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April 28, 2006

PG&E Letter HBL-06-012



U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, DC 20555-0001

Docket No. 50-133, OL-DPR-7  
Humboldt Bay Power Plant Unit 3  
Annual Radiological Environmental Monitoring Report for 2005

Dear Commissioners and Staff:

Enclosed is the Humboldt Bay Power Plant Unit 3 "Annual Radiological Environmental Monitoring Report" for 2005. This report provides the information required by Section 5.7.2 of the Unit 3 Technical Specifications, and by Section 4.1 of the SAFSTOR Offsite Dose Calculation Manual (ODCM).

The report has three sections. Section A provides a summary description of the SAFSTOR Radiological Environmental Monitoring Program (REMP), including maps of sampling locations. Section A also provides the results of licensee laboratory participation in the Interlaboratory Comparison Program.

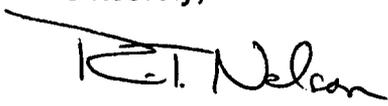
Section B provides summaries, interpretations, and analyses of trends of the results of the REMP for the reporting period. The material provided is consistent with the objectives outlined in the ODCM, and in 10 CFR 50, Appendix I, Sections IV.B.2, IV.B.3, and IV.C. Section B also includes a comparison with the baseline environmental conditions at the beginning of SAFSTOR.

Section C provides monitoring results for the reporting period, with summaries and tabulations. Radiological environmental samples and environmental radiation measurements were taken at the locations identified in ODCM Table 2-7 as quality-related locations. The summarized results are formatted for applicable reporting requirements of the NRC Radiological Assessment Branch's Branch Technical Position.

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If you wish to discuss the information in the enclosed report, please contact Joe Davis at (707) 444-0851 or David Sokolsky at (707) 444-0801.

Sincerely,



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Enclosure

Enclosure  
PG&E Letter HBL-06-012

**HUMBOLDT BAY POWER PLANT UNIT 3  
ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT**

**JANUARY 1 THROUGH DECEMBER 31, 2005**

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**PACIFIC GAS AND ELECTRIC COMPANY  
ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT FOR  
HUMBOLDT BAY POWER PLANT UNIT 3, COVERING THE PERIOD  
JANUARY 1 THROUGH DECEMBER 31, 2005**

This annual report is required by Section 5.7.2 of the Humboldt Bay Power Plant (HBPP) Unit 3 Technical Specifications (TS), and by Section 4.1 of the SAFSTOR Offsite Dose Calculation Manual (ODCM). This report provides information about the Radiological Environmental Monitoring Program (REMP) for the period of January 1 through December 31, 2005, in a manner consistent with the objectives outlined in the ODCM, and in 10CFR 50, Appendix I, Sections IV.B.2, IV.B.3, and IV.C.

The report has three sections. Section A provides a summary description of the REMP, including maps of sampling locations. Section A also provides the results of licensee laboratory participation in the Interlaboratory Comparison Program.

Section B provides summaries, interpretations, and analyses of trends of the results of the REMP for the reporting period. The material provided is consistent with the objectives outlined in the ODCM, and in 10CFR 50, Appendix I, Sections IV.B.2, IV.B.3, and IV.C. Section B also includes a comparison with the baseline environmental conditions at the beginning of SAFSTOR.

Section C provides the results of analyses of radiological environmental samples and of environmental radiation measurements taken during the period pursuant to the quality related locations specified in the table and figures in the ODCM, presented as both summarized and tabulated results of these analyses and measurements. The summarized results are formatted for applicable reporting requirements of the NRC Radiological Assessment Branch's Branch Technical Position.

## **A. RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM**

### **1. Program Description**

The NRC Radiological Assessment Branch issued a Branch Technical Position (BTP) on environmental monitoring in March 1978. Revision 1 of the BTP was issued as Generic Letter 79-65, "Radiological Environmental Monitoring Program Requirements – Enclosing Branch Technical Position," Revision 1, dated November 27, 1979, and sets forth an example of an acceptable minimum radiological monitoring program. The specified environmental monitoring program provides measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposures of individuals resulting from plant effluents.

As discussed below, many of the exposure pathway sample requirements specified in the BTP are not required for the HBPP REMP because of the baseline conditions established in the SAFSTOR Decommissioning Plan and the

Environmental Report. In addition, the nuclides specified for analysis by the BTP have been revised to reflect the available source term at a nuclear power plant that has been shut down since July 2, 1976.

The REMP consists of the collection and analysis of both onsite and offsite environmental samples. HBPP personnel perform sample collection and PG&E's Technical and Ecological Services (TES) personnel perform sample analysis. The Diablo Canyon Power Plant (DCPP) dosimetry group performs analysis of thermoluminescent dosimeters (TLDs) used for monitoring direct radiation. A summary of the REMP is provided as Table A-1, "HBPP Radiological Environmental Monitoring Program."

Sample collection for the REMP is performed at the sampling stations defined by Table A-2, Distances and Directions to Environmental Monitoring Stations; Figure A-1, HBPP Onsite TLD Locations; Figure A-2, HBPP Onsite Monitoring Well Locations; and Figure A-3, HBPP Offsite TLD Locations.

## 2. Monitoring Requirements

### a. Offsite Environmental Monitoring - Direct Radiation

The SAFSTOR ODCM requires four offsite environmental monitoring stations equipped with TLDs to monitor gamma exposure. The TLDs are to be exchanged quarterly. The stations selected to satisfy this requirement are Stations 1, 2, 14 and 25, shown on Figure A-3. These stations are considered to be the four control locations for the direct radiation dose pathway.

### b. Onsite Environmental Monitoring

#### (1) Direct Radiation

The SAFSTOR ODCM requires sixteen onsite environmental monitoring stations, equipped with TLDs to monitor gamma exposure. The TLDs are to be exchanged quarterly. The stations selected to satisfy this requirement are Stations T1 through T16, shown on Figure A-1.

Each quarter the exposures from 16 stations are determined which results in the 64 analyses for the year. Each TLD station has three TLDs, each containing a number of phosphors (normally three). The phosphor exposures for each TLD are averaged and then the three TLDs per station are averaged to provide the quarterly exposure for the station.

## **(2) Surface Water**

The SAFSTOR ODCM requires that the discharge canal effluent be monitored by gamma isotopic analysis and by tritium analysis. Composite samples are normally collected weekly from a continuous sampler, with dip (grab) samples collected if the sampler is inoperable.

## **(3) Groundwater**

The SAFSTOR ODCM requires that five groundwater wells be monitored by gamma isotopic analysis and by tritium analysis. Samples are to be collected quarterly. The monitoring wells selected to satisfy this requirement are identified as MW-1, MW-2, MW-4, MW-6, and MW-11, shown on Figure A-2.

### **c. Other Monitoring**

Airborne, ingestion and terrestrial pathway monitoring is not required by the ODCM. The Environmental Report, submitted to the NRC as Attachment 6 to the SAFSTOR license amendment request, established baseline conditions for these pathways. In accordance with the NRC approved SAFSTOR Decommissioning Plan, (now identified as the Defueled Safety Analysis Report (DSAR)), these baseline conditions will only need to be reestablished prior to final decommissioning if a significant release occurs during SAFSTOR. The Environmental Report also contains a description of the demography and human activities within the environs surrounding the site.

As a matter of plant policy, groundwater leakage into the reactor caisson is routinely sampled, approximately monthly, and analyzed for Tritium, in order to develop a historical record of this parameter for the remainder of SAFSTOR. The results are included in this report, but are not considered part of the SAFSTOR REMP.

### **3. Interlaboratory Comparison Program**

PG&E's TES has analyzed evaluation samples provided by a commercial supplier to satisfy the requirement to participate in an Interlaboratory Cross-Check Program. This participation includes sufficient determinations (sample medium and radionuclide combination) to ensure independent checks on the precision and accuracy of the measurements of radioactive materials in the REMP samples. Table A-3 presents the participation in this Interlaboratory Cross-Check Program for samples analyzed in the report period. The agreement criteria are consistent with the guidance for "Confirmatory Measurements" in NRC Inspection Procedure 83502.3, "Radiological Environment Monitoring Program and Radioactive Material Control Program." All of the sample results met the acceptance criteria.

## **B. TRENDS, BASELINE COMPARISONS AND INTERPRETATIONS**

Section B provides interpretations of results, and analyses of trends of the results. The material provided is consistent with the objectives outlined in the ODCM, and in 10CFR 50, Appendix I, Sections IV.B.2, IV.B.3, and IV.C. Section B also includes a comparison with the baseline environmental conditions at the beginning of SAFSTOR.

### **1. General Comments**

The Environmental Report, submitted to the NRC as Attachment 6 to the SAFSTOR license amendment request, established baseline conditions for soil, biota and sediments. In accordance with the NRC approved SAFSTOR Decommissioning Plan (now identified as the DSAR)), these baseline conditions will only need to be reestablished prior to final decommissioning if a significant release occurs during SAFSTOR. The results to date indicate no significant change (other than normal radioactive decay) from the baseline environmental conditions established in the Environmental Report.

The results, interpretations, and analysis of trends of the results, indicate that SAFSTOR activities have had no measurable radiological effect on the environment. Facility surveys for radiation and radioactive surface contamination are performed on both a scheduled basis and on an as-required basis. These surveys indicate that the radioactivity control barriers established for SAFSTOR continue to be effective.

As discussed below, the ODCM calculation model conservatively assumes that exposure pathways begin at the unrestricted area boundary. Since there have not been any changes in the location of the boundary, no survey for changes to the use of unrestricted areas was necessary.

With the exception of the direct radiation pathway (discussed below), there were no measurement results that could be directly compared to calculated doses to individuals.

### **2. Direct Radiation Pathway**

A plot of the radiation level trends for the four control locations is shown in Figure B-1, Offsite Environmental Radiation Level Trends. A plot of the radiation level trends for onsite stations is shown in Figure B-2, Onsite Environmental Radiation Level Trends, showing the average dose for two groups of onsite stations, selected by their potential to be affected by radioactive waste handling activities.

The plots suggest that there has been an apparent long term increase in both onsite and offsite annual doses of about 7 mRem over a period of 17 years. This rate is slightly lower than was noted in last year's report, and it appears that

the rate has changed over the most recent 5 to 6 years. Station No. 2, which is located approximately 9.4 miles from the facility, and which served as a background monitoring location during plant operation, continued to show slightly higher readings than the 3 stations located within 1.3 miles of the facility. The trend for Station No. 2 also appears to indicate that after it was relocated in the year 2000, its background readings increased by approximately 3 mRem per year.

Figure B-2 also shows that dose measurement variations can be attributed to in-plant sources and low-level waste packaging and shipping activities. However, allowing for the background change in the general environs, all measurements were comparable to the ranges observed at these locations since entering SAFSTOR, with the onsite station dose levels approximately within the range of dose levels shown by the offsite stations.

The ODCM calculation model for the direct radiation exposure pathway assumes an occupancy factor for the portion of the unrestricted area boundary that is closest to the radioactive waste handling area of the plant, which is the location of the highest potential exposure. The occupancy factor is 67 hours per year, based on regulatory guidance for shoreline recreation, even though the actual shoreline is farther from the boundary. Since there have been no changes of the locations of the radioactive waste handling activities, boundary, or shoreline, no further survey for changes to the use of unrestricted areas is necessary.

### 3. Airborne Pathway

Airborne pathway monitoring is not required by the ODCM. The Environmental Report, submitted to the NRC as Attachment 6 to the SAFSTOR license amendment request, established baseline conditions for the airborne pathway. In accordance with the NRC approved SAFSTOR Decommissioning Plan, (now identified as the DSAR), these baseline conditions will only need to be reestablished prior to final decommissioning if a significant release occurs during SAFSTOR.

The ODCM calculation model for the airborne pathway assumes that the airborne exposure pathway (inhalation exposure) is at the unrestricted area boundary, which is the location of the highest potential exposure.

### 4. Waterborne Pathway

#### a. Surface Water

None of the REMP samples indicated detectable levels of Tritium or gamma radioactivity. These sample results were typical of those observed since entering SAFSTOR.

The ODCM calculation model for the surface water waterborne pathway assumes that the waterborne exposure pathway (vertebrate and invertebrate food consumption) begins at the unrestricted area boundary, which is the location of the highest potential exposure.

The ODCM calculation model is based on the average concentration of the radioactivity released and diluted by the flow of water circulating through the outfall canal. For the purposes of comparing the sampling results with effluents, consider a conservatively estimated liquid waste batch of 7,000 gallons containing Tritium at 30,000 pico-Curies/liter, Cs-137 at 1,000 pico-Curies/liter, and Co-60 at 100 pico-Curies/liter. For a single batch release during a week-long canal composite sample, the circulating water volume is rarely lower than 1.6E8 gallons, so the diluted activity for Tritium, Cs-137 and Co-60 would be 1.3, 0.044, and 0.0044, pico-Curies/liter, respectively. These concentrations are unlikely to be detected.

**b. Groundwater**

None of the REMP samples indicated detectable levels of Tritium or gamma radioactivity. For gamma radioactivity, these sample results were typical of those observed since entering SAFSTOR. Tritium, which had previously been detected in wells MW-1 and MW-11, has decayed to a level that is rarely likely to be detected, and also as a result of removing the suspected source of the contamination in MW-11. Results for other parameters and samples were comparable to the ranges observed since entering SAFSTOR.

The ODCM does not provide a model for the groundwater waterborne pathway, as the groundwater is saline and is not used for either direct consumption or for agricultural purposes.

**5. Ingestion Pathway**

Ingestion pathway monitoring is not required by the ODCM. The Environmental Report, submitted to the NRC as Attachment 6 to the SAFSTOR license amendment request, established baseline conditions for the ingestion pathway. In accordance with the NRC approved SAFSTOR Decommissioning Plan, (now identified as the DSAR), these baseline conditions will only need to be reestablished prior to final decommissioning if a significant release occurs during SAFSTOR.

The ODCM calculation model for the airborne pathway assumes that the airborne exposure ingestion pathways (milk, meat and vegetable consumption) begin at the unrestricted area boundary, which is the location of the highest potential exposure, whether any dairy, farm, etc. is actually present.

## 6. Terrestrial Pathway

Terrestrial pathway monitoring is not required by the ODCM. The Environmental Report, submitted to the NRC as Attachment 6 to the SAFSTOR license amendment request, established baseline conditions for the terrestrial pathway. In accordance with the NRC approved SAFSTOR Decommissioning Plan, (now identified as the DSAR), these baseline conditions will only need to be reestablished prior to final decommissioning if a significant release occurs during SAFSTOR.

The ODCM calculation model for the terrestrial pathway conservatively assumes that the terrestrial exposure (direct radiation from airborne radioactivity deposition) is at the unrestricted area boundary, which is the location of the highest potential exposure.

## C. MONITORING RESULTS

### 1. Annual Summary

Results of the REMP sampling and analysis are summarized in Table C-1 in the format of the BTP Table 3. None of the REMP samples results exceeded the reporting levels for radioactivity concentration in environmental samples specified in HBPP ODCM Table 2-8.

None of the REMP analysis minimum detectable activities (MDAs) exceeded the lower limit of detection (LLD) criteria for radioactivity in environmental samples specified in HBPP ODCM Table 2-9.

### 2. Direct Radiation Pathway

Monitoring of the direct radiation pathway is performed at 16 onsite locations near the facility fence line, and at 4 offsite (control) locations in the vicinity of the facility. Monitoring is performed with TLDs with multiple crystal elements. Three TLDs are installed at each station, and the set is exchanged quarterly. The reported result and its standard error are calculated from the measurements of multiple elements in the TLD triplet. Results of the onsite and offsite monitoring are provided in Tables C-2 and C-3, respectively.

The results for the second quarter of 2005 include a correction for the data for station T9. One element of three in one TLD (of three) had an anomalous reading. That reading was rejected and period dose for the station was recalculated from the remaining 8 element readings.

Otherwise, all required sampling and analysis for the direct radiation pathway was performed successfully during this reporting period.

### 3. Airborne Pathway

Airborne pathway monitoring is not required by the ODCM.

### 4. Waterborne Pathway

#### a. Surface Water

Surface water sampling of the waterborne pathway is performed by sampling the discharge canal effluent. Sampling is normally performed by collecting a weekly sample from a discharge canal continuous composite sampler. If the composite sampler is found to be inoperable, dip samples from the discharge canal are taken. All samples during the reporting period were obtained from the continuous composite sampler.

Detailed results of the discharge canal monitoring are provided in Table C-4. None of these samples indicated detectable levels of Tritium or gamma radioactivity. Since no activity was detected, a comparison with the baseline levels was not performed.

#### b. Groundwater

Groundwater sampling of the waterborne pathway is performed by sampling five monitoring wells located to monitor for leakage from the spent fuel pool. Sampling of these monitoring wells is performed quarterly. Detailed results of groundwater monitoring are provided in Table C-5. None of these samples indicated detectable levels of Tritium or gamma radioactivity. Since no activity was detected, a comparison with the baseline levels was not performed.

Because Alpha and Beta radioactivity analyses of the saline ground water are less effective than Tritium and Gamma radioactivity analyses for monitoring potential spent fuel pool leakage, the ODCM does not currently require Alpha and Beta radioactivity analyses to be part of the SAFSTOR REMP. Nevertheless, Alpha and Beta radioactivity analyses are performed as a matter of plant policy, in order to maintain a historical record of this parameter for the remainder of SAFSTOR. These results are included in Table C-5, but are not considered part of the SAFSTOR REMP.

The Third Quarter Ground Water sample for Monitoring Well #4 could not be performed when scheduled due to failure of the sampling apparatus. The ¼" polyflow tubing in the well failed. The bubbler tubing was replaced. The parts necessary to repair the sampling apparatus were not received and the repairs completed prior to the end of the Third Quarter.

Otherwise, all required sampling and analysis for the five monitoring wells of the waterborne pathway required during this reporting period was performed successfully.

Groundwater leakage into the reactor caisson is also routinely sampled, approximately monthly, and analyzed for Tritium as a matter of plant policy, in order to develop a historical record of this parameter for the remainder of SAFSTOR. These results are included in Table C-6, but are not considered part of the SAFSTOR REMP.

**5. Ingestion Pathway**

Ingestion pathway monitoring is not required by the ODCM.

**6. Terrestrial Pathway**

Terrestrial pathway monitoring is not required by the ODCM.

**7. Errata For Previous Report**

None.

**TABLE A-1  
HBPP RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM**

<b>Exposure Pathway And/Or Sample</b>	<b>Number of Samples And Locations</b>	<b>Sampling and Collection Frequency</b>	<b>Type of Analysis</b>
<b>DIRECT RADIATION</b>	16 onsite stations with TLDs	TLDs exchanged quarterly	Gamma exposure
	4 offsite stations with TLDs	TLDs exchanged quarterly	Gamma exposure
<b>WATERBORNE Surface Water</b>	Discharge canal effluent	Continuous sampler operation with sample collection weekly. Dip samples if sampler inoperable	Gamma isotopic <sup>(a)</sup> and Tritium analysis of weekly sample
Groundwater	5 groundwater monitoring wells	Quarterly	Tritium and gamma isotopic <sup>(a)</sup> analysis

<sup>(a)</sup> Gamma isotopic analysis means the identification and quantification of gamma emitting radionuclides that may be attributable to the effluents from the facility.

**TABLE A-2  
DISTANCES AND DIRECTIONS TO OFFSITE ENVIRONMENTAL MONITORING STATIONS**

Station Number	Station Name	Radial Direction		Radial Distance From Plant (Miles)
		Sector	By Degrees	
1	King Salmon Picnic Area	W	270	0.3
2	City of Fortuna Water Pollution Control Plant, 180 Dinsmore Drive, Fortuna	SSE	158	9.4
14	South Bay School Parking Lot	S	180	0.4
25	Irving Drive, Humboldt Hill	SSE	175	1.3

**TABLE A-3  
TES PARTICIPATION – INTERLABORATORY CROSS-CHECK PROGRAM DATA**

<b>Sample/Analysis</b>	<b>Radionuclide</b>	<b>Month</b>	<b>Analytcs</b>	<b>TES</b>	<b>Ratio</b>	<b>Evaluation</b>
Water/Gamma	Mn-54	September	9.77E-6	1.01E-5	1.03	Agreement
	Co-60	September	1.19E-4	1.20E-4	1.01	Agreement
	Cs-134	September	9.16E-6	8.81E-6	0.96	Agreement
	Cs-137	September	1.23E-4	1.28E-4	1.04	Agreement
Water/Gamma	Am-241	February	5.63E-6	5.31E-6	0.94	Agreement
	Cs-134	February	1.99E-5	1.83E-5	0.92	Agreement
	Cs-137	February	5.27E-5	5.51E-5	1.05	Agreement
	Ba-133	February	1.65E-5	1.62E-5	0.98	Agreement
	Co-60	February	6.84E-5	7.07E-5	1.03	Agreement
Gamma/Filter	Mn-54	November	1.58E-3	1.51E-3	0.96	Agreement
	Co-60	November	1.85E-2	1.82E-2	0.98	Agreement
	Cs-134	November	1.78E-3	1.79E-3	1.01	Agreement
	Cs-137	November	1.43E-2	1.56E-2	1.09	Agreement

Table Notation: (a) All of the values shown are relative. Therefore, the units for total activity or concentration levels are not shown.

**TABLE A-3 (CONTINUED)**  
**TES PARTICIPATION – INTERLABORATORY CROSS-CHECK PROGRAM DATA**

<b>Sample/Analysis</b>	<b>Radionuclide</b>	<b>Month</b>	<b>Analytcs</b>	<b>TES</b>	<b>Ratio</b>	<b>Evaluation</b>
Gamma/Filter	Cs-134	June	9.27E-4	9.30E-4	1.00	Agreement
	Cs-137	June	1.10E-2	1.16E-2	1.05	Agreement
	Mn-54	June	9.71E-4	1.07E-3	1.19	Agreement
	Zn-65	June	4.82E-3	5.23E-3	1.09	Agreement
	Co-60	June	6.36E-3	6.53E-3	1.03	Agreement
Water/Alpha	Gross Alpha	February	1.97E-4	1.84E-4	0.93	Agreement
Water/Beta	Gross Beta	February	4.08E-4	3.86E-4	0.95	Agreement
Water/Tritium	Tritium	May	2.16E-3	2.13E-3	0.99	Agreement
Water/Tritium	Tritium	October	3.16E-3	3.26E-3	0.99	Agreement
Particulate Filter	Alpha	July	19	16.2	0.85	Agreement
Particulate Filter	Beta	July	51	47.4	0.93	Agreement

Table Notation: (a) All of the values shown are relative. Therefore, the units for total activity or concentration levels are not shown.

**TABLE C-1**  
**RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL REPORT SUMMARY**

Name of Facility Humboldt Bay Power Plant Unit 3

Docket No. 50-133, OL-DPR-7

Location of Facility Humboldt County, California  
 (County, State)

Reporting Period January 1 – December 31, 2004

Medium or Pathway Sampled [Unit of Measurement]	Type and Total Number of Analyses Performed	Lower Limit of Detection <sup>a</sup> (LLD)	All Indicator Locations	Location with Highest Annual Mean		Control Locations	Number of Nonroutine Reported Measurements
			Mean, (Fraction) & [Range] <sup>b</sup>	Name, Distance and Direction	Mean, (Fraction) & [Range] <sup>b</sup>	Mean, (Fraction) & [Range] <sup>b</sup>	
AIRBORNE Radioiodine and Particulates	Not Required	N/A	N/A	N/A	N/A	Not Required	N/A
DIRECT RADIATION [mR/quarter]	Direct radiation (64)	3	13.0 ± 0.1 (64/64) [11.7 – 14.5]	Station T1, Figure B-1	14.3 ± 0.2 (4/4) [14.0 – 14.4]	12.7 ± 0.1 (16/16) [11.7 – 14.6]	0
WATERBORNE Surface Water (Discharge canal effluent) [pCi/l]	Gamma isotopic (52)	Co-60: 15 Cs-137: 18	<MDA (0/52) [N/A]	N/A	N/A	Not Required	0
	Tritium (52)	400	<MDA (0/52) [N/A]	N/A	N/A	Not Required	0

**TABLE C-1 (Continued)**  
**RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL REPORT SUMMARY**

Medium or Pathway Sampled [Unit of Measurement]	Type and Total Number of Analyses Performed	Lower Limit of Detection <sup>a</sup> (LLD)	All Indicator Locations		Location with Highest Annual Mean				Control Locations		Number of Nonroutine Reported Measurements
			Mean, (Fraction) & [Range] <sup>b</sup>		Name, Distance and Direction		Mean, (Fraction) & [Range] <sup>b</sup>		Mean, (Fraction) & [Range] <sup>b</sup>		
WATERBORNE (continued) Groundwater (Monitoring wells) [pCi/l]	Gamma isotopic (20)	Co-60: 15 Cs-137: 18	Co-60 <MDA (0/20) [N/A]	Cs-137 <MDA (0/20) [N/A]	Co-60 N/A	Cs-137 N/A	Co-60 <MDA (0/4) [N/A]	Cs-137 <MDA (0/4) [N/A]	Co-60 <MDA (0/4) [N/A]	Cs-137 <MDA (0/4) [N/A]	0
	Tritium (20)	400	<MDA (0/20) [N/A]		N/A		<MDA (0/4) [N/A]		<MDA (0/4) [N/A]		0
Drinking Water	Not Required	N/A	N/A		N/A		N/A		Not Required		N/A
Sediment	Not Required	N/A	N/A		N/A		N/A		Not Required		N/A
Algae	Not Required	N/A	N/A		N/A		N/A		Not Required		N/A
INGESTION Milk	Not Required	N/A	N/A		N/A		N/A		Not Required		N/A
Fish and invertebrates	Not Required	N/A	N/A		N/A		N/A		Not Required		N/A
TERRESTRIAL Soil	Not Required	N/A	N/A		N/A		N/A		Not Required		N/A

<sup>a</sup> The LLD is defined as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95 percent probability with only 5 percent probability of falsely concluding that a blank observation represents a "real" signal. LLD is defined as the a priori lower limit of detection (as pCi per unit mass or volume) representing the capability of a measurement system and not as the a posteriori (after the fact) limit for a particular measurement. (Current literature defines the LLD as the detection capability for the instrumentation only, and the MDA, minimum detectable concentration, as the detection capability for a given instrument, procedure and type of sample.) The actual MDA for these analyses was at or below the LLD.

<sup>b</sup> The mean and the range are based on detectable measurements only. The fraction of detectable measurements at specified locations is indicated in parentheses; e.g., (10/12) means that 10 out of 12 samples contained detectable activity. The range of detected results is indicated in brackets; e.g., [23-34].

Not Required: Not required by the HBPP Unit 3 Technical Specifications or the SAFSTOR Offsite Dose Calculation Manual. Baseline environmental conditions for this parameter were established in the Environmental Report as referenced by the SAFSTOR Decommissioning Plan (now identified as the Defueled Safety Analysis Report).

N/A – Not applicable

**TABLE C-2  
ONSITE ENVIRONMENTAL TLD STATIONS**

Station Number	TLD Exposure Measurements (mR)			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
T1	14.4 ± 0.4	14.4 ± 0.2	14.0 ± 0.3	14.2 ± 0.3
T2	12.8 ± 0.3	13.2 ± 0.4	13.1 ± 0.2	13.4 ± 0.4
T3	12.7 ± 0.2	12.7 ± 0.5	12.3 ± 0.4	12.7 ± 0.3
T4	12.7 ± 0.1	12.7 ± 0.4	12.6 ± 0.4	12.7 ± 0.4
T5	12.8 ± 0.3	12.7 ± 0.4	12.7 ± 0.5	12.9 ± 0.3
T6	13.0 ± 0.2	12.4 ± 0.2	12.5 ± 0.3	12.3 ± 0.3
T7	13.1 ± 0.4	12.5 ± 0.3	12.4 ± 0.3	12.5 ± 0.4
T8	12.3 ± 0.3	12.7 ± 0.4	12.2 ± 0.3	12.3 ± 0.3
T9	12.7 ± 0.5	11.7 ± 0.3	12.7 ± 0.3	12.8 ± 0.3
T10	12.3 ± 0.5	12.3 ± 0.5	12.2 ± 0.5	12.4 ± 0.2
T11	12.9 ± 0.5	12.5 ± 0.4	12.5 ± 0.4	12.8 ± 0.2
T12	14.1 ± 0.3	13.6 ± 0.2	13.4 ± 0.3	13.6 ± 0.3
T13	13.1 ± 0.4	13.2 ± 0.5	13.2 ± 0.3	13.3 ± 0.2
T14	14.3 ± 0.3	14.1 ± 0.3	13.8 ± 0.4	14.5 ± 0.4
T15	12.9 ± 0.2	13.8 ± 0.3	13.5 ± 0.3	13.3 ± 0.2
T16	13.6 ± 0.3	13.5 ± 0.3	12.9 ± 0.2	13.4 ± 0.3

Parameter	Calculated Parameters (mR)			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Average	13.1 ± 0.1	13.0 ± 0.1	12.9 ± 0.1	13.1 ± 0.1
Maximum	14.4 ± 0.5	14.4 ± 0.5	14.0 ± 0.5	14.5 ± 0.4

Notes:

1. These exposures are reported for a standardized period of 90 days.
2. The results for the second quarter of 2005 include a correction for the data for station T9. One element of three in one TLD (of three) had an anomalous reading. That reading was rejected and period dose for the station was recalculated from the remaining 8 element readings.

**TABLE C-3  
OFFSITE ENVIRONMENTAL TLD STATIONS**

Station Number	TLD Exposure Measurements (mR)			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1	12.7 ± 0.4	12.9 ± 1.0	12.5 ± 0.3	12.9 ± 0.3
2	14.9 ± 0.4	14.6 ± 0.3	14.1 ± 0.3	14.6 ± 0.3
14	11.8 ± 0.5	11.9 ± 0.3	11.4 ± 0.2	11.8 ± 0.3
25	12.1 ± 0.2	11.7 ± 0.3	11.3 ± 0.4	11.9 ± 0.4

Parameter	Calculated Parameters (mR)			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Average	12.9 ± 0.2	12.8 ± 0.3	12.3 ± 0.2	12.8 ± 0.2
Maximum	14.9 ± 0.5	14.6 ± 1.0	14.1 ± 0.4	14.6 ± 0.4

Note:

1. These exposures are reported for a standardized period of 90 days.

**TABLE C-4  
DISCHARGE CANAL SAMPLE RESULTS**

Sample Date	Gamma Activity (pCi/l)		Tritium Activity (pCi/l)
	Cs-137	Co-60	
1/5/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
1/12/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
1/19/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
1/26/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
2/2/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
2/09/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
2/16/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
2/23/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
3/2/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
3/09/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
3/16/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
3/23/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
3/30/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
4/6/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
4/13/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
4/20/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
4/27/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
5/4/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
5/11/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
5/18/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
5/25/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
6/1/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
6/8/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
6/15/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
6/22/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
6/29/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
7/6/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
7/13/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
7/20/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
7/27/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
8/3/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
8/10/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
8/17/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
8/24/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
8/31/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
9/7/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
9/14/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
9/21/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
9/28/05	<18 (MDA)	<15 (MDA)	<400 (MDA)

**TABLE C-4 (CONTINUED)  
DISCHARGE CANAL SAMPLE RESULTS**

Sample Date	Gamma Activity (pCi/l)		Tritium Activity (pCi/l)
	Cs-137	Co-60	
10/5/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
10/12/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
10/19/05 <sup>b</sup>	<18 (MDA)	<15 (MDA)	<400 (MDA)
10/26/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
11/2/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
11/09/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
11/16/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
11/23/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
11/30/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
12/7/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
12/14/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
12/21/05	<18 (MDA)	<15 (MDA)	<400 (MDA)
12/28/05	<18 (MDA)	<15 (MDA)	<400 (MDA)

Calculated Parameters	Gamma Activity (pCi/l)		Tritium Activity (pCi/l)
	Cs-137	Co-60	
Average	Note 4	Note 4	Note 4
Maximum	Note 4	Note 4	Note 4

Notes:

- Gamma measurements are performed on the original sample, with results corrected to the time of sampling. Naturally occurring isotopes are not reported. The maximum lower limits of detection (LLDs) for Co-60 and Cs-137 are 15 and 18 pCi/l, respectively. The MDA for these analyses was at or below the LLD.
- For purposes of this report, LLD is defined as the a priori (before the fact) lower limit of detection, which represents the capability of the measurement system. MDA is defined as the a posteriori (after the fact) limit of detection capability considering a given instrument, procedure and type of sample.
- Tritium analysis is performed on a measured aliquot of distilled sample. The reported values are net measurements above instrument background. The normal MDA for the analyses for tritium was approximately 400 pCi/l. Results that are at or below the normal MDA are reported as "<MDA".
- Results identified as "<MDA" are not included in the calculation of average and maximum values.
- The discharge canal sample pump was taken out of service from 1410 to 1430 on 10/19/05.

**TABLE C-5  
GROUNDWATER MONITORING WELL RESULTS**

Monitor Well Number	Sample Date	Alpha Activity (pCi/l)	Beta Activity (pCi/l)	Gamma Activity (pCi/l)		Tritium Activity (pCi/l)
				Cs-137	Co-60	
MW-1	3/15/05	<3 (MDA)	14.2 ± 6.4	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-2	3/15/05	<3 (MDA)	2.42 ± 2.3	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-4	3/15/05	<3 (MDA)	6.55 ± 4.1	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-6	3/15/05	<3 (MDA)	4.32 ± 2.5	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-11	3/15/05	<3 (MDA)	9.0 ± 5.9	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-1	6/08/05	<3 (MDA)	7.1 ± 6.6	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-2	6/08/05	<3 (MDA)	<4 (MDA)	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-4	6/08/05	<3 (MDA)	3.4 ± 4.1	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-6	6/08/05	<3 (MDA)	<4 (MDA)	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-11	6/08/05	<3 (MDA)	10.5 ± 8.1	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-1	9/06/05	<3 (MDA)	6.3 ± 7.2	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-2	9/06/05	<3 (MDA)	<4 (MDA)	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-4	Note 1					
MW-6	9/06/05	<3 (MDA)	<4 (MDA)	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-11	9/06/05	<3 (MDA)	<4 (MDA)	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-1	12/06/05	<3 (MDA)	7.8 ± 6.1	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-2	12/06/05	<3 (MDA)	<4 (MDA)	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-4	12/06/05	<3 (MDA)	12.1 ± 5.6	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-6	12/06/05	<3 (MDA)	<4 (MDA)	<18 (MDA)	<15 (MDA)	<400 (MDA)
MW-11	12/06/05	<3 (MDA)	6.0 ± 6.1	<18 (MDA)	<15 (MDA)	<400 (MDA)

Notes:

1. The Third Quarter Ground Water sample for Monitoring Well #4 could not be performed when scheduled due to failure of the sampling apparatus. The ¼" polyflow tubing in the well failed. The bubbler tubing was replaced. The parts necessary to repair the sampling apparatus were not received and the repairs completed prior to the end of the Third Quarter.

**TABLE C-5 (CONTINUED)  
GROUNDWATER MONITORING WELL RESULTS**

Calculated Parameters (By Monitor Well Number)	Alpha Activity (pCi/l)	Beta Activity (pCi/l)	Gamma Activity (pCi/l)		Tritium Activity (pCi/l)
			Cs-137	Co-60	
Average: MW-1	Note 4	8.9 ± 3.3	Note 4	Note 4	Note 4
Average: MW-2	Note 4	2.4 ± 2.3	Note 4	Note 4	Note 4
Average: MW-4	Note 4	7.4 ± 2.7	Note 4	Note 4	Note 4
Average: MW-6	Note 4	4.3 ± 2.5	Note 4	Note 4	Note 4
Average: MW-11	Note 4	8.5 ± 3.9	Note 4	Note 4	Note 4
Maximum: MW-1	Note 4	14.2 ± 7.2	Note 4	Note 4	Note 4
Maximum: MW-2	Note 4	2.42 ± 2.3	Note 4	Note 4	Note 4
Maximum: MW-4	Note 4	12.1 ± 5.6	Note 4	Note 4	Note 4
Maximum: MW-6	Note 4	4.32 ± 2.5	Note 4	Note 4	Note 4
Maximum: MW-11	Note 4	10.5 ± 8.1	Note 4	Note 4	Note 4

Notes:

1. Reported values are net measurements (above instrument background). The normal minimum detectable activities (MDAs) for the analyses for gross alpha, gross beta and tritium are approximately 3, 4 and 400 pCi/l, respectively. Results that are at or below the normal MDA are reported as "<MDA".
2. Gamma activity measurements are performed on the original sample, with results corrected to the time of sampling. Naturally occurring isotopes are not reported. The maximum lower limits of detection (LLDs) for Co-60 and Cs-137 are 15 and 18 pCi/l, respectively. The actual MDAs for these analyses were at or below the LLD.
3. For purposes of this report, LLD is defined as the a priori (before the fact) lower limit of detection, which represents the capability of the measurement system. MDA is defined as the a posteriori (after the fact) limit of detection capability considering a given instrument, procedure and type of sample.
4. Results identified as "<" are not included in the calculation of average and maximum values.

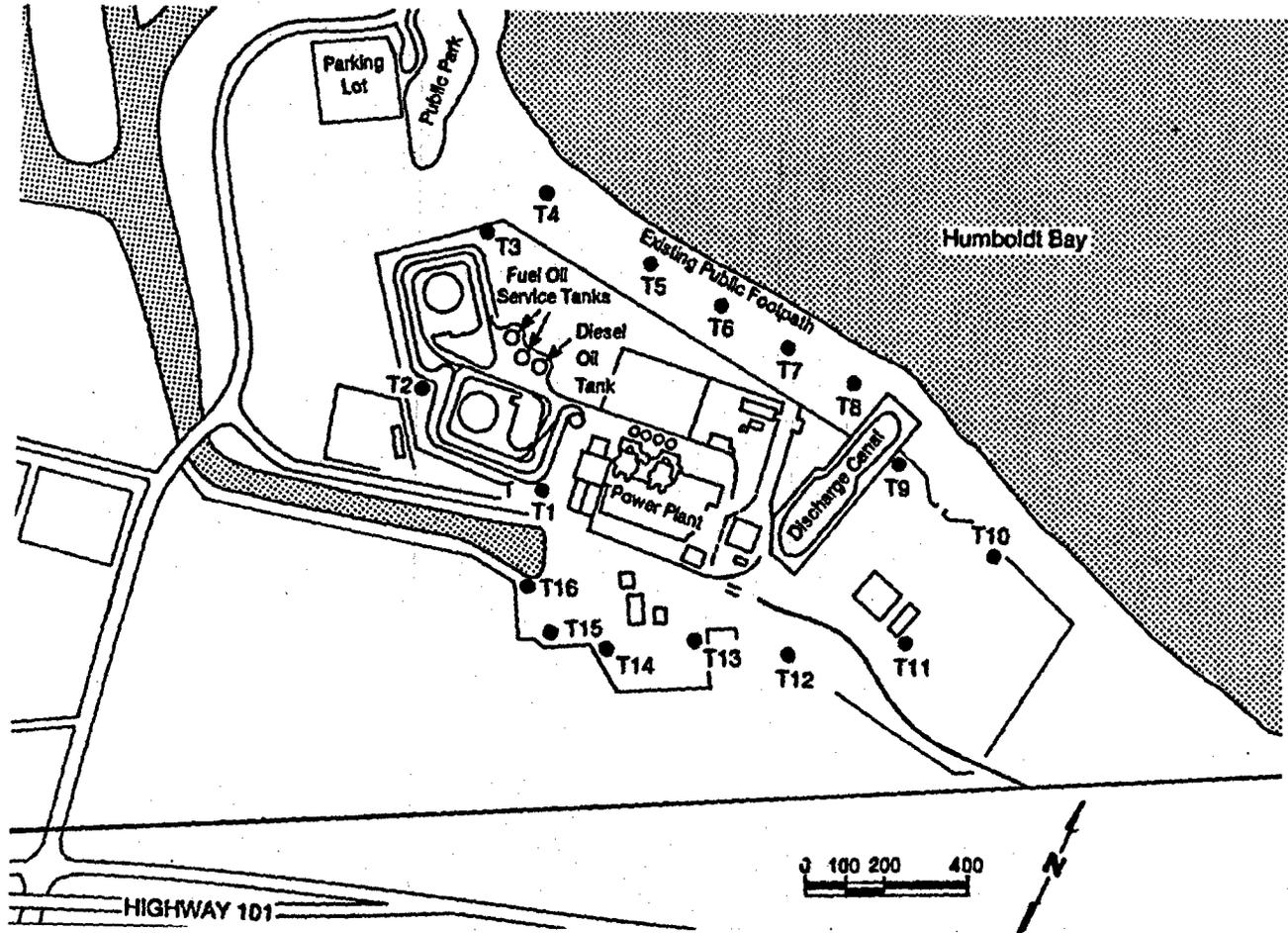
**TABLE C-6  
CAISSON SUMP MONITORING RESULTS**

<b>Sample Date</b>	<b>Tritium Activity (pCi/l)</b>
1/5/05	336± 133
2/2/05	621± 146
3/2/05	600 ± 144
3/30/05	979 ± 152
4/27/05	936 ± 313
5/25/05	935 ± 313
6/22/05	4025 ± 209
7/20/05	1120 ± 154
8/17/05	952 ± 154
9/14/05	756 ± 155
10/12/05	566 ± 142
11/9/05	334 ±147
12/7/05	624 ± 149

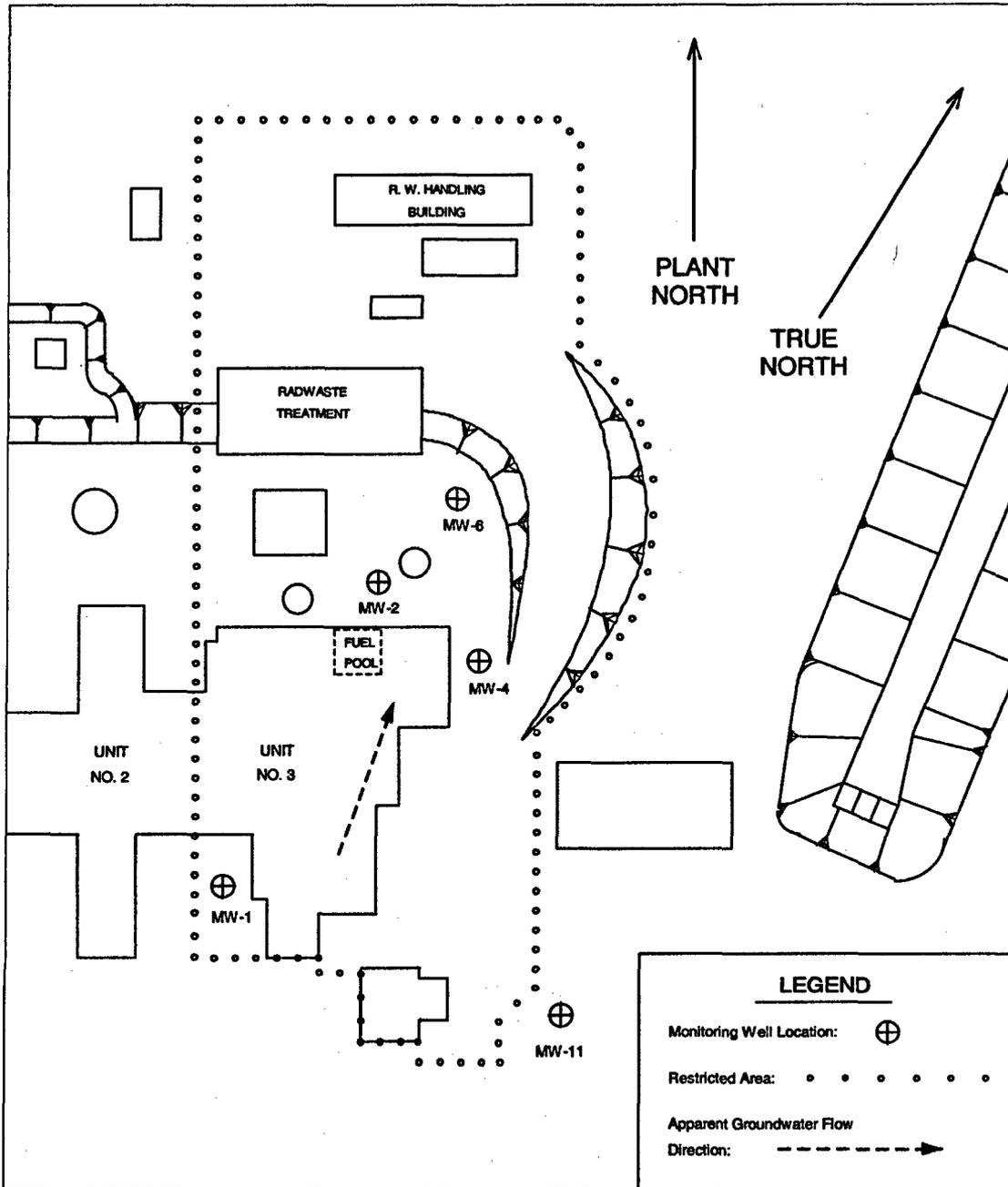
Notes:

1. Reported values are net measurements (above instrument background). The normal minimum detectable activity for the tritium analysis was approximately 400 pCi/L.

**FIGURE A-1  
HBPP ONSITE TLD LOCATIONS**



**FIGURE A-2  
HBPP ONSITE MONITORING WELL LOCATIONS**



**FIGURE A-3  
HBPP OFFSITE TLD LOCATIONS**

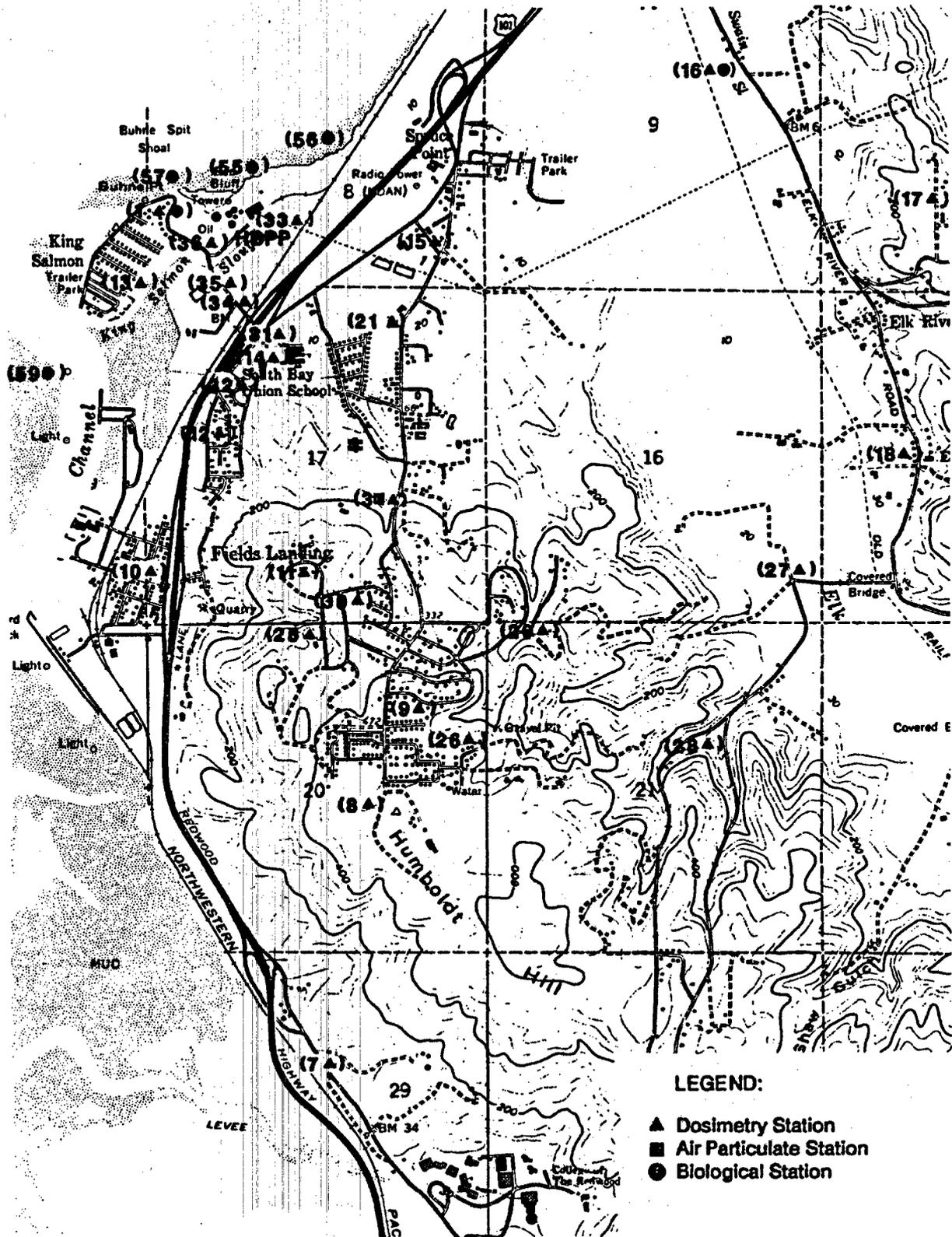
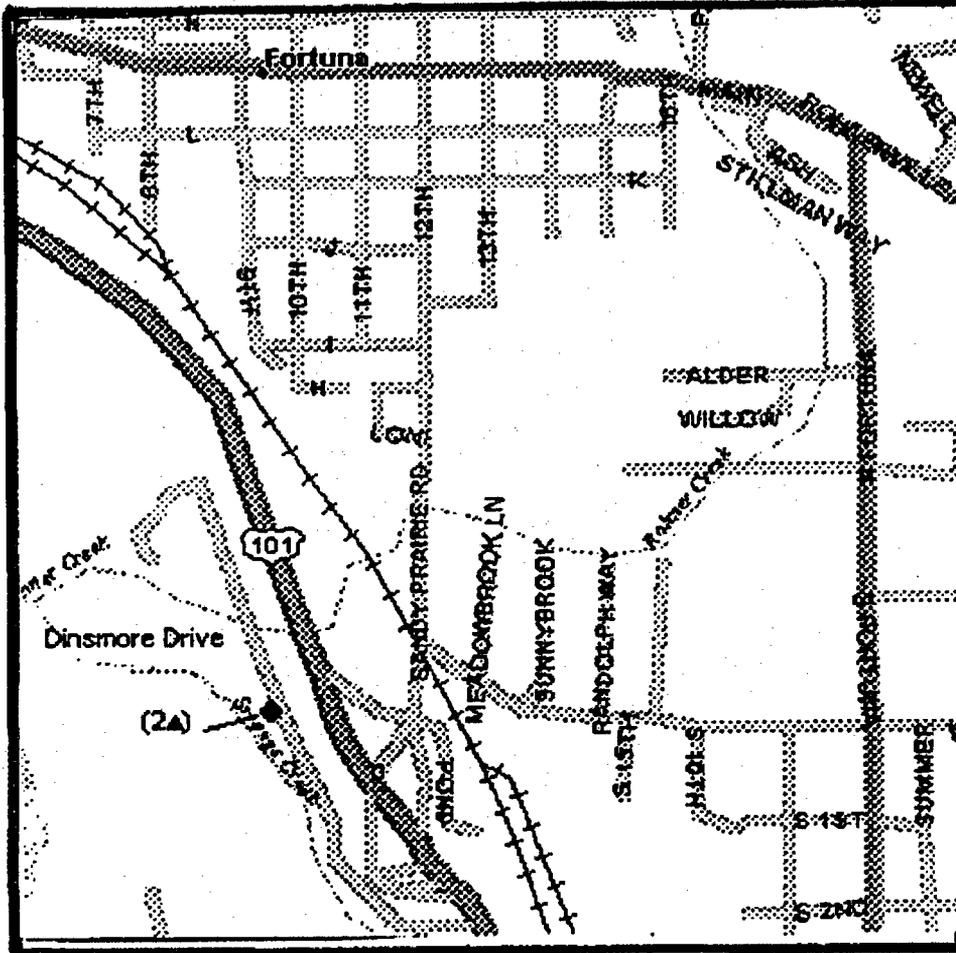
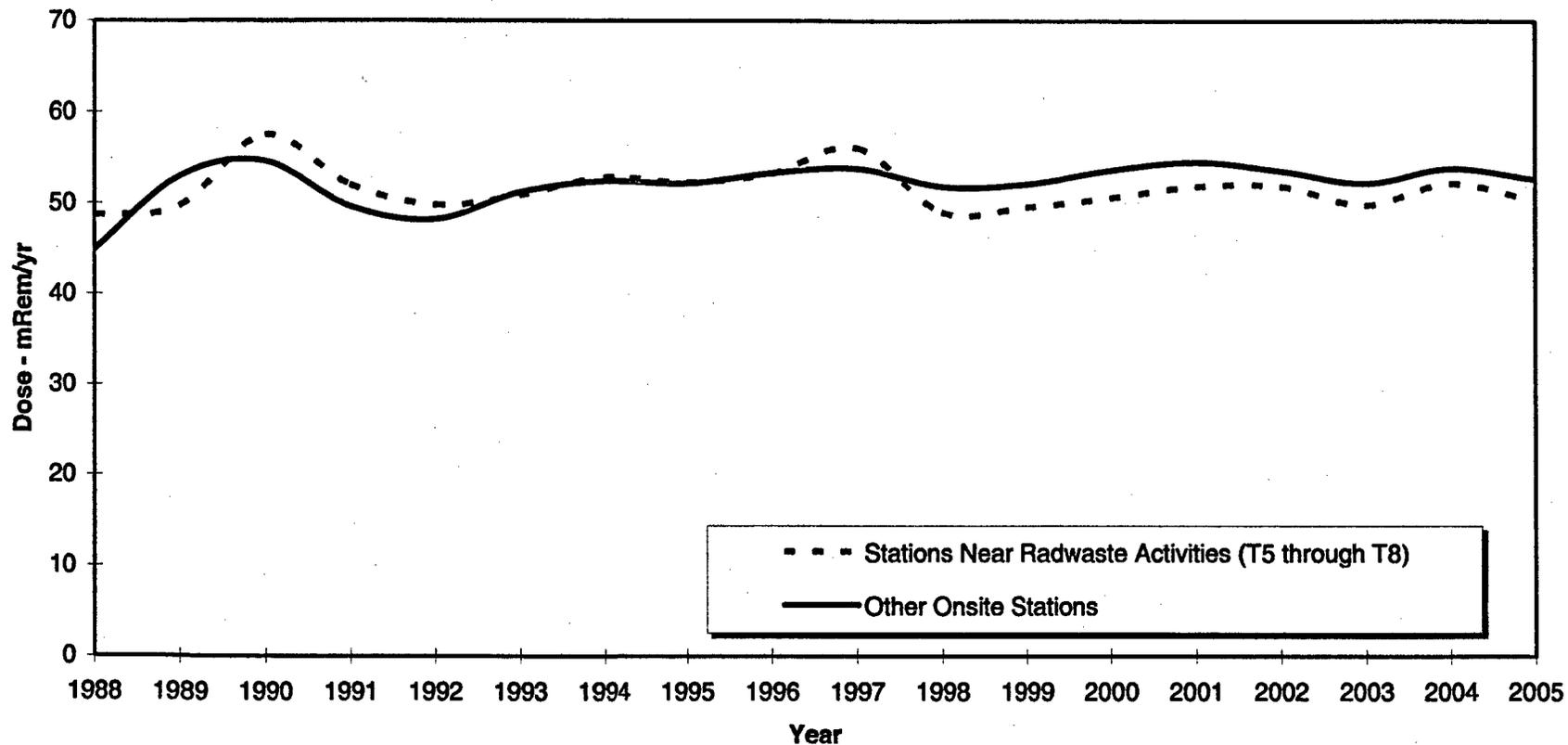


FIGURE A-3 (CONTINUED)  
HBPP OFFSITE TLD LOCATIONS

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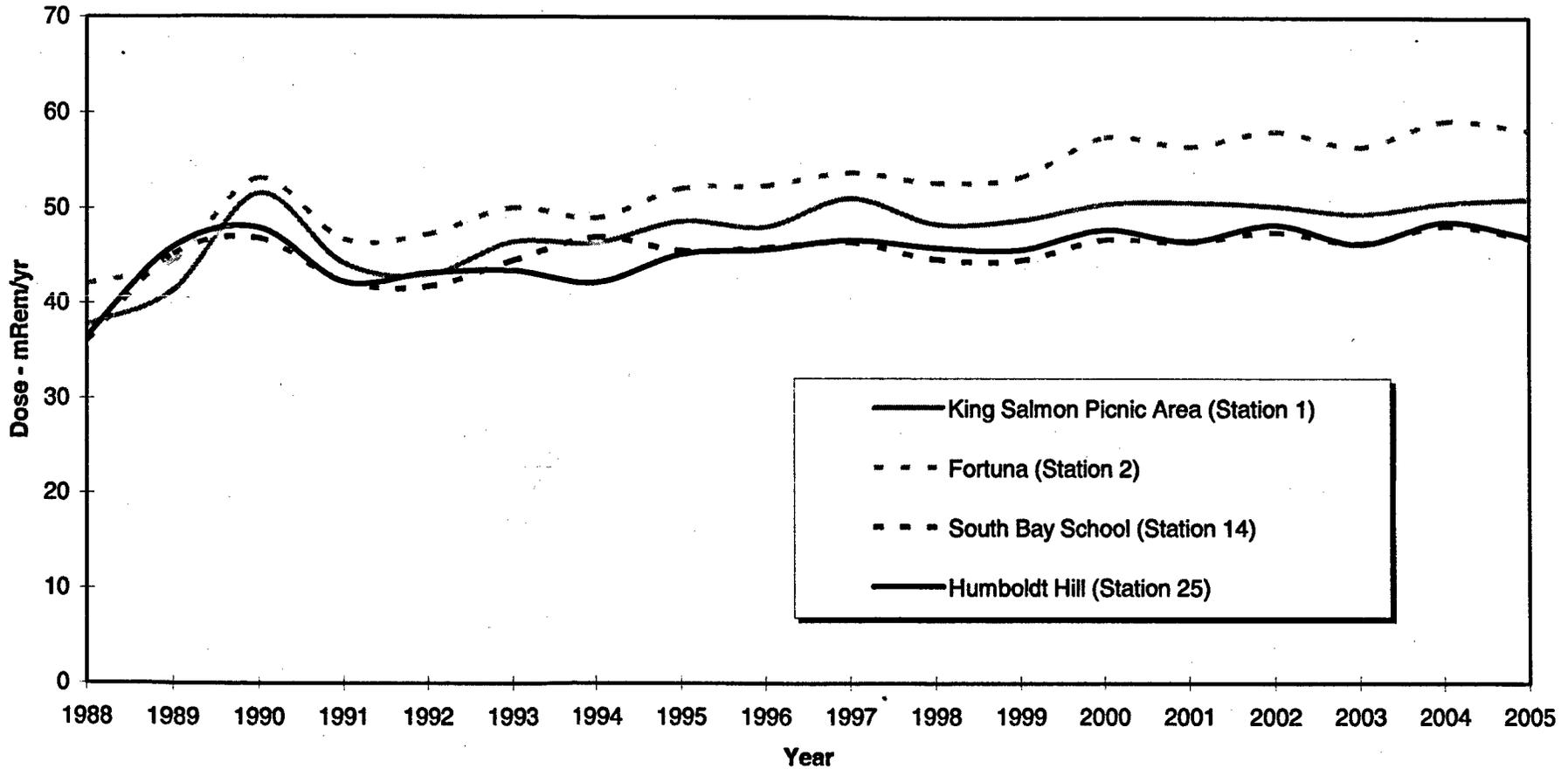


**Figure B-2**  
**Onsite Environmental Radiation Level Trends**



The baseline values for each location were obtained by averaging the readings at each location from 1977 through 1983. These values, however, were obtained using ion chambers instead of TLDs. The average values are Station 1 – 83.0 mrem, Station 2 – 79.8 mrem, Station 14 – 80.2 mrem, and Station 25 – 73.7 mrem.

**Figure B-1  
Offsite Environmental Radiation Level Trends**



The baseline values for the two areas were obtained by averaging the readings for each area from 1977 through 1983. These values, however, were obtained using ion chambers instead of TLDs. The average for the stations near the Radwaste Activities was 78.6 mrem and the average for Other Onsite stations was 79.4 mrem.