Decembnr 24, 1980.

*2. Oak Ridge National Laboratory Letter Wilbur D. Shults to J. A. Daniel, GPU, dated September 14, 1979.

3. GPU Letter No. TLL-657, G. K. Hovey to L. Barrett, U.S., NRC, dated December 15, 1980.

4. GPU Letter No. TLL-678, G. K. Hovey to L. Barrett, U.S., NRC, dated December 19, 1980.

5. GPU Letter No. LL2-81-0014, G. K. Hovey to L. Barrett, U.S. NRC, dated January 19, 1981.

6. GPU Letter No. WER-637, W. E. Riethle to Carlyle Westland dated October 28, 1980.

*7. GPU Internal Memo No. TMI-II-R-6294, T. R. Block to B. Elam dated February 6, 1980.

*8. Porter - Gertz Consultants Inc. Memo No. TMI-II-R-14062 RC6.11, C. E. Smedley to Bill Potts, GPU, dated June 2, 1980.

*9. Porter - Gertz Consultants Inc. Memo No. TMI-II-R-14063 RC6.11, S. W. Porter Jr. to B. Potts, D. Heward, W. Riethle, GPU, Received by GPU June 9, 1980.

*References with limited distribution attached for information.

REF. 2

OAK RIDGE NATIONAL LABORATORY

OPERATED BY

UNION CARBIDE CORPORATION

NUCLEAR DIVISION

POST OFFICE BOX X

OAK RIDGE, TENNESSEE 37830

September 14, 1979

Mr. J. A. Daniel
GPU Service Corporation
260 Cherry Hill Road
Parsippany, NJ 67054

Dear Mr. Daniel:

The attached Tables 1-7 present analytical results on three samples of TMI containment water, as per your request of August 22, 1979, to R. E. Brooksbank. "Top", "Middle" and "Bottom" correspond to your numbers 1, 2 and 3. Tables 1-4 pertain to the solutions themselves; Tables 5-7 pertain to solid material recovered from the "Bottom" sample.

Table 8 presents results obtained when the section of steel plate (taken from the containment vessel) was examined for contamination.

Table 9 presents results obtained upon examination of air filter sample number 17711.

These tables comprise a complete set of firm analytical results for the samples that you submitted.

Sincerely yours,

Wilbur D. Shults
Director
Analytical Chemistry Division

WDS:sjw

cc: B. C. Rusche (Met Ed/TMI)
R. E. Brooksbank
D. O. Campbell
J. A. Carter
L. T. Corbin
J. F. Emery
W. R. Laing
J. R. Stokely
A. Zucker

Attachment

Table 1. Solution characteristics

	Top	Middle	Bottom
Color	Light yellow	Light yellow	Greenish with precipitate
Visible organic	None	None	None
Radiation level, side (mR/hr)	580	500	530
Radiation level, bottom (mR/hr)	740	780	800
Precipitate	None	None	Yes[a]
Volume (ml)	30	30	30
Dissolved organic carbon	22 ± 2 µg/ml		

[a]Flocculent in appearance, gelatinous, dirty green color, 10% by volume, centrifuged to 4% by volume.

Table 2. Radiochemical analyses of three solutions
(μCi/ml at 0800, 8/28/79)

Isotope	Top	Middle	Bottom
^{137}Cs	176	179	174
^{134}Cs	40	40	39.6
^{140}La	0.09	0.078	0.14
$^{89+90}Sr$	46.3	43.5	44.9
^{3}H	1.03	1.05	1.01
^{129}I	0.079[a]	0.080[a]	0.076[a]
^{131}I	0.012	0.012	0.013
^{90}Sr	2.70	2.90	2.83
Activity in scavenging precipitation with $Pr(OH)_3$			
^{95}Zr	—	0.0030	0.0025
^{95}Nb	0.0021	0.0030	0.0099
^{103}Ru	0.005	0.0050	0.0071
^{106}Ru	0.0039	0.0072	0.0099
^{113}Sn*	—	—	0.0016
^{125}Sb	0.012	0.015	0.017
^{129}Te	—	—	0.035
^{134}Cs	0.0066	0.0059	0.0042
^{137}Cs	0.029	0.028	0.0175
^{141}Ce	—	0.00047	0.0019
^{144}Ce	—	0.0046	0.0030
^{140}La	0.036	0.028	0.052
^{140}Ba	—	0.0038	—
Gross α	3.4 ± 1.6[b]	1.2 ± 1.3[b]	5.4 ± 2[b]

[a]Units are μg/ml.

[b]Units are dpm/ml.

*Tentative identification.

Table 3. Spark source mass analysis of three solutions (ppm)

Element	Top	Middle	Bottom
Ag	<0.5	<0.2	<0.3
Al	3	3	3
As	<0.2	<0.05	<0.1
B	1950	2200	1500
Cl	10	15	8
Ca	10	10	8
Cd	<0.2	<0.2	<0.2
Co	<0.1	<0.1	<0.1
Cr	0.7	0.7	0.7
Cs	0.6[a]	0.7[a]	0.7[a]
Cu	≤0.2	≤0.2	10
Fe	0.58	1.1	1.8
I	<0.5	<0.5	<0.5
In	<0.1	<0.1	<0.1
K	4	4	4
Li	1.61[b]	1.55[b]	1.44[b]
Mg	≤3	≤2	≤1
Mn	≤0.1	≤0.05	≤0.1
Mo	≤0.5[c]	≤0.5[c]	1[c]
Na	1080	1200	1200
Ni	≤0.2	≤0.2	3
P	0.3	0.3	0.2
Rb	0.3	0.3	0.3
S	9	8	7
Sr	≤0.1	≤0.1	≤0.1
Te	<0.2	<0.5	<0.4
Ti	≤2	≤1	≤1
V	≤0.2	≤0.1	≤0.1
Y	≤0.4	≤0.1	≤0.1
Zn	0.5	0.5	0.4

[a] Fission product Cs.

[b] >99% ^{7}Li

[c] Stable Mo, not fission product.

WELL LOCATIONS

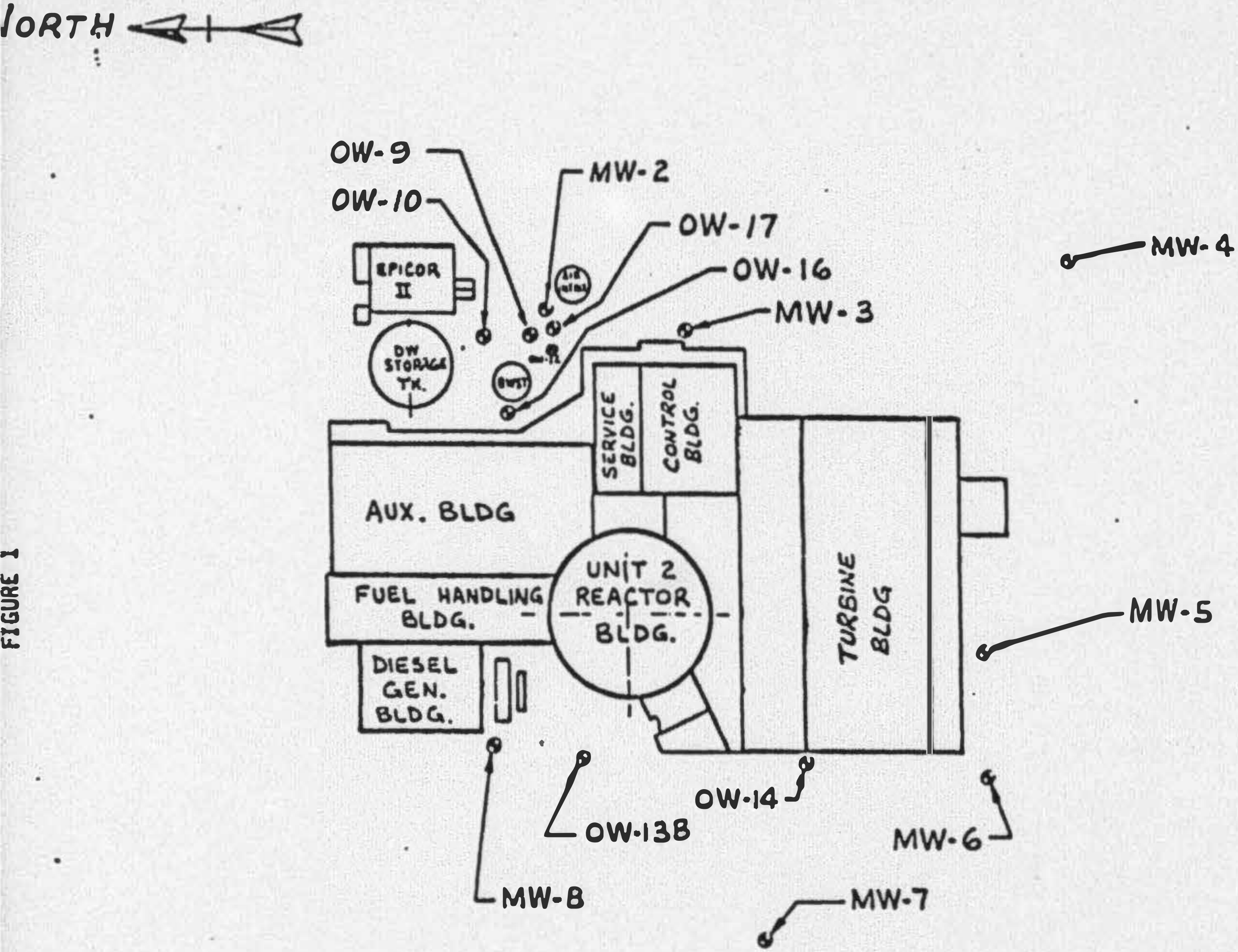


FIGURE 1

COMMENTS:

1. MW-1 LOCATED IN NORTH PARKING LOT @ COORDINATES N 301,460.04 E 2,286,538.94

2. OW-15 LOCATED ON SOUTH END OF ISLAND @ COORDINATES N 292,965.44 E 2,287,765.09

Table 4. Solution isotopic analysis

Sample	Top	Middle	Bottom
U, ppb	7	13	28
234, %	0.021	0.014	0.021
235, %	1.98	1.34	2.04
236, %	0.058	0.036	0.066
Pu, ppb	0.010	0.011	0.033
239, %	89.1	89.4	89.8
240, %	8.5	8.4	8.1
241, %	2.3	2.1	2.0
242, %	—	—	Assume 0.1

Table 5. Solids from bottom sample (μCi/ml at 0800, 8/28/79, based on total volume of bottom sample)

Isotope	Sample 1[a]	Sample 2[a]
^{58}Co	0.0055	0.0079
^{60}Co	0.0011	0.0015
^{95}Zr	0.037	0.061
^{95}Nb	0.104	0.162
^{103}Ru	0.042	0.078
^{106}Ru	0.035	0.051
^{110m}Ag	0.0015	0.0025
^{113}Sn*	0.015	0.021
^{125}Sb	0.022	0.033
^{129m}Te	0.277	0.514
^{131}I	0.0108	0.016
^{134}Cs	0.018	0.031
^{137}Cs	0.078	0.049
^{140}Ba	0.041	0.047
^{140}La	0.106	0.122
^{141}Ce	0.0034	0.0097
^{144}Ce	0.0134	0.0446
$^{89+90}Sr$	2.78	

[a] Two samples were taken at different times; they were centrifuged, washed, and γ-scanned.

*Tentative identification.

Table 6. Solids from bottom sample, neutron activation analysis (units are µg/ml, based on total volume of bottom sample)

^{235}U	0.00459
In	0.16
^{129}I	0.07
Cu	54
Mn	0.62
Al	7
Ca	≤2

Table 7. Spark source mass analysis of solids from bottom sample (ppm) based on total volume of bottom sample

Ag	8*	Li	<0.3
Al	8	Mg	7
B	3	Mn	1
Ca	2	Mo	≤1[b]
Cd	<0.5	Na	<1
Co	<0.1	Ni	10
Cr	2	P	0.4
Cs	<0.5	Rb	<0.3
Cu	54[a]	S	5
Fe	10	Sr	<0.2
I	0.7	Te	<0.2
In	0.3	Ti	0.5
K	1	Zn	2
U[c]	0.106	Pu[c]	0.00016
^{234}U	0.022 AT %	^{238}Pu	<0.1 AT %
^{235}U	2.35 AT %	^{239}Pu	91.13 AT %
^{236}U	0.065 AT %	^{240}Pu	7.57 AT %
^{238}U	97.56 AT %	^{241}Pu	1.10 AT %
		^{242}Pu	0.1 assumed

* May be some memory.

[a]Internal standard from NAA.

[b]Stable Mo; not fission product.

[c]Thermal emission mass resin bead analysis.

Table 8. Painted steel plug (μCi total at 0800, 8/29/79)

Isotope	μCi
^{58}Co	0.032
^{60}Co	0.01
^{95}Zr	0.09
^{95}Nb	1.7
^{103}Ru	0.58
^{106}Ru	0.42
^{110m}Ag	0.080
^{113}Sn	0.24
^{124}Sb	0.005
^{125}Sb	0.45
^{127m}Te	7.8
^{129m}Te	23.6
^{125m}Te	0.5
^{131}I	0.33
^{134}Cs	0.47
^{137}Cs	2.07
^{140}Ba	—
^{140}La	0.019
^{141}Ce	0.057
^{144}Ce	0.24

REF. 7

METROPOLITAN EDISON COMPANY Subsidiary of General Public Utilities Corporation

Subject: Soil Results from the BWST

Location: TMI-U-2 Site Ops
TMI-II-R-[illegible]

Date: February 6, 19[illegible]

To: Branch Elam

Attached are the results of the Soil Samples taken from the Unit II BWST. Please note that the last three samples--(27001, 27002, 27003)--were taken outside the marked off contamination area, and consequently showed that the ground was contamination free.

If you have any questions regarding the samples or areas in which the samples were taken please contact me.

T.R. Block
T. R. Block

TRB/jep

CC: J. J. Barton
P. J. Arthur

INTER-OFFICE MEMORANDUM

GAMMA ANALYSIS SUMMARY SHEET

ME No. 1 ____ No. 2 ____ BRW ____ SAI ____ WP ✓ NRC ____ Other ____

Title *Unit 2 RWST Soil Sample* Sample No. *22573*

Time/Date Sample *23 JAN 80 2320* Time/Date Analysis *24 JAN 80 [illegible]*

Geometry *250 ml plastic* Counting Time *2500*

Volume *346.426 gm* Analyst *[illegible]*

Air ____ (1) Liquid ____ (2) Other *D1341*

1. Report MDA's for I-131 on charcoal cartridges and for Cs-134, Cs-137, Co-58 and Co-60 on particulate filters for those isotopes which are not detected in sample.

2. Report MDA's for I-131, Cs-134, Cs-137, Co-58 and Co-60 for those isotopes which are not detected in sample.

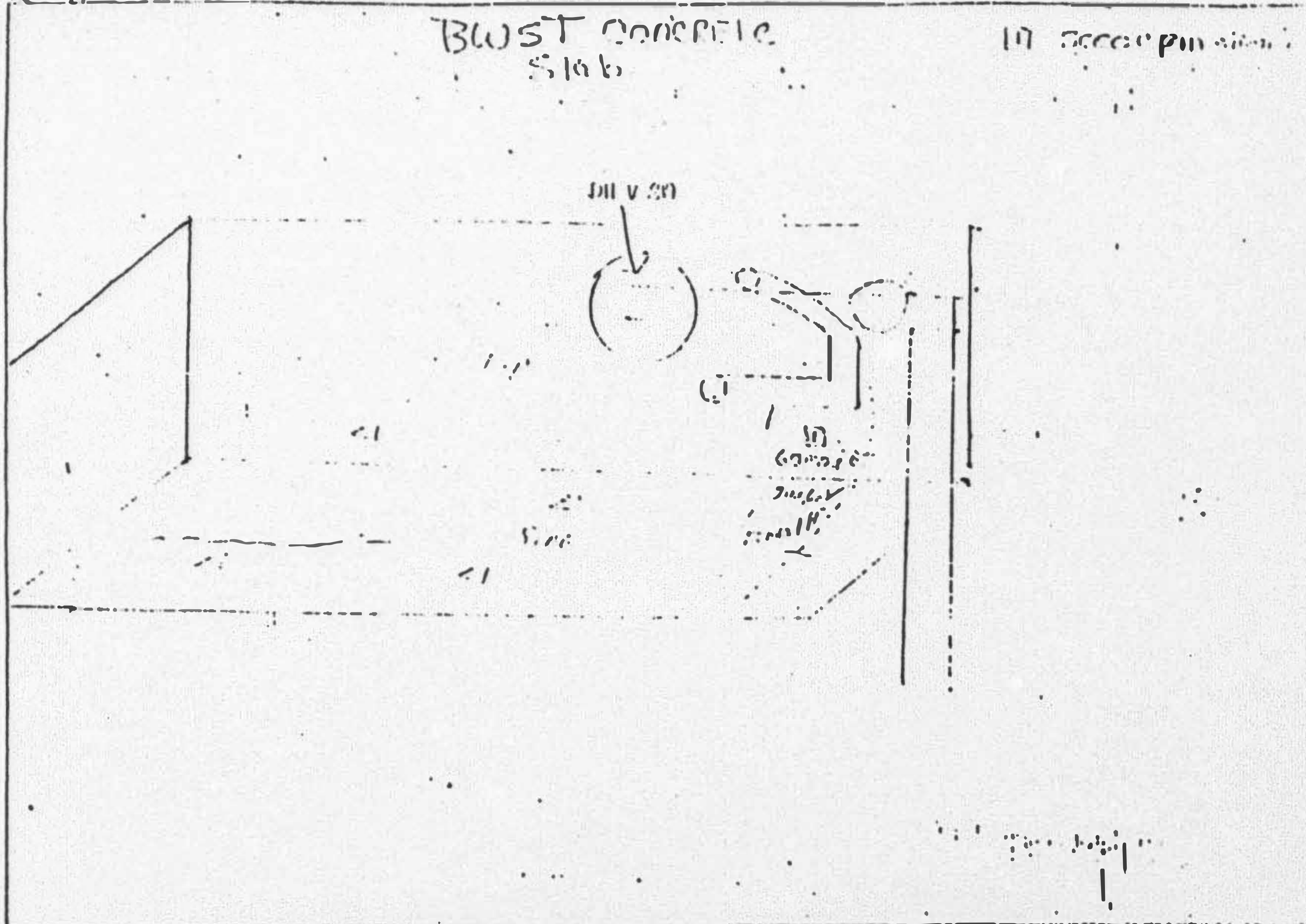
Isotope	Concentration	LLD	Uncertainty
I-131		<2.94E-07	
Cs-134	9.04 E-6		± 25 %
Cs-137	1.64E-5		± 25 %
Co-58	4.32 E-6		± 25 %
Co-60	8.49E-7		± 27 %
Mn-54	7.14 E-7		± 27 %
		Releasable per J. Daniel	
Cs-134	3.6 E-8 uci/gm	5.2 E-6 uci/gm	
Cs-137	6.6 E-8 uci/gm	2.2 E-3 uci/gm	
Co-58	1.7 E-8 uci/gm	9.4 E-6 uci/gm	
Co-60	3.4 E-7 uci/gm	4.5 E-6 uci/gm	
	13		

3' down.

TML 119 7-79

SPECIAL SURVEY FORM

← 11



Beta Gamma Readings in Mr/hr.

(B) = Background

Date: 1/22/80
Technician

26371
12/15 001.

GAMMA ANALYSIS SUMMARY SHEET

ME No. 1 ____ No. 2 ____ B&W ____ SAI ____ RMC ____ NRC ____ Other ____

Title UNIT NO 2 RUST DIRT Sample No. 26371

Time/Date Sample 1 Dec 79 @ 1530 Time/Date Analysis 30 Dec 1524

Geometry 250 ml Counting Time 4500 sec.

Volume Calculated from Total Act Analyst CKood

Air ________ (1) Liquid ________ (2) Other ________

1. Report MDA's for I-131 on charcoal cartridges and for Cs-134, Cs-137, Co-58 and Co-60 on particulate filters for those isotopes which are not detected in sample.

2. Report MDA's for I-131, Cs-134, Cs-137, Co-58 and Co-60 for those isotopes which are not detected in sample.

Isotope	Concentration	LLD	Uncertainty
I 131		<2.7 E-7	
Cs 134	9.74 E-7		± 28 %
Cs 137	2.19 E-6		± 26 %
Co 58	9.69 E-7		± 28 %
Co 60		<2.22 E-7	

TMI-119 7-79

.3.60 SAMPLE

27001

12/9 - 1800

GAMMA ANALYSIS SUMMARY SHEET

ME No. 1 ____ No. 2 ____ B&W ____ SAI ____ RMC ✓ NRC ____ Other ____

Title BWST AREA Soil Sample Sample No: 27001

Time/Date Sample 9DEC79 @ Time/Date Analysis 9DEC79 @ 1553

Geometry 250ml PLASTIC Counting Time 2500sec

Volume 231grams Analyst [illegible]

Air ____ (1) Liquid ____ (2) Other D 3971

1. Report MDA's for I-131 on charcoal cartridges and for Cs-134, Cs-137, Co-58 and Co-60 on particulate filters for those isotopes which are not detected in sample.

2. Report MDA's for I-131, Cs-134, Cs-137, Co-58 and Co-60 for those isotopes which are not detected in sample.

Isotope	Concentration	LLD	Uncertainty
I 131		< 2.6 E-7	
Cs 134	1.064 E-6		± 28%
Cs 137	2.520 E-6		± 25%
Co 58	1.313 E-6		± 26%
Co 60	1.703 E-7		± 40%

TMI-119 7-79

2100:
12/10 06

GAMMA ANALYSIS SUMMARY SHEET

ME No. 1 ____ No. 2 ____ B&W ____ SAI ____ RMC ✓ NRC ____ Other ____

Title *BUST SOIL SAMPLE #3* Sample No. *27022*

Time/Date Sample *9 DEC 79 0915* Time/Date Analysis *9 DEC 79 2343*

Geometry *250 ml plastic* Counting Time *2500*

Volume *212.73 grams* Analyst *R.F. [illegible]*

Air ____________ (1) Liquid ____________ (2) Other *S D3992*

1. Report MDA's for I-131 on charcoal cartridges and for Cs-134, Cs-137, Co-58 and Co-60 on particulate filters for those isotopes which are not detected in sample.

2. Report MDA's for I-131, Cs-134, Cs-137, Co-58 and Co-60 for those isotopes which are not detected in sample.

Isotope	Concentration	LLD	Uncertainty
I-131		<4.73E 07	
Cs-134	2.45 E-7		±25
Cs-137	3.29 E-7		±25
Co-58	1.31 E-5		±25
Co-60	2.02 E-6		±25
Mn-54	1.57 E-7		±26

TMI-119 7-79

12/10 O/C

GAMMA ANALYSIS SUMMARY SHEET

ME No. 1 ___ No. 2 ___ B&W ___ SAI ___ RMC ✓ NRC ___ Other ___

Title BLUST SOIL SAMPLE # 2 Sample No. 17663

Time/Date Sample 9DEC79 @0915 Time/Date Analysis 9DEC79 @ 1251

Geometry 250 ml PLASTIC Counting Time 2500 sec

Volume 173.45 g Analyst S-[illegible]

Air ___ (1) Liquid [illegible] (2) Other D3991

1. Report MDA's for I-131 on charcoal cartridges and for Cs-134, Cs-137, Co-58 and Co-60 on particulate filters for those isotopes which are not detected in sample.

2. Report MDA's for I-131, Cs-134, Cs-137, Co-58 and Co-60 for those isotopes which are not detected in sample.

Isotope	Concentration	LLD	Uncertainty
I^{131}		< 4.41 E-7	
Cs^{134}	5.15 E-6		± 25%
Cs^{137}	9.62 E-6		± 25%
Co^{58}	6.31 E-6		± 25%
Co^{60}	8.82 E-7		± 28%
Mn^{54}	3.77 E-7		± 35%

Porter-Gertz Consultants, Inc.
76 RITTENHOUSE PLACE
ARDMORE, PA. 19003
215-896-5353

REF. 8

TMI-II-B-14062
RC6.11

June 2, 1980

TO: Bill Potts

FROM: Charles E. Smedley

SUBJECT: Soil Samples for Determining Origin of Ag-110m Found by the State of Maryland near the East Dike

Soil Samples have been taken around the BWST, Cap Gun I, and the Demineralized Water Storage Tank near Epicor II, and analyzed for the isotopes shown in the table below.

So far, Ag-110m has not been found in any of these soil samples.

		pCi/kg					
Sample #	Location	Ag-110m	Cs-134	Cs-137	Co-58	Co-60	Mn-54
39877	South side, Cap-Gun I	<40	- 1,534	85,[illegible]	<36	<56	
39879	South side, Cap-Gun I	<165	12,174	38,2[illegible]	432	3,522	287
40413	East Dike	<33	<28	[illegible]5.	<18	<27.	
39872	Southeast of BWST, U-II	<51	<50	<[illegible]	<30	<39	
39873	South of BWST, Unit-II	<115	17,250	36,[illegible]	1,300	410	
39874	Southeast of BWST, U-II	<392	22,222	47,[illegible]	3,790	2,614	
39875	West of BWST, U-II	<460	7,667	16,667	[illegible],867	1,200	
39876	Corner of DWST near Epicor II	<54	86	340	<	<	
		To be counted week of June 2, 1980					
39878	South side of Cap-Gun I	<84	4,200	26,000	<60	535	

Charles E. Smedley

CES/sa
cc: S. Porter
D. Dubiel

Porter-Gertz Consultants, Inc.
[illegible] PLACE
[illegible], PA 19003
[illegible]

REF 9

TMI-II-R-14063
RC6.11

Received June 9, 1980
Effluent and Dose Assessment Group
Three Mile Island Nuclear Station
Porter Gertz Consultants, Inc.

MEMO

TO: Bill Potts, Dick Heward and William Riethle
FROM: Sydney W. Porter, Jr.

SUBJECT: TMI Soil Samples With Possible Radiocontamination

REFERENCE:
1. Memo to B. Potts from C. Smedley, same subject, TMI-II-R-14062 RC6.11
2. Meeting held in B. Pott's office on June 4, 1980 with R. Dubiel, D. Lane and S. W. Porter to discuss Reference #1.

A. Radiocontamination Action Level For Soil Removal

As a result of the Referenced to meeting, the following criteria have been adooted for uses in action level for removal of radiocontamined soil: >1/10 MPC_W (avg over ~ 10 m^2) or any single sample >½ MPC_W where µCi/gr is assumed to be equal to µCi/cc for use of MPC_W.

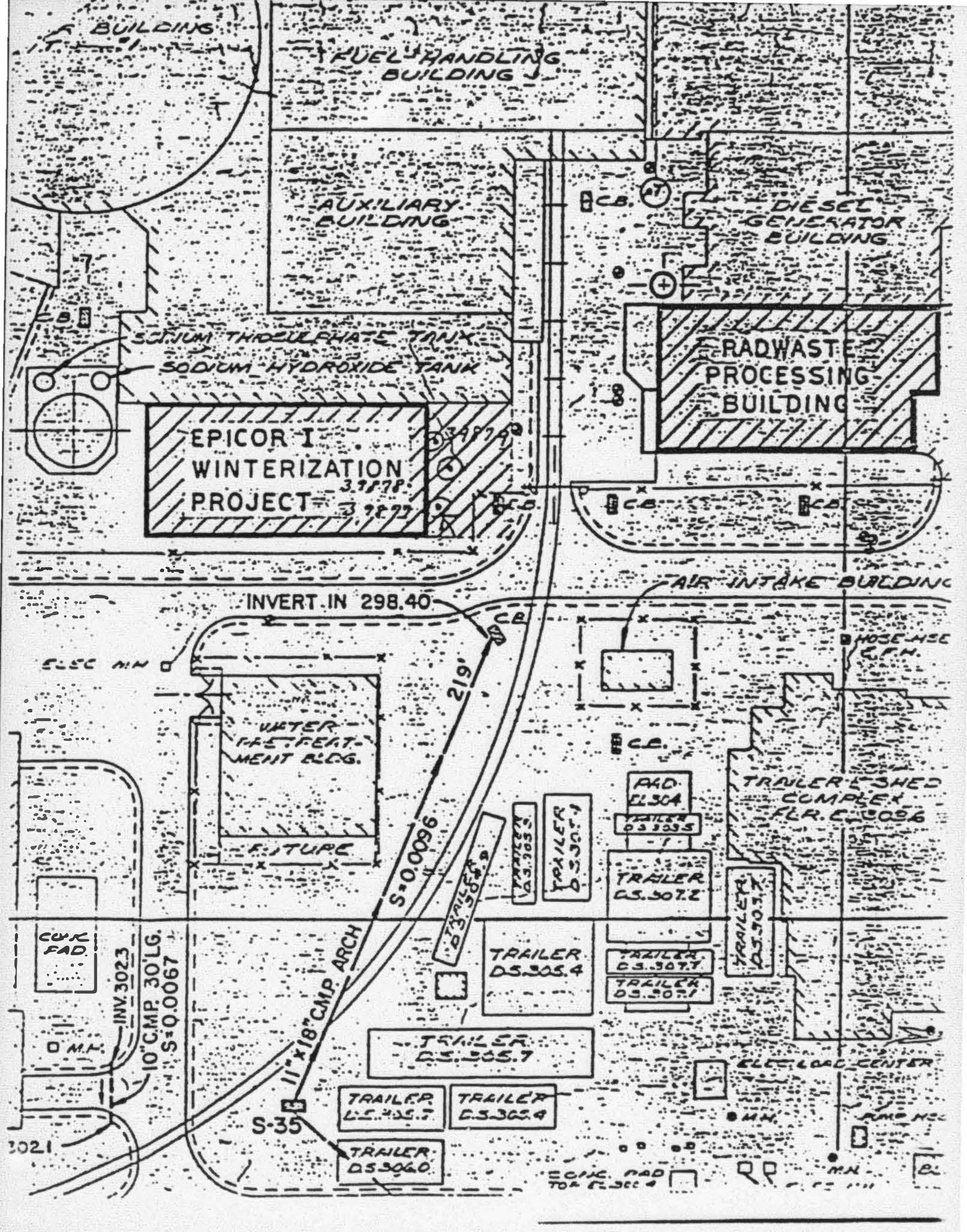
B. The following soil samples exceed the above listed criteria for both Cs-137 and Cs-134:

	Samole #	Location	µCi/grx10^{-5} Cs-137	µCi/grx10^{-5} Cs-134
[illegible]	39877	South side, Cap-Gun I	8.5	0.1
[illegible]	39879	South side, Cap-Gun I	3.8	1.2
3.	40413	East Dike	<	0.008
4.	39872	Southeast of BWST, U-II	<	<
5.	39873	South of BWST, Unit-II	3.6	1.7
6.	39874	Southeast of BWST, U-II	4.7	2.2
7.	39875	West of BWST, U-II	1.6	0.7
8.	39876	Corner of DWST near Eoicor II	0.008	0.03
9.	39373	South side of Cap-Gun I	2.6	0.4
1/10 MPC_W			0.2	0.09

The enclosed maps show the exact locations of the soil samples.

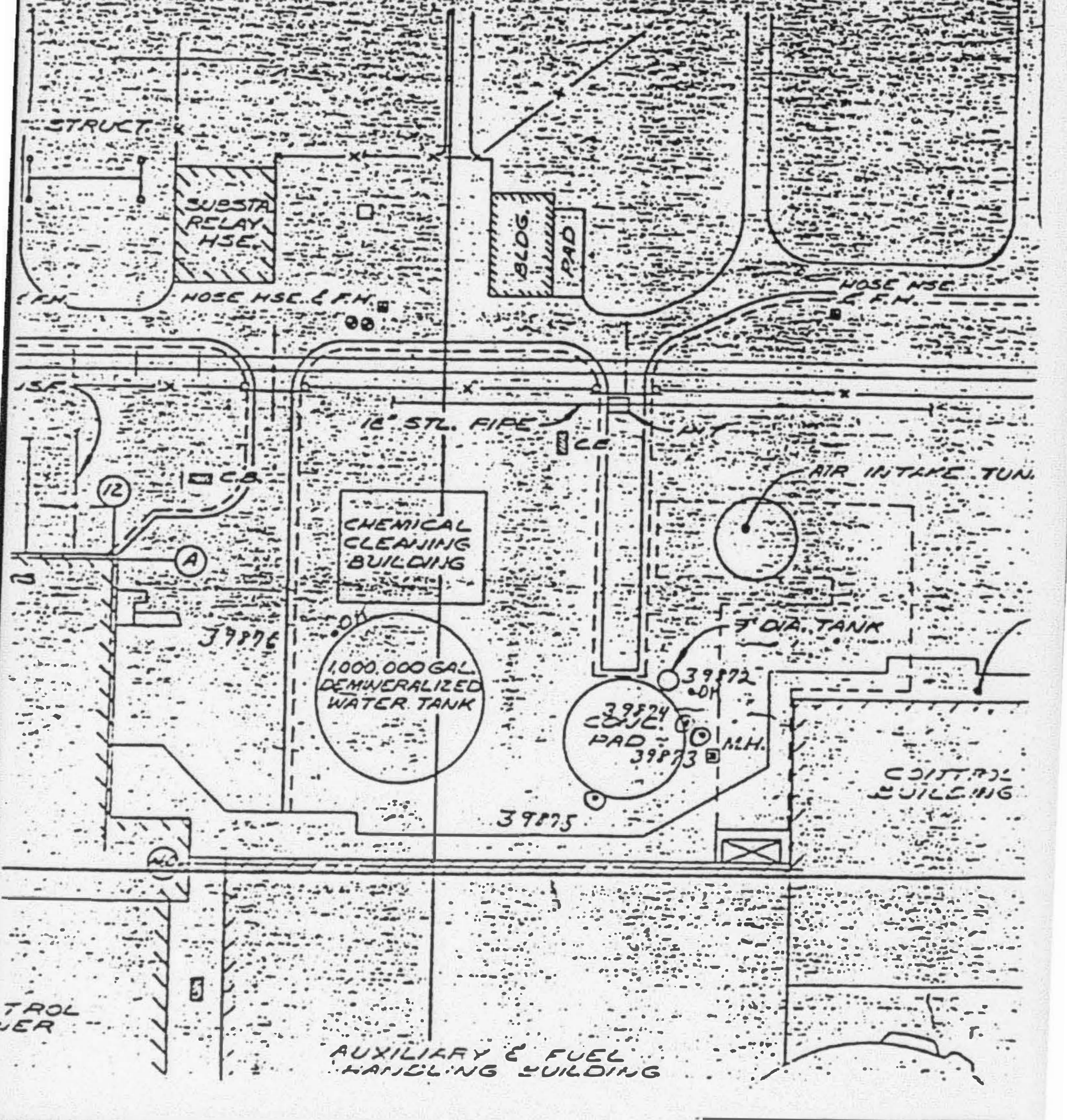
Sydney W. Porter, Jr.
C.H.P.

SWP:mmh
Enc: as stated
[illegible] Elahr, [illegible] Prasher, D. Lane, C. Dubiel, P. Ruhter, G. Lodde, C. Smedley



FUEL HANDLING BUILDING
AUXILIARY BUILDING
DIESEL GENERATOR BUILDING
SODIUM HYDROXIDE TANK
RADWASTE PROCESSING BUILDING
EPICOR I WINTERIZATION PROJECT
AIR INTAKE BUILDING
INVERT IN 298.40
219'
S=0.0096
11"x18" CMP ARCH
S-35
INV. 302.3
10' CMP. 30' LG.
S=0.0067
FUTURE
TRAILER D.S. 305.4
TRAILER D.S. 305.7
TRAILER D.S. 306.0
ELEC LOAD CENTER

A EXTENSION CATCH BASIN AND PAVING DETAILS
AND HEADWALL DETAILS
NG AROUND RIVER WATER INTAKE STRUCTURES
FINISHED GRADING DETAILS FOR IMMEDIATE PLANT AREA



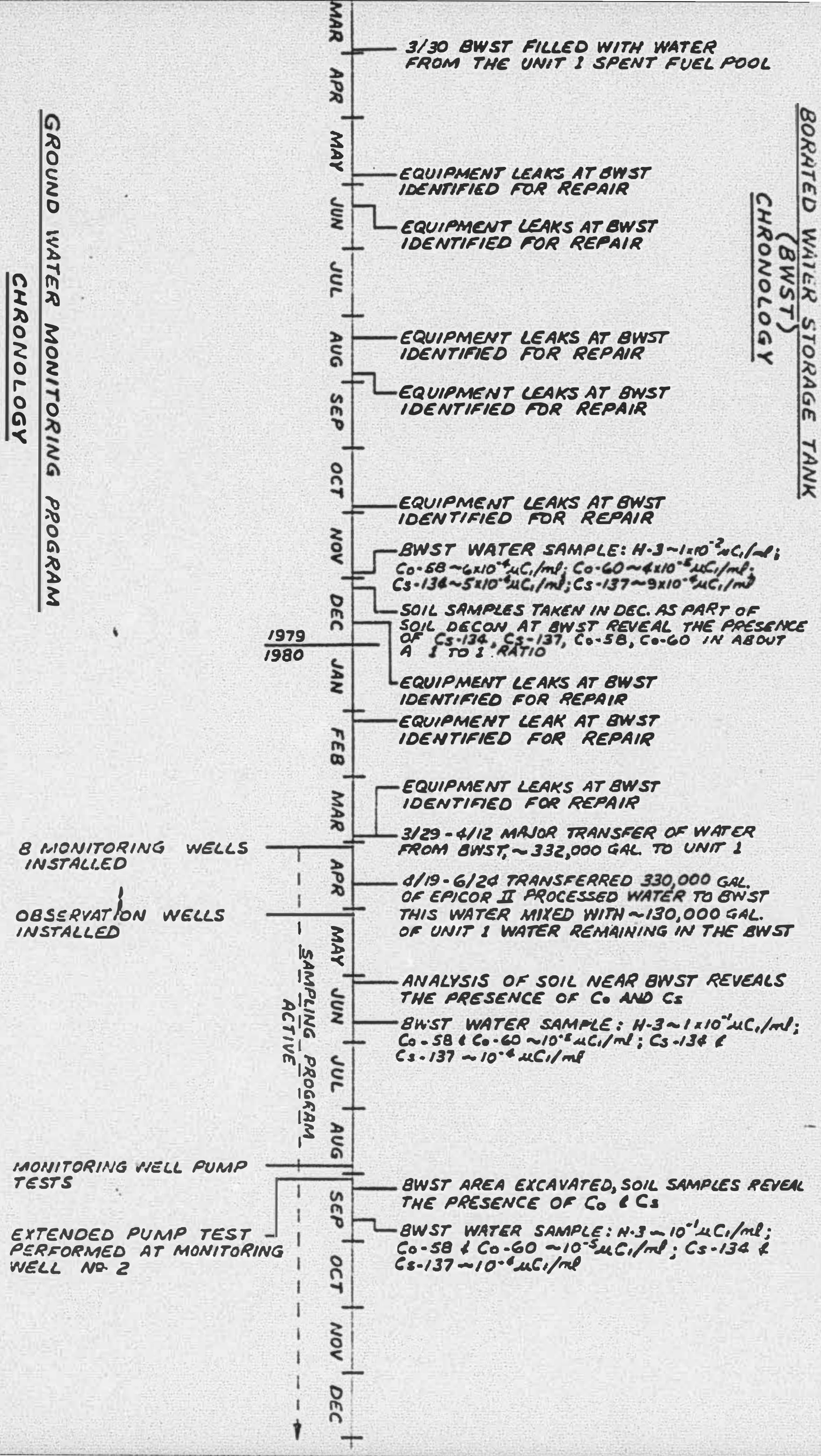
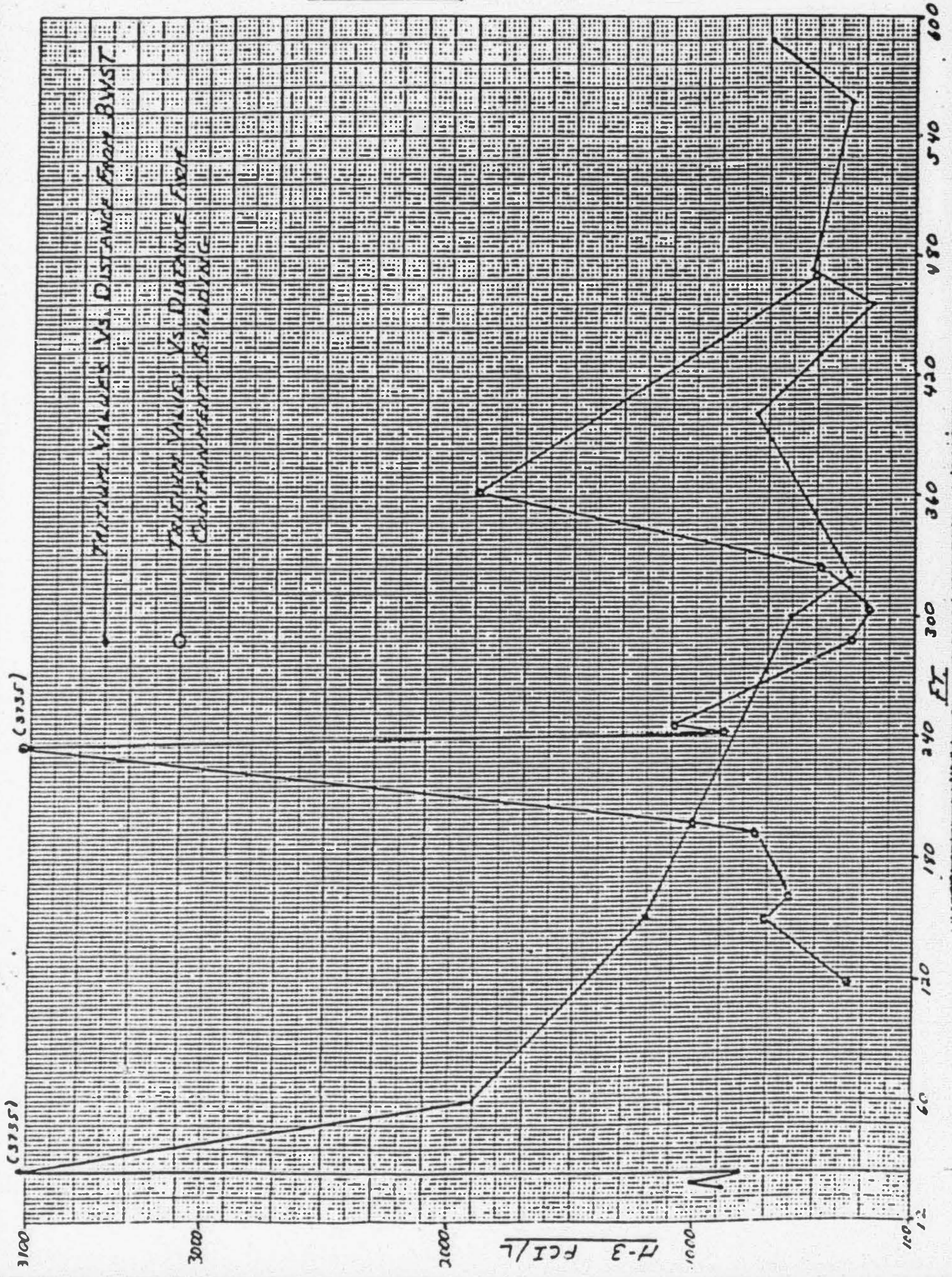

GROUND WATER MONITORING PROGRAM CHRONOLOGY
BORATED WATER STORAGE TANK (BWST) CHRONOLOGY
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
1979
1980
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
3/30 BWST FILLED WITH WATER FROM THE UNIT 1 SPENT FUEL POOL
EQUIPMENT LEAKS AT BWST IDENTIFIED FOR REPAIR
EQUIPMENT LEAKS AT BWST IDENTIFIED FOR REPAIR
EQUIPMENT LEAKS AT BWST IDENTIFIED FOR REPAIR
EQUIPMENT LEAKS AT BWST IDENTIFIED FOR REPAIR
EQUIPMENT LEAKS AT BWST IDENTIFIED FOR REPAIR
BWST WATER SAMPLE: H-3 ~ 1×10^{-2} µCi/ml; Co-58 ~ 6×10^{-4} µCi/ml; Co-60 ~ 4×10^{-5} µCi/ml; Cs-134 ~ 5×10^{-4} µCi/ml; Cs-137 ~ 9×10^{-4} µCi/ml
SOIL SAMPLES TAKEN IN DEC. AS PART OF SOIL DECON AT BWST REVEAL THE PRESENCE OF Cs-134, Cs-137, Co-58, Co-60 IN ABOUT A 1 TO 1 RATIO
EQUIPMENT LEAKS AT BWST IDENTIFIED FOR REPAIR
EQUIPMENT LEAK AT BWST IDENTIFIED FOR REPAIR
EQUIPMENT LEAKS AT BWST IDENTIFIED FOR REPAIR
3/29 - 4/12 MAJOR TRANSFER OF WATER FROM BWST, ~ 332,000 GAL. TO UNIT 1
4/19 - 6/24 TRANSFERRED 330,000 GAL. OF EPICOR II PROCESSED WATER TO BWST THIS WATER MIXED WITH ~130,000 GAL. OF UNIT 1 WATER REMAINING IN THE BWST
ANALYSIS OF SOIL NEAR BWST REVEALS THE PRESENCE OF Co AND Cs
BWST WATER SAMPLE: H-3 ~ 1×10^{-1} µCi/ml; Co-58 & Co-60 ~ 10^{-5} µCi/ml; Cs-134 & Cs-137 ~ 10^{-4} µCi/ml
BWST AREA EXCAVATED, SOIL SAMPLES REVEAL THE PRESENCE OF Co & Cs
BWST WATER SAMPLE: H-3 ~ 10^{-1} µCi/ml; Co-58 & Co-60 ~ 10^{-5} µCi/ml; Cs-134 & Cs-137 ~ 10^{-4} µCi/ml
8 MONITORING WELLS INSTALLED
OBSERVATION WELLS INSTALLED
SAMPLING PROGRAM ACTIVE
MONITORING WELL PUMP TESTS
EXTENDED PUMP TEST PERFORMED AT MONITORING WELL No. 2

FIGURE 2

FIGURE 3



TRITIUM VALUES VS. DISTANCE FROM BURST
TRITIUM VALUES VS. DISTANCE FROM CONTAINMENT BUILDING
(3735)
(3735)
H-3 PCI/L
FT
3100
3000
2000
1000
100
12
60
120
180
240
300
360
420
480
540
600

APPENDIX A

GROUND WATER MONITORING DATA
AND OBSERVATION WELL SOIL SAMPLES

GROUND WATER MONITORING
DATA

GAMMA SCAN RESULTS

Test results received for the November 12, 1980 to December 17, 1980 reporting period were negative with the exceptions listed below in Table 1. MW-2 results are listed through January 28, 1981. The other well results have not been received.

Table 1

Date	Well #	Cs-134 (pCi/ℓ)	Cs-137 (pCi/ℓ)
November 12, 1980	2		9.62±4.42
November 12, 1980	16*		8.98±4.96
November 26, 1980	14*		6.67±2.95
December 3, 1980	2		5.90±2.36
December 10, 1980	2	12.9±6.2	30.2±4.2
December 17, 1980	2	35.0±4.9	88.1±8.8
December 24, 1980	2	10.5±3.9	24.1±5.9
December 31, 1980	2	<9.0	<10.0
January 7, 1981	2	9.68±4.28	16.9±5.9
January 14, 1981	2	36.6±5.0	81.4±7.8
January 21, 1981	2	7.71±3.62	13.7±4.5
January 28, 1981	2	<5.0	7.70±4.36

*Sample being reanalyzed

REPORT NO. 15

DATE: February 3, 1981

PAGE 1 OF 3

[illegible] ENVIRONMENTAL CONTROLS GROUP

TRITIUM CONCENTRATION (PCI/L)

DATE OF SAMPLE	M.U. 1 H-3	M.U. 1 +/-	M.U. 2 H-3	M.U. 2 +/-	M.U. 3 H-3	M.U. 3 +/-	M.U. 4 H-3	M.U. 4 +/-	M.U. 5 H-3	M.U. 5 +/-	M.U. 6 H-3	M.U. 6 +/-	M.U. 7 H-3	M.U. 7 +/-	M.U. 8 H-3	M.U. 8 +/-
January 25,1980							170	70								
February 20,1980					290	90										
February 25,1980			1530	150												
February 29,1980											280	90				
March 5 ,1980							260	90								
March 7 ,1980																
March 11,1980	200	90													150	90
March 26,1980							200	80					333	80		
March 27,1980					370	90			380	90						
March 27,1980					660	110										
March 28,1980			2500	180							920	100				
March 28,1980											660	100				
April 1 ,1980	990	120														
April 2 ,1980			1550	140	380	80					430	80			870	90
April 2 ,1980			1770	140	240	90					320	80				
April 3 ,1980									330	70						
April 3 ,1980									300	70						
April 8 ,1980	150	80	1830	140	770	110			80	70	330	80	283	80	840	110
April 11,1980																
April 12,1980																
April 13,1980																
April 14,1980																
April 15,1980																
April 16,1980																
April 17,1980																

REPORT NO. 18

DATE: February 2, 1981
PAGE 2 OF 3

GPU ENVIRONMENTAL CONTROLS GROUP
TRITIUM CONCENTRATION (PCI/L)

DATE	M.W. 1		M.W. 2		M.W. 3		M.W. 4		M.W. 5		M.W. 6		M.W. 7		M.W. 8	
DATE	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-
April 18,1980																
April 29,1980	190	120	830	320	756	430	284	120	196	160	378	200	352	100	785	420
May 2 ,1980	130	70	490	80	1090	90	360	70	350	70	910	80	310	80	710	100
May 9 ,1980	260	80	810	100	860	90	380	80	260	80	920	90	280	80	630	90
May 16,1980	180	60	670	90	980	100	310	90	130	80	780	100	270	100	570	70
May 23,1980	170	80	880	80	1270	130	520	130	200	80	750	110	300	120	790	110
May 30,1980	140	80	850	80	920	80	820	100	250	90	730	110	290	90	540	130
June 6 ,1980	180	90	950	100	1260	130	570	120	270	90	870	80	380	120	600	120
June 13,1980	220	80	710	80	1200	100	500	80	370	100	530	110	660	120	600	70
June 20,1980	130	80			1430	140	470	120	230	90	640	130	280	80	550	130
June 27,1980	320	120	1400	110	1370	120	450	80	3 20	80			320	80	410	80
July 3 ,1980	240	120	1310	100	1400	90	450	70	120	60	422	50	440	90	630	90
July 11,1980	180	80	1900	100	1250	130	510	130	250	50	330	110	370	110	800	80
July 25,1980	180	80	2130	210	1350	140	560	130	290	50	410	120	310	110	400	120
July 30,1980	190	80	1830	190	1570	180	350	110	260	50	330	120	330	130	490	120
August 6 ,1980	180	80	2560	260	1670	170	420	120	250	50	370	120	340	110	640	120
August 13,1980	130	80	1360	140	1840	190	440	120	280	50	350	120	250	90	360	110
August 20,1980	130	80	1800	180	1840	130	410	70	840	80	340	120	870	90	490	130
August 27,1980	180	80	3010	300	1810	180	900	130			370	120	310	110	650	180
September 3 ,1980	600	120	3950	400	1470	150	830	90	270	60	370	120	250	50	530	130
September 10,1980	840	80	4400	270	1500	220	1050	180	770	100	430	90	300	70	570	90
September 17,1980	370	80	4300	260	8040	140	870	150	460	50	720	100	740	80	610	100
September 24,1980	820	90	4940	300	8880	130	1020	130	600	80	820	100	470	50	520	80
October 1 ,1980	170	70	4290	280	1360	170	930	100	200	80	300	80	450	80	420	80
October 8 ,1980	190	83	3540	350	1770	208	730	110	293	80	360	110	390	110	410	120

REPORT NO. 18

ORL ENVIRONMENTAL CONTROLS GROUP
TRITIUM CONCENTRATION (PCI/L)

DATE	M.W. 1		M.W. 2		M.W. 3		M.W. 4		M.W. 5		M.W. 6		M.W. 7		M.W. 8	
DATE	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-
October 15,1980	170	70	3520	530	1770	270	740	120	298	80	348	50	420	100	380	80
October 22,1980	160	70	2920	440	1870	280	780	120	298	80	338	80	453	100	460	100
October 29,1980	160	70	3170	400	1670	250	610	120	300	90	320	60	326	80	470	100
November 5 ,1980	160	70	2000	310	1620	240	570	100	251	80	270	80	293	88	810	140
November 12,1980	160	70	2430	360	2050	310	740	120	180	70	350	80	323	90	520	100
November 19,1980	270	90	2630	380	2250	140	590	100	310	100	540	100	440	130	270	100
November 26,1980	120	70	2950	440	3620	540	310	90	170	70	220	80	268	80	520	100
December 3 ,1980	260	70	3410	230	2120	180	450	70	282	100	320	110	342	70	360	70
December 10,1980	110	70	2750	410	2030	300	470	100	272	80	250	80	231	82	360	80
December 17,1980	130	70	2110	330	2330	360	420	100	302	90	280	80	272	82	420	100
December 24,1980	140	70	2610	330			390	90	312	90	230	80	262	82	330	80

REPORT NO. 15

DATE: February 3, 1981
PAGE 1 OF 8

GPU ENVIRONMENTAL CONTROLS GROUP
TRITIUM CONCENTRATION (PCI/L)

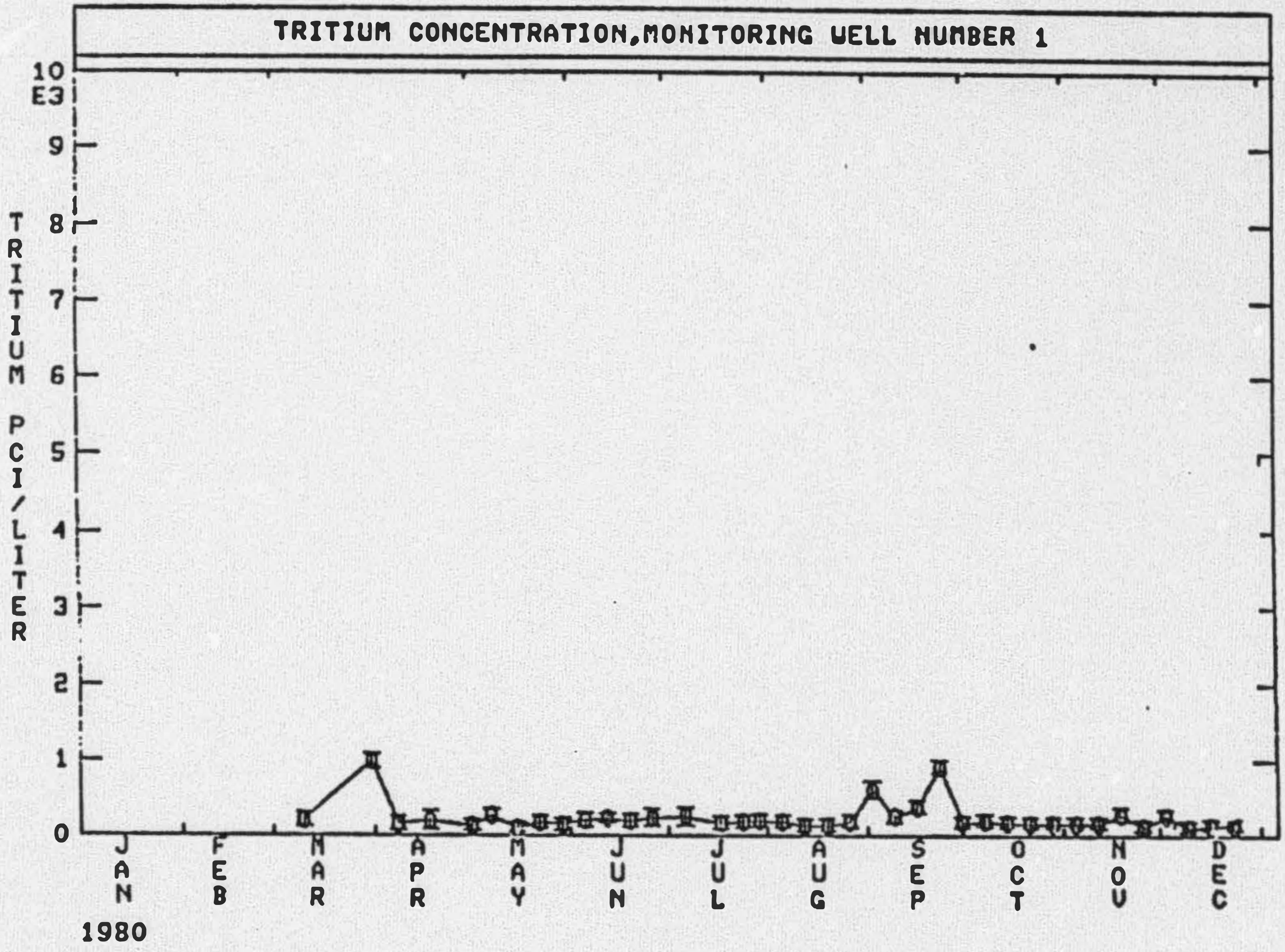
DATE OF SAMPLE	O.U. 9 H-3	O.U. 9 +/-	O.U. 10 H-3	O.U. 10 +/-	O.U. 13 H-3	O.U. 13 +/-	O.U. 14 H-3	O.U. 14 +/-	O.U. 15 H-3	O.U. 15 +/-	O.U. 16 H-3	O.U. 16 +/-	O.U. 17 H-3	O.U. 17 +/-
April 25,1980	2610	160	1400	100										
May 2 ,1980	350	88	170	30							1050	110	3210	200
May 8 ,1980	320	78	430	90			1320	120	280	90	1030	110	3220	200
May 16,1980	448	80	350	70	440	70	1280	110			1120	110	3560	220
May 23,1980	293	108	360	110	360	110	1[illegible]0 2	120	150	80	850	80	3620	360
May 30,1980	363	113	430	120	400	120	1230	130	110	80	770	110	3500	350
June 6 ,1980	373	110	300	110	350	110	830	80	150	80	770	110	3710	370
June 14,1980	273	100	460	80	300	80	730	50	220	60	590	100	3830	240
June 20,1980	323	110	300	110	350	110	810	120	180	80	820	90	3620	360
June 27,1980	490	80	3[illegible]0	90	390	80	640	100			760	100	3810	260
July 7 ,1980	563	110	[illegible]0	90	410	80	540	100	210	80	500	90	4180	330
July 18,1980	508	130	600	120	370	113	670	120	150	80	680	130	3820	360
July 25,1980	498	120	340	110	200	98	610	130	140	80	720	110	4030	480
July 30,1980	558	133	800	80	350	113	530	130			710	110	3830	380
August 8 ,1980	418	122			180	88	430	120			720	110	3570	360
August 13,1980	578	138			220	92	440	120			850	80	3540	350
August 20,1980	810	88			420	128	470	120			950	100	3740	370
August 27,1980	2420	248	1500	190	320	118	530	130			960	100	3360	340
September 3 ,1980	910	60	1850	200	340	110	700	110			1160	110	3670	370
September 10,1980	1100	100	850	110	300	100	1030	80			1180	140	4030	280
September 17,1980	1050	100	500	80	400	93	1173	100			1490	110	4080	280
September 24,1980	1320	100	330	70	930	90	1320	110			1610	130	4130	280
October 1 ,1980	1270	100			260	93	7[illegible]	80			1370	100	4130	280
October 8 ,1980	1800	130			180	80	8[illegible]0	100			1470	130	3830	380
October 15,1980	1200	100	1000	110	510	93	510	100			1470	190	3980	600

REPORT NO. 16

DATE: February 3, 1981
PAGE 2 OF 4

DPL ENVIRONMENTAL CONTROLS GROUP
TRITIUM CONCENTRATION (PCI/L)

DATE	O.U. 9		O.U. 10		O.U. 13B		O.U. 14		O.U. 15		O.U. 16		O.U. 17	
DATE	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-
October 22,1980	2070	310			290	80	550	100			860	140	1340	260
October 29,1980	610	120	360	90	210	80	560	100			1290	130	4170	610
November 5 ,1980	1650	250	1100	170	240	80	460	100			1060	250	3120	550
November 12,1980	1620	240	2670	820	310	90	310	90			1460	220	1560	250
November 19,1980	790	90	2600	160	140	100	600	80			1310	110	4470	200
November 26,1980	340	90	830	140	810	80	330	90			1820	240	4690	700
December 3 ,1980	1040	80	1090	130	340	60	600	100			1560	140	5070	300
December 10,1980	1000	150	1300	280	260	80	370	90					3200	480
December 17,1980	1340	300	1350	230	280	80	390	90					3010	450
December 24,1980	1340	300	1060	180	290	80	470	100					3050	460



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TRITIUM PCI/LITER
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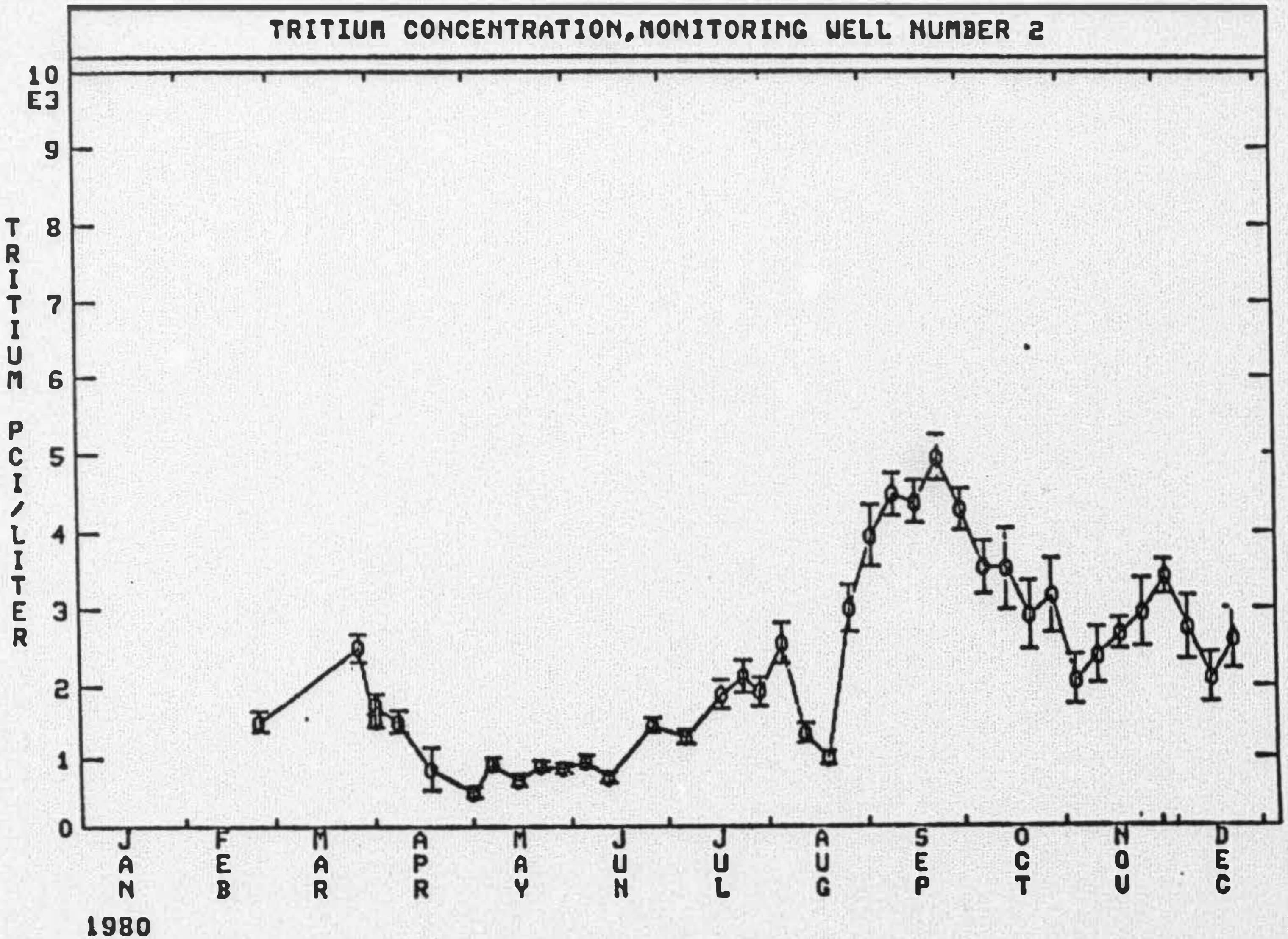
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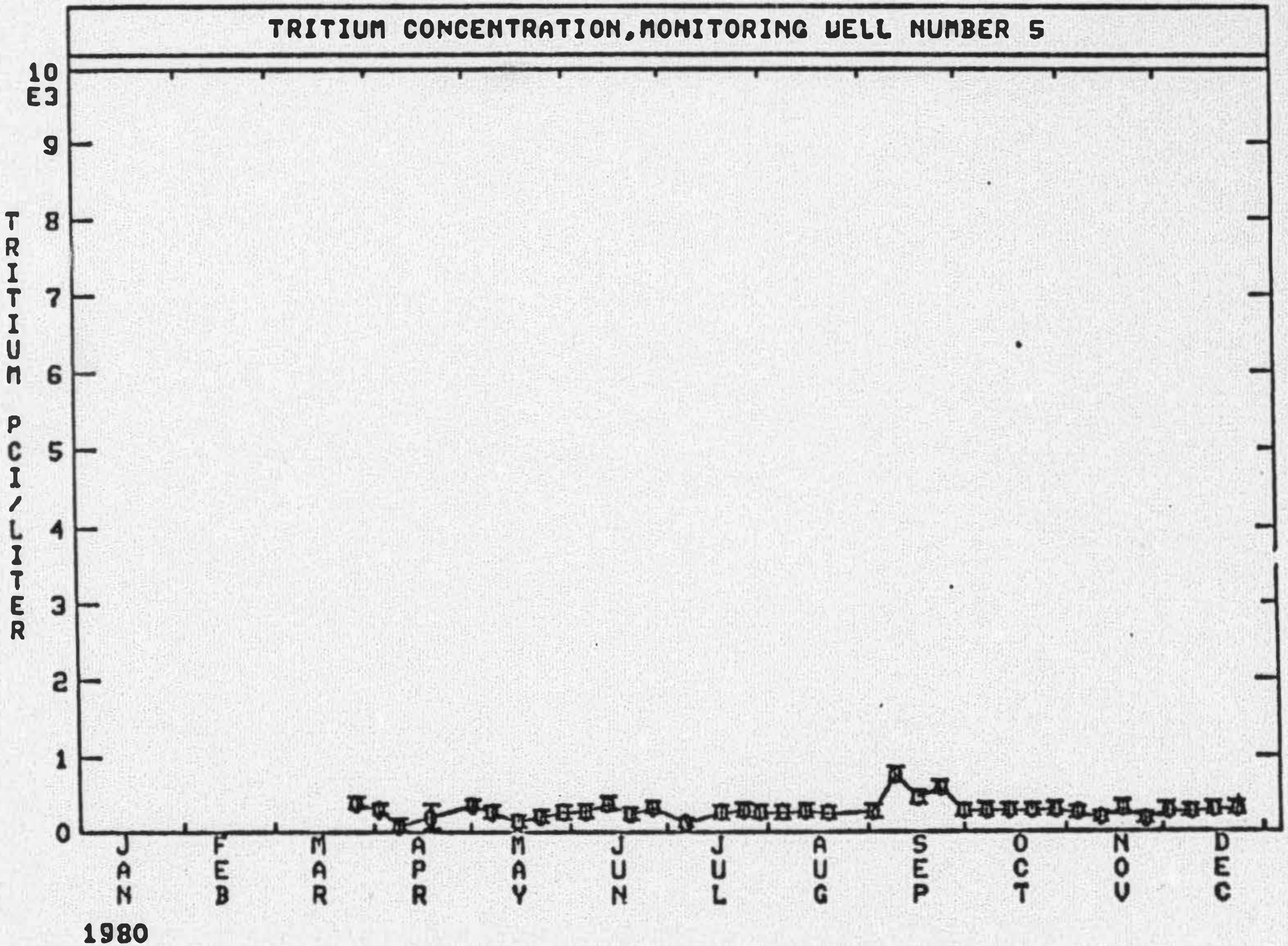
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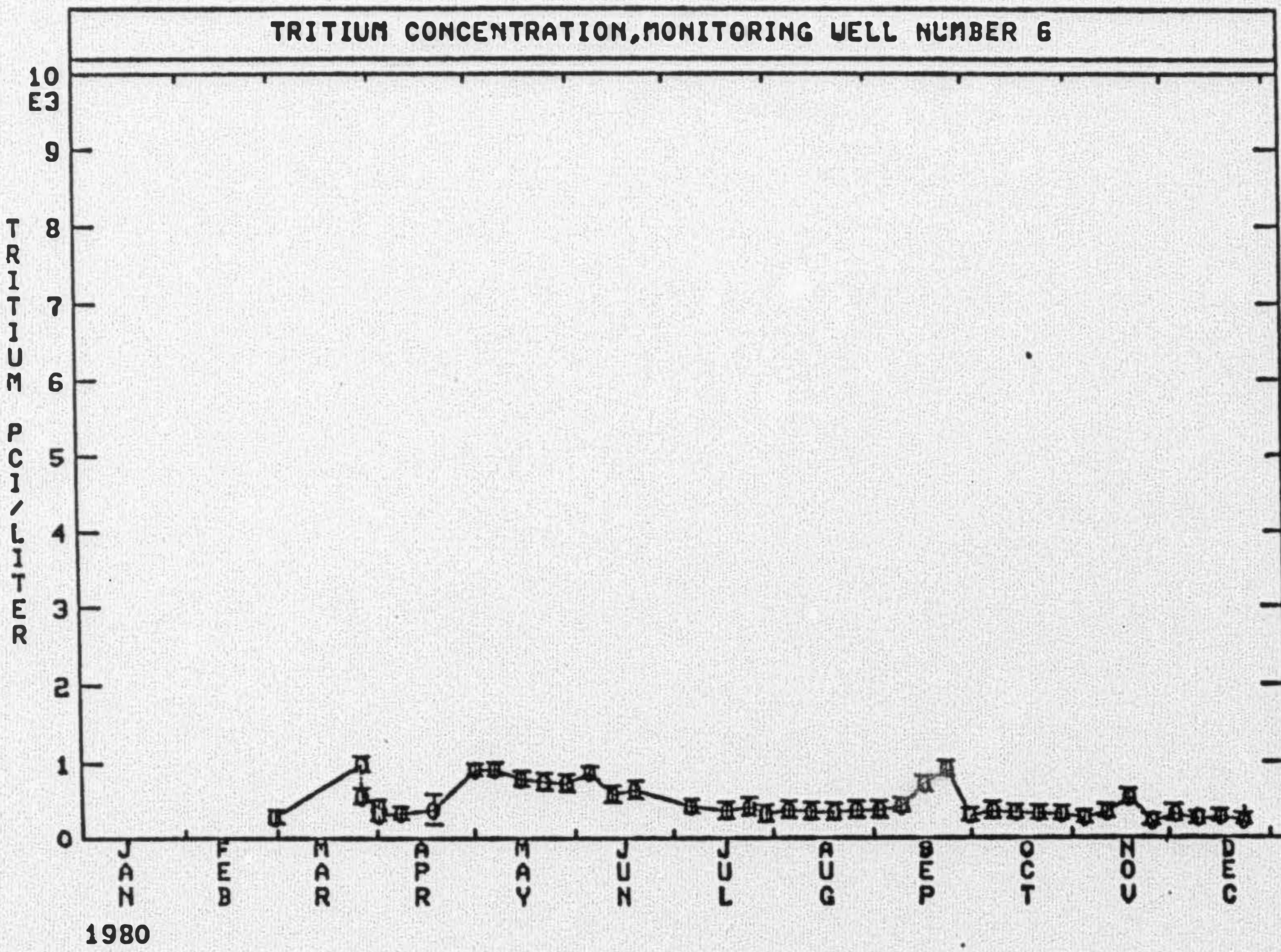
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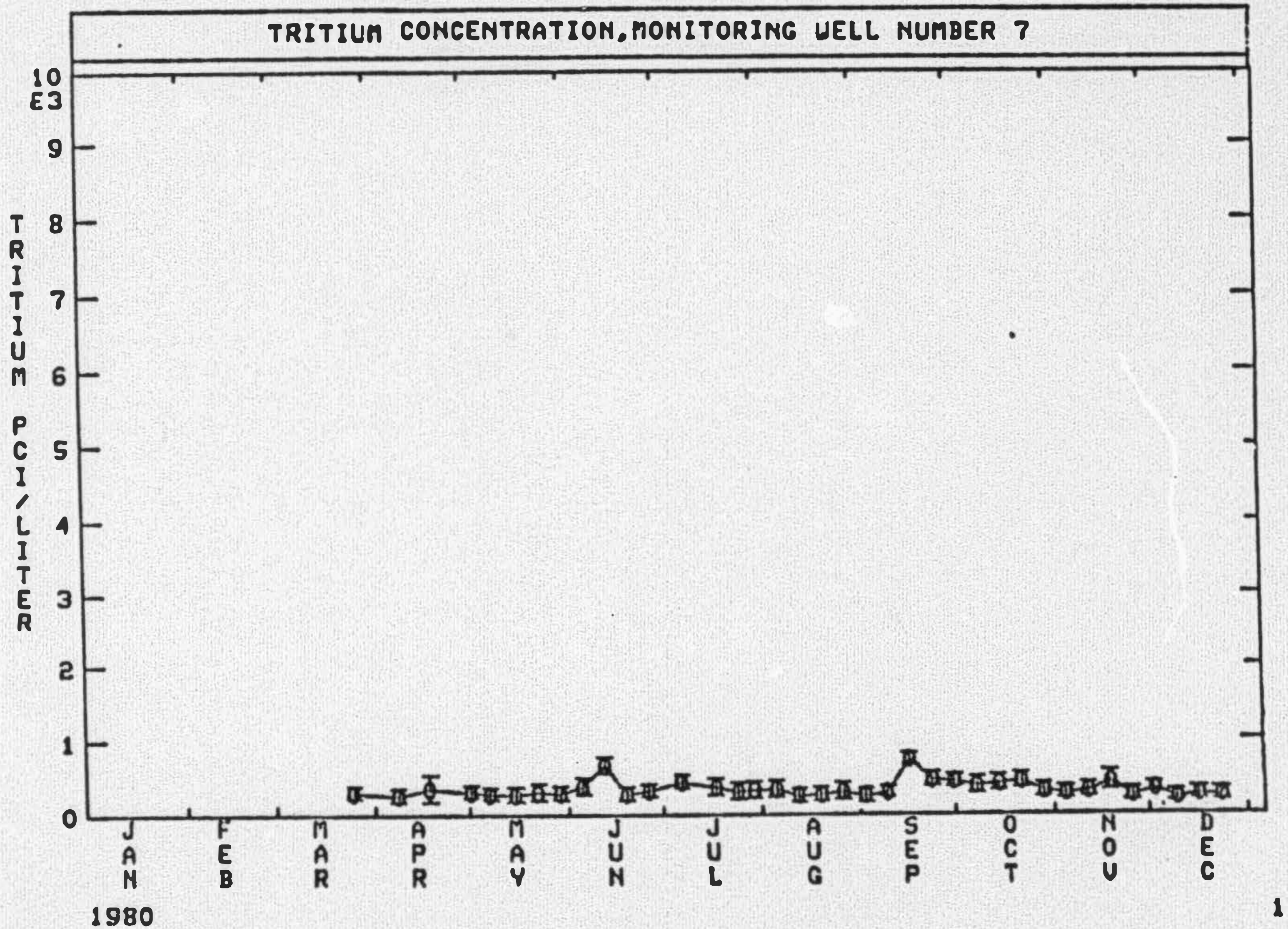
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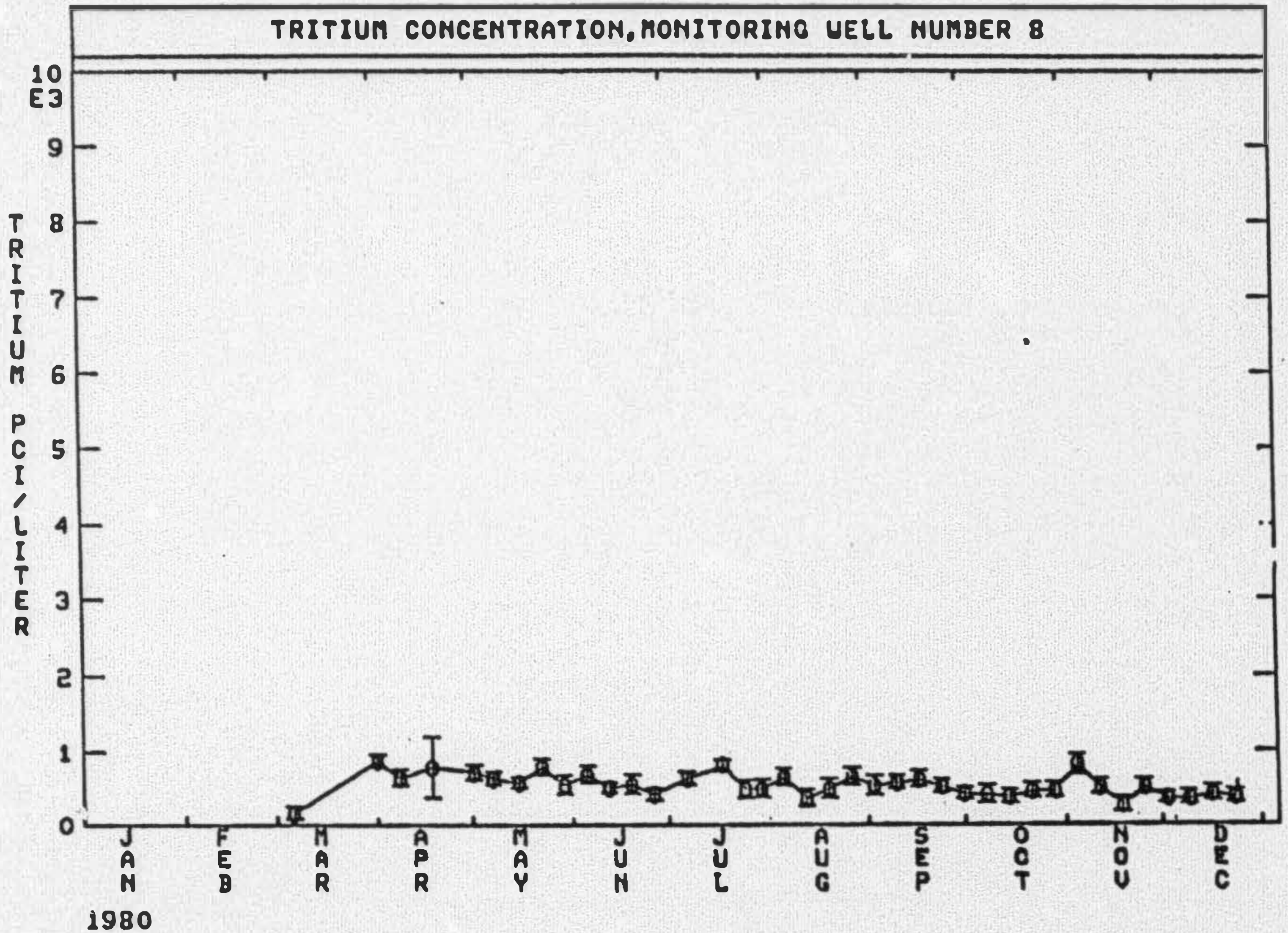
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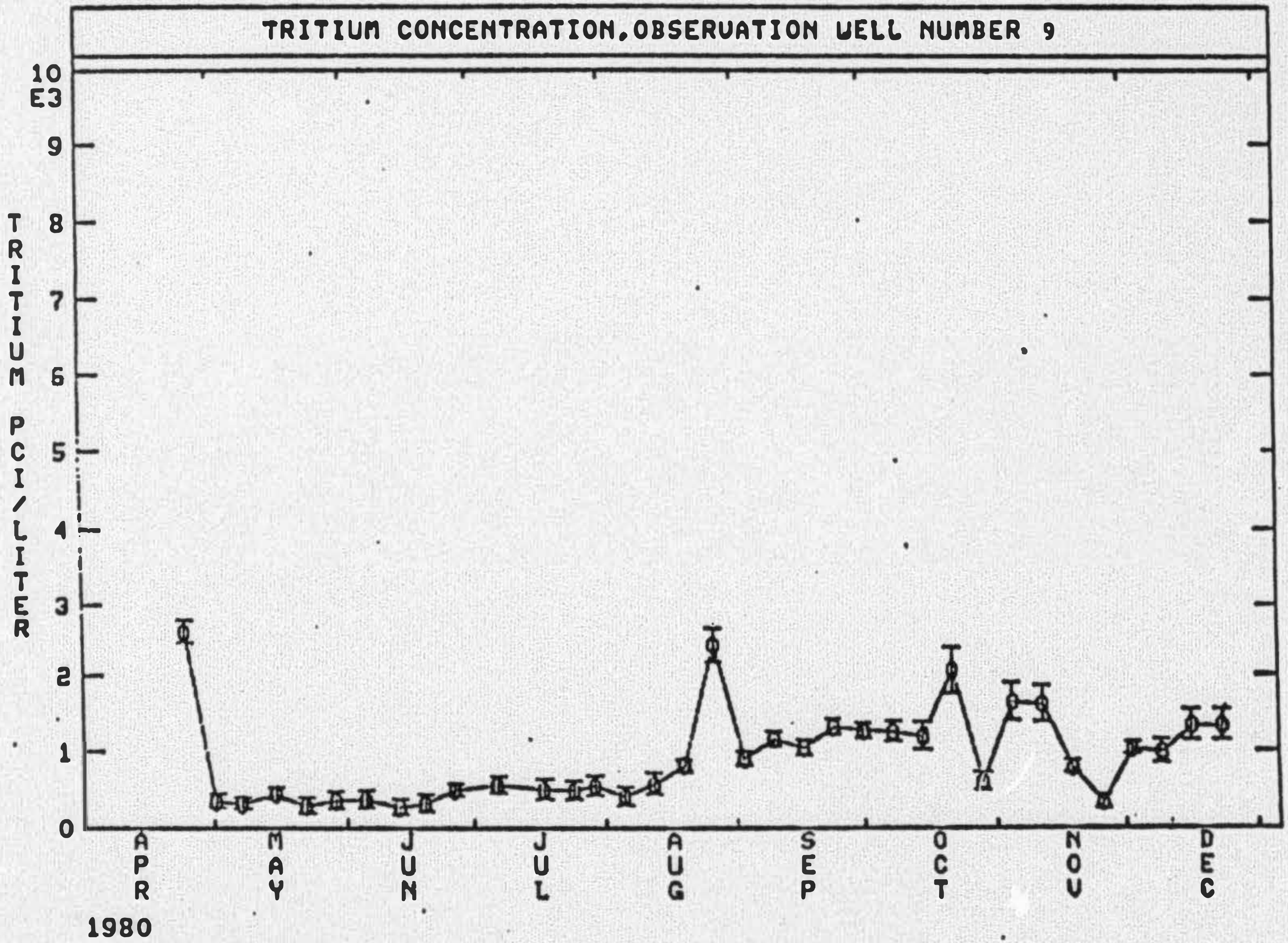
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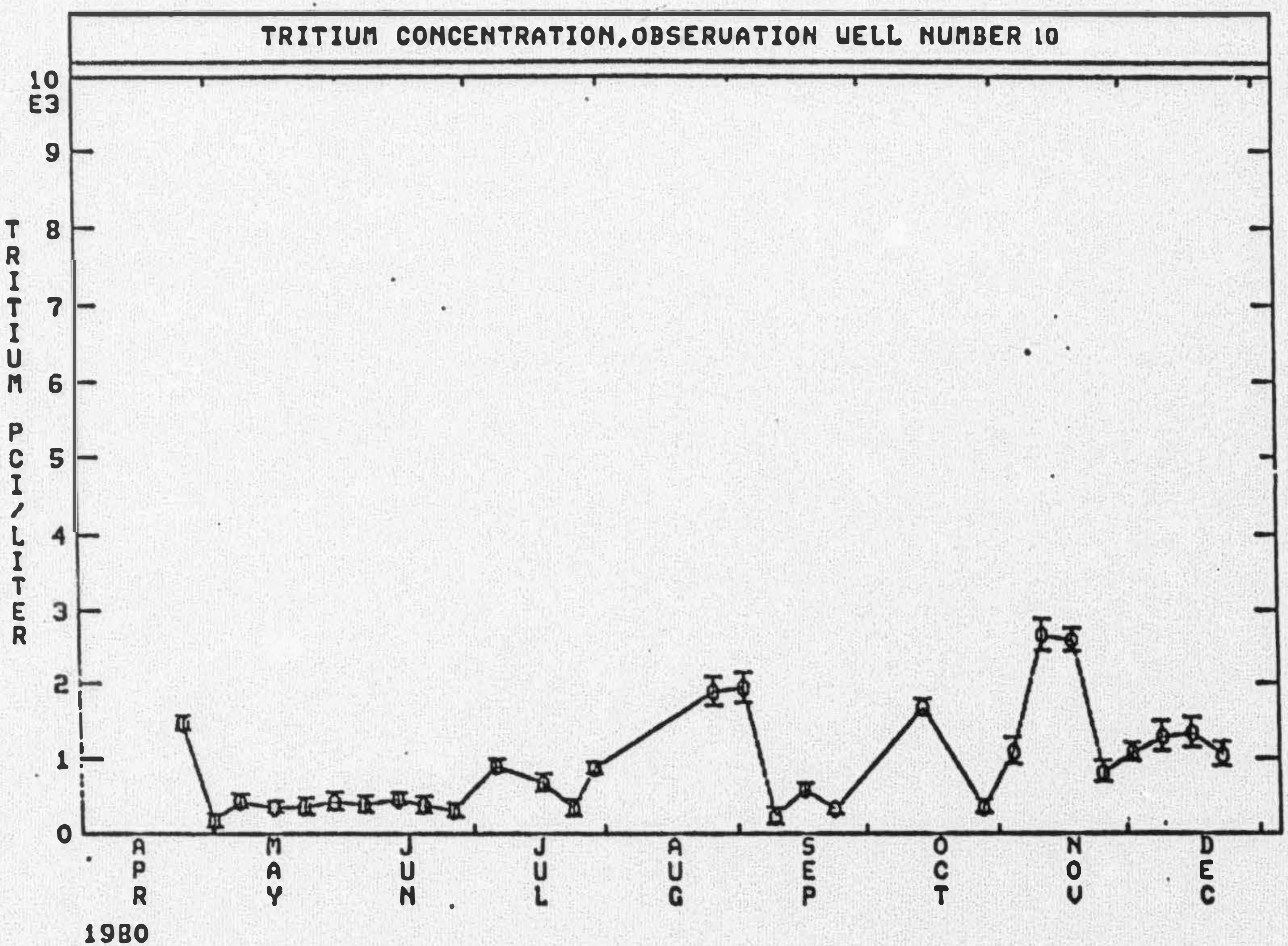
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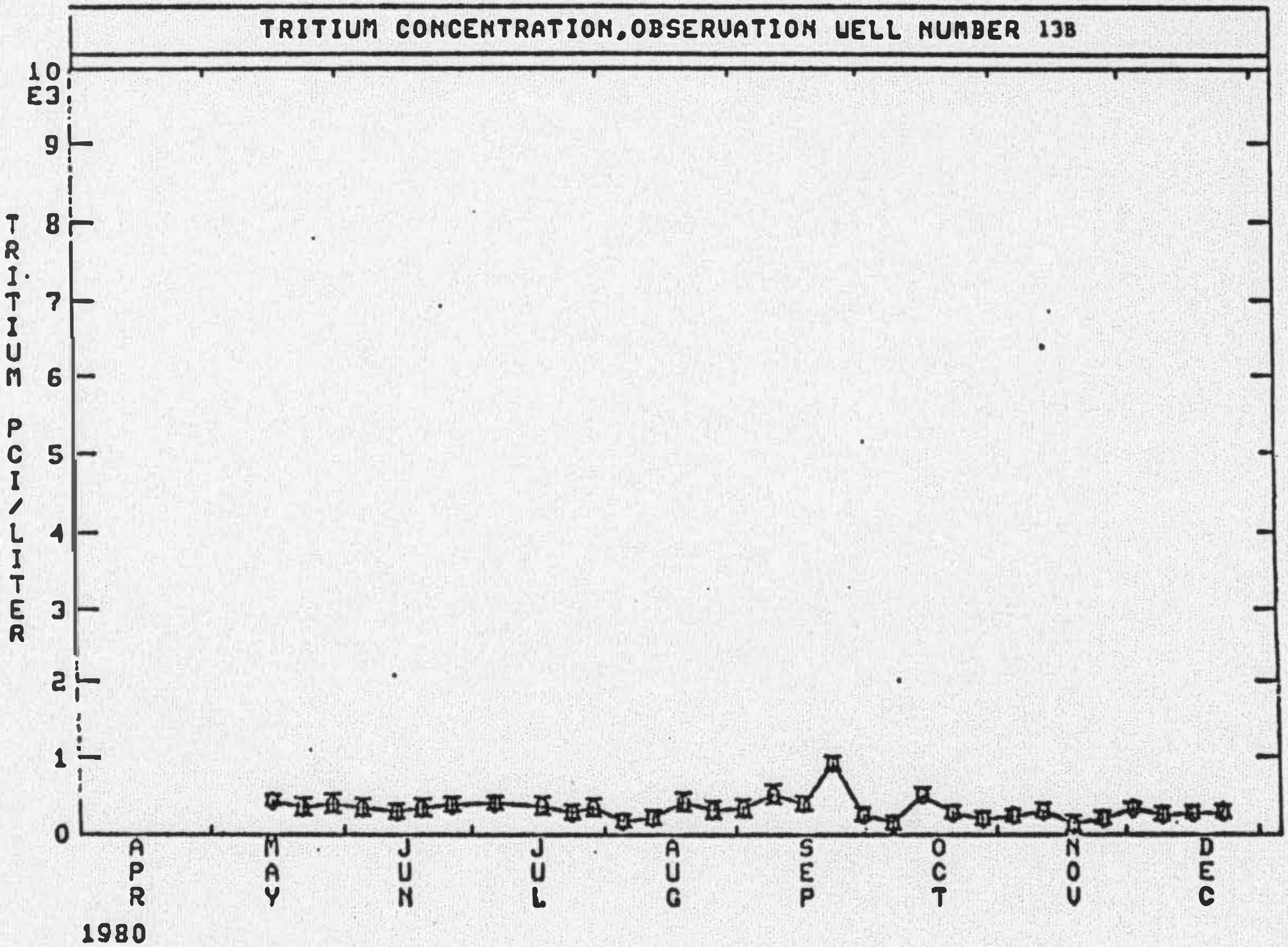
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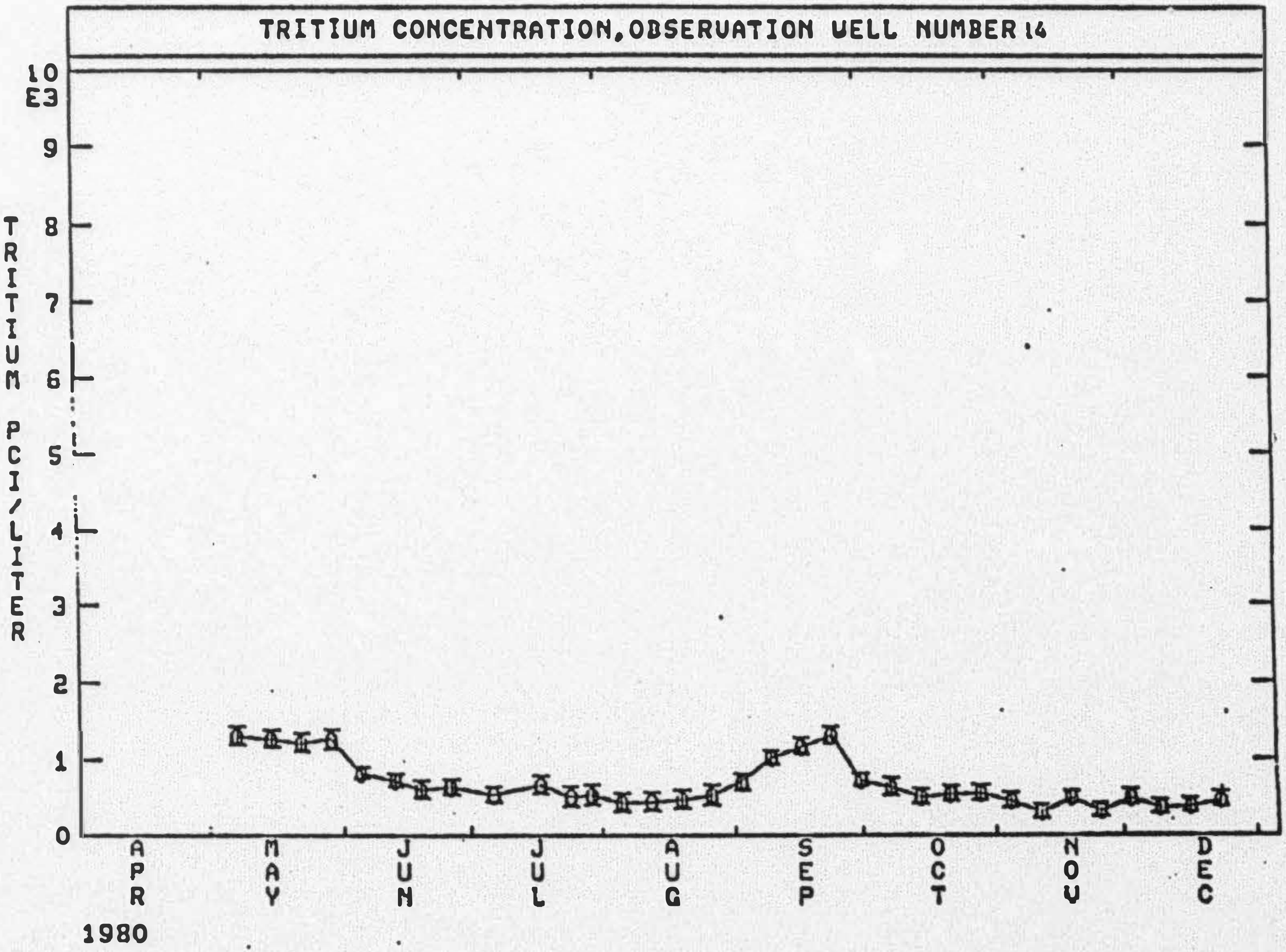
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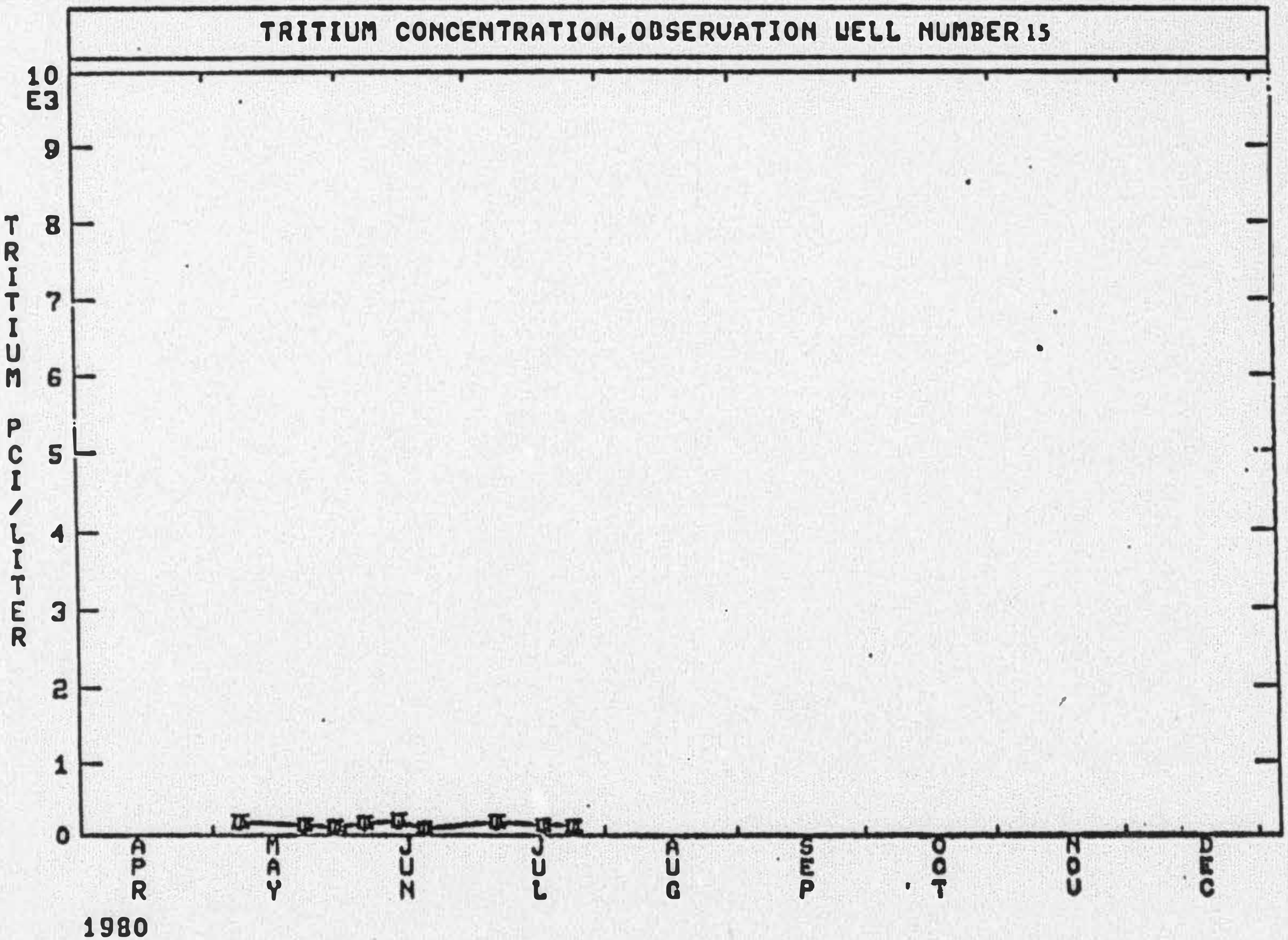

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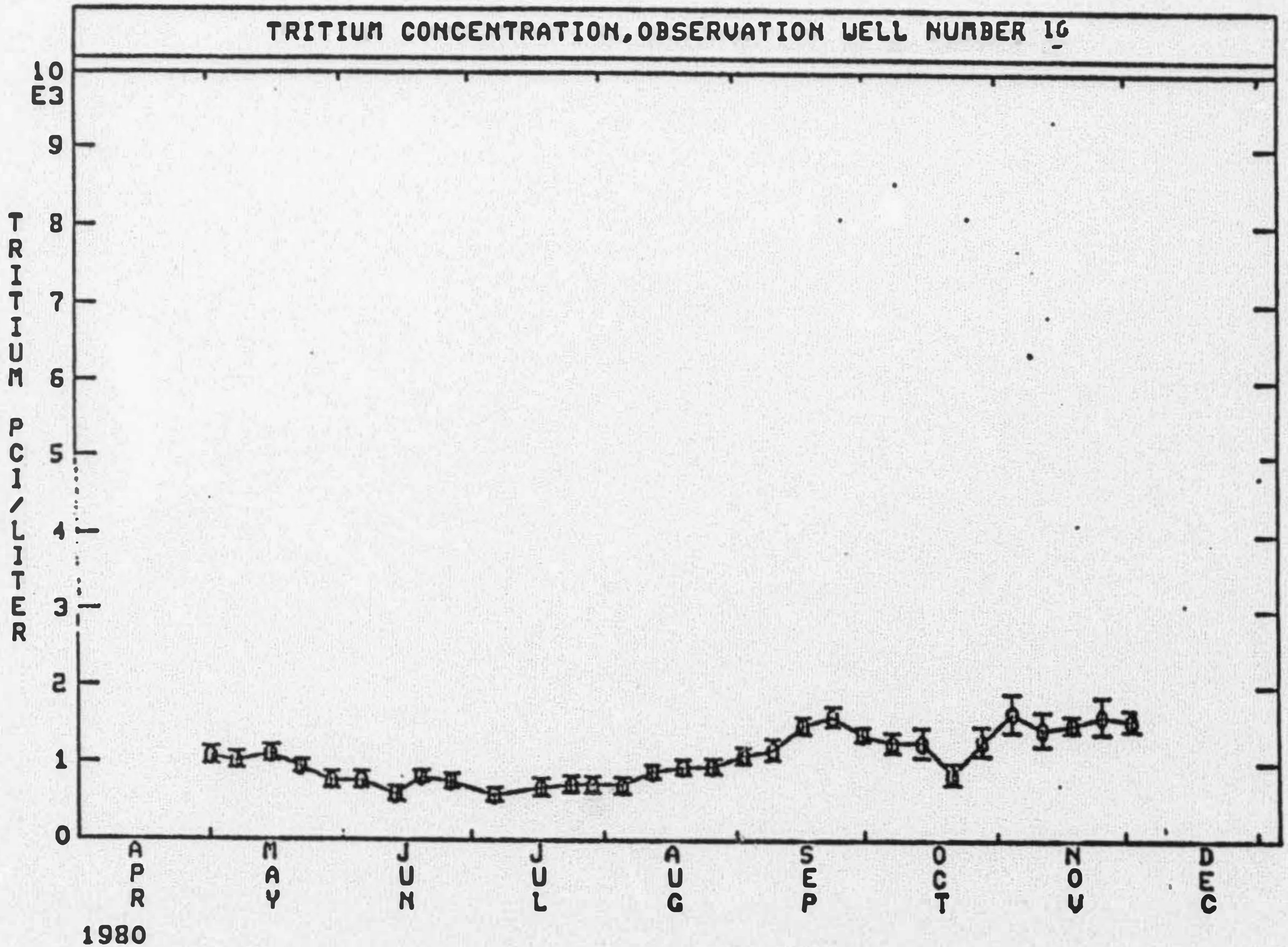

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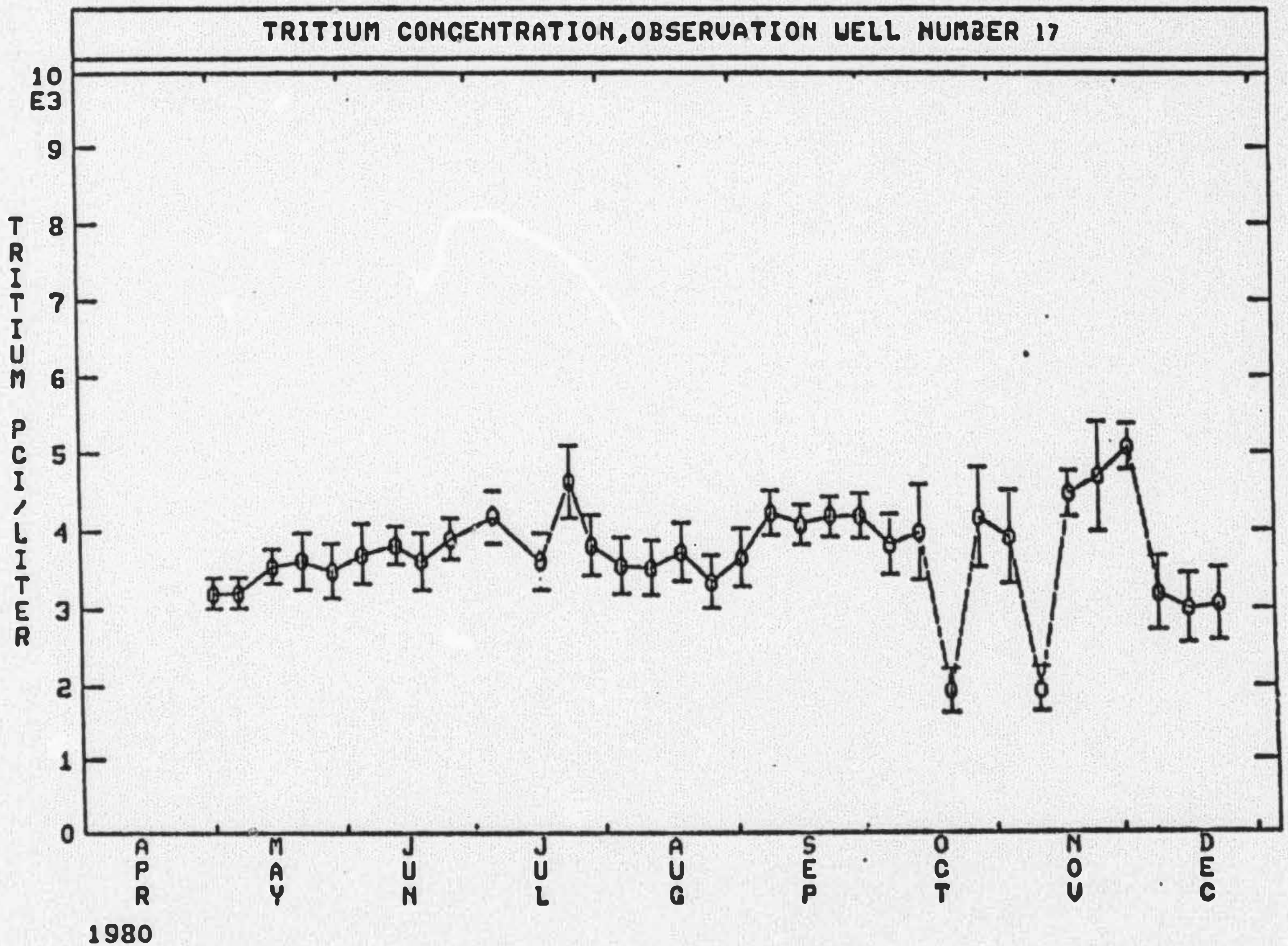
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OBSERVATION WELL SOIL SAMPLES

DATA SHEET

SUBJECT Observation Well Soil Sample Results

DATE ______ SHEET 1 of

LOCATION ______

ENGINEER ______

OW-Core-9 4/22/80 | OW-Core-16 4/28/80

Core Depth Feet	Core Description	H_3 pCi/l		Core Depth Feet	Core Description	H_3 pCi/l
0-1	brown to black fill	290±120		0-1	sand, gravel	2070±1
1-2	medium to coarse sand, fine silt &	130±100		1-2	clay, sand & gravel	1930±1
	clay			2-3	"	1560±1
2-3	some gravel, very fine sand & silt	300± 90		3-4	clay, sand, gravel & bedrock	910±1
3-4	medium to coarse sand, some gravel	280± 80		4-5	same as 3-4 level	2270±1
	& fine sand			5-7	same as 4-5 level	4210±2
4-5	same as 3-4	370± 80		7-9	clay, gravel & sandstone	2550±1
5-6	fine materials	220± 80		9-11	same as 7-9 level	2120±1
6-7	same as 5-6 but more coarse than	340± 90		11-13	dense clay, gravel & sand	480±
	above			13-15	same as 11-13 level	330±
7-9	composition as in 6-7 "	490±100		15-17	gravel & sand	430±
9-11	[illegible]	<100		17-19	gravel & sand	370±
11-13	[illegible]	<140		19-21	dark gravel & clay	830±1
13-15	[illegible]	230± 80		21-23	gravel & clay	600±1
15-17	[illegible]	150± 90		23-25	gravel, clay & sand	790±1
17-19	[illegible]	200± 70		25-27	sand, gravel, clay & limestone	1150±1
19-21	at 19' water table	830± 80		27-28	bedrock, fine sand & gravel	880±
21-22	some gravel, dense, medium to coarse	820± 80				
	sand					
22-24	24'-bedrock very dense	650±100				
24-26	limestone, quartz, cobbles, red color	1440±140				
	very dense					
26.5-27.1	medium dense rock; red sandstone	3480±220				
26-28	fine sandstone-siltstone	3340±220				
	bedrock 27.1'					

DATA SHEET

SUBJECT: H_3 Levels (pCi/l) in Observation Wells

DATE: 　 SHEET:

LOCATION: OW-10 (4/24/80)

ENGINEER: OW-SS1 (4/29/80) Located between BWST and Service Bldg.

Core Depth Feet	Core Description	H_3 pCi/l		Core Depth Feet	Core Description	H_3 pCi/l
0-1	sand and gravel	390± 90		0-1	sand, gravel, and stone	540± 80
1-2	fill, chips & sand	560± 90		1-2	" " "	1030±100
2-3	sand and chips	240± 80		2-3	sand and gravel	1300±110
3-4	sand, clay & chips	240± 70		3-4	" " "	580± 90
4-5	" " " "	350± 80		4-5	" " "	1180± 90‡
5-7	sand and gravel	160± 70		5-7	" " "	950±120
7-9	" " "	260± 70		7-9	" " "	1350±120
9-11	" " "	200± 80		9-10.5	" " "	1220± 90
11-13	sand, clay & gravel	330± 80		10.5-12	" " "	1180±100
13-15A	sand, shale and quartz	<120				
13-15B	"	160± 80				
15-17	sand, shale, gravel quartz & clay	320± 80			*Cs-137 Detected	
17-19	"	100± 80			Value .101±.041pCi/gm	
19-21	shale, sand, clay & gravel	140± 70				
21-23	sand and gravel	110± 80			+-Sample reanalyzed-	
23-25	sand and gravel	1700±140			Cs-137 <.05 pCi/gm	
25-27	sand, gravel and bedrock	1630±150				

DATA SHEET

SUBJECT H_3 Levels (pCi/1) in Observation Wells

DATE 4/25/80 SHEET

LOCATION OW-11

ENGINEER

Core Depth Feet	Core Description	H_3 pCi/1		Core Depth Feet	Core Description	H_3 pCi/1
0-1	sand & gravel	2010±140				
1-2	gravel	1450±120				
2-3	sand, gravel, bed-rock & quartz	1211±110				
3-4	sand, gravel & bedrock	1950±150				
4-5	gravel & sand	1020± 90				
5-5.8	gravel & clay	1460±110				

DATA SHEET

SUBJECT: H_3 Levels (pCi/1) in Observation Wells

DATE: 4/23,4/24/80 SHEET:

LOCATION: OW-12 (was 5 Ft. West of OW-17)

ENGINEER:

Core Depth Feet	Core Description	H_3 pCi/1		Core Depth Feet	Core Description	H_3 pCi/1
0-1	small stones & sand	610± 90				
1-2	no sample	*				
2-3	small stones & sandy soil	*				
3-4	small stones	*				
4-5	gravel, sand & small stones	*				
5-7.5	gravel & small stones	*				
7.5-10.5	no sample	*				
10.5-11.5	small stones & sandy gravel	580±100				
11.5-12.5	small stones & sandy gravel	340± 80				
13-14.1	fine to coarse sand & gravel	1280±140				
14.1-15	fine to coarse sand & gravel, some silt/clay	1010±110				
15-16	cobbles & sand	980±100				
18-20 A	clay, cobbles & sand	4230±260				
18-20 B	"	4140±240				
20-21.6 A	"	4530±280				
20-21.6 B	"	5900±360				
21.6-21.8	"	9550±580				
21.8-22.5A	"	7390±444				
21.8-22.5B	"	10100±600				
23.5-25.5	sand, stone & gravel	6080±360				
25.5-27	sand, rock & sandstone	5700±340				
27.5-27.6	"	3620±220				

*-no water could be extracted from the sample for tritium analysis.

DATA SHEET

SUBJECT H3 Levels (pCi/ℓ) in Observation Wells

DATE 5/7/80 SHEET

LOCATION OW-13B

ENGINEER

Core Depth Feet	Core Description	H_3 pCi/1		Core Depth Feet	Core Description	H_3 pCi/1
0-1	Sand and Gravel	630 ± 90				
1-2	Sand, Gravel and Cobbel	780 ± 90				
2-3	Sand and Gravel	1240±100				
3-4	" " "	1030±100				
4-5	" " "	560±110				
5-7	" " "	1150±110				
7-9	Sand, Gravel and Clay	200 ± 80				
9-11	Sand and Gravel	250 ± 80				
11-13	" " "	490 ± 80				
13-15	Sand, Gravel and Clay	420 ± 90				
15-17	Sand and Gravel	420 ± 90				
17-19	" " "	640±110				
19-21	" " "	1020±100				
21-12	" " "	440 ± 80				
23-24.1	Sand, Gravel and Bedrock	530 ± 80				
24.1-25	Sand and Bedrock	590 ± 80				

DATA SHEET

SUBJECT H_3 Levels in Observation Wells

DATE 4/30, 5/1 SHEET

LOCATION OW-14

ENGINEER

Core Depth Feet	Core Description	H_3 pCi/l		Core Depth Feet	Core Description	H_3 pCi/l
0-1	Sand, Cobbles and Gravel	1820±110				
1-2	Sand, Cobbles, Gravel and Clay	1240±100				
2-3	Clay, Sand and Gravel	780±100				
3-4	Sand and Gravel	910 ± 90				
4-5	Sand, Gravel and Quartz	1050±100				
5'-7'	"	550 ± 90				
7'-9'	Sand and Gravel	690±100				
9'-11'	Sandstone, Sand, Gravel and Quartz	650 ± 90				
11'-13'	Sand and Gravel	670 ± 80				
13'-15'	Sand, Gravel and Clay	590 ± 80				
15'-17'	Sand, Gravel and Clay	1610±160				
17'-19'	Bedrock, Sand Silt and Gravel	430±160				
19'-21'	Gravel and Sand	800 ± 80				
21'-23'	Quartz, Sand and Cobbles	700 ± 80				
23.5-25.5	Sand and Gravel	550 ± 80				
25.5-27.5	Sand and Gravel	2210±140				
27.5-29.5	Sand and Gravel	2270±150				
29.5-30.7	"	1450±120				

DATA SHEET

SUBJECT H_3 Levels (pCi/1) in Observation Wells

DATE 5/6/80 SHEET

LOCATION OW-15

ENGINEER

Core Depth Feet	Core Description	H_3 pCi/1		Core Depth Feet	Core Description	H_3 pCi/1
0-1	loam/silt fine sandy, clay-silt	350±100*				
1-2	same as 0-1' level	<130				
2-4	clay, silt	160± 80				
4-5	clay, silt	520± 90				
5-7	silt, sand & clay	<130				
7-9	trace clay, sand, gravel, mica & quartz	170± 80				
9-11	clay/sand	330± 90				
	*Cs-137					
	-.388± 070 pCi/g					

DATA SHEET

SUBJECT: H_3 Levels (pCi/l) in Observation

DATE: 4/29, 4/30 SHEET:

LOCATION: OW-17

ENGINEER:

Core Depth Feet	Core Description	H_3 pCi/l		Core Depth Feet	Core Description	H_3 pCi/l
0-1	Gravel	1080±100				
1-2	Gravel	250± 70				
2-3	Fine Sand/Gravel	620± 80				
3-4	Sand/Gravel	420± 80				
4-5	" "	370±100				
5-7	" "	300± 80				
7-9	No Sample	-				
10-12	Sand/Gravel	350±100				
12-14	Loose Sand and Gravel	370+ 80				
14-17	Sand/Gravel	510± 70				
17-20	No Sample	-				
20-22	Clay, Sand, Gravel and Cobbles	1630±150				
23-25	Sand, Gravel and Limestone	4180±260				
25-27	Sand, Gravel and Some Cobbles	4190±260				
27-28	Fine and Medium Sand, Some Gravel	3340±200				