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PG&E Letter HBL-20-009

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

Docket No. 50-133, DPR-7
Humboldt Bay Power Plant Unit 3
Annual Radiological Environmental Monitoring Report for 2019

Dear Commissioners and Staff:

Enclosed is the Humboldt Bay Power Plant Unit 3, "Annual Radiological Environmental Monitoring Report," for 2019. This report provides the information required by Section 4.1 of the SAFSTOR/Decommissioning 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. 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 Generic Letter 79-65, "Radiological Environmental Monitoring Program Requirements – Enclosing Branch Technical Position," Revision 1, dated November 27, 1979.

There are no new or revised regulatory commitments (as defined in NEI 99-04) in this submittal.

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If you have any questions regarding information in the enclosed report, please contact Mr. Philippe Soenen at (805) 459-3701.

Sincerely,



Loren D. Sharp
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Enclosure

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HUMBOLDT BAY POWER PLANT UNIT 3
ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT
JANUARY 1 THROUGH DECEMBER 31, 2019

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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, 2019**

This annual report is required by Section 4.1 of the SAFSTOR/Decommissioning 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, 2019, in a manner consistent with the objectives outlined in the ODCM, and in 10 CFR Part 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 10 Part 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 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 Humboldt Bay Power Plant (HBPP) REMP because of the baseline conditions established in the SAFSTOR Decommissioning Plan (now identified as the Post Shutdown Decommissioning Activities Report (PSDAR) and Defueled Safety Analysis Report (DSAR)) 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 sample analysis of airborne radioactivity. General Engineering Laboratories (GEL) personnel no longer perform effluent sample analyses as ground water radioactivity monitoring was discontinued in 2017. Mirion Technologies personnel perform 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 HBPP OFFSITE SAMPLE LOCATIONS", Figure A-1, "HBPP ONSITE AIR SAMPLE LOCATIONS," Figure A-2, "HBPP OFFSITE AIR SAMPLE LOCATION," Figure A-3, "HBPP ONSITE TLD LOCATIONS", and Figure A-4 "HBPP OFFSITE TLD LOCATIONS."

2. Monitoring Requirements

a. Offsite Environmental Monitoring

1. Airborne

The ODCM requires one (1) offsite environmental air sampling station. The air sampler is run continuously, and samples are analyzed weekly for Gross Beta and Gross Alpha activity. Station 3 satisfies this requirement as shown on Figure A-2. The composited samples are analyzed quarterly for Gamma Isotopic.

2. Direct Radiation

The ODCM requires four (4) offsite environmental monitoring stations and one (1) offsite control station equipped with TLDs to monitor gamma exposure. The TLDs are required to be exchanged quarterly. Offsite environmental stations selected to satisfy this requirement are Stations 1, 2, 14, 25, while T17 is the offsite control station as shown on Figure A-4. These stations are considered to represent the offsite locations for the direct radiation pathway.

3. Ingestion

The requirement to perform milk sampling was removed from the ODCM in Revision 24 based upon no detection of Sr-90 or plant-related gamma emitters in milk since decommissioning began.

b. Onsite Environmental Monitoring

1. Airborne

The ODCM requires two (2) onsite air sampling stations. The stations selected to satisfy this requirement are Stations AM2 and AM4 as shown on Figure A-1. The air samplers are run continuously, and samples are analyzed weekly for Gross Beta and Gross Alpha activity. The composited samples are analyzed quarterly for Gamma Isotopic, by station. The number of onsite air sampling stations was reduced from four (4) to two (2) during 2019. Also, continuously is currently defined to be during onsite work activities. These adjustments were made to the environmental monitoring program during 2019 to accommodate the progress of decommissioning the elimination of any effluent pathway other than active work evolutions and difficulty in maintaining power supplies during non-active work hours to remote areas of the site. The three remaining air sampling locations generally represent two major compass sectors (N, S) and areas that are potentially approachable by a member of the public.

2. Direct Radiation

The ODCM requires a minimum of 8 onsite environmental monitoring stations at or within the site boundary fence line, equipped with TLDs to monitor gamma exposure. TLDs are required to be exchanged quarterly. A total of 16 TLD stations are currently used to satisfy this requirement. Stations T1 through T16 are shown on Figure A-3.

The exposures from 16 stations are determined quarterly, which normally results in 64 analyses for a full 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.

The minimum number of TLDs was modified in the ODCM from 16 to 8 stations to allow monitoring locations to be reduced as source term is removed from the site during the final phase of decommissioning.

3. Waterborne

Surface Water

Effective December 31, 2013, discharge of processed radioactive liquid effluents to Humboldt Bay was terminated. Any remaining or incidental radioactive liquids in concentrations exceeding 10 times 10 CFR 20, Appendix B, Table 2 Column 2 are manifested for disposal at a regulated disposal facility. Sampling of surface water is not required by the current revision of the ODCM.

Groundwater

Revision 23 of the ODCM transferred ground water monitoring program requirements from the ODCM to HBPP's ground water monitoring program procedures. This was done to allow operational flexibility needed to adjust to changes to site access and hydrogeology as soils and building substructures are removed. After May 2017, formal closure of the ground water monitoring program was initiated. There were no well locations sampled in 2019.

c. Other Monitoring

Offsite airborne, ingestion, and terrestrial pathway monitoring is not required by the ODCM. The Environmental Report, submitted to the NRC as Attachment 6 to SAFSTOR License Amendment Request 84-01, dated July 31, 1984, established baseline conditions for these pathways. In accordance with the NRC-approved SAFSTOR Decommissioning Plan, (now identified as the PSDAR and 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.

3. Interlaboratory Comparison Program

PG&E's contract laboratory, GEL, has analyzed evaluation samples provided by a commercial supplier to satisfy the requirement to participate in an Interlaboratory Cross-Check Program. Results are provided in Table A-3, "GEL PARTICIPATION – INTERLABORATORY CROSS-CHECK PROGRAM DATA." With the termination of the ground water monitoring program in 2017, GEL no longer provides analyses of REMP samples for HBPP.

GEL's Third-Party Cross-Check Program provides environmental matrices representative of past HBPP analyses and is intended to meet or exceed the interlaboratory comparison program requirements of NRC Regulatory Guide 4.15. GEL analyzed 92 Eckert & Ziegler individual environmental sample analyses. All results met GEL's acceptance criteria (100 percent within acceptance).

HBPP count room personnel also participated in the Eckert & Ziegler 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 REMP samples. Table A-4, "HBPP PARTICIPATION – ECKERT & ZIEGLER INTERLABORATORY CROSS-CHECK PROGRAM DATA", represent analyses performed by HBPP personnel (Table A-4). The agreement criteria are consistent with the guidance for "Confirmatory Measurements" as described in NRC Inspection Procedure 83502.03, "Radiological Environment Monitoring Program and Radioactive Material Control Program."

HBPP analyzed three sets of Eckert & Ziegler Analytics samples for gamma in soil, (first quarter), gamma air filter and alpha/beta air filter (second quarter), and gamma in water and tritium in water (third quarter). These analyses are representative of those performed by HBPP count room personnel during 2019. All results met the acceptance criteria.

Corrective action SAPN 1448716, created on December 8, 2018, was the procurement SAPN for the 2019 Cross-Check Program. Due to a procurement issue, the 2019 first quarter cross check was not received until mid-May. HBPP analysis results were found to be acceptable in comparison with Eckert & Ziegler reported results except for the Ce-141 value, which was outside the agreement ratio range, but was reported by HBPP as conservatively high. Ce-141 has a 32.5-day half-life and is not included as part of the known suite of radionuclides present at HBPP. All actions were documented in corrective action SAPN 1452043.

4. NEI Groundwater Protection Initiative

Based on the state of decommissioning at HBPP, there remains little potential for ground water to become contaminated during the final stages of decommissioning. Formal closure of the ground water monitoring wells was initiated in 2017 and continued into 2019. Ground water monitoring wells were closed in accordance with local water authority guidance and permits under Work Package 99-28, "Well Abandonment." Sampling of ground water monitoring wells was discontinued after the second quarter of 2017.

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 10 CFR Part 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 SAFSTOR License Amendment Request 84-01, established baseline conditions for soil, biota, and sediments. The results to date indicate no change 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 and decommissioning continue to be effective.

As discussed below, the ODCM calculation model conservatively assumes that exposure pathways begin at the unrestricted area boundary, also known as the owner-controlled area (OCA) boundary. Since there have been no changes in

the location of the unrestricted area boundary, no survey for changes to the use of unrestricted areas was necessary.

2. Direct Radiation Pathway

A plot of the radiation level trends for the five (offsite) 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." The plots show that the offsite annual doses continue to be within the ranges that have been observed over the last ten years.

HBPP changed TLD processing services beginning in January 2014. Data from previous years was based on a Panasonic TLD system. Data in 2014 to the present is based on Mirion Genesis type TLD system. The apparent rise in Figures B-1 and B-2 after 2014 may be a result of the change in monitoring devices in tandem with the increase in decommissioning activities.

Figure B-2 includes the average dose for two groups of onsite stations, selected by their potential to be affected by radioactive waste handling activities. 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 in past years assumed an occupancy factor for the portion of the unrestricted area boundary that was closest to the radioactive waste handling area of the plant. During 2019, maximum yearly dose was seen on TLD T9, corrected to the 67-hour occupancy, and subtracting the average of the five (5) offsite TLDs, the dose to the maximum exposed individual from this source was approximately 0.1 millirem (mrem) above background.

The Humboldt Bay independent spent fuel storage installation (ISFSI) is licensed under 10 CFR Part 72, but is contained within the licensed boundary of the HBPP site, so no other dose contributions to the public are considered. The HBPP site had no measurable liquid or gaseous radioactive effluents that would challenge the limitations of 40 CFR 190. The direct dose is the only contributor to public dose and is within the 25 mrem limit to the whole body.

3. Airborne Pathway

Dose assessment based on offsite airborne pathway monitoring is not required by the ODCM. The Environmental Report, submitted to the NRC as Attachment 6 to SAFSTOR License Amendment Request 84-01, established baseline conditions for the airborne pathway. In accordance with the NRC-approved SAFSTOR Decommissioning Plan, (now identified as the PSDAR and 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

Liquid radioactive wastes are shipped for disposal to a regulated disposal facility. Discharges of liquid radioactive effluent to Humboldt Bay were eliminated after December 2013.

b. Groundwater

Groundwater sampling of the waterborne pathway ceased in the second quarter of 2017. There were no spills challenging the groundwater in 2019.

The ODCM does not provide a model for the groundwater waterborne pathway, because the groundwater is saline and is not used now nor likely to be used in the future 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 SAFSTOR License Amendment Request 84-01, established baseline conditions for the ingestion pathway. In accordance with the NRC-approved SAFSTOR Decommissioning Plan, (now identified as the PSDAR and 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 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 SAFSTOR License Amendment Request 84-01, established baseline conditions for the terrestrial pathway. In accordance with the NRC-approved SAFSTOR Decommissioning Plan, (now identified as the PSDAR and 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.

All the minimum detectable activities (MDAs) for analyses required by the REMP were less than or equal to the lower limit of detection (LLD) criteria for radioactivity in environmental samples specified in Table C-1 of this report.

Because alpha and beta radioactivity analyses of the saline ground water are less effective than tritium and gamma radioactivity analyses, the ODCM does not currently require alpha and beta radioactivity analyses in water to be part of the REMP. However, HBPP maintains gamma and tritium in water analysis capability as a prerequisite to evaluate ground water/storm water radioactivity for GWTS (ground water treatment system), independent of the REMP program.

2. Direct Radiation Pathway

Monitoring of the direct radiation pathway is performed at 16 onsite locations near the OCA fence line, and at 4 offsite environmental monitoring stations and one offsite (control) location (Location number T17) near the facility. Monitoring is performed with TLDs with multiple crystal elements. Three TLDs are installed at each station, and the TLD sets are 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.

Offsite TLD Station T1 was moved approximately 20 feet on February 26, 2019, to allow cutting of vegetation and removal of fencing. The relocation was documented in corrective action SAPN 1450240.

Onsite TLD Stations T9 and T10 were relocated from temporary fence posts to permanent fencing on May 3, 2019, and new GPS coordinates were obtained. The relocation was documented in corrective action SAPN 1450240.

On May 6, 2019, Onsite TLD Station T8 was moved closer to TLD T7 on the Coastal Trail Fence due to environmental remediation within the immediate area. On May 9, 2019, T8 was removed from the Coastal Trail Fence and transferred to Building 13. The excavated area appeared to be expanding so T8 was removed from the fence line to prevent the TLD from being lost. TLD T7 was removed from the fence line and transferred to Building 13 on May 20, 2019, for the same reasons. TLD T6, also located on the Coastal Trail Fence, was removed on June 13, 2019, due to environmental remediation. T6 was also transferred to Building 13. Onsite TLD Station T5 was pulled from the Coastal Trail Fence on June 27, 2019, again due to environmental remediation along the Coastal Trail Fence and transferred to Building 13. All TLD relocations were documented in corrective action SAPN 1450240. Onsite TLD

Stations T5, T6, T7, and T8 were installed on new permanent fencing at the station perimeter on July 25, 2019.

Onsite TLD Station T11 was relocated from the East Fence (AM1) air sampler doghouse to permanent fencing within the immediate vicinity of the air sampler on August 7, 2019. The East Fence air sampler is scheduled to be eliminated due to electrical power issues. The transfer was documented in corrective action SAPN 1450240.

The 2019 first quarter TLD report contained two anomalies. T8A registered 3 elements with exposures of 14 mR, 12 mR, and 135 mR. T8B displayed exposures of 12 mR, 11 mR, and 12 mR. T8C showed measurements of 12 mR, 13 mR, and 13 mR. The 135 mR measurement was discarded by Mirion as not valid. The second anomaly was T9A with readings of 14 mR, 14 mR, and 13 mR while T9B displayed readings of 35 mR, 13 mR, and 13 mR. T9C displayed readings of 14 mR, 14 mR, and 14 mR. The 35 mR measurement also appeared to be artificially high above the average and the decision was made to delete the measurement from the calculated average. All actions were documented in corrective action SAPN 1453104.

3. Airborne Pathway

Four onsite samples and one offsite sample were collected and analyzed weekly for Gross Beta and Gross Alpha activity until August 28, 2019, when AM1 (East Fence) was removed from service due electrical power issues. The ODCM was revised to require only three (3) onsite air samplers. This was documented in corrective action SAPN 1450240

The required quarterly composited samples were analyzed for Gamma Isotopic by station. All air sample results for alpha and beta activity and quarterly composite results for Co-60 and Cs-137 are provided in Table C-4. The weekly sample results for alpha and beta particulate met the effluent acceptance criteria in the ODCM. All LLD's were met for Gross Beta (required LLD 1.0E-02 pCi/m³).

Interruptions of continuous REMP air sampler operations occurred on the following dates due to ongoing decommissioning activities and were entered into the corrective action program as documented below:

Date	SAPN	Description
01/30/2019	1450240	The offsite REMP air sampler at Humboldt Hill was found to be not operating due to a tripped GFCI. The air sampler had run for approximately 95 hours. The totalizer reading was used to calculate sample volume and the resultant sample activity.

05/01/2019	1450240	The REMP air sampler adjacent to GWTS was relocated to the road adjacent to the ISFSI. The air sampler was turned off for approximately 20 minutes during relocation activities. The change in location was due to discontinuing GWTS operations and resultant loss of electrical power for the air sampler.
06/25/2019	1450240	The offsite REMP air sampler at Humboldt Hill was discovered to be not operating after approximately 118 hours of run time. Electrical power to the sample station may have been shut down to allow grass trimming around the perimeter of the sample station.
08/28/2019	1450240	The East Fence air sampler (AM1) was powered off and retired from service due to electrical power issues. As a result, the ODCM Revision 30 was revised to reduce the number of required onsite air sampling stations from 4 to 3.

4. Waterborne Pathway

a. Surface Water

Surface water sampling of the waterborne pathway is no longer performed due to the termination of liquid effluent releases in December 2013.

b. Groundwater

Groundwater sampling of the waterborne pathway ceased in the second quarter of 2017.

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. NEI Groundwater Protection Initiative Voluntary Reporting Results

The NEI Groundwater Protection Initiative contains the following requirements:

OBJECTIVE 2.2 VOLUNTARY COMMUNICATION

Make informal notification as soon as practicable to appropriate State/Local officials, with follow up notification to the NRC, as appropriate, regarding significant onsite leaks/spills into groundwater and onsite or offsite water sample results exceeding the criteria in the REMP as described in the ODCM/ODAM.

HBPP Response to 2.2:

There were no reports or notifications required to be generated in 2019 for groundwater results exceeding reporting/notification levels or significant onsite leaks/spills.

OBJECTIVE 2.3 THIRTY-DAY REPORTS

Submit a 30-day report to the NRC for any water sample result for onsite groundwater that is or may be used as a source of drinking water that exceeds the criteria in the licensee's existing REMP for 30-day reporting of offsite water sample results. Copies of 30-day reports for both onsite and offsite water samples will also be provided to the appropriate State agency, and:

HBPP Response to 2.3:

There were no reports or notifications required to be generated in 2019 for groundwater results exceeding reporting/notification levels or significant onsite leaks/spills.

OBJECTIVE 2.4 ANNUAL REPORTING

Document all on-site ground water sample results and a description of any significant on-site leaks/spills into groundwater for each calendar year in the AREOR for REMP or the ARERR for the RETS as contained in the appropriate reporting procedure, beginning with Calendar year 2006.

HBPP Response to 2.4:

Groundwater sampling of the waterborne pathway ceased in the second quarter of 2017.

There were no significant onsite leaks/spills into groundwater in 2019.

Note: the term "significant" is defined by the NEI Initiative as greater than 100 gallons.

8. Errata for Previous Years' Reports

None.

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

Exposure Pathway And/Or Sample	Number of Samples And Locations ^(a)	Sampling and Collection Frequency	Type of Analysis
AIRBORNE	2 onsite locations	Continuous sampler operation with sample collection at least once per 7 days	Gross alpha and Gross beta radioactivity following filter change. Gamma Isotopic ^(b) analysis on quarterly composite (by station).
DIRECT RADIATION	8 onsite stations with TLDs	TLDs exchanged quarterly	Gamma exposure
	5 offsite stations with TLDs	TLDs exchanged quarterly	Gamma exposure
WATERBORNE			
Groundwater	No longer required	N/A	N/A.

^(a) The number of onsite sample / monitoring locations was scaled back in November 2019 (ODCM Revision 31) based on decommissioning status and completion of remediation activities.

^(b) 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 HBPP OFFSITE SAMPLE LOCATIONS

Station Number	Offsite Measurement Pathway	Station Name	Radial Direction		Radial Distance From Plant (Miles)
			Sector	By Degrees	
3	Airborne	Humboldt Hill	SSE	158	0.9
1	Direct Radiation	King Salmon Picnic Area	W	270	0.3
2	Direct Radiation	City of Fortuna Water Pollution Control Plant, 180 Dinsmore Drive, Fortuna	SSE	158	9.4
14	Direct Radiation	South Bay School Parking Lot	S	180	0.4
25	Direct Radiation	Irving Drive, Humboldt Hill	SSE	175	1.3
T17	Direct Radiation	Mitchell Heights Drive	NNE	61	5.8

TABLE A-3
GEL PARTICIPATION – INTERLABORATORY CROSS-CHECK PROGRAM DATA

Sample/ Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	GEL Value (pCi/L)	Reference Value (pCi/L)	Ratio	Evaluation
Gamma Water	I-131	E12367	1st	5/10/19	8.89E+01	8.65E+01	1.03	Acceptable
	Ce-141	E12367	1st	5/10/19	1.20E+02	1.13E+02	1.06	Acceptable
	Cr-51	E12367	1st	5/10/19	3.55E+02	2.84E+02	1.25	Acceptable
	Cs-134	E12367	1st	5/10/19	1.43E+02	1.55E+02	0.92	Acceptable
	Cs-137	E12367	1st	5/10/19	2.09E+02	1.91E+02	1.10	Acceptable
	Co-58	E12367	1st	5/10/19	1.43E+02	1.39E+02	1.03	Acceptable
	Mn-54	E12367	1st	5/10/19	1.55E+02	1.39E+02	1.12	Acceptable
	Fe-59	E12367	1st	5/10/19	1.76E+02	1.54E+02	1.14	Acceptable
	Zn-65	E12367	1st	5/10/19	2.44E+02	2.14E+02	1.14	Acceptable
	Co-60	E12367	1st	5/10/19	3.18E+02	2.90E+02	1.10	Acceptable
Sample/ Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	GEL Value (pCi/L)	Reference Value (pCi/L)	Ratio	Evaluation
Milk	Ce-141	E12366A	1st	5/10/19	1.23E+02	1.17E+02	1.05	Acceptable
	Co-58	E12366A	1st	5/10/19	1.51E+02	1.43E+02	1.05	Acceptable
	Co-60	E12366A	1st	5/10/19	3.12E+02	2.99E+02	1.04	Acceptable
	Cr-51	E12366A	1st	5/10/19	3.04E+02	2.93E+02	1.04	Acceptable
	Cs-134	E12366A	1st	5/10/19	1.53E+02	1.60E+02	0.96	Acceptable
	Cs-137	E12366A	1st	5/10/19	2.04E+02	1.96E+02	1.04	Acceptable
	Mn-54	E12366A	1st	5/10/19	1.55E+02	1.43E+02	1.08	Acceptable
	Fe-59	E12366A	1st	5/10/19	1.78E+02	1.59E+02	1.12	Acceptable
	Zn-65	E12366A	1st	5/10/19	2.42E+02	2.20E+02	1.1	Acceptable
Sample/ Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	GEL Value (pCi)	Reference Value (pCi)	Ratio	Evaluation
Cartridge	I-131	E12364	1st	05/10/19	7.80E+01	7.54E+01	1.03	Acceptable

TABLE A-3 (Continued)
GEL PARTICIPATION – INTERLABORATORY CROSS-CHECK PROGRAM DATA

Sample/ Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	GEL Value (pCi/L)	Reference Value (pCi/L)	Ratio	Evaluation
Gamma Water	I-131	E12363	2nd	07/29/19	8.92E+01	8.91E+01	1.00	Acceptable
	Ce-141	E12363	2nd	07/29/19	1.50E+02	1.45E+02	1.03	Acceptable
	Cr-51	E12363	2nd	07/29/19	3.56E+02	3.68E+02	0.97	Acceptable
	Cs-134	E12363	2nd	07/29/19	1.37E+02	1.53E+02	0.89	Acceptable
	Cs-137	E12363	2nd	07/29/19	1.90E+02	1.84E+02	1.03	Acceptable
	Co-58	E12363	2nd	07/29/19	1.22E+02	1.22E+02	1.00	Acceptable
	Mn-54	E12363	2nd	07/29/19	2.27E+02	2.07E+02	1.10	Acceptable
	Fe-59	E12363	2nd	07/29/19	1.73E+02	1.54E+02	1.12	Acceptable
	Zn-65	E12363	2nd	07/29/19	3.01E+02	2.70E+02	1.11	Acceptable
	Co-60	E12363	2nd	07/29/19	2.22E+02	2.16E+02	1.03	Acceptable
Sample/ Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	GEL Value (pCi/L)	Reference Value (pCi/L)	Ratio	Evaluation
Milk	Sr-89	E12361	2nd	7/29/19	1.01E+02	8.29E+01	1.22	Acceptable
	Sr-90	E12361	2nd	7/29/19	1.21E+01	1.35E+01	0.90	Acceptable
	I-131	E12362	2nd	7/29/19	8.51E+01	8.14E+01	1.05	Acceptable
	Ce-141	E12362	2nd	7/29/19	1.39E+02	1.33E+02	1.04	Acceptable
	Co-58	E12362	2nd	7/29/19	1.17E+02	1.12E+02	1.05	Acceptable
	Co-60	E12362	2nd	7/29/19	2.05E+02	1.98E+02	1.04	Acceptable
	Cr-51	E12362	2nd	7/29/19	3.41E+02	3.37E+02	1.01	Acceptable
	Cs-134	E12362	2nd	7/29/19	1.30E+02	1.40E+02	0.93	Acceptable
	Cs-137	E12362	2nd	7/29/19	1.78E+02	1.68E+02	1.06	Acceptable
	Mn-54	E12362	2nd	7/29/19	2.09E+02	1.90E+02	1.10	Acceptable
	Fe-59	E12362	2nd	7/29/19	1.66E+02	1.41E+02	1.18	Acceptable
	Zn-65	E12362	2nd	7/29/19	2.82E+02	2.47E+02	1.14	Acceptable
Sample/ Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	GEL Value (pCi)	Reference Value (pCi)	Ratio	Evaluation
Cartridge	I-131	E12360	2nd	07/29/19	8.40E+01	8.17E+01	1.03	Acceptable

TABLE A-3 (Continued)
GEL PARTICIPATION – INTERLABORATORY CROSS-CHECK PROGRAM DATA

Sample/ Analysis	Radionuclide	Sample Number	Quarter 2018	Report Date	GEL Value (pCi/L)	Reference Value (pCi/L)	Ratio	Evaluation
Gamma Water	I-131	E12371	3rd	11/08/19	9.34E+01	8.94E+01	1.04	Acceptable
	Ce-141	E12371	3rd	11/08/19	1.41E+02	1.27E+02	1.11	Acceptable
	Cr-51	E12371	3rd	11/08/19	2.45E+02	2.51E+02	0.98	Acceptable
	Cs-134	E12371	3rd	11/08/19	1.50E+02	1.57E+02	0.96	Acceptable
	Cs-137	E12371	3rd	11/08/19	1.22E+02	1.14E+02	1.07	Acceptable
	Co-58	E12371	3rd	11/08/19	1.36E+02	1.33E+02	1.03	Acceptable
	Mn-54	E12371	3rd	11/08/19	1.34E+02	1.17E+02	1.15	Acceptable
	Fe-59	E12371	3rd	11/08/19	1.27E+02	1.12E+02	1.13	Acceptable
	Zn-65	E12371	3rd	11/08/19	2.57E+02	2.22E+02	1.16	Acceptable
	Co-60	E12371	3rd	11/08/19	1.68E+02	1.60E+02	1.036	Acceptable
Sample/ Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	GEL Value (pCi/L)	Reference Value (pCi/L)	Ratio	Evaluation
Milk	I-131	E12370	3rd	11/08/19	9.28E+01	9.21E+01	1.01	Acceptable
	Sr-89	E12369	3rd	11/08/19	8.71E+01	9.39E+01	0.93	Acceptable
	Sr-90	E12369	3rd	11/08/19	7.02E+00	1.29E+01	0.54	Acceptable
	Ce-141	E12370	3rd	11/08/19	1.69E+02	1.67E+02	1.01	Acceptable
	Cr-51	E12370	3rd	11/08/19	3.64E+02	3.31E+02	1.1	Acceptable
	Cs-134	E12370	3rd	11/08/19	1.93E+02	2.07E+02	0.93	Acceptable
	Cs-137	E12370	3rd	11/08/19	1.49E+02	1.51E+02	0.99	Acceptable
	Co-58	E12370	3rd	11/08/19	1.74E+02	1.75E+02	0.99	Acceptable
	Mn-54	E12370	3rd	11/08/19	1.69E+02	1.54E+02	1.09	Acceptable
	Fe-59	E12370	3rd	11/08/19	1.66E+02	1.48E+02	1.12	Acceptable
	Zn-65	E12371	3rd	11/08/19	3.21E+02	2.93E+02	1.1	Acceptable
	Co-60	E12370	3rd	11/08/19	2.08E+02	2.11E+02	0.99	Acceptable
Sample/ Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	GEL Value (pCi)	Reference Value (pCi)	Ratio	Evaluation
Cartridge	I-131	E12368	3rd	11/08/19	9.93E+01	9.33E+01	1.06	Acceptable

TABLE A-3 (Continued)
GEL PARTICIPATION – INTERLABORATORY CROSS-CHECK PROGRAM DATA

Sample/ Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	GEL Value (pCi/L)	Reference Value (pCi/L)	Ratio	Evaluation
Gamma Water	I-131	E12375	4th	02/05/20	1.04E+02	9.45E+01	1.10	Acceptable
	Ce-141	E12375	4th	02/05/20	8.92E+01	8.41E+01	1.06	Acceptable
	Cr-51	E12375	4th	02/05/20	2.64E+02	2.44E+02	1.08	Acceptable
	Cs-134	E12375	4th	02/05/20	1.06E+02	1.14E+02	0.93	Acceptable
	Cs-137	E12375	4th	02/05/20	1.09E+02	1.03E+02	1.06	Acceptable
	Co-58	E12375	4th	02/05/20	9.54E+01	9.11E+01	1.05	Acceptable
	Mn-54	E12375	4th	02/05/20	1.44E+02	1.31E+02	1.10	Acceptable
	Fe-59	E12375	4th	02/05/20	9.32E+01	8.82E+01	1.06	Acceptable
	Zn-65	E12375	4th	02/05/20	1.91E+02	1.61E+02	1.19	Acceptable
	Co-60	E12375	4th	02/05/20	1.22E+02	1.17E+02	1.05	Acceptable
Sample/ Analysis	Radionuclide	Sample Number	Quarter 2018	Report Date	GEL Value (pCi/L)	Reference Value (pCi/L)	Ratio	Evaluation
Milk	Sr-89	E12373	4th	02/05/20	6.60E+01	8.06E+01	0.82	Acceptable
	Sr-90	E12373	4th	02/05/20	1.11E+01	1.10E+01	1.00	Acceptable
	I-131	E12374	4th	02/05/20	9.34E+01	9.45E+01	0.99	Acceptable
	Ce-141	E12374	4th	02/05/20	7.95E+01	8.30E+01	0.96	Acceptable
	Cr-51	E12374	4th	02/05/20	2.67E+02	2.41E+02	1.11	Acceptable
	Cs-134	E12374	4th	02/05/20	9.79E+01	1.13E+02	0.87	Acceptable
	Cs-137	E12374	4th	02/05/20	1.01E+02	1.02E+02	0.99	Acceptable
	Co-58	E12374	4th	02/05/20	8.93E+01	8.99E+01	0.99	Acceptable
	Mn-54	E12374	4th	02/05/20	1.34E+02	1.30E+02	1.03	Acceptable
	Fe-59	E12374	4th	02/05/20	1.01E+02	8.71E+01	1.16	Acceptable
	Zn-65	E12374	4th	02/05/20	1.71E+02	1.59E+02	1.08	Acceptable
	Co-60	E12374	4th	02/05/20	1.17E+02	1.15E+02	1.02	Acceptable
Sample/ Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	GEL Value (pCi)	Reference Value (pCi)	Ratio	Evaluation
Cartridge	I-131	E12372	4th	02/05/20	9.07E+01	8.88E+01	1.02	Acceptable

TABLE A-4
HBPP PARTICIPATION – ECKERT & ZIEGLER INTERLABORATORY CROSS-CHECK PROGRAM DATA

Sample Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	HBPP (pCi/g)	Reference (pCi/g)	Ratio	Evaluation
Gamma Soil Detector 1	Ce-141	E12544	1st	5/28/2019	7.23E-02 ¹	5.33E-02	1.36 ¹	Acceptable
	Co-58	E12544	1st	5/28/2019	1.37E-01	1.32E-01	1.04	Acceptable
	Co-60	E12544	1st	5/28/2019	4.90E-01	4.88E-01	1.00	Acceptable
	Cr-51	E12544	1st	5/28/2019	9.45E-02	1.06E-01	0.89	Acceptable
	Cs-134	E12544	1st	5/28/2019	2.50E-01	2.53E-01	0.99	Acceptable
	Cs-137	E12544	1st	5/28/2019	4.05E-01	4.01E-01	1.01	Acceptable
	Fe-59	E12544	1st	5/28/2019	1.07E-01	1.03E-01	1.04	Acceptable
	Mn-54	E12544	1st	5/28/2019	2.24E-01	2.09E-01	1.07	Acceptable
	Zn-65	E12544	1st	5/28/2019	2.95E-01	3.10E-01	0.95	Acceptable
Sample Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	HBPP (pCi/g)	Reference (pCi/g)	Ratio	Evaluation
Gamma Soil Detector 3	Ce-141	E12544	1st	5/28/2019	7.05E-02 ¹	5.33E-02	1.32 ¹	Acceptable
	Co-58	E12544	1st	5/28/2019	1.25E-01	1.32E-01	0.95	Acceptable
	Co-60	E12544	1st	5/28/2019	4.86E-01	4.88E-01	1.00	Acceptable
	Cr-51	E12544	1st	5/28/2019	9.60E-02	1.06E-01	0.90	Acceptable
	Cs-134	E12544	1st	5/28/2019	2.52E-01	2.53E-01	1.00	Acceptable
	Cs-137	E12544	1st	5/28/2019	4.03E-01	4.01E-01	1.00	Acceptable
	Fe-59	E12544	1st	5/28/2019	1.08E-01	1.03E-01	1.05	Acceptable
	Mn-54	E12544	1st	5/28/2019	2.29E-01	2.09E-01	1.10	Acceptable
	Zn-65	E12544	1st	5/28/2019	3.18E-01	3.10E-01	1.03	Acceptable
Sample Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	HBPP (pCi/g)	Reference (pCi/g)	Ratio	Evaluation
Gamma Soil Det 0848	Ce-141	E12544	1st	5/28/2019	6.97E-02 ¹	5.33E-02	1.31 ¹	Acceptable
	Co-58	E12544	1st	5/28/2019	1.34E-01	1.32E-01	1.02	Acceptable
	Co-60	E12544	1st	5/28/2019	4.67E-01	4.88E-01	0.96	Acceptable
	Cr-51	E12544	1st	5/28/2019	1.04E-01	1.06E-01	0.98	Acceptable
	Cs-134	E12544	1st	5/28/2019	2.52E-01	2.53E-01	1.00	Acceptable
	Cs-137	E12544	1st	5/28/2019	4.35E-01	4.01E-01	1.08	Acceptable
	Fe-59	E12544	1st	5/28/2019	1.02E-01	1.03E-01	0.99	Acceptable
	Mn-54	E12544	1st	5/28/2019	2.31E-01	2.09E-01	1.11	Acceptable
	Zn-65	E12544	1st	5/28/2019	3.08E-01	3.10E-01	0.99	Acceptable

TABLE A-4 (Continued)
HBPP PARTICIPATION – ECKERT & ZIEGLER INTERLABORATORY CROSS-CHECK PROGRAM DATA

Sample Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	HBPP (pCi/L)	Reference (pCi/L)	Ratio	Evaluation
Gamma Soil Detector 6	Ce-141	E12544	1st	5/28/2019	6.41E-02 ¹	5.33E-02	1.20	Acceptable
	Co-58	E12544	1st	5/28/2019	1.34E-01	1.32E-01	1.02	Acceptable
	Co-60	E12544	1st	5/28/2019	4.87E-01	4.88E-01	1.00	Acceptable
	Cr-51	E12544	1st	5/28/2019	1.07E-01	1.06E-01	1.01	Acceptable
	Cs-134	E12544	1st	5/28/2019	2.50E-01	2.53E-01	0.99	Acceptable
	Cs-137	E12544	1st	5/28/2019	4.03E-01	4.01E-01	1.00	Acceptable
	Fe-59	E12544	1st	5/28/2019	1.04E-01	1.03E-01	1.01	Acceptable
	Mn-54	E12544	1st	5/28/2019	2.34E-01	2.09E-01	1.12	Acceptable
	Zn-65	E12544	1st	5/28/2019	3.16E-01	3.10E-01	1.02	Acceptable
Sample Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	HBPP (pCi)	Reference (pCi)	Ratio	Evaluation
Air Filter Protean 7108	Gross Alpha	E12545	2nd	6/25/2019	7.24E+01	6.76E+01	1.07	Acceptable
	Gross Beta	E12545	2nd	6/25/2019	2.26E+02	2.25E+02	1.00	Acceptable
Sample Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	HBPP (pCi)	Reference (pCi)	Ratio	Evaluation
Air Filter Protean 7109	Gross Alpha	E12545	2nd	6/25/2019	7.00E+01	6.76E+01	1.04	Acceptable
	Gross Beta	E12545	2nd	6/25/2019	2.30E+02	2.25E+02	1.02	Acceptable
Sample Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	HBPP (pCi)	Reference (pCi)	Ratio	Evaluation
Air Filter Tennelec-1171	Gross Alpha	E12545	2nd	6/25/2019	7.55E+01	6.76E+01	1.12	Acceptable
	Gross Beta	E12545	2nd	6/25/2019	2.23E+02	2.25E+02	0.99	Acceptable
Sample/ Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	HBPP (pCi)	Reference (pCi)	Ratio	Evaluation
Gamma Air Filter Detector 1	Ce-141	E12546	2nd	6/25/2019	9.52E+01	8.82E+01	1.08	Acceptable
	Co-58	E12546	2nd	6/25/2019	7.47E+01	7.41E+01	1.01	Acceptable
	Co-60	E12546	2nd	6/25/2019	1.35E+02	1.31E+02	1.03	Acceptable
	Cr-51	E12546	2nd	6/25/2019	2.24E+02	2.23E+02	1.00	Acceptable
	Cs-134	E12546	2nd	6/25/2019	8.45E+01	9.29E+01	0.91	Acceptable
	Cs-137	E12546	2nd	6/25/2019	1.15E+02	1.11E+02	1.03	Acceptable
	Fe-59	E12546	2nd	6/25/2019	1.06E+02	9.35E+01	1.13	Acceptable
	Mn-54	E12546	2nd	6/25/2019	1.33E+02	1.26E+02	1.06	Acceptable
	Zn-65	E12546	2nd	6/25/2019	1.80E+02	1.64E+02	1.10	Acceptable

TABLE A-4 (Continued)
HBPP PARTICIPATION – ECKERT & ZIEGLER INTERLABORATORY CROSS-CHECK PROGRAM DATA

Sample Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	HBPP (pCi)	Reference (pCi)	Ratio	Evaluation
Gamma Air Filter Detector 3	Ce-141	E12546	2nd	6/25/2019	8.46E+01	8.82E+01	0.96	Acceptable
	Co-58	E12546	2nd	6/25/2019	7.31E+01	7.41E+01	0.99	Acceptable
	Co-60	E12546	2nd	6/25/2019	1.32E+02	1.31E+02	1.01	Acceptable
	Cr-51	E12546	2nd	6/25/2019	2.22E+02	2.23E+02	1.00	Acceptable
	Cs-134	E12546	2nd	6/25/2019	8.18E+01	9.29E+01	0.88	Acceptable
	Cs-137	E12546	2nd	6/25/2019	1.13E+02	1.11E+02	1.01	Acceptable
	Fe-59	E12546	2nd	6/25/2019	9.80E+01	9.35E+01	1.05	Acceptable
	Mn-54	E12546	2nd	6/25/2019	1.30E+02	1.26E+02	1.04	Acceptable
	Zn-65	E12546	2nd	6/25/2019	1.81E+02	1.64E+02	1.10	Acceptable
Sample Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	HBPP (pCi/L)	Reference (pCi/L)	Ratio	Evaluation
TriCarb	Tritium (H ³)	E12547	3rd	09/12/19	3.61E+03	4.00E+03	0.90	Acceptable
Sample/ Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	HBPP (pCi)	Reference (pCi)	Ratio	Evaluation
Gamma Water Detector 1	Ce-141	E12548	3rd	09/12/19	1.28E+02	1.27E+02	1.01	Acceptable
	Co-58	E12548	3rd	09/12/19	1.25E+02	1.33E+02	0.94	Acceptable
	Co-60	E12548	3rd	09/12/19	1.58E+02	1.60E+02	0.99	Acceptable
	Cr-51	E12548	3rd	09/12/19	2.60E+02	2.51E+02	1.04	Acceptable
	Cs-134	E12548	3rd	09/12/19	1.40E+02	1.57E+02	0.89	Acceptable
	Cs-137	E12548	3rd	09/12/19	1.13E+02	1.14E+02	0.99	Acceptable
	Fe-59	E12548	3rd	09/12/19	1.13E+02	1.12E+02	1.00	Acceptable
	I-131	E12548	3rd	09/12/19	8.02E+01	8.99E+00	0.89	Acceptable
	Mn-54	E12548	3rd	09/12/19	1.19E+02	1.17E+02	1.02	Acceptable
	Zn-65	E12548	3rd	09/12/19	2.22E+02	2.22E+02	1.00	Acceptable

TABLE A-4 (Continued)
HBPP PARTICIPATION – ECKERT & ZIEGLER INTERLABORATORY CROSS-CHECK PROGRAM DATA

Sample Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	HBPP (pCi/L)	Reference (pCi/L)	Ratio	Evaluation
Gamma Water Detector 3	Ce-141	E12548	3rd	09/12/19	1.26E+02	1.27E+02	1.00	Acceptable
	Co-58	E12548	3rd	09/12/19	1.38E+02	1.33E+02	1.04	Acceptable
	Co-60	E12548	3rd	09/12/19	1.60E+02	1.60E+02	1.00	Acceptable
	Cr-51	E12548	3rd	09/12/19	2.45E+02	2.51E+02	0.98	Acceptable
	Cs-134	E12548	3rd	09/12/19	1.41E+02	1.57E+02	0.90	Acceptable
	Cs-137	E12548	3rd	09/12/19	1.19E+02	1.14E+02	1.04	Acceptable
	Fe-59	E12548	3rd	09/12/19	1.20E+02	1.12E+02	1.07	Acceptable
	I-131	E12548	3rd	09/12/19	9.40E+01	8.99E+01	1.05	Acceptable
	Mn-54	E12548	3rd	09/12/19	1.20E+02	1.17E+02	1.03	Acceptable
	Zn-65	E12548	3rd	09/12/19	2.36E+02	2.22E+02	1.06	Acceptable
Sample Analysis	Radionuclide	Sample Number	Quarter 2019	Report Date	HBPP (pCi)	Reference (pCi)	Ratio	Evaluation
Gamma Water Det 0848	Ce-141	E12548	3rd	09/12/19	1.37E+02	1.27E+02	1.08	Acceptable
	Co-58	E12548	3rd	09/12/19	1.36E+02	1.33E+02	1.03	Acceptable
	Co-60	E12548	3rd	09/12/19	1.54E+02	1.60E+02	0.96	Acceptable
	Cr-51	E12548	3rd	09/12/19	2.79E+02	2.51E+02	1.11	Acceptable
	Cs-134	E12548	3rd	09/12/19	1.48E+02	1.57E+02	0.94	Acceptable
	Cs-137	E12548	3rd	09/12/19	1.22E+02	1.14E+02	1.07	Acceptable
	Fe-59	E12548	3rd	09/12/19	1.17E+02	1.12E+02	1.04	Acceptable
	I-131	E12548	3rd	09/12/19	9.89E+01	8.99E+01	1.10	Acceptable
	Mn-54	E12548	3rd	09/12/19	1.25E+02	1.17E+02	1.07	Acceptable
	Zn-65	E12548	3rd	09/12/19	2.31E+02	2.22E+01	1.04	Acceptable

Table A-4 Notes:

1. Interlaboratory cross-checks for Quarter 1 of 2019 were not received within the first quarter due to a procurement problem. This was documented in corrective action SAPN 1452043. The gamma in soil cross-check was received in mid-May and was analyzed on Detectors 1, 3, 0848, and 6. HBPP results were found to be acceptable in comparison with Eckert & Ziegler reported results with the exception of Ce-141, which was outside the agreement ratio range but was reported conservatively high. Ce-141 has a 32.5 day half-life and is not included as part of the known suite of radionuclides present at HBPP.
2. Analysis results based on 10-minute count times for alpha and beta analyses on Proteans SN 7108 and SN 7109, and Tennelec SN 1171. Alpha filter cross checks normally performed on each Protean gas flow proportional counter at count times of 5 minutes, 10 minutes, and 20 minutes. Beta filter cross checks normally performed on each Protean gas flow proportional counter at count times of 5 minutes and 10 minutes.

TABLE C-1
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL REPORT SUMMARY

Name of Facility	Humboldt Bay Power Plant Unit 3	Docket No.	50-133; License No. DPR-7
Location of Facility	Humboldt County, California (County, State)	Reporting Period	January 1 – December 31, 2019

Medium or Pathway Sampled [Unit of Measurement]	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations	Location with Highest Annual Mean		Control Locations	Number of Non-routine Reported Measurements
			Mean, (Fraction), & [Range] ^b	Name	Mean, (Fraction) & [Range] ^b	Mean, (Fraction) & [Range] ^b	
AIRBORNE Particulates [pCi/m ³]	(53) samples per station <ul style="list-style-type: none"> Gross Beta, Gross Alpha Gamma Isotopic analysis on quarterly composite (by station) (4) Onsite ^c Locations (1) Offsite ^c Locations	<ul style="list-style-type: none"> Gross Beta 1.00E-02 pCi/m³ Gamma Isotopic analysis on quarterly composite (by station) Cs-137 6.00E-02 pCi/m³ 	East Fence (AM1) Gross Alpha (pCi/m ³) mean 2.76E-03, (7/35), [2.34E-03 to 3.59E-03] Gross Beta (pCi/m ³) mean 8.99E-03, (32/35), [3.41E-03 to 1.88E-02] Building 12 (AM2) Gross Alpha (pCi/m ³) mean 2.43E-03, (14/53), [6.58E-03 to 8.37E-04] Gross Beta (pCi/m ³) mean 1.05E-02, (49/53), [3.34E-03 to 2.73E-02] Annex (AM3) Gross Alpha (pCi/m ³) mean 3.03E-03, (13/45), [1.41E-03 to 5.07E-03] Gross Beta (pCi/m ³) mean 1.05E-02, (44/45), [3.26E-03 to 2.26E-02] Relay Building (AM4) Gross Alpha (pCi/m ³) mean 2.35E-03, (14/53), [2.39E-03 to 6.05E-03] Gross Beta (pCi/m ³) mean 1.03E-02, (47/53), [8.28E-03 to 3.07E-02]	Annex (AM3)	Gross Alpha (pCi/m ³) mean 3.03E-03, (13/45), [1.41E-03 to 5.07E-03]	Humboldt Hill (Station 3) Gross Alpha (pCi/m ³) mean 2.65E-03, (6/53), [1.35E-03 to 4.01E-03]	N/A
				Relay Bldg. (AM2)	Gross Beta (pCi/m ³) mean 1.05E-02, (49/53), [3.34E-03 to 2.73E-02] Cs-137 <MDA	Gross Beta (pCi/m ³) mean 7.46E-03, (48/53), [5.36E-03 to 1.72E-02]	
DIRECT RADIATION [mR/quarter]	(63) Fence line TLD readings (20) Off-site TLD Readings	5 mRem	Fence Line TLDs (T1 to T16) 13.3 ± 0.1, (63/63), [10.7 to 16.4]	Station T-1, Figure B-1	T1 (mR/qtr) mean 15.7 ± 0.3, (4/4), [15.1 to 16.4]	Stations 1, 2, 14, 25 and T17 (mR/qtr) mean 12.6 ± 0.2, (20/20), [10.8 to 15.1]	0

TABLE C-1
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 (LLD)	All Indicator Locations	Location with Highest Annual Mean		Control Locations	Number of Non-routine Reported Measurements
			Mean, (Fraction) & [Range] ^b	Name, Distance and Direction	Mean, (Fraction) & [Range] ^b	Mean, (Fraction) & [Range] ^b	
WATERBORNE							0
Groundwater	Not Required	N/A	N/A	N/A	N/A	Not Required	Not Required
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	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

^aThe 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 (before the fact) 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 values for the radionuclide specific analyses were at or below the LLD.

^bThe 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 to 34].

^cOn 11/06/2019 air samplers Annex Building (AM3) and Humboldt Hill (Station 3) were turned off and removed from service. Number of onsite and offsite air sample locations reduced in ODCM Revision 30 & 31. Onsite air samplers reduced from four to two, offsite air samplers reduced from one to zero. In addition, beginning 4th Quarter all samples were sent to GEL for offsite analysis to facilitate demobilization of the onsite count room.

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 Post Shutdown Decommissioning Activities Report and 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	15.3 ± 0.1	15.1 ± 0.2	16.4 ± 0.7	16.1 ± 0.2
T2	13.2 ± 0.4	12.3 ± 0.3	14.1 ± 0.6	13.8 ± 0.5
T3	13.1 ± 0.1	11.8 ± 0.3	13.4 ± 0.2	13.2 ± 0.7
T4	13.7 ± 0.5	12.5 ± 0.3	14.3 ± 0.4	13.8 ± 0.5
T5	12.6 ± 0.1	11.4 ± 0.3	12.6 ± 0.3	12.8 ± 0.2
T6	12.0 ± 0.2	10.7 ± 0.2	13.1 ± 0.1	13.4 ± 0.3
T7	11.8 ± 0.4	10.7 ± 0.1	13.2 ± 0.3	14.5 ± 1.2
T8	12.4 ± 0.6	11.0 ± 0.3	13.9 ± 0.1	14.1 ± 0.4
T9	13.6 ± 0.5	11.7 ± 0.1	13.0 ± 0.2	12.9 ± 0.7
T10	13.2 ± 0.1	11.9 ± 0.4	13.2 ± 0.1	12.6 ± 0.6
T11	14.2 ± 0.0	14.4 ± 0.2	15.6 ± 0.0	15.5 ± 0.3
T12	12.8 ± 0.3	12.3 ± 0.4	13.8 ± 1.0	13.7 ± 0.3
T13	13.1 ± 0.1	12.7 ± 0.1	13.7 ± 1.0	14.0 ± 0.4
T14	13.6 ± 0.2	12.8 ± 0.2	14.4 ± 0.2	14.6 ± 0.5
T15	12.9 ± 0.4	12.4 ± 0.3	13.6 ± 0.9	14.4 ± 1.7
T16	12.8 ± 0.5	12.3 ± 0.2	13.7 ± 0.2	13.9 ± 0.3

Parameter	Calculated Parameters (mR)			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Average	13.1 ± 0.1	12.3 ± 0.1	13.9 ± 0.1	14.0 ± 0.2
Maximum	15.3 ± 0.1	15.1 ± 0.2	16.4 ± 0.2	16.1 ± 0.2

Table C-2 Notes:

1. Offsite TLD Station 1 was moved approximately 20 feet on January 30, 2019, to allow cutting of vegetation and removal of fencing. This is documented in corrective action SAPN 1450240.
2. Two anomalies were reported in the 2019 Q1 TLD Report from Mirion. Three TLDs are installed at each station, with each TLD containing 3 crystal elements. The reported TLD results is based on an average of the 9 elements at each location. T-8A registered exposures of 14 mR, 12 mR, and 135 mR. T-8B displayed 12 mR, 11 mR, and 12 mR while T-8C showed measurements of 12 mR, 13 mR, and 13 mR. The high measurement of 135 mR was discarded as not valid. T-9A had readings of 14 mR, 14 mR, and 13 mR, while T-9B displayed measurements of 35 mR, 13 mR, and 13 mR. T-9C showed readings of 14 mR, 14 mR, and 14 mR. The 35 mR measurement also appeared to be an anomaly and was discarded from the average at this location. This was documented in corrective action SAPN 1453104.
3. Onsite TLD locations T-9 and T-10 were relocated to permanent fencing along RCA Way on May 3, 2019. This is documented in corrective action SAPN 1450240.
4. Onsite TLD location T-8 was retrieved from the field on May 9, 2019, because of planned remediation of an environmental area within the immediate vicinity. Onsite TLD location T-7 was also retrieved from the field on May 20, 2019 due to expansion of the environmental remediation.

Both T-7 and T-8 were installed on permanent plant fencing at the site perimeter on July 25, 2019. This is documented in corrective action SAPN 1450240.

5. Onsite TLD location T-6 was retrieved from the field on June 13, 2019, because of further environmental remediation along the plant fence line. T-6 was installed on permanent plant fencing at the site perimeter on July 25, 2019. This is documented in corrective action SAPN 1450240.
6. Onsite TLD location T-5 was retrieved from the field on June 27, 2019, because of further environmental remediation along the plant fence line. T-5 was installed on the ISFSI fence on July 25, 2019. This is documented in corrective action SAPN 1450240.
7. Onsite TLD location T-11 was relocated on August 7, 2019, from the East Fence dog house air sampler to permanent fence directly across from the air sampler. The air sampler is scheduled to be discontinued due to electrical power issues. This is documented in corrective action SAPN 1450240.
8. These exposures are reported for a standardized period of 90 days.
9. The reported exposures do not have an average background or transient dose subtracted.

TABLE C-3
OFFSITE (Control) ENVIRONMENTAL TLD STATIONS

Station Number	TLD Exposure Measurements (mR)			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1	12.4 ± 0.0	11.7 ± 0.3	13.5 ± 0.2	12.9 ± 0.8
2	14.2 ± 0.3	13.4 ± 0.1	15.1 ± 0.0	14.9 ± 0.4
14	11.6 ± 0.8	10.8 ± 1.1	12.6 ± 0.3	12.2 ± 0.7
25	11.8 ± 0.2	11.1 ± 0.4	12.8 ± 0.3	12.8 ± 0.7
T17	11.8 ± 0.2	11.2 ± 0.1	12.5 ± 0.2	12.6 ± 0.1

Parameter	Calculated Parameters (mR)			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Average	12.4 ± 0.2	11.6 ± 0.2	13.3 ± 0.1	13.1 ± 0.3
Maximum	14.2 ± 0.3	13.4 ± 0.1	15.1 ± 0.0	14.9 ± 0.4

Table C-3 Notes:

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

Table C-4
ODCM REQUIRED AIR SAMPLES: EAST FENCE (AM1)

Sample Start Date	Alpha Activity (pCi/m ³)	Beta Activity (pCi/m ³)	Composite Gamma Activity (pCi/m ³)	
			Co-60	Cs-137
12/26/2018	< 3.40E-03 (MDA)	7.59E-03 ± 3.54E-03	<2.05E-03 (MDA)	< 2.49E-03 (MDA)
1/2/2019	< 3.58E-03 (MDA)	3.93E-03 ± 3.13E-03		
1/9/2019	< 3.45E-03 (MDA)	1.62E-02 ± 4.60E-03		
1/16/2019	< 3.49E-03 (MDA)	< 6.05E-03 (MDA)		
1/23/2019	2.34E-03 ± 1.85E-03	1.88E-02 ± 4.76E-03		
1/30/2019	< 3.25E-03 (MDA)	7.07E-03 ± 3.35E-03		
2/6/2019	3.59E-03 ± 2.34E-03	1.21E-02 ± 4.09E-03		
2/13/2019	< 3.32E-03 (MDA)	6.16E-03 ± 3.27E-03		
2/20/2019	< 3.43E-03 (MDA)	3.41E-03 ± 2.95E-03		
2/27/2019	< 3.50E-03 (MDA)	1.14E-02 ± 4.10E-03		
3/6/2019	< 3.49E-03 (MDA)	1.07E-02 ± 4.01E-03		
3/13/2019	< 3.46E-03 (MDA)	1.52E-02 ± 4.49E-03		
3/20/2019	< 3.40E-03 (MDA)	6.89E-03 ± 3.45E-03		
3/27/2019	< 3.31E-03 (MDA)	9.67E-03 ± 3.75E-03		
4/3/2019	< 3.24E-03 (MDA)	6.02E-03 ± 3.19E-03	< 2.96E-03 (MDA)	< 2.12E-03 (MDA)
4/10/2019	< 3.48E-03 (MDA)	< 6.03E-03 (MDA)		
4/17/2019	< 3.58E-03 (MDA)	1.13E-02 ± 4.15E-03		
4/24/2019	< 3.39E-03 (MDA)	1.42E-02 ± 4.33E-03		
5/1/2019	3.12E-03 ± 2.23E-03	1.05E-02 ± 4.03E-03		
5/8/2019	< 3.47E-03 (MDA)	7.74E-03 ± 3.61E-03		
5/15/2019	< 3.48E-03 (MDA)	5.25E-03 ± 3.26E-03		
5/22/2019	< 3.41E-03 (MDA)	6.91E-03 ± 3.47E-03		
5/29/2019	3.00E-03 ± 2.14E-03	3.77E-03 ± 2.96E-03		
6/5/2019	2.38E-03 ± 1.88E-03	1.45E-02 ± 4.35E-03		
6/12/2019	2.49E-03 ± 1.96E-03	5.70E-03 ± 3.37E-03		
6/19/2019	< 3.31E-03 (MDA)	5.10E-03 ± 3.10E-03		
6/26/2019	< 3.42E-03 (MDA)	9.40E-03 ± 3.79E-03		
7/3/2019	< 3.39E-03 (MDA)	9.90E-03 ± 3.84E-03	<3.26E-04 (MDA)	<3.06E-04 (MDA)
7/10/2019	< 3.48E-03 (MDA)	5.97E-03 ± 3.37E-03		
7/17/2019	< 3.37E-03 (MDA)	< 5.84E-03 (MDA)		
7/24/2019	< 3.48E-03 (MDA)	8.13E-03 ± 3.68E-03		
7/31/2019	< 3.57E-03 (MDA)	9.45E-03 ± 3.92E-03		
8/7/2019	2.37E-03 ± 1.88E-03	1.20E-02 ± 4.07E-03		
8/14/2019	< 3.47E-03 (MDA)	7.75E-03 ± 3.61E-03		
8/21/2019	< 3.60E-03 (MDA) ⁴	5.06E-03 ± 3.32E-03 ⁴		

Table C-4 (Continued)
ODCM REQUIRED AIR SAMPLES: AM2 NORTH (AM2)

Table C-4 (Continued)
ODCM REQUIRED AIR SAMPLES: ANNEX BUILDING (AM3)

Sample Start Date	Alpha Activity (pCi/m ³)	Beta Activity (pCi/m ³)	Composite Gamma Activity (pCi/m ³)	
			Co-60	Cs-137
12/26/2018	< 3.39E-03 (MDA)	7.22E-03 ± 3.48E-03	<2.59E-03 (MDA)	< 2.66E-03 (MDA)
1/2/2019	< 3.58E-03 (MDA)	1.02E-02 ± 4.02E-03		
1/9/2019	< 3.45E-03 (MDA)	9.49E-03 ± 3.83E-03		
1/16/2019	< 3.49E-03 (MDA)	8.52E-03 ± 3.73E-03		
1/23/2019	2.34E-03 ± 1.85E-03	2.26E-02 ± 5.13E-03		
1/30/2019	2.88E-03 ± 2.05E-03	1.05E-02 ± 3.80E-03		
2/6/2019	< 3.38E-03 (MDA)	1.57E-02 ± 4.50E-03		
2/13/2019	< 3.32E-03 (MDA)	1.18E-02 ± 4.01E-03		
2/20/2019	< 3.43E-03 (MDA)	6.95E-03 ± 3.48E-03		
2/27/2019	2.47E-03 ± 1.95E-03	1.68E-02 ± 4.71E-03		
3/6/2019	< 3.49E-03 (MDA)	1.14E-02 ± 4.08E-03		
3/13/2019	< 3.46E-03 (MDA)	1.73E-02 ± 4.72E-03		
3/20/2019	< 3.40E-03 (MDA)	1.14E-02 ± 4.03E-03		
3/27/2019	4.14E-03 ± 2.49E-03	9.78E-03 ± 3.79E-03		
4/3/2019	< 3.24E-03 (MDA)	3.26E-03 ± 2.76E-03	< 2.58E-03 (MDA)	< 3.08E-03 (MDA)
4/10/2019	< 3.47E-03 (MDA)	7.40E-03 ± 3.56E-03		
4/17/2019	< 3.58E-03 (MDA)	1.39E-02 ± 4.44E-03		
4/24/2019	< 3.39E-03 (MDA)	1.80E-02 ± 4.73E-03		
5/1/2019	< 3.56E-03 (MDA)	1.09E-02 ± 4.09E-03		
5/8/2019	3.05E-03 ± 2.17E-03	7.38E-03 ± 3.56E-03		
5/15/2019	< 3.48E-03 (MDA)	7.77E-03 ± 3.63E-03		
5/22/2019	< 3.41E-03 (MDA)	9.01E-03 ± 3.74E-03		
5/29/2019	< 3.39E-03 (MDA)	7.38E-03 ± 3.50E-03		
6/5/2019	< 3.38E-03 (MDA)	1.03E-02 ± 3.88E-03		
6/12/2019	< 3.53E-03 (MDA)	< 6.11E-03 (MDA)		
6/19/2019	3.52E-03 ± 2.29E-03	9.33E-03 ± 3.70E-03		
6/26/2019	< 3.42E-03 (MDA)	7.99E-03 ± 3.61E-03		
7/3/2019	< 3.39E-03 (MDA)	5.57E-03 ± 3.23E-03	<2.59E-04 (MDA)	<2.32E-04 (MDA)
7/10/2019	< 3.48E-03 (MDA)	5.25E-03 ± 3.26E-03		
7/17/2019	< 3.37E-03 (MDA)	6.83E-03 ± 3.42E-03		
7/24/2019	2.45E-03 ± 1.94E-03	4.54E-03 ± 3.16E-03		
7/31/2019	< 3.57E-03 (MDA)	1.20E-02 ± 4.24E-03		
8/7/2019	< 3.37E-03 (MDA)	1.34E-02 ± 4.22E-03		
8/14/2019	< 3.47E-03 (MDA)	1.20E-02 ± 4.15E-03		
8/21/2019	2.53E-03 ± 2.00E-03	8.40E-03 ± 3.80E-03		
8/28/2019	< 3.35E-03 (MDA)	9.88E-03 ± 3.79E-03		
9/4/2019	< 3.54E-03 (MDA)	1.52E-02 ± 4.56E-03		
9/11/2019	< 3.51E-03 (MDA)	4.58E-03 ± 3.19E-03		
9/18/2019	< 3.37E-03 (MDA)	9.95E-03 ± 3.82E-03		
9/25/2019	< 3.56E-03 (MDA)	1.09E-02 ± 4.01E-03		
10/2/2019	2.40E-03 ± 1.17E-03	1.36E-02 ± 1.83E-03	<1.05E-03 (MDA)	<9.96E-04 (MDA)
10/9/2019	5.07E-03 ± 1.57E-03	1.72E-02 ± 2.01E-03		
10/16/2019	1.64E-03 ± 9.48E-04	1.01E-02 ± 1.58E-03		
10/23/2019	1.41E-03 ± 9.62E-04	1.24E-02 ± 1.181E-03		
10/30/2019	4.06E-03 ± 1.19E-03	2.17E-02 ± 2.01E-03		

Table C-4 (Continued)
ODCM REQUIRED AIR SAMPLES: RELAY BUILDING (AM4)

Sample Start Date	Alpha Activity (pCi/m ³)	Beta Activity (pCi/m ³)	Composite Gamma Activity (pCi/m ³)	
			Co-60	Cs-137
12/26/2018	2.39E-03 ± 1.89E-03	8.28E-03 ± 3.62E-03	<3.00E-03 (MDA)	< 2.95E-03 (MDA)
1/2/2019	< 3.58E-03 (MDA)	1.31E-02 ± 4.37E-03		
1/9/2019	< 3.45E-03 (MDA)	1.20E-02 ± 4.13E-03		
1/16/2019	< 3.49E-03 (MDA)	< 6.05E-03 (MDA)		
1/23/2019	< 3.30E-03 (MDA)	1.42E-02 ± 4.27E-03		
1/30/2019	< 3.25E-03 (MDA)	9.84E-03 ± 3.72E-03		
2/6/2019	< 3.38E-03 (MDA)	9.53E-03 ± 3.78E-03		
2/13/2019	< 3.32E-03 (MDA)	< 5.74E-03 (MDA)		
2/20/2019	< 3.43E-03 (MDA)	< 5.94E-03 (MDA)		
2/27/2019	< 3.50E-03 (MDA)	1.21E-02 ± 4.19E-03		
3/6/2019	< 3.49E-03 (MDA)	7.07E-03 ± 3.54E-03		
3/13/2019	< 3.46E-03 (MDA)	1.24E-02 ± 4.17E-03		
3/20/2019	< 3.40E-03 (MDA)	8.99E-03 ± 3.73E-03		
3/27/2019	< 3.34E-03 (MDA)	4.08E-03 ± 2.97E-03		
4/3/2019	< 3.24E-03 (MDA)	5.67E-03 ± 3.14E-03	< 8.61E-04 (MDA)	< 3.44E-03 (MDA)
4/10/2019	< 3.48E-03 (MDA)	5.61E-03 ± 3.32E-03		
4/17/2019	< 3.58E-03 (MDA)	1.28E-02 ± 4.31E-03		
4/24/2019	< 3.39E-03 (MDA)	1.14E-02 ± 4.01E-03		
5/1/2019	< 3.56E-03 (MDA)	8.67E-03 ± 3.79E-03		
5/8/2019	< 3.47E-03 (MDA)	7.74E-03 ± 3.61E-03		
5/15/2019	2.45E-03 ± 1.94E-03	< 6.03E-03 (MDA)		
5/22/2019	< 3.41E-03 (MDA)	8.67E-03 ± 3.69E-03		
5/29/2019	< 3.39E-03 (MDA)	7.74E-03 ± 3.55E-03		
6/5/2019	2.38E-03 ± 1.88E-03	5.10E-03 ± 3.17E-03		
6/12/2019	< 3.53E-03 (MDA)	< 6.11E-03 (MDA)		
6/19/2019	< 3.31E-03 (MDA)	6.16E-03 ± 3.26E-03		
6/26/2019	< 3.42E-03 (MDA)	3.41E-03 ± 2.95E-03		
7/3/2019	< 3.39E-03 (MDA)	7.38E-03 ± 3.50E-03	<2.05E-04 (MDA)	<1.91E-04 (MDA)
7/10/2019	< 3.48E-03 (MDA)	< 6.02E-03 (MDA)		
7/17/2019	< 3.37E-03 (MDA)	6.48E-03 ± 3.37E-03		
7/24/2019	< 3.48E-03 (MDA)	6.70E-03 ± 3.48E-03		
7/31/2019	< 3.57E-03 (MDA)	1.06E-02 ± 4.05E-03		
8/7/2019	< 3.37E-03 (MDA)	1.38E-02 ± 4.27E-03		
8/14/2019	< 3.47E-03 (MDA)	6.32E-03 ± 3.42E-03		
8/21/2019	< 3.60E-03 (MDA)	1.43E-02 ± 4.50E-03		
8/28/2019	< 3.35E-03 (MDA)	6.43E-03 ± 3.35E-03		
9/4/2019	2.49E-03 ± 1.97E-03	8.62E-03 ± 3.77E-03		
9/11/2019	< 3.52E-03 (MDA)	1.04E-02 ± 3.99E-03		
9/18/2019	< 3.37E-03 (MDA)	4.74E-03 ± 3.11E-03		
9/25/2019	< 3.56E-03 (MDA)	1.38E-02 ± 4.42E-03		
10/2/2019	2.72E-03 ± 1.11E-03	1.21E-02 ± 1.70E-03	<2.98E-04 (MDA)	<2.21E-04 (MDA)
10/9/2019	2.38E-03 ± 1.04E-03	1.50E-02 ± 1.89E-03		
10/16/2019	3.24E-04 ± 4.83E-04	7.89E-03 ± 1.48E-03		
10/23/2019	1.40E-03 ± 8.00E-04	1.49E-02 ± 1.80E-03		
10/30/2019	5.48E-03 ± 1.64E-03	3.07E-02 ± 2.81E-03		
11/06/2019	6.05E-03 ± 1.61E-03	2.75E-02 ± 2.40E-03		
11/13/2019	1.39E-03 ± 9.91E-04	1.32E-02 ± 1.77E-03		
11/20/2019	1.23E-03 ± 8.07E-04	1.91E-02 ± 2.04E-03		
11/27/2019	1.13E-03 ± 7.78E-04	8.94E-03 ± 1.50E-03		
12/04/2019	<6.76E-04 (MDA)	5.88E-03 ± 1.15E-03		
12/12/2019	<1.01E-03 (MDA)	8.18E-03 ± 1.46E-03		
12/17/2019	1.08E-03 ± 7.37E-04	7.56E-03 ± 1.28E-03		
12/26/2019	<7.34E-04	1.07E-02 ± 1.53E-03		

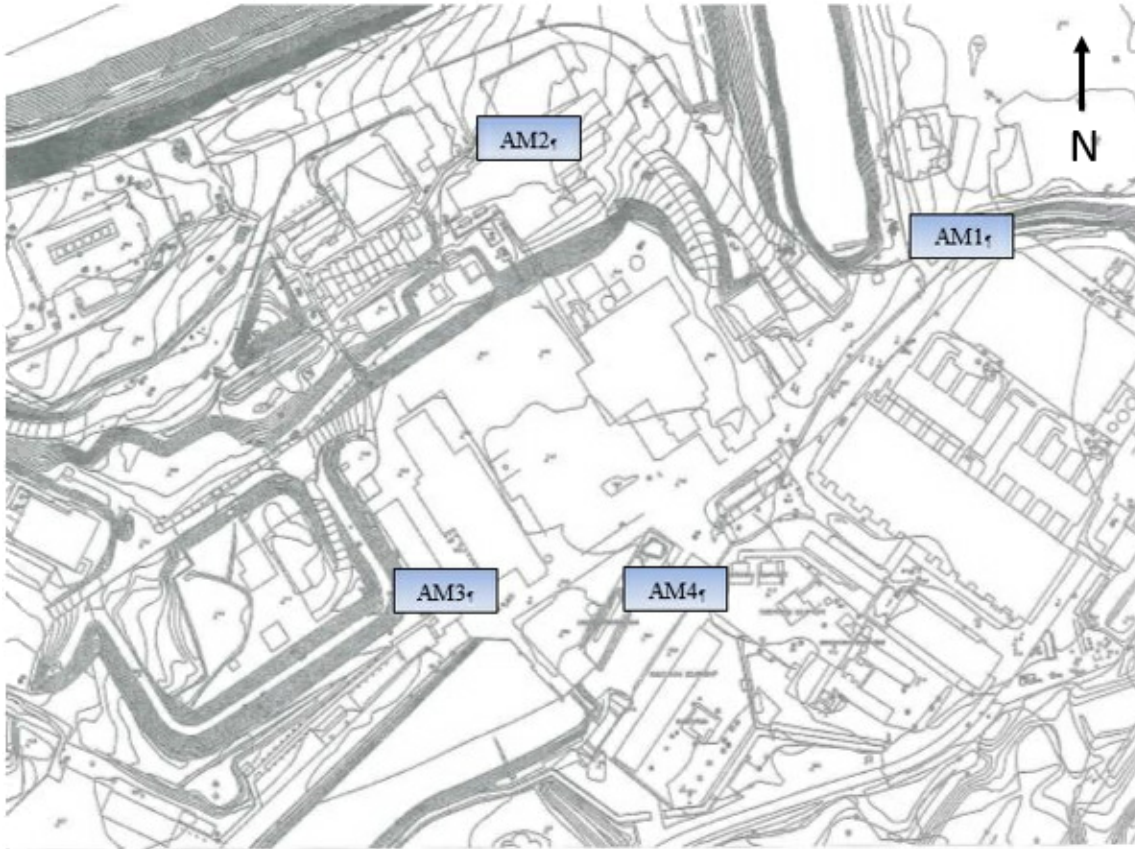
Table C-4 (Continued)
ODCM REQUIRED AIR SAMPLES: HUMBOLDT HILL (STATION 3)

Sample Start Date	Alpha Activity (pCi/m ³)	Beta Activity (pCi/m ³)	Composite Gamma Activity (pCi/m ³)	
			Co-60	Cs-137
12/26/2018	< 3.37E-03 (MDA)	5.43E-03 ± 3.21E-03	< 3.08E-03 (MDA)	< 2.77E-03 (MDA)
1/2/2019	< 3.54E-03 (MDA)	1.12E-02 ± 4.10E-03		
1/9/2019	< 3.47E-03 (MDA)	7.39E-03 ± 3.56E-03		
1/16/2019	< 3.47E-03 (MDA)	4.53E-03 ± 3.15E-03		
1/23/2019	< 6.88E-03 (MDA) ¹	1.57E-02 ± 7.22E-03 ¹		
1/30/2019	< 3.31E-03 (MDA)	4.74E-03 ± 3.05E-03		
2/6/2019	< 3.31E-03 (MDA)	9.67E-03 ± 3.75E-03		
2/13/2019	< 3.30E-03 (MDA)	8.24E-03 ± 3.55E-03		
2/20/2019	< 3.47E-03 (MDA)	< 6.00E-03 (MDA)		
2/27/2019	< 3.48E-03 (MDA)	9.56E-03 ± 3.86E-03		
3/6/2019	< 3.44E-03 (MDA)	3.42E-03 ± 2.96E-03		
3/13/2019	< 3.47E-03 (MDA)	1.20E-02 ± 4.15E-03		
3/20/2019	< 3.47E-03 (MDA)	4.53E-03 ± 3.15E-03		
3/27/2019	2.93E-03 ± 2.09E-03	< 5.72E-03 (MDA)		
4/3/2019	< 3.28E-03 (MDA)	4.70E-03 ± 3.02E-03	< 2.65E-03 (MDA)	< 2.55E-03 (MDA)
4/10/2019	< 3.49E-03 (MDA)	< 6.04E-03 (MDA)		
4/17/2019	< 3.56E-03 (MDA)	8.32E-03 ± 3.76E-03		
4/24/2019	< 3.40E-03 (MDA)	1.32E-02 ± 4.22E-03		
5/1/2019	< 3.57E-03 (MDA)	7.60E-03 ± 3.66E-03		
5/8/2019	< 3.47E-03 (MDA)	< 6.01E-03 (MDA)		
5/15/2019	< 3.43E-03 (MDA)	5.54E-03 ± 3.28E-03		
5/22/2019	< 3.44E-03 (MDA)	4.49E-03 ± 3.12E-03		
5/29/2019	2.35E-03 ± 1.85E-03	6.14E-03 ± 3.25E-03		
6/5/2019	< 3.50E-03 (MDA)	1.25E-02 ± 4.23E-03		
6/12/2019	< 4.92E-03 (MDA)	5.40E-03 ± 4.31E-03		
6/19/2019	< 3.35E-03 (MDA) ³	4.09E-03 ± 2.98E-03 ³		
6/26/2019	2.40E-03 ± 1.90E-03	4.10E-03 ± 3.04E-03		
7/3/2019	3.61E-03 ± 2.36E-03	5.60E-03 ± 3.24E-03	< 2.58E-04 (MDA)	< 3.32E-04 (MDA)
7/10/2019	2.45E-03 ± 1.94E-03	< 6.02E-03 (MDA)		
7/17/2019	< 3.42E-03 (MDA)	6.22E-03 ± 3.37E-03		
7/24/2019	< 3.48E-03 (MDA)	3.46E-03 ± 3.00E-03		
7/31/2019	< 3.58E-03 (MDA)	8.36E-03 ± 3.78E-03		
8/7/2019	< 3.36E-03 (MDA)	7.49E-03 ± 3.49E-03		
8/14/2019	< 3.43E-03 (MDA)	8.01E-03 ± 3.62E-03		
8/21/2019	< 3.64E-03 (MDA)	6.63E-03 ± 3.59E-03		
8/28/2019	< 3.37E-03 (MDA)	1.03E-02 ± 3.87E-03		
9/4/2019	< 3.44E-03 (MDA)	4.13E-03 ± 3.07E-03		
9/11/2019	< 3.53E-03 (MDA)	8.97E-03 ± 3.82E-03		
9/18/2019	< 3.43E-03 (MDA)	4.12E-03 ± 3.06E-03		
9/25/2019	2.38E-03 ± 1.88E-03	3.36E-03 ± 2.91E-03		
10/2/2019	1.78E-03 ± 9.43E-04	1.04E-02 ± 1.56E-03	< 8.67E-04 (MDA)	< 6.82E-04 (MDA)
10/9/2019	4.01E-03 ± 1.30E-03	1.46E-02 ± 1.89E-03		
10/16/2019	1.35E-03 ± 8.71E-04	5.36E-03 ± 1.41E-03		
10/23/2019	2.17E-03 ± 1.03E-03	1.11E-02 ± 1.70E-03		
10/30/2019	3.76E-03 ± 1.20E-03	1.72E-02 ± 1.83E-03		

Table C-4 Notes

1. The REMP air sampler at Humboldt Hill was found to be not operating on January 30, 2019, after approximately 95 hours of run time. The GFCI was tripped, causing the air sampler to shut down prematurely. This is described in corrective action SAPN 1450240. The totalizer reading was used to calculate sample volume and resulting sample activity.
2. AM-2 was moved from GWTS 2.0 to the road adjacent to the ISFSI on May 1, 2019. Due to the shutdown and dismantlement of GWTS, electrical power to the air sampler was scheduled to be discontinued. The air sampler was turned off for approximately 20 minutes during the relocation. This is described in corrective action SAPN 1450240.
3. On June 25, 2019, the REMP air sampler at Humboldt Hill was found to be not operating after approximately 118 hours on the totalizer. Electrical power to the air sampler may have been shut down to allow grass trimming around the perimeter of the air sample station. This is described in corrective action SAPN 1450240.
4. On August 28, 2019, the REMP air sampler at the East Fence (AM1) was turned off and removed from service. The ODCM was revised to reflect the elimination of AM1 on the eastern perimeter fence line and the change from 4 onsite air sampling locations to 3. This is documented in corrective action SAPN 1450240.
5. On November 6, 2019, air samplers Annex Building (AM3) and Humboldt Hill (Station 3) were turned off and removed from service. The ODCM was revised to reflect the elimination of AM3 and Station 3 and change from 3 onsite air sampling locations to 2. This is documented in corrective action SAPN 1450240.
6. To facilitate demobilization and survey of HBPP onsite count room building and equipment, beginning fourth quarter 2019, all air samples were sent to GEL for sample analysis.

**FIGURE A-1
HBPP ONSITE AIR SAMPLE LOCATIONS**

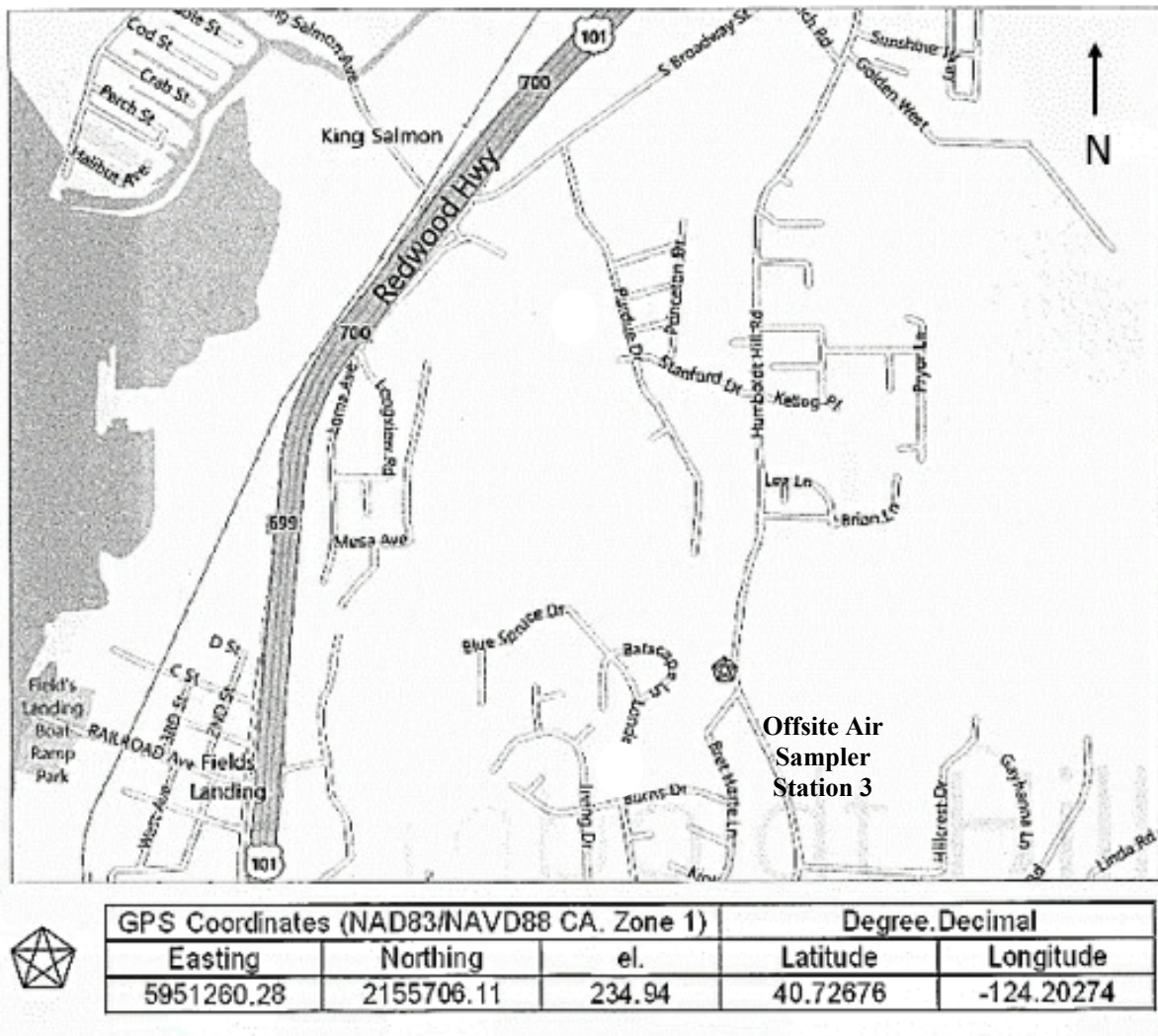


Location Number	GPS Coordinates (NAD83/NAVD88 CA. Zone 1)	
	Easting	Northing
East Fence AM1	5949844	2161231
GWTS AM2	59498846	2161067
Annex Bldg. AM3	5949178	2160817
Relay Bldg. AM4	5949456	2160858

Figure A-1 Note:

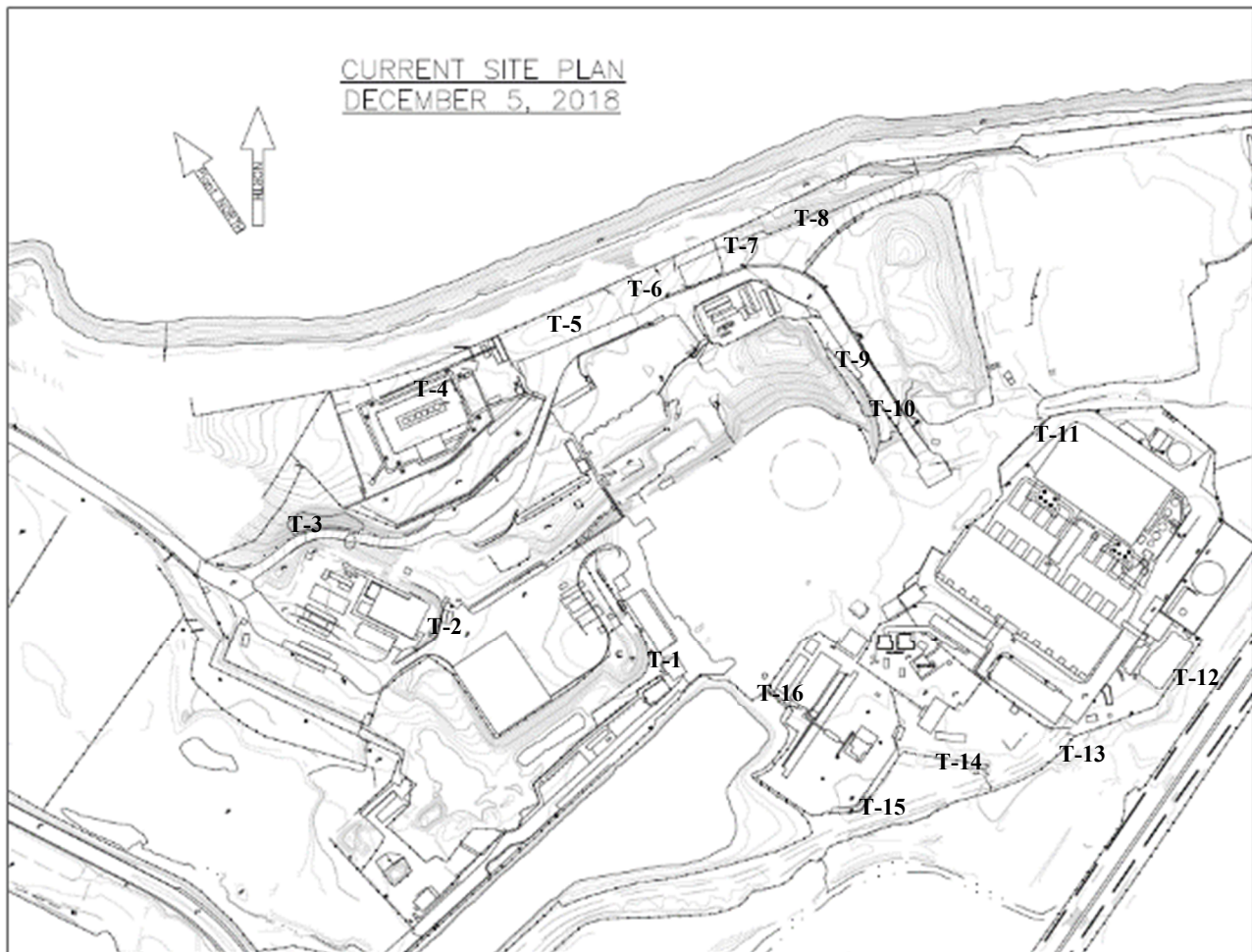
1. Humboldt Hill (Offsite) is also known as Station 3, East Fence is also known as AM1, GWTS (formerly Building 12) is also known as AM2, Annex is also known as AM3, and the Relay Building is also known as AM4.
2. AM1 was powered down and removed from service on August 28, 2019. The change in the number of onsite air samplers was reflected in ODCM Revision 30 and corrective action SAPN 1450240.
3. AM3, was powered down and removed from service on November 6, 2019. The change in the number of onsite air samplers was reflected in ODCM Revision 31 as noted in corrective action SAPN 1459240.

**FIGURE A-2
HBPP OFFSITE AIR SAMPLE LOCATION
HUMBOLDT HILL (Station 3)**



1. Offsite air sampler, also known as Humboldt Hill (Station 3), was powered down and removed from service on November 6, 2019. The change in the number of onsite air samplers was reflected in ODCM Revision 31 as noted in corrective action SAPN 1459240.

FIGURE A-3
HBPP ONSITE TLD LOCATIONS
Stations T1 – T16 (excluding T17)



Monitoring Locations T7, T10, T11, T13, T16, T2, T3, and T5 generally represent REMP Site Boundary direct exposure monitoring locations in the 8 primary compass points beginning with T7 representing north and moving clockwise.

Location Number	GPS Coordinates (NAD83/NAVD88 CA Zone 1)		
	Easting	Northing	Elevation
T1	5949179	2160815	11
T2	5948794	2160911	17
T3	5948610	2161062	42
T4	5948779	2161270	44
T5	5948944	2161301	40
T6	5949140	2161433	36
T7	5949249	2161482	33
T8	5949428	2161435	28
T9	5949478	2161241	23
T10	5949519	2161199	19
T11	5949772	2161202	13
T12	5950019	2160858	11
T13	5949842	2160718	10
T14	5949584	2160684	10
T15	5949473	2160590	11
T16	5949327	2160771	11

FIGURE A-4
HBPP OFFSITE TLD LOCATIONS
Stations (1, 14 & 25)

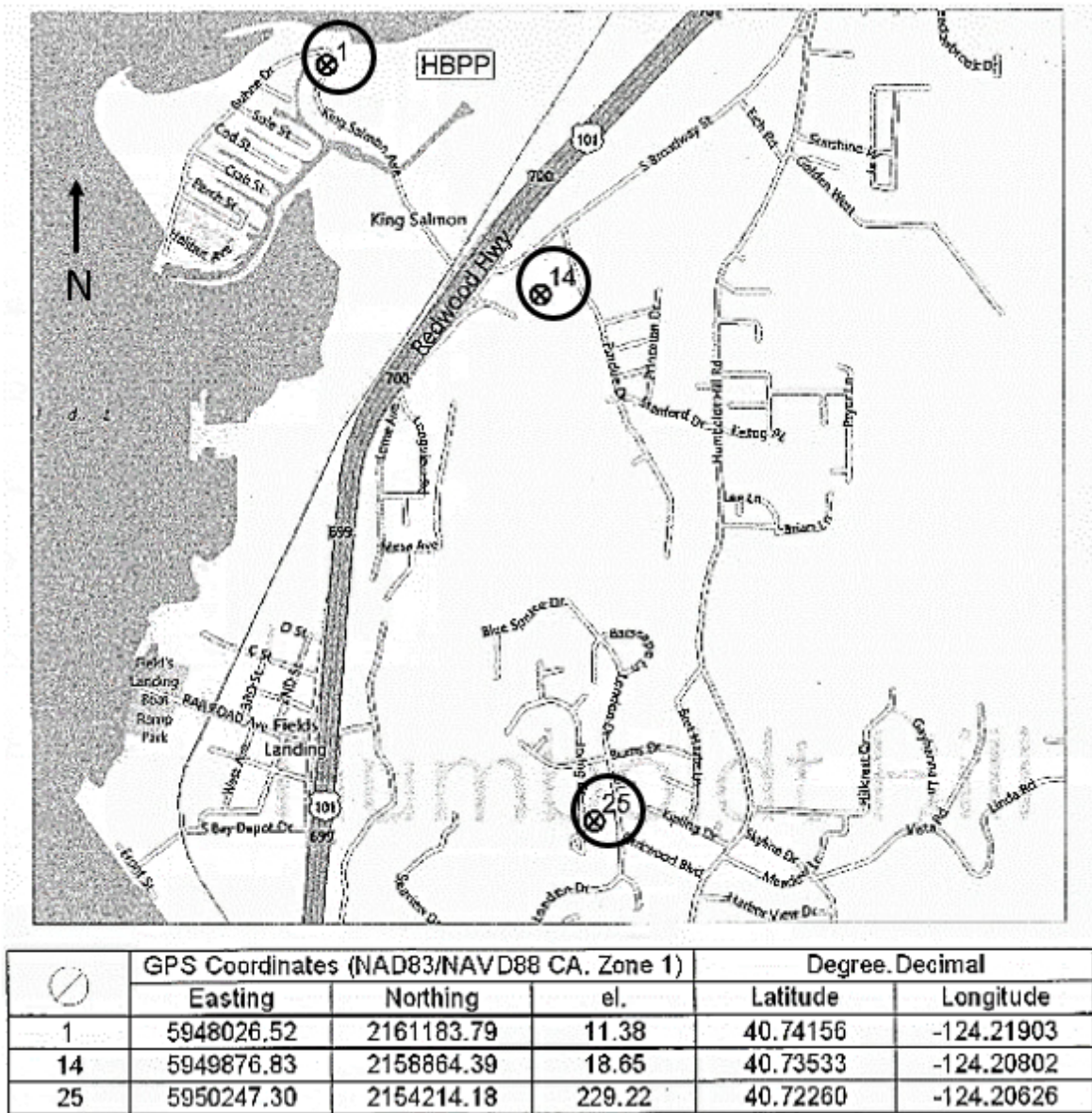
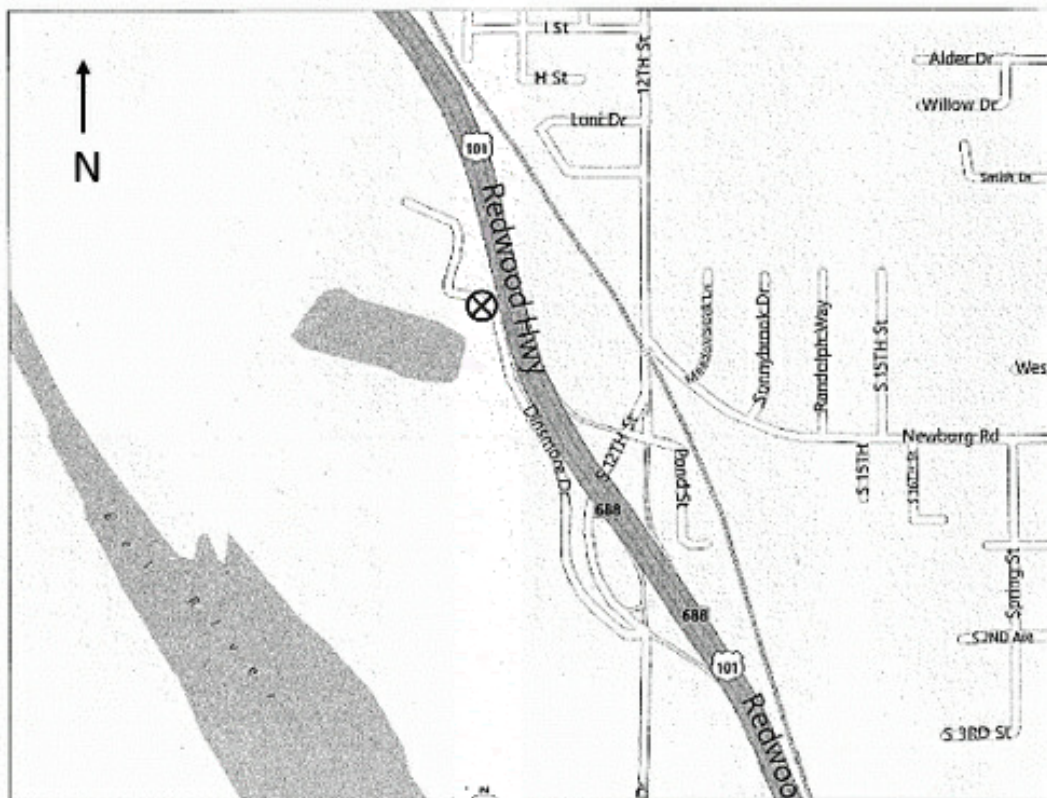
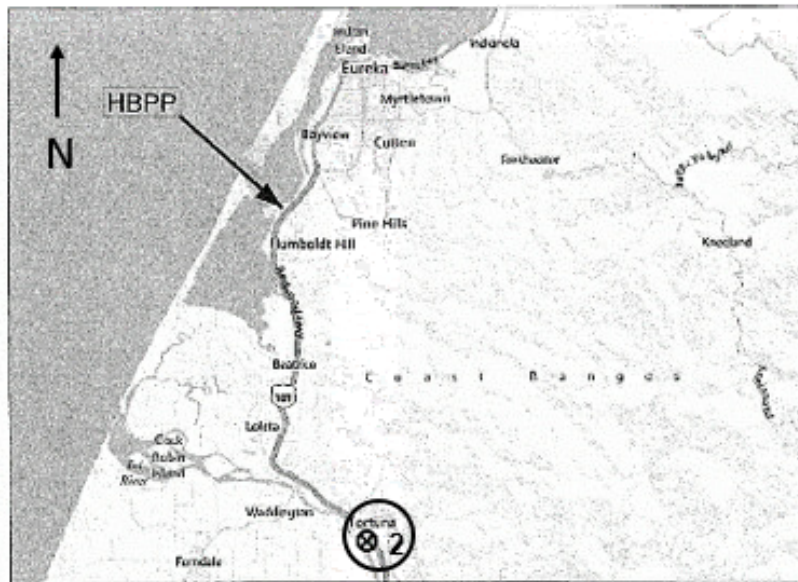
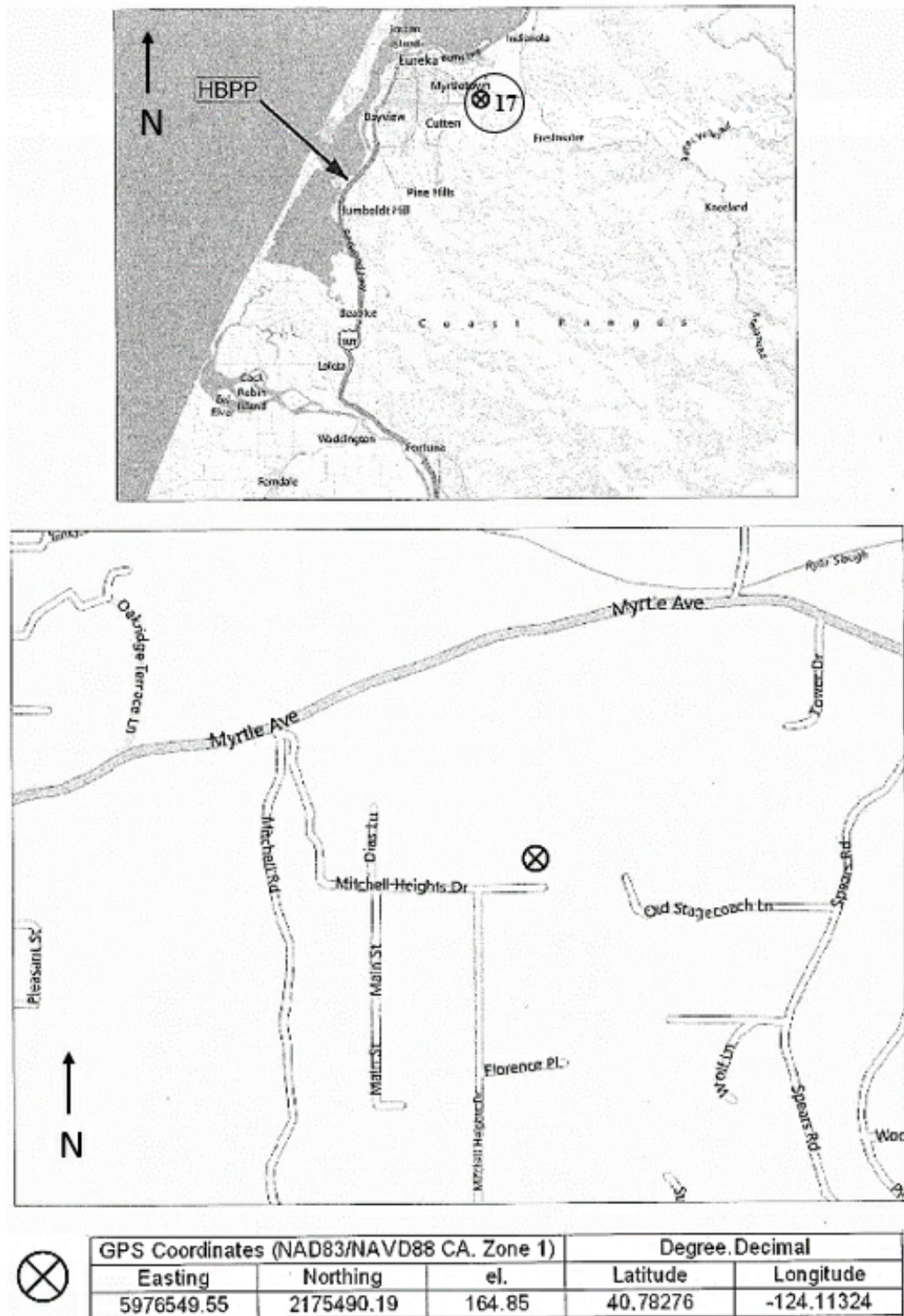


FIGURE A-4 (Continued)
HBPP OFFSITE TLD LOCATION
FORTUNA (Station 2)

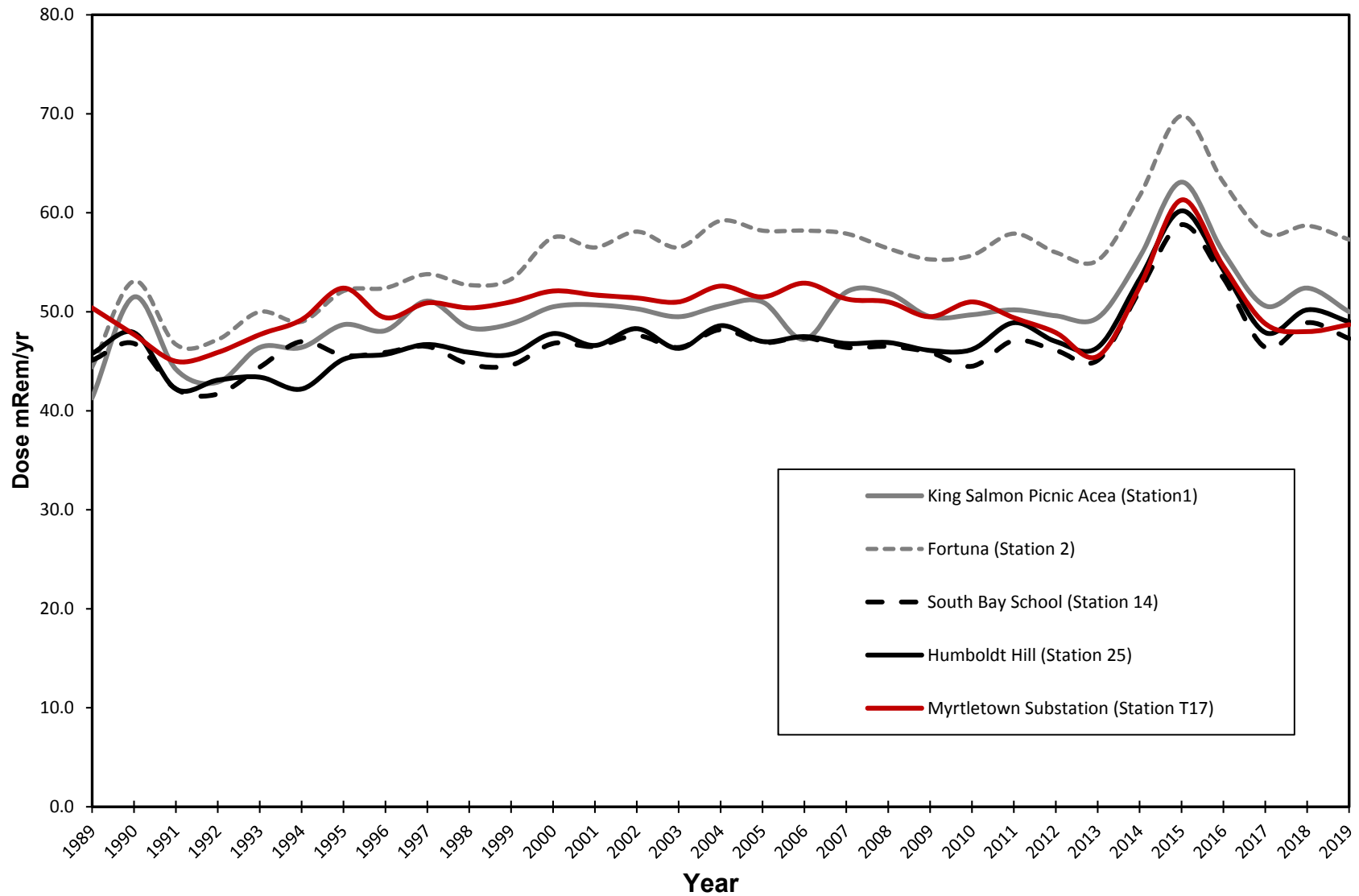


⊗	GPS Coordinates (NAD83/NAVD88 CA. Zone 1)			Degree.Decimal	
	Easting	Northing	el.	Latitude	Longitude
	5962583.86	2105797.82	35.53	40.59057	-124.15746

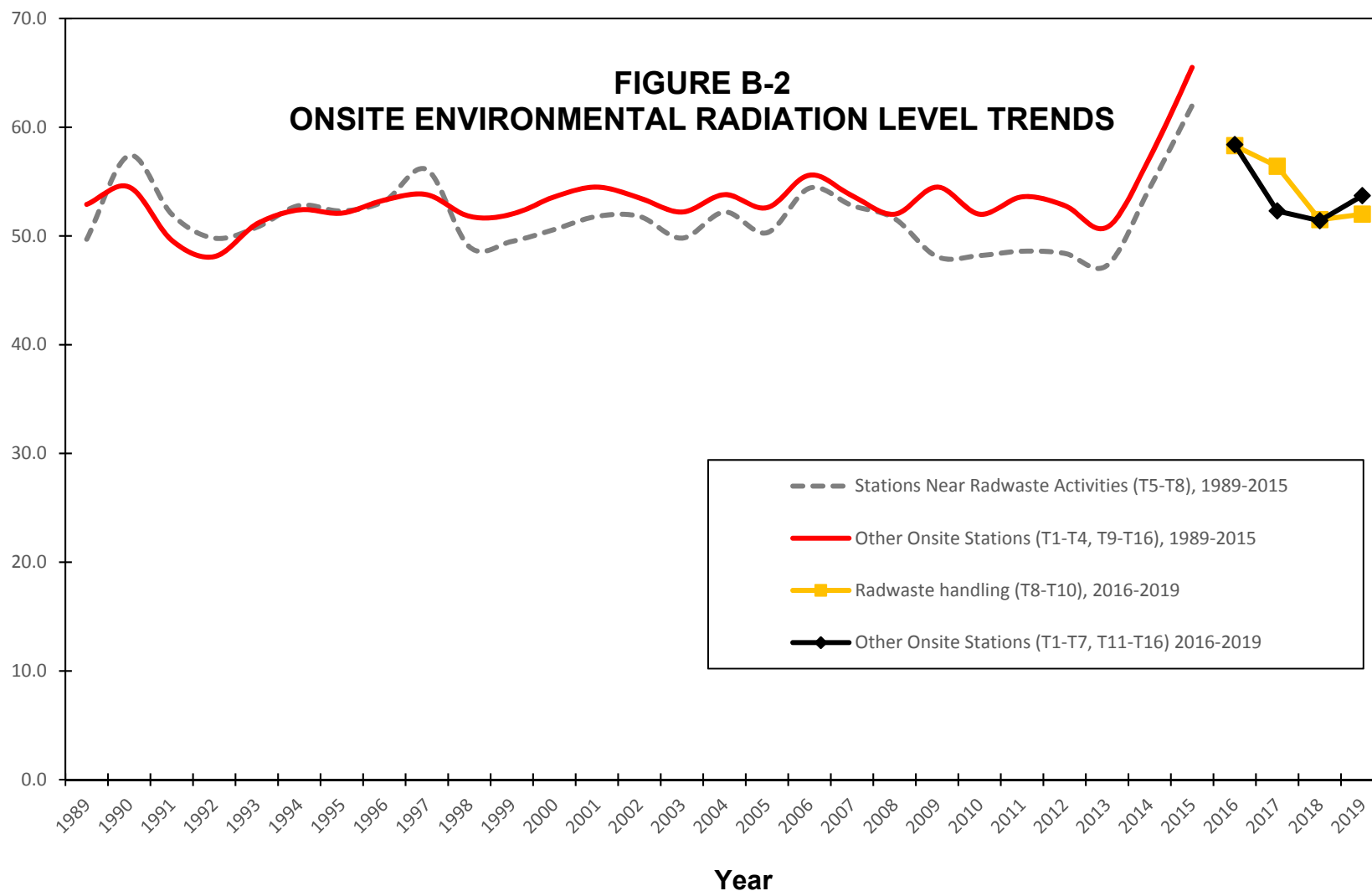
FIGURE A-4 (Continued)
HBPP OFFSITE TLD LOCATION
EUREKA (Control Location T17)



**FIGURE B-1
OFFSITE 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 annual values from 1977 through 1983 were Station 1 – 83.0 mRem, Station 2 – 79.8 mRem, Station 14 – 80.2 mRem, and Station 25 – 73.7 mRem.



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 annual value from 1977 through 1983 for the stations near the radwaste activities was 78.6 mRem and the average annual value for other onsite stations was 79.4 mRem.