Pacific Gas and Electric Company

Loren D. Sharp
Senior Director
Nuclear Decommissioning

4111 Broad Street
Suite 120
San Luis Obispo, CA 93401

Phone: 805.595.6481
Email: Loren.Sharp@pge.com

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PG&E Letter HBL-19-010

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

Docket No. 50-133
License No. DPR-7
Humboldt Bay Power Plant Unit 3
Annual Radiological Environmental Monitoring Report for 2018

Dear Commissioners and Staff:

Enclosed is the Humboldt Bay Power Plant Unit 3, "Annual Radiological Environmental Monitoring Report" for 2018. 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) made in this letter.

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

Sincerely,

Loren Sharp
Senior Director, Nuclear Decommissioning

Enclosure

cc: HBPP Humboldt Distribution
cc/enc: John B. Hickman, NRC Project Manager
Scott A.Morris, NRC Region IV Administrator

HUMBOLDT BAY POWER PLANT UNIT 3

ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

JANUARY 1 THROUGH DECEMBER 31, 2018

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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, 2018

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, 2018, in a manner 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.

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 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 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. Quarterly the composited samples are analyzed 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, and 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 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 four (4) onsite air sampling stations. The stations selected to satisfy this requirement are Stations AM1 through 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. Quarterly the composited samples are analyzed for Gamma Isotopic, by station. The number of onsite air sampling stations was reduced from five (5) to four (4) during 2018. Also, continuously is currently defined to be during onsite work activities. These adjustments to the environmental monitoring program during 2018 were made to accommodate the progress of decommissioning, the elimination of any effluent pathway other than active work evolutions and difficulty in maintaining power supplies during nonactive work hours to remote areas of the site. The four remaining air sampling locations generally represent the four major compass sectors (N, S, E, W) 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.

Each quarter the exposures from 16 stations are determined, which normally results in 64 analyses for a full year. However, T-10 was lost in the 2nd quarter 2018, resulting in 63 analyses for 2018. 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. After discovering monitoring location T10 had been lost during decommissioning activities, the TLD was replaced and monitoring continued through the remainder of the year (SAPN 1443647). In December 2018, monitoring locations T9 and T10 were relocated to better represent the northeast and east north east perimeter of the site fence.

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 2018.

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 ninety-two (92) Eckert & Ziegler individual environmental sample analyses. All results met GEL's acceptance criteria (100% 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 four sets of Eckert & Ziegler Analytics samples for gamma in soil, (1st and 4th quarters), gamma air filter and alpha/beta air filter (2nd quarter), and gamma in water and tritium in water (3rd quarter). These analyses are representative of those performed by HBPP count room personnel during 2018. All results met the acceptance criteria.

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 2018. 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 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 2018, 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 mrem above background.

The Humboldt Bay ISFSI is licensed under 10 CFR 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 millirem 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 2018.

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 four 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.

TLD T16 was relocated on February 26, 2018, due to installation of a new north fence line boundary adjacent to the switchyard. T16 was relocated to the permanent HBGS switchyard fence northeast of the Intake Canal on April 4, 2018, to represent the southwest sector of HBPP. The move was documented in SAPN 1438430.

Corrective action SAPN 1439150 documented the increase in dose rate on TLD T9 at the site fence line early in 2017. In 2018, the waste management area at the east end of the site was disassembled. However, the elevated TLD result at T9 location persisted. Upon further investigation, it was determined that a granite boulder near the T9 TLD location exhibited dose rates of 8 uR/hr general area and 13 uR/hr on contact. Therefore, the dose assessment based on the perimeter TLD results was accurate, but the dose was not attributable to licensed material or dominated by the waste operations in the area, as previously believed. SAPN 1441849 documents the as found condition.

During the second quarter TLD exchange, TLD T10 was discovered to be missing – the post, housing and TLD had been removed. TLD T10's location had previously been in the Trailer City excavation near the bay front Coastal Trail. Attempts to recover the missing TLD were unsuccessful. A replacement TLD for monitoring third quarter dose was installed on the coastal fence on June 29, 2018, near the previous location of TLD T10. Actions were documented in SAPN 1443647.

TLD T11 was relocated on July 10, 2018, to the HBGS fence adjacent to the East Fence air sampler (AM1). The TLD was moved due to decommissioning activities within the immediate vicinity of the former location. Actions were documented in SAPN 1438430.

TLD 11 was relocated on August 22, 2018, from the gate adjacent to HBGS to the doghouse of the East Fence air sampler (AM1). Because the HBGS fence may be relocated or replaced, the TLD box was attached to the REMP air sampler doghouse to prevent the environmental TLD from disappearing. Actions were documented in SAPN 1438430.

Due to the removal and replacement of several temporary onsite fences, TLD 2 was transferred from the west perimeter fence to the gas cage at the rear of the Count Room building on September 26, 2018. Actions were documented in SAPN 1446341.

At the end of the fourth quarter of 2018, environmental TLDs T9 and T10 were relocated due to changes in perimeter fencing within the respective areas. The TLDs were transferred to new locations and GPS coordinates were obtained. This was documented in corrective action SAPN 1446341.

3. Airborne Pathway

Four onsite samples and one offsite sample were collected and analyzed weekly for Gross Beta and Gross Alpha activity.

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/m^3).

Interruptions of continuous REMP air sampler operations occurred on the following dates due to ongoing decommissioning activities:

Date	SAPN	Description
01/04/2018	1438309	The AM2 air sampler formerly adjacent to Building 12 was found to be not operating due to a tripped GFCI. The air sampler had run for approximately 47 hours. Longer analysis count times were performed to meet the required MDAs.
01/13/2018	1438739	The AM3 air sampler adjacent to the Annex was turned off for 2.5 hours due to a planned power outage for electrical maintenance activities.
02/20/2018	1438430	The East Fence air sampler (AM1) was powered down for 10 minutes to allow relocation of the light plant that supplies power to the air sample pump.
02/26/2018	1438430	The East Fence air sampler (AM1) was powered off for approximately 20 minutes due to electrical maintenance activities.
04/03/2018	1441219	The East Fence air sampler (AM1) was reported as not operating on 4/3/2018. The sample pump was changed out on 4/4/2018, and the totalizer reading was used to determine sample volume. During the time the sample pump was not running, there were no field activities that could have caused an airborne event.
04/09/2018	1441521	The GWTS air sampler (AM2) was discovered to be out of service due to a tripped breaker.
04/12/2018	1438430	AM2 was relocated to a corner of the GWTS 2.0 area, primarily due to electrical power supply issues. The down time for the filter was adequately documented.
04/25/2018	1438430	The East Fence air sampler (AM1) was shut down to relocate the generator which powers the sampler.
04/26/2018	1441799	The East Fence air sampler (AM1) was found to be not operating due to a tripped GFCI. The sampler was later shut down for approximately 10 minutes to switch generators.
05/07/2018	1442270	The East Fence air sampler (AM1) was found to be not operating. The sampler was restarted, and totalizer readings were used to determine sample volume.
05/18/2018	1442601	The East Fence air sampler (AM1) was found to be not running, most likely due to the generator tripping off line.

Date	SAPN	Description
06/04/2018	1443150	The East Fence air sampler (AM1) was found to be not running.
06/07/2018	1438430	The East Fence air sampler (AM1) was relocated to the HBGS fence line. An extension cord from HBGS was used to power the sample pump. The air sampler was turned off during the relocation.
06/27/2018	1438430	The O.W.S air sampler (AM5) located at the former location of the oily water separator was permanently turned off. The location was deleted from the ODCM and the air sampler was noted to no longer be required.
07/03/2018	1444106	HBGS initiated a clearance on the power source for the East Fence air sampler (AM1) which lasted for several days. The decision was made not to attempt to power the air sampler by generator from 7/3/2018 to 7/10/2018. Because no work was planned during the time interval (site was shut down for the holiday week), the air sampler was not required to be run during nonbusiness hours.
07/23/2018	1444412	Due to a site wide electrical outage of approximately 8 hours and problems encountered following the power outage, the Annex air sampler (AM3) and GWTS air sampler (AM2) could not immediately be returned to service. AM3 was returned to service on 7/24/2018 while AM2 was returned to service on 7/26/2018.
07/31/2018	1444804	The Annex air sampler (AM3) was found to be unplugged with a totalizer run time of approximately 50 hours and 55 minutes. It appeared a worker may have tripped over the electrical extension cord, causing it to become unplugged. The sampler was restarted and the totalizer reading used to determine the sample volume.
08/07/2018	1438430	The Annex air sampler (AM3) was without power for approximately 2 hours on 8/7/2018 due to a planned electrical outage. The GWTS 2.0 air sampler (AM2) was without power for approximately 30 minutes on 8/8/2018 due to a planned electrical outage.
12/11/2018	1438430	The Annex air sampler (AM3) lost power sometime around 12/11/2018.

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 2018 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 2018 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 2018.

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

8. Errata for Previous Years’ Reports

A small dose was reported for calendar year 2017 based on what was believed to be from area waste operations on the east end of the site. It was determined in 2018 to be attributable to natural sources, specifically granite boulders, associated with the restoration of the coastal trail. See section C.2 above.

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	4 onsite locations, 1 offsite location	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 February 2018 (ODCM Revision 28) based on decommissioning status, the closure of ground water wells, 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 2018	Report Date	GEL Value (pCi/L)	Reference Value (pCi/L)	Ratio	Evaluation
Gamma Water	I-131	E12103	1st	5/11/2018	9.37E+01	9.10E+01	1.03	Acceptable
	Ce-141	E12103	1st	5/11/2018	7.86E+01	7.34E+01	1.07	Acceptable
	Cr-51	E12103	1st	5/11/2018	3.44E+02	3.10E+02	1.11	Acceptable
	Cs-134	E12103	1st	5/11/2018	1.61E+02	1.71E+02	0.94	Acceptable
	Cs-137	E12103	1st	5/11/2018	1.64E+02	1.64E+02	1.00	Acceptable
	Co-58	E12103	1st	5/11/2018	1.92E+02	1.78E+02	1.08	Acceptable
	Mn-54	E12103	1st	5/11/2018	1.36E+02	1.25E+02	1.09	Acceptable
	Fe-59	E12103	1st	5/11/2018	1.48E+02	1.32E+02	1.12	Acceptable
	Zn-65	E12103	1st	5/11/2018	2.53E+02	2.33E+02	1.09	Acceptable
	Co-60	E12103	1st	5/11/2018	1.92E+02	1.78E+02	1.08	Acceptable
Sample/ Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**GEL Value (pCi/L)**	**Reference Value (pCi/L)**	**Ratio**	**Evaluation**
Milk	Sr-89	E12101	1st	5/11/2018	9.16E+01	9.01E+01	1.02	Acceptable
	Sr-90	E12101	1st	5/11/2018	8.00E+01	1.25E+02	0.64	Acceptable
	I-131	E12102	1st	5/11/2018	1.05E+02	1.08E+02	0.97	Acceptable
	Ce-141	E12102	1st	5/11/2018	7.23E+01	7.70E+01	0.94	Acceptable
	Co-58	E12102	1st	5/11/2018	1.11E+02	1.14E+02	0.97	Acceptable
	Co-60	E12102	1st	5/11/2018	1.90E+02	1.87E+02	1.02	Acceptable
	Cr-51	E12102	1st	5/11/2018	3.00E+02	3.26E+02	0.92	Acceptable
	Cs-134	E12102	1st	5/11/2018	1.58E+02	1.80E+02	0.88	Acceptable
	Cs-137	E12102	1st	5/11/2018	1.75E+02	1.72E+02	1.02	Acceptable
	Mn-54	E12102	1st	5/11/2018	1.36E+02	1.31E+02	1.04	Acceptable
	Fe-59	E12102	1st	5/11/2018	1.52E+02	1.39E+02	1.10	Acceptable
	Zn-65	E12102	1st	5/11/2018	2.73E+02	2.44E+02	1.12	Acceptable
Sample/ Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**GEL Value (pCi)**	**Reference Value (pCi)**	**Ratio**	**Evaluation**
Cartridge	I-131	E12100	1st	5/11/2018	9.20E+01	8.52E+01	0.97	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	E12174	2nd	7/7/2018	7.31E+01	7.44E+01	0.98	Acceptable
	Ce-141	E12174	2nd	7/7/2018	1.02E+02	8.58E+01	1.19	Acceptable
	Cr-51	E12174	2nd	7/7/2018	2.73E+02	2.49E+02	1.10	Acceptable
	Cs-134	E12174	2nd	7/7/2018	1.06E+02	1.19E+02	0.89	Acceptable
	Cs-137	E12174	2nd	7/7/2018	9.86E+01	1.03E+02	0.96	Acceptable
	Co-58	E12174	2nd	7/7/2018	9.76E+01	9.29E+01	1.05	Acceptable
	Mn-54	E12174	2nd	7/7/2018	1.47E+02	1.35E+02	1.09	Acceptable
	Fe-59	E12174	2nd	7/7/2018	1.08E+02	8.97E+01	1.20	Acceptable
	Zn-65	E12174	2nd	7/7/2018	1.97E+02	1.64E+02	1.20	Acceptable
	Co-60	E12174	2nd	7/7/2018	1.22E+02	1.18E+02	1.03	Acceptable
Sample/ Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**GEL Value (pCi/L)**	**Reference Value (pCi/L)**	**Ratio**	**Evaluation**
Milk	Sr-89	E12172	2nd	7/7/2018	9.58E+01	8.46E+01	1.13	Acceptable
	Sr-90	E12172	2nd	7/7/2018	8.47E+00	1.14E+01	0.74	Acceptable
	I-131	E12173	2nd	7/7/2018	7.89E+01	7.19E+01	1.10	Acceptable
	Ce-141	E12173	2nd	7/7/2018	9.01E+01	8.22E+01	1.10	Acceptable
	Co-58	E12173	2nd	7/7/2018	9.26E+01	8.90E+01	1.04	Acceptable
	Co-60	E12173	2nd	7/7/2018	1.18E+02	1.13E+02	1.04	Acceptable
	Cr-51	E12173	2nd	7/7/2018	2.58E+02	2.39E+02	1.08	Acceptable
	Cs-134	E12173	2nd	7/7/2018	1.10E+02	1.14E+02	0.97	Acceptable
	Cs-137	E12173	2nd	7/7/2018	1.04E+02	9.88E+01	1.05	Acceptable
	Mn-54	E12173	2nd	7/7/2018	1.42E+02	1.30E+02	1.09	Acceptable
	Fe-59	E12173	2nd	7/7/2018	8.87E+01	8.60E+01	1.03	Acceptable
	Zn-65	E12173	2nd	7/7/2018	1.83E+02	1.57E+02	1.16	Acceptable
Sample/ Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**GEL Value (pCi)**	**Reference Value (pCi)**	**Ratio**	**Evaluation**
Cartridge	I-131	E12171	2nd	7/7/2018	7.22E+01	7.16E+01	1.01	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	E12243	3rd	11/12/2018	6.76E+01	6.25E+01	1.08	Acceptable
	Ce-141	E12243	3rd	11/12/2018	1.48E+02	1.33E+02	1.11	Acceptable
	Cr-51	E12243	3rd	11/12/2018	2.92E+02	2.75E+02	1.06	Acceptable
	Cs-134	E12243	3rd	11/12/2018	1.20E+02	1.28E+02	0.94	Acceptable
	Cs-137	E12243	3rd	11/12/2018	1.64E+02	1.54E+02	1.07	Acceptable
	Co-58	E12243	3rd	11/12/2018	1.53E+02	1.50E+02	1.02	Acceptable
	Mn-54	E12243	3rd	11/12/2018	1.91E+02	1.74E+02	1.10	Acceptable
	Fe-59	E12243	3rd	11/12/2018	1.39E+02	1.24E+02	1.12	Acceptable
	Zn-65	E12243	3rd	11/12/2018	2.41E+02	2.09E+02	1.15	Acceptable
	Co-60	E12243	3rd	11/12/2018	2.09E+02	1.98E+02	1.06	Acceptable
Sample/ Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**GEL Value (pCi/L)**	**Reference Value (pCi/L)**	**Ratio**	**Evaluation**
Milk	Sr-89	E12241	3rd	11/12/2018	8.57E+01	8.17E+01	1.05	Acceptable
	Sr-90	E12241	3rd	11/12/2018	9.22E+00	1.48E+01	0.62	Acceptable
	I-131	E12242	3rd	11/12/2018	7.18E+01	5.82E+01	1.23	Acceptable
	Ce-141	E12242	3rd	11/12/2018	1.43E+02	1.28E+02	1.12	Acceptable
	Cr-51	E12242	3rd	11/12/2018	2.54E+02	2.65E+02	0.96	Acceptable
	Cs-134	E12242	3rd	11/12/2018	1.18E+02	1.23E+02	0.96	Acceptable
	Cs-137	E12242	3rd	11/12/2018	1.53E+02	1.47E+02	1.04	Acceptable
	Co-58	E12242	3rd	11/12/2018	1.54E+02	1.44E+02	1.07	Acceptable
	Mn-54	E12242	3rd	11/12/2018	1.84E+02	1.67E+02	1.09	Acceptable
	Fe-59	E12242	3rd	11/12/2018	1.20E+02	1.19E+02	1.01	Acceptable
	Zn-65	E12242	3rd	11/12/2018	2.44E+02	2.01E+02	1.22	Acceptable
	Co-60	E12242	3rd	11/12/2018	2.02E+02	1.90E+02	1.06	Acceptable
Sample/ Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**GEL Value (pCi)**	**Reference Value (pCi)**	**Ratio**	**Evaluation**
Cartridge	I-131	E12240	3rd	11/12/2018	7.95E+01	8.03E+01	0.99	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	E12349	4th	1/23/2019	8.19E+01	8.04E+01	1.02	Acceptable
	Ce-141	E12349	4th	1/23/2019	1.26E+02	1.24E+02	1.02	Acceptable
	Cr-51	E12349	4th	1/23/2019	3.20E+02	2.78E+02	1.15	Acceptable
	Cs-134	E12349	4th	1/23/2019	1.41E+02	1.60E+02	0.88	Acceptable
	Cs-137	E12349	4th	1/23/2019	1.21E+02	1.13E+02	1.07	Acceptable
	Co-58	E12349	4th	1/23/2019	1.09E+02	1.11E+02	0.99	Acceptable
	Mn-54	E12349	4th	1/23/2019	1.51E+02	1.44E+02	1.05	Acceptable
	Fe-59	E12349	4th	1/23/2019	1.16E+02	1.07E+02	1.09	Acceptable
	Zn-65	E12349	4th	1/23/2019	2.76E+02	2.46E+02	1.12	Acceptable
	Co-60	E12349	4th	1/23/2019	2.06E+02	1.98E+02	1.04	Acceptable
Sample/ Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**GEL Value (pCi/L)**	**Reference Value (pCi/L)**	**Ratio**	**Evaluation**
Milk	Sr-89	E12347	4th	1/23/2019	8.67E+01	9.19E+01	0.94	Acceptable
	Sr-90	E12347	4th	1/23/2019	1.07E+01	1.33E+01	0.80	Acceptable
	I-131	E12348	4th	1/23/2019	9.58E+01	9.33E+01	1.03	Acceptable
	Ce-141	E12348	4th	1/23/2019	1.37E+02	1.33E+02	1.03	Acceptable
	Cr-51	E12348	4th	1/23/2019	2.66E+02	2.98E+02	0.89	Acceptable
	Cs-134	E12348	4th	1/23/2019	1.52E+02	1.71E+02	0.89	Acceptable
	Cs-137	E12348	4th	1/23/2019	1.25E+02	1.21E+02	1.03	Acceptable
	Co-58	E12348	4th	1/23/2019	1.19E+02	1.19E+02	1.00	Acceptable
	Mn-54	E12348	4th	1/23/2019	1.70E+02	1.54E+02	1.10	Acceptable
	Fe-59	E12348	4th	1/23/2019	1.25E+02	1.14E+02	1.09	Acceptable
	Zn-65	E12348	4th	1/23/2019	2.75E+02	2.64E+02	1.04	Acceptable
	Co-60	E12348	4th	1/23/2019	2.12E+02	2.12E+02	1.00	Acceptable
Sample/ Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**GEL Value (pCi)**	**Reference Value (pCi)**	**Ratio**	**Evaluation**
Cartridge	I-131	E12346	4th	1/23/2019	8.92E+01	8.98E+01	0.99	Acceptable

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

Sample Analysis	Radionuclide	Sample Number	Quarter 2018	Report Date	HBPP (pCi/g)	Reference (pCi/g)	Ratio	Evaluation
Gamma Soil Detector 1	Ce-141	E12099	1st	4/4/2018	1.35E-01	1.18E-01	1.15	Acceptable
	Co-58	E12099	1st	4/4/2018	1.77E-01	1.74E-01	1.01	Acceptable
	Co-60	E12099	1st	4/4/2018	2.81E-01	2.86E-01	0.98	Acceptable
	Cr-51	E12099	1st	4/4/2018	4.76E-01	4.98E-01	0.96	Acceptable
	Cs-134	E12099	1st	4/4/2018	2.71E-01	2.75E-01	0.99	Acceptable
	Cs-137	E12099	1st	4/4/2018	3.42E-01	3.37E-01	1.01	Acceptable
	Fe-59	E12099	1st	4/4/2018	2.20E-01	2.12E-01	1.04	Acceptable
	Mn-54	E12099	1st	4/4/2018	2.12E-01	2.01E-01	1.06	Acceptable
	Zn-65	E12099	1st	4/4/2018	3.72E-01	3.74E-01	1.00	Acceptable
Sample Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**HBPP (pCi/g)**	**Reference (pCi/g)**	**Ratio**	**Evaluation**
Gamma Soil Detector 3	Ce-141	E12099	1st	4/4/2018	1.31E-01	1.18E-01	1.11	Acceptable
	Co-58	E12099	1st	4/4/2018	1.64E-01	1.74E-01	0.94	Acceptable
	Co-60	E12099	1st	4/4/2018	2.73E-01	2.86E-01	0.95	Acceptable
	Cr-51	E12099	1st	4/4/2018	4.97E-01	4.98E-01	1.00	Acceptable
	Cs-134	E12099	1st	4/4/2018	2.70E-01	2.75E-01	0.98	Acceptable
	Cs-137	E12099	1st	4/4/2018	3.46E-01	3.37E-01	1.03	Acceptable
	Fe-59	E12099	1st	4/4/2018	2.19E-01	2.12E-01	1.03	Acceptable
	Mn-54	E12099	1st	4/4/2018	2.08E-01	2.01E-01	1.04	Acceptable
	Zn-65	E12099	1st	4/4/2018	3.93E-01	3.74E-01	1.05	Acceptable
Sample Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**HBPP (pCi/g)**	**Reference (pCi/g)**	**Ratio**	**Evaluation**
Gamma Soil Det 0848	Ce-141	E12099	1st	4/4/2018	1.33E-01	1.18E-01	1.13	Acceptable
	Co-58	E12099	1st	4/4/2018	1.82E-01	1.74E-01	1.04	Acceptable
	Co-60	E12099	1st	4/4/2018	2.67E-01	2.86E-01	0.93	Acceptable
	Cr-51	E12099	1st	4/4/2018	5.31E-01	4.98E-01	1.07	Acceptable
	Cs-134	E12099	1st	4/4/2018	2.71E-01	2.75E-01	0.99	Acceptable
	Cs-137	E12099	1st	4/4/2018	3.62E-01	3.37E-01	1.07	Acceptable
	Fe-59	E12099	1st	4/4/2018	2.10E-01	2.12E-01	0.99	Acceptable
	Mn-54	E12099	1st	4/4/2018	2.17E-01	2.01E-01	1.08	Acceptable
	Zn-65	E12099	1st	4/4/2018	3.72E-01	3.74E-01	1.00	Acceptable

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

Sample Analysis	Radionuclide	Sample Number	Quarter 2018	Report Date	HBPP (pCi/L)	Reference (pCi/L)	Ratio	Evaluation
Gamma Soil Detector 6	Ce-141	E12099	1st	4/4/2018	1.31E-01	1.18E-01	1.11	Acceptable
	Co-58	E12099	1st	4/4/2018	1.72E-01	1.74E-01	0.99	Acceptable
	Co-60	E12099	1st	4/4/2018	2.81E-01	2.86E-01	0.98	Acceptable
	Cr-51	E12099	1st	4/4/2018	4.86E-01	4.98E-01	0.98	Acceptable
	Cs-134	E12099	1st	4/4/2018	2.62E-01	2.75E-01	0.95	Acceptable
	Cs-137	E12099	1st	4/4/2018	3.37E-01	3.37E-01	1.00	Acceptable
	Fe-59	E12099	1st	4/4/2018	2.22E-01	2.12E-01	1.05	Acceptable
	Mn-54	E12099	1st	4/4/2018	2.10E-01	2.01E-01	1.05	Acceptable
	Zn-65	E12099	1st	4/4/2018	3.63E-01	3.74E-01	0.97	Acceptable
Sample Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**HBPP (pCi)**	**Reference (pCi)**	**Ratio**	**Evaluation**
Air Filter Protean 7108	Gross Alpha	E12194	2nd	6/7/2018	1.29E+02	1.16E+02	1.11	Acceptable
	Gross Beta	E12194	2nd	6/7/2018	2.40E+02	2.34E+02	1.02	Acceptable
Sample Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**HBPP (pCi)**	**Reference (pCi)**	**Ratio**	**Evaluation**
Air Filter Protean 7109	Gross Alpha	E12194	2nd	6/7/2018	1.30E+02	1.16E+02	1.12	Acceptable
	Gross Beta	E12194	2nd	6/7/2018	2.38E+02	2.34E+02	1.02	Acceptable
Sample Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**HBPP (pCi)**	**Reference (pCi)**	**Ratio**	**Evaluation**
Air Filter Tennelec-1171	Gross Alpha	E12194	2nd	6/7/2018	1.28E+02	1.16E+02	1.10	Acceptable
	Gross Beta	E12194	2nd	6/7/2018	2.42E+02	2.34E+02	1.03	Acceptable
Sample/ Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**HBPP (pCi)**	**Reference (pCi)**	**Ratio**	**Evaluation**
Gamma Air Filter Detector 1	Ce-141	E12195	2nd	6/7/2018	1.57E+02	1.45E+02	1.08	Acceptable
	Co-58	E12195	2nd	6/7/2018	1.63E+02	1.57E+02	1.04	Acceptable
	Co-60	E12195	2nd	6/7/2018	2.04E+02	2.00E+02	1.02	Acceptable
	Cr-51	E12195	2nd	6/7/2018	4.24E+02	4.21E+02	1.01	Acceptable
	Cs-134	E12195	2nd	6/7/2018	1.83E+02	2.00E+02	0.91	Acceptable
	Cs-137	E12195	2nd	6/7/2018	1.83E+02	1.74E+02	1.05	Acceptable
	Fe-59	E12195	2nd	6/7/2018	1.70E+02	1.52E+02	1.12	Acceptable
	Mn-54	E12195	2nd	6/7/2018	2.45E+02	2.29E+02	1.07	Acceptable
	Zn-65	E12195	2nd	6/7/2018	3.02E+02	2.78E+02	1.09	Acceptable

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

Sample Analysis	Radionuclide	Sample Number	Quarter 2018	Report Date	HBPP (pCi)	Reference (pCi)	Ratio	Evaluation
Gamma Air Filter Detector 3	Ce-141	E12195	2nd	6/7/2018	1.45E+02	1.45E+02	1.00	Acceptable
	Co-58	E12195	2nd	6/7/2018	1.54E+02	1.57E+02	0.98	Acceptable
	Co-60	E12195	2nd	6/7/2018	1.93E+02	2.00E+02	0.96	Acceptable
	Cr-51	E12195	2nd	6/7/2018	4.17E+02	4.21E+02	0.99	Acceptable
	Cs-134	E12195	2nd	6/7/2018	1.75E+02	2.00E+02	0.87	Acceptable
	Cs-137	E12195	2nd	6/7/2018	1.78E+02	1.74E+02	1.02	Acceptable
	Fe-59	E12195	2nd	6/7/2018	1.57E+02	1.52E+02	1.04	Acceptable
	Mn-54	E12195	2nd	6/7/2018	2.37E+02	2.29E+02	1.04	Acceptable
	Zn-65	E12195	2nd	6/7/2018	3.02E+02	2.78E+02	1.09	Acceptable
Sample Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**HBPP (pCi/L)**	**Reference (pCi/L)**	**Ratio**	**Evaluation**
TriCarb	Tritium (H^3)	E12265	3rd	10/9/2018	4.29E+03	3.80E+03	1.13	Acceptable
Sample/ Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**HBPP (pCi)**	**Reference (pCi)**	**Ratio**	**Evaluation**
Gamma Water Detector 1	Ce-141	E12266	3rd	10/9/2018	1.37E+02	1.33E+02	1.03	Acceptable
	Co-58	E12266	3rd	10/9/2018	1.51E+02	1.50E+02	1.01	Acceptable
	Co-60	E12266	3rd	10/9/2018	1.96E+02	1.98E+02	0.99	Acceptable
	Cr-51	E12266	3rd	10/9/2018	2.52E+02	2.75E+02	0.91	Acceptable
	Cs-134	E12266	3rd	10/9/2018	1.10E+02	1.28E+02	0.86	Acceptable
	Cs-137	E12266	3rd	10/9/2018	1.56E+02	1.54E+02	1.02	Acceptable
	Fe-59	E12266	3rd	10/9/2018	1.27E+02	1.24E+02	1.02	Acceptable
	I-131	E12266	3rd	10/9/2018	6.37E+01	6.25E+01	1.02	Acceptable
	Mn-54	E12266	3rd	10/9/2018	1.83E+02	1.74E+02	1.05	Acceptable
	Zn-65	E12266	3rd	10/9/2018	2.03E+02	2.09E+02	0.97	Acceptable

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

Sample Analysis	Radionuclide	Sample Number	Quarter 2018	Report Date	HBPP (pCi/L)	Reference (pCi/L)	Ratio	Evaluation
Gamma Water Detector 3	Ce-141	E12266	3rd	10/9/2018	1.35E+02	1.33E+02	1.01	Acceptable
	Co-58	E12266	3rd	10/9/2018	1.50E+02	1.50E+02	1.00	Acceptable
	Co-60	E12266	3rd	10/9/2018	1.96E+02	1.98E+02	0.99	Acceptable
	Cr-51	E12266	3rd	10/9/2018	2.75E+02	2.75E+02	1.00	Acceptable
	Cs-134	E12266	3rd	10/9/2018	1.11E+02	1.28E+02	0.87	Acceptable
	Cs-137	E12266	3rd	10/9/2018	1.51E+02	1.54E+02	0.98	Acceptable
	Fe-59	E12266	3rd	10/9/2018	1.28E+02	1.24E+02	1.03	Acceptable
	I-131	E12266	3rd	10/9/2018	5.96E+01	6.25E+01	0.95	Acceptable
	Mn-54	E12266	3rd	10/9/2018	1.83E+02	1.74E+02	1.05	Acceptable
	Zn-65	E12266	3rd	10/9/2018	2.21E+02	2.09E+02	1.06	Acceptable
Sample Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**HBPP (pCi)**	**Reference (pCi)**	**Ratio**	**Evaluation**
Gamma Water Det 0848	Ce-141	E12266	3rd	10/9/2018	1.40E+02	1.33E+02	1.05	Acceptable
	Co-58	E12266	3rd	10/9/2018	1.58E+02	1.50E+02	1.06	Acceptable
	Co-60	E12266	3rd	10/9/2018	1.91E+02	1.98E+02	0.97	Acceptable
	Cr-51	E12266	3rd	10/9/2018	2.85E+02	2.75E+02	1.03	Acceptable
	Cs-134	E12266	3rd	10/9/2018	1.14E+02	1.28E+02	0.89	Acceptable
	Cs-137	E12266	3rd	10/9/2018	1.63E+02	1.54E+02	1.06	Acceptable
	Fe-59	E12266	3rd	10/9/2018	1.34E+02	1.24E+02	1.08	Acceptable
	I-131	E12266	3rd	10/9/2018	6.67E+01	6.25E+01	1.07	Acceptable
	Mn-54	E12266	3rd	10/9/2018	1.85E+02	1.74E+02	1.06	Acceptable
	Zn-65	E12266	3rd	10/9/2018	2.14E+02	2.09E+02	1.02	Acceptable
Sample/ Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**HBPP (pCi)**	**Reference (pCi)**	**Ratio**	**Evaluation**
Gamma Soil Detector 1	Ce-141	E12328	4th	12/20/2018	2.34E-01	2.23E-01	1.05	Acceptable
	Co-58	E12328	4th	12/20/2018	1.96E-01	1.99E-01	0.99	Acceptable
	Co-60	E12328	4th	12/20/2018	3.46E-01	3.55E-01	0.97	Acceptable
	Cr-51	E12328	4th	12/20/2018	4.50E-01	4.99E-01	0.90	Acceptable
	Cs-134	E12328	4th	12/20/2018	2.65E-01	2.87E-01	0.92	Acceptable
	Cs-137	E12328	4th	12/20/2018	2.56E-01	2.75E-01	0.93	Acceptable
	Fe-59	E12328	4th	12/20/2018	1.90E-01	1.91E-01	0.99	Acceptable
	Mn-54	E12328	4th	12/20/2018	2.71E-01	2.58E-01	1.05	Acceptable
	Zn-65	E12328	4th	12/20/2018	4.47E-01	4.42E-01	1.01	Acceptable

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

Sample Analysis	Radionuclide	Sample Number	Quarter 2018	Report Date	HBPP (pCi/L)	Reference (pCi/L)	Ratio	Evaluation
Gamma Soil Detector 3	Ce-141	E12328	4th	12/20/2018	2.30E-01	2.23E-01	1.03	Acceptable
	Co-58	E12328	4th	12/20/2018	1.90E-01	1.99E-01	0.96	Acceptable
	Co-60	E12328	4th	12/20/2018	3.42E-01	3.55E-01	0.96	Acceptable
	Cr-51	E12328	4th	12/20/2018	4.82E-01	4.99E-01	0.97	Acceptable
	Cs-134	E12328	4th	12/20/2018	2.67E-01	2.87E-01	0.93	Acceptable
	Cs-137	E12328	4th	12/20/2018	2.62E-01	2.75E-01	0.95	Acceptable
	Fe-59	E12328	4th	12/20/2018	1.89E-01	1.91E-01	0.99	Acceptable
	Mn-54	E12328	4th	12/20/2018	2.65E-01	2.58E-01	1.03	Acceptable
	Zn-65	E12328	4th	12/20/2018	4.57E-01	4.42E-01	1.03	Acceptable
Sample Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**HBPP (pCi/L)**	**Reference (pCi/L)**	**Ratio**	**Evaluation**
Gamma Soil Det 0848	Ce-141	E12328	4th	12/20/2018	2.34E-01	2.23E-01	1.05	Acceptable
	Co-58	E12328	4th	12/20/2018	1.97E-01	1.99E-01	0.99	Acceptable
	Co-60	E12328	4th	12/20/2018	3.28E-01	3.55E-01	0.92	Acceptable
	Cr-51	E12328	4th	12/20/2018	5.10E-01	4.99E-01	1.02	Acceptable
	Cs-134	E12328	4th	12/20/2018	2.71E-01	2.87E-01	0.95	Acceptable
	Cs-137	E12328	4th	12/20/2018	2.78E-01	2.75E-01	1.01	Acceptable
	Fe-59	E12328	4th	12/20/2018	1.77E-01	1.91E-01	0.92	Acceptable
	Mn-54	E12328	4th	12/20/2018	2.76E-01	2.58E-01	1.07	Acceptable
	Zn-65	E12328	4th	12/20/2018	4.37E-01	4.42E-01	0.99	Acceptable
Sample Analysis	**Radionuclide**	**Sample Number**	**Quarter 2018**	**Report Date**	**HBPP (pCi/L)**	**Reference (pCi/L)**	**Ratio**	**Evaluation**
Gamma Soil Detector 6	Ce-141	E12328	4th	12/20/2018	2.31E-01	2.23E-01	1.04	Acceptable
	Co-58	E12328	4th	12/20/2018	1.95E-01	1.99E-01	0.98	Acceptable
	Co-60	E12328	4th	12/20/2018	3.41E-01	3.55E-01	0.96	Acceptable
	Cr-51	E12328	4th	12/20/2018	4.93E-01	4.99E-01	0.99	Acceptable
	Cs-134	E12328	4th	12/20/2018	2.64E-01	2.87E-01	0.92	Acceptable
	Cs-137	E12328	4th	12/20/2018	2.68E-01	2.75E-01	0.97	Acceptable
	Fe-59	E12328	4th	12/20/2018	1.85E-01	1.91E-01	0.97	Acceptable
	Mn-54	E12328	4th	12/20/2018	2.68E-01	2.58E-01	1.04	Acceptable
	Zn-65	E12328	4th	12/20/2018	4.48E-01	4.42E-01	1.01	Acceptable

Table A-4 Notes:

1. Analysis results based on 10-minute count times for alpha and beta analysis on Proteans SN 7108, 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, 2018

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 Measure-ments
			Mean, (Fraction), & [Range][b]	Name	Mean, (Fraction) & [Range][b]	Mean, (Fraction) & [Range][b]	
AIRBORNE Particulates [pCi/m3]	(53) samples per station • Gross Beta, • Gross Alpha • Gamma Isotopic analysis on quarterly composite (by station) (4) Onsite Locations (1) Offsite Locations	• 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/m3) mean 2.85E-03, (8/53), [2.35E-03 to 4.09E-03] Gross Beta (pCi/m3) mean 1.16E-02, (48/53), [3.42E-03 to 4.62E-02] **Building 12 (AM2)** Gross Alpha (pCi/m3) mean 3.01E-03, (14/53), [1.90E-03 to 6.71E-03] Gross Beta (pCi/m3) mean 1.10E-02, (51/53), [3.66E-03 to 4.84E-02] **Annex (AM3)** Gross Alpha (pCi/m3) mean 3.41E-03, (9/53), [2.41E-03 to 6.10E-03] Gross Beta (pCi/m3) mean 1.20E-02, (50/53), [3.44E-03 to 5.09E-02] **Relay Building (AM4)** Gross Alpha (pCi/m3) mean 2.98E-03, (8/53), [2.38E-03 to 4.27E-03] Gross Beta (pCi/m3) mean 1.24E-02, (50/53), [3.50E-03 to 4.37E-02] **Oil Water Separator (OWS – AM5)** Gross Alpha (pCi/m3) mean 2.57E-03, (6/26), [2.25E-03 to 3.62E-03] Gross Beta (pCi/m3) mean 9.69E-03, (25/26), [3.90E-03 to 1.84E-02]	**Annex (AM3)** **Relay Bldg. (AM1)**	Gross Alpha (pCi/m3) mean 3.41E-03, (9/53), [2.41E-03 to 6.10E-03] Gross Beta (pCi/m3) mean 1.24E-02, (50/53), [3.50E-03 to 4.37E-02] Cs-137 <MDA	**Humboldt Hill (Station 3)** Gross Alpha (pCi/m3) mean 3.77E-03, (4/53), [3.05E-03 to 5.47E-03] Gross Beta (pCi/m3) mean 9.90E-03, (45/53), [2.94E-03 to 4.28E-02]	N/A
DIRECT RADIATION [mR/quarter]	(63) Fence line TLD readings (20) Off-site TLD Readings	**5 mRem**	**Fence Line TLDs (T1 to T16)** **13.0 ± 0.1, (63/63), [10.4 to 17.0]**	**Station T-9, Figure B-1**	**T9 (mR/qtr) mean 15.9 ± 0.4, (4/4), [15.3 to 17.0]**	**Stations 1, 2, 14, 25 and T17 (mR/qtr) mean 12.9 ± 0.1, (20/20), [10.0 to 16.8]**	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[a] (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

[a] 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 (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.

[b] 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 to 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 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	12.4 ± 0.1	12.9 ± 0.4	14.1 ± 0.5	15.7 ± 0.4
T2	12.1 ± 0.2	12.9 ± 0.3	13.4 ± 0.3	14.4 ± 0.3
T3	11.4 ± 0.2	12.3 ± 0.3	13.0 ± 0.5	14.1 ± 0.3
T4	12.1 ± 0.3	12.2 ± 0.6	13.3 ± 0.5	14.6 ± 0.4
T5	10.9 ± 0.3	11.7 ± 0.3	12.8 ± 0.3	13.6 ± 0.1
T6	10.4 ± 0.1	10.8 ± 0.0	12.0 ± 0.1	13.1 ± 0.2
T7	10.7 ± 0.4	11.2 ± 0.2	11.9 ± 0.7	13.5 ± 0.1
T8	10.8 ± 0.4	11.6 ± 0.5	13.3 ± 0.2	13.8 ± 0.3
T9	15.5 ± 0.5	15.3 ± 0.2	17.0 ± 1.3	15.6 ± 0.2
T10	11.6 ± 0.1	[1]	15.2 ± 1.1	14.7 ± 0.2
T11	11.4 ± 0.0	12.3 ± 0.3	13.4 ± 0.2	14.1 ± 0.9
T12	11.8 ± 0.1	12.9 ± 0.4	13.6 ± 0.1	14.8 ± 0.3
T13	11.5 ± 0.6	12.7 ± 0.3	13.9 ± 0.3	14.1 ± 0.9
T14	12.4 ± 0.1	12.8 ± 0.2	14.2 ± 0.6	14.6 ± 0.6
T15	11.7 ± 0.1	12.0 ± 0.3	13.3 ± 0.1	14.5 ± 0.2
T16	12.1 ± 0.1	12.6 ± 0.2	13.3 ± 0.7	14.7 ± 0.4

Parameter	Calculated Parameters (mR)			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Average	11.8 ± 0.1	12.4 ± 0.1	13.6 ± 0.1	14.4 ± 0.1
Maximum	15.5 ± 0.5	15.3 ± 0.2	17.0 ± 1.3	15.7 ± 0.4

Table C-2 Notes:

1. Corrective action SAPN 1443647 documents the TLD at location T10 was lost at the end of the second quarter 2018.
2. These exposures are reported for a standardized period of 90 days.
3. The reported exposures do not have an average background subtracted.

TABLE C-3
OFFSITE (Control) ENVIRONMENTAL TLD STATIONS

Station Number	TLD Exposure Measurements (mR)			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1	10.9 ± 0.7	12.1 ± 0.4	15.5 ± 0.7	13.9 ± 0.2
2	12.8 ± 0.5	13.3 ± 0.4	16.8 ± 0.5	15.8 ± 0.1
14	10.0 ± 0.6	11.1 ± 0.2	15.2 ± 0.8	12.6 ± 0.7
25	10.8 ± 0.4	11.4 ± 0.2	15.1 ± 0.1	12.9 ± 0.3
T17	10.7 ± 0.3	11.3 ± 0.4	12.5 ± 0.3	13.5 ± 0.1

Parameter	Calculated Parameters (mR)			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Average	11.0 ± 0.2	11.8 ± 0.1	15.0 ± 0.2	13.7 ± 0.2
Maximum	12.8 ± 0.5	13.3 ± 0.4	16.8 ± 0.5	15.8 ± 0.1

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
12/28/2017	2.40E-03 ± 1.90E-03	1.47E-02 ± 4.41E-03	<1.48E-03 (MDA)	< 1.39E-03 (MDA)
1/4/2018	< 3.46E-03 (MDA)	8.46E-03 ± 3.70E-03		
1/11/2018	< 3.39E-03 (MDA)	7.59E-03 ± 3.54E-03		
1/18/2018	< 3.38E-03 (MDA)	3.72E-03 ± 2.97E-03		
1/25/2018	< 3.42E-03 (MDA)	3.42E-03 ± 2.96E-03		
2/1/2018	< 3.39E-03 (MDA)	9.68E-03 ± 3.82E-03		
2/8/2018	< 3.37E-03 (MDA)	9.63E-03 ± 3.80E-03		
2/15/2018	< 3.40E-03 (MDA)[3]	9.36E-03 ± 3.77E-03[3]		
2/22/2018	< 3.46E-03 (MDA)[4]	7.38E-03 ± 3.55E-03[4]		
3/1/2018	< 3.40E-03 (MDA)	4.45E-03 ± 3.10E-03		
3/8/2018	< 3.35E-03 (MDA)	6.12E-03 ± 3.31E-03		
3/15/2018	< 3.32E-03 (MDA)	< 5.77E-03 (MDA)		
3/22/2018	< 3.56E-03 (MDA)	< 6.18E-03 (MDA)		
3/29/2018	< 5.41E-03 (MDA)[5]	1.04E-02 ± 5.43E-03[5]	< 2.76E-03 (MDA)	< 2.47E-03 (MDA)
4/4/2018	< 2.87E-03 (MDA)	7.18E-03 ± 3.09E-03		
4/12/2018	< 3.32E-03 (MDA)	6.52E-03 ± 3.32E-03		
4/19/2018	< 1.93E-03 (MDA)[8,9]	1.54E-02 ± 4.44E-03[8,9]		
4/26/2018	< 3.25E-03 (MDA)	1.33E-02 ± 4.14E-03		
5/5/2018	< 4.59E-03 (MDA)[10]	1.54E-02 ± 5.45E-03[10]		
5/10/2018	< 3.23E-03 (MDA)	7.03E-03 ± 3.33E-03		
5/17/2018	< 3.48E-03 (MDA)[11]	1.80E-02 ± 4.84E-03[11]		
5/24/2018	< 3.30E-03 (MDA)	5.78E-03 ± 3.20E-03		
5/31/2018	< 3.82E-03 (MDA)[12]	1.04E-02 ± 4.21E-03[12]		
6/7/2018	< 3.29E-03 (MDA)[13]	< 5.70E-03 (MDA)[13]		
6/14/2018	< 3.38E-03 (MDA)	7.36E-03 ± 3.49E-03		
6/21/2018	< 3.82E-03 (MDA)	7.10E-03 ± 3.76E-03		
6/27/2018	< 2.71E-02 (MDA)[15]	9.09E-03 ± 2.31E-03[15]	< 2.37E-03 (MDA)	< 2.46E-03 (MDA)
7/10/2018	< 2.13E-02 (MDA)[15]	7.15E-03 ± 4.65E-03[15]		
7/11/2018	3.57E-03 ± 2.33E-03	8.40E-03 ± 3.62E-03		
7/18/2018	< 3.30E-03 (MDA)	4.38E-03 ± 2.99E-03		
7/25/2018	< 3.22E-03 (MDA)	5.65E-03 ± 3.12E-03		
8/1/2018	< 3.37E-03 (MDA)	7.35E-03 ± 3.48E-03		
8/8/2018	< 3.29E-03 (MDA)	< 5.69E-03 (MDA)		
8/15/2018	2.35E-03 ± 1.86E-03	4.74E-03 ± 3.05E-03		
8/22/2018	< 3.52E-03 (MDA)	7.86E-03 ± 3.67E-03		
8/29/2018	< 3.43E-03 (MDA)	3.77E-03 ± 3.01E-03		
9/5/2018	< 3.35E-03 (MDA)	1.05E-02 ± 3.89E-03		
9/12/2018	< 3.33E-03 (MDA)	1.90E-02 ± 4.81E-03		
9/19/2018	2.39E-03 ± 1.89E-03	2.22E-02 ± 5.14E-03		
9/26/2018	2.47E-03 ± 1.95E-03	1.98E-02 ± 5.02E-03		
10/3/2018	2.45E-03 ± 1.93E-03	1.24E-02 ± 4.19E-03	< 2.95E-03 (MDA)	< 2.65E-03 (MDA)
10/10/2018	< 3.32E-03 (MDA)	2.49E-02 ± 5.35E-03		
10/17/2018	3.05E-03 ± 2.17E-03	2.81E-02 ± 5.72E-03		
10/24/2018	< 3.45E-03 (MDA)	9.48E-03 ± 3.82E-03		
10/31/2018	< 3.52E-03 (MDA)	1.26E-02 ± 4.25E-03		
11/7/2018	4.09E-03 ± 2.47E-03	3.50E-02 ± 6.15E-03		
11/14/2018	< 3.49E-03 (MDA)	4.62E-02 ± 7.12E-03		
11/21/2018	< 3.39E-03 (MDA)	7.39E-03 ± 3.51E-03		
11/28/2018	< 3.48E-03 (MDA)	< 6.02E-03 (MDA)		
12/5/2018	< 3.27E-03 (MDA)	1.52E-02 ± 4.36E-03		
12/12/2018	< 3.51E-03 (MDA)	1.04E-02 ± 3.98E-03		
12/19/2018	< 3.44E-03 (MDA)	8.02E-03 ± 3.63E-03		
12/26/2018	< 3.40E-03 (MDA)	7.59E-03 ± 3.54E-03		

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

Sample Start Date	Alpha Activity (pCi/m^3)	Beta Activity (pCi/m^3)	Composite Gamma Activity (pCi/m^3)	
			Co-60	Cs-137
12/28/2017	< 4.29E-03 (MDA)[1]	1.04E-02 ± 2.99E-03[1]	<1.64E-03 (MDA)	< 1.18E-03 (MDA)
1/4/2018	< 3.45E-03 (MDA)	4.16E-03 ± 3.09E-03		
1/11/2018	< 3.40E-03 (MDA)	5.15E-03 ± 3.20E-03		
1/18/2018	< 3.38E-03 (MDA)	5.11E-03 ± 3.18E-03		
1/25/2018	< 3.42E-03 (MDA)	6.95E-03 ± 3.48E-03		
2/1/2018	< 3.38E-03 (MDA)	1.11E-02 ± 3.97E-03		
2/8/2018	< 3.38E-03 (MDA)	1.94E-02 ± 4.87E-03		
2/15/2018	< 3.39E-03 (MDA)	5.84E-03 ± 3.30E-03		
2/22/2018	< 3.45E-03 (MDA)	5.93E-03 ± 3.35E-03		
3/1/2018	< 3.40E-03 (MDA)	5.50E-03 ± 3.25E-03		
3/8/2018	2.36E-03 ± 1.87E-03	4.74E-03 ± 3.11E-03		
3/15/2018	< 3.32E-03 (MDA)	5.38E-03 ± 3.18E-03		
3/22/2018	< 3.55E-03 (MDA)	7.94E-03 ± 3.70E-03		
3/29/2018	< 3.39E-03 (MDA)	1.53E-02 ± 4.45E-03	< 2.63E-03 (MDA)	< 2.35E-03 (MDA)
4/5/2018	< 3.34E-03 (MDA)[6]	8.34E-03 ± 3.59E-03[6]		
4/12/2018	< 3.42E-03 (MDA)[7]	9.27E-03 ± 3.77E-03[7]		
4/19/2018	1.90E-03 ± 1.25E-03	1.72E-02 ± 4.62E-03		
4/26/2018	< 3.18E-03 (MDA)	1.40E-02 ± 4.16E-03		
5/3/2018	< 3.44E-03 (MDA)	1.19E-02 ± 4.12E-03		
5/10/2018	< 3.19E-03 (MDA)	8.29E-03 ± 3.48E-03		
5/17/2018	3.62E-03 ± 2.36E-03	1.98E-02 ± 4.96E-03		
5/24/2018	< 3.30E-03 (MDA)	5.08E-03 ± 3.10E-03		
5/31/2018	< 3.28E-03 (MDA)	8.55E-03 ± 3.59E-03		
6/7/2018	2.32E-03 ± 1.83E-03	7.11E-03 ± 3.37E-03		
6/14/2018	< 3.38E-03 (MDA)	5.91E-03 ± 3.27E-03		
6/21/2018	< 3.82E-03 (MDA)	7.10E-03 ± 3.76E-03		
6/27/2018	< 3.92E-03 (MDA)	< 6.79E-03 (MDA)	< 2.69E-03 (MDA)	< 2.21E-03 (MDA)
7/3/2018	< 2.86E-03 (MDA)	8.06E-03 ± 3.20E-03		
7/11/2018	< 3.37E-03 (MDA)	9.84E-03 ± 3.82E-03		
7/18/2018	< 4.63E-03 (MDA)[16]	< 8.01E-03 (MDA)[16]		
7/26/2018	< 3.88E-03 (MDA)[16]	3.90E-03 ± 3.30E-03[16]		
8/1/2018	< 3.37E-03 (MDA)[18]	5.91E-03 ± 3.27E-03[18]		
8/8/2018	2.34E-03 ± 1.85E-03	3.66E-03 ± 2.87E-03		
8/15/2018	< 3.31E-03 (MDA)	1.04E-02 ± 3.84E-03		
8/22/2018	< 3.52E-03 (MDA)	6.41E-03 ± 3.47E-03		
8/29/2018	3.01E-03 ± 2.15E-03	1.05E-02 ± 3.94E-03		
9/5/2018	2.96E-03 ± 2.11E-03	4.79E-03 ± 3.08E-03		
9/12/2018	< 3.33E-03 (MDA)	1.26E-02 ± 4.12E-03		
9/19/2018	< 3.39E-03 (MDA)	1.63E-02 ± 4.56E-03		
9/26/2018	2.48E-03 ± 1.96E-03	1.51E-02 ± 4.53E-03		
10/3/2018	< 3.47E-03 (MDA)	1.24E-02 ± 4.19E-03	< 2.99E-03 (MDA)	< 2.49E-03 (MDA)
10/10/2018	2.36E-03 ± 1.86E-03	2.24E-02 ± 5.12E-03		
10/17/2018	< 3.47E-03 (MDA)	3.28E-02 ± 6.10E-03		
10/24/2018	< 3.46E-03 (MDA)	1.31E-02 ± 4.26E-03		
10/31/2018	3.70E-03 ± 2.41E-03	1.51E-02 ± 4.53E-03		
11/7/2018	2.94E-03 ± 2.09E-03	2.68E-02 ± 5.50E-03		
11/14/2018	6.71E-03 ± 3.28E-03	4.84E-02 ± 7.27E-03		
11/21/2018	< 3.36E-03 (MDA)	7.67E-03 ± 3.52E-03		
11/28/2018	3.08E-03 ± 2.20E-03	1.00E-02 ± 3.94E-03		
12/5/2018	2.33E-03 ± 1.84E-03	1.27E-02 ± 4.08E-03		
12/12/2018	< 3.51E-03 (MDA)	5.29E-03 ± 3.29E-03		
12/19/2018	< 3.44E-03 (MDA)	6.25E-03 ± 3.38E-03		
12/26/2018	< 3.40E-03 (MDA)	7.24E-03 ± 3.49E-03		

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
12/28/2017	2.41E-03 ± 1.90E-03	1.93E-02 ± 4.90E-03	<1.28E-03 (MDA)	< 1.23E-03 (MDA)
1/4/2018	< 3.45E-03 (MDA)	3.44E-03 ± 2.98E-03		
1/11/2018	< 3.45E-03 (MDA)[2]	8.79E-03 ± 3.74E-03[2]		
1/18/2018	2.96E-03 ± 2.11E-03	3.71E-03 ± 2.96E-03		
1/25/2018	< 3.42E-03 (MDA)	5.89E-03 ± 3.32E-03		
2/1/2018	< 3.39E-03 (MDA)	5.14E-03 ± 3.19E-03		
2/8/2018	< 3.38E-03 (MDA)	2.08E-02 ± 4.99E-03		
2/15/2018	< 3.39E-03 (MDA)	6.89E-03 ± 3.45E-03		
2/22/2018	< 3.45E-03 (MDA)	9.49E-03 ± 3.83E-03		
3/1/2018	< 3.39E-03 (MDA)	6.89E-03 ± 3.46E-03		
3/8/2018	< 3.37E-03 (MDA)	4.40E-03 ± 3.06E-03		
3/15/2018	< 3.33E-03 (MDA)	5.38E-03 ± 3.18E-03		
3/22/2018	< 3.54E-03 (MDA)	< 6.16E-03 (MDA)		
3/29/2018	< 3.38E-03 (MDA)	1.35E-02 ± 4.25E-03	< 2.62E-03 (MDA)	< 2.34E-03 (MDA)
4/5/2018	< 3.30E-03 (MDA)	9.28E-03 ± 3.69E-03		
4/12/2018	< 3.31E-03 (MDA)	1.00E-02 ± 3.79E-03		
4/19/2018	< 1.93E-03 (MDA)	1.61E-02 ± 4.51E-03		
4/26/2018	< 3.16E-03 (MDA)	1.13E-02 ± 3.83E-03		
5/3/2018	3.06E-03 ± 2.18E-03	9.35E-03 ± 3.80E-03		
5/10/2018	< 3.19E-03 (MDA)	6.26E-03 ± 3.19E-03		
5/17/2018	< 3.41E-03 (MDA)	1.36E-02 ± 4.30E-03		
5/24/2018	2.92E-03 ± 2.08E-03	9.65E-03 ± 3.74E-03		
5/31/2018	< 3.30E-03 (MDA)	7.18E-03 ± 3.41E-03		
6/7/2018	< 3.26E-03 (MDA)	7.44E-03 ± 3.42E-03		
6/14/2018	< 3.37E-03 (MDA)	6.27E-03 ± 3.32E-03		
6/21/2018	< 3.82E-03 (MDA)	7.50E-03 ± 3.82E-03		
6/27/2018	< 3.92E-03 (MDA)	4.78E-03 ± 3.49E-03	< 2.20E-03 (MDA)	< 2.49E-03 (MDA)
7/3/2018	< 2.86E-03 (MDA)	7.45E-03 ± 3.13E-03		
7/11/2018	< 3.35E-03 (MDA)	< 5.81E-03 (MDA)		
7/18/2018	< 4.64E-03 (MDA)[16]	< 8.03E-03 (MDA)[16]		
7/25/2018	< 7.57E-03 (MDA)[16,17]	5.96E-03 ± 1.81E-03[16,17]		
8/1/2018	< 3.37E-03 (MDA)[18]	5.19E-03 ± 3.16E-03[18]		
8/8/2018	< 3.29E-03 (MDA)	5.06E-03 ± 3.08E-03		
8/15/2018	< 3.31E-03 (MDA)	9.33E-03 ± 3.70E-03		
8/22/2018	3.09E-03 ± 2.21E-03	8.59E-03 ± 3.76E-03		
8/29/2018	< 3.43E-03 (MDA)	1.26E-02 ± 4.19E-03		
9/5/2018	< 3.35E-03 (MDA)	8.36E-03 ± 3.60E-03		
9/12/2018	2.95E-03 ± 2.10E-03	1.79E-02 ± 4.70E-03		
9/19/2018	< 3.39E-03 (MDA)	2.01E-02 ± 4.94E-03		
9/26/2018	< 3.51E-03 (MDA)	2.45E-02 ± 5.44E-03		
10/3/2018	< 3.48E-03 (MDA)	1.24E-02 ± 4.20E-03	< 2.61E-03 (MDA)	< 2.67E-03 (MDA)
10/10/2018	< 3.32E-03 (MDA)	2.92E-02 ± 5.73E-03		
10/17/2018	< 3.47E-03 (MDA)	3.06E-02 ± 5.94E-03		
10/24/2018	< 3.46E-03 (MDA)	6.29E-03 ± 3.40E-03		
10/31/2018	< 3.52E-03 (MDA)	1.36E-02 ± 4.37E-03		
11/7/2018	4.68E-03 ± 2.67E-03	3.50E-02 ± 6.15E-03		
11/14/2018	6.10E-03 ± 3.12E-03	5.09E-02 ± 7.43E-03		
11/21/2018	< 3.35E-03 (MDA)	1.55E-02 ± 4.46E-03		
11/28/2018	2.48E-03 ± 1.96E-03	9.30E-03 ± 3.86E-03		
12/5/2018	< 3.74E-03 (MDA)[19]	1.53E-02 ± 4.76E-03[19]		
12/12/2018	< 3.51E-03 (MDA)	7.46E-03 ± 3.60E-03		
12/19/2018	< 3.44E-03 (MDA)	8.38E-03 ± 3.67E-03		
12/26/2018	< 3.39E-03 (MDA)	7.22E-03 ± 3.48E-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
12/28/2017	< 3.42E-03 (MDA)	2.36E-02 ± 5.28E-03	<1.55E-03 (MDA)	< 1.22E-03 (MDA)
1/4/2018	< 3.45E-03 (MDA)	< 5.99E-03 (MDA)		
1/11/2018	< 3.40E-03 (MDA)	9.71E-03 ± 3.83E-03		
1/18/2018	< 3.37E-03 (MDA)	6.49E-03 ± 3.38E-03		
1/25/2018	< 3.43E-03 (MDA)	9.09E-03 ± 3.78E-03		
2/1/2018	< 3.40E-03 (MDA)	5.85E-03 ± 3.30E-03		
2/8/2018	< 3.37E-03 (MDA)	1.94E-02 ± 4.86E-03		
2/15/2018	< 3.40E-03 (MDA)	8.31E-03 ± 3.64E-03		
2/22/2018	< 3.45E-03 (MDA)	8.43E-03 ± 3.69E-03		
3/1/2018	< 3.39E-03 (MDA)	7.95E-03 ± 3.60E-03		
3/8/2018	< 3.37E-03 (MDA)	5.79E-03 ± 3.27E-03		
3/15/2018	< 3.33E-03 (MDA)	7.10E-03 ± 3.42E-03		
3/22/2018	< 3.54E-03 (MDA)	5.74E-03 ± 3.39E-03		
3/29/2018	2.38E-03 ± 1.88E-03	1.98E-02 ± 4.92E-03	< 3.03E-03 (MDA)	< 2.52E-03 (MDA)
4/5/2018	< 3.29E-03 (MDA)	1.07E-02 ± 3.86E-03		
4/12/2018	2.94E-03 ± 2.09E-03	1.08E-02 ± 3.88E-03		
4/19/2018	< 1.93E-03 (MDA)	1.72E-02 ± 4.64E-03		
4/26/2018	< 3.17E-03 (MDA)	1.10E-02 ± 3.80E-03		
5/3/2018	< 3.45E-03 (MDA)	1.59E-02 ± 4.59E-03		
5/10/2018	< 3.19E-03 (MDA)	5.92E-03 ± 3.14E-03		
5/17/2018	< 3.41E-03 (MDA)	1.47E-02 ± 4.41E-03		
5/24/2018	< 3.29E-03 (MDA)	8.92E-03 ± 3.63E-03		
5/31/2018	< 3.30E-03 (MDA)	9.29E-03 ± 3.69E-03		
6/7/2018	< 3.26E-03 (MDA)	1.02E-02 ± 3.79E-03		
6/14/2018	< 3.37E-03 (MDA)	9.50E-03 ± 3.77E-03		
6/21/2018	< 3.82E-03 (MDA)	1.16E-02 ± 4.37E-03		
6/27/2018	2.79E-03 ± 2.20E-03	8.96E-03 ± 4.11E-03	< 2.35E-03 (MDA)	< 2.33E-03 (MDA)
7/3/2018	< 2.86E-03 (MDA)	7.76E-03 ± 3.16E-03		
7/11/2018	< 3.35E-03 (MDA)	4.45E-03 ± 3.04E-03		
7/18/2018	< 3.30E-03 (MDA)	5.79E-03 ± 3.20E-03		
7/25/2018	< 3.23E-03 (MDA)	< 5.59E-03 (MDA)		
8/1/2018	< 3.37E-03 (MDA)	9.14E-03 ± 3.72E-03		
8/8/2018	< 3.28E-03 (MDA)	8.90E-03 ± 3.62E-03		
8/15/2018	< 3.31E-03 (MDA)	9.34E-03 ± 3.70E-03		
8/22/2018	< 3.52E-03 (MDA)	3.50E-03 ± 3.03E-03		
8/29/2018	< 3.43E-03 (MDA)	8.71E-03 ± 3.71E-03		
9/5/2018	< 3.34E-03 (MDA)	9.07E-03 ± 3.69E-03		
9/12/2018	< 3.32E-03 (MDA)	1.50E-02 ± 4.39E-03		
9/19/2018	2.40E-03 ± 1.90E-03	2.02E-02 ± 4.97E-03		
9/26/2018	< 3.49E-03 (MDA)	1.68E-02 ± 4.69E-03		
10/3/2018	< 3.48E-03 (MDA)	1.49E-02 ± 4.48E-03	< 2.58E-03 (MDA)	< 1.64E-03 (MDA)
10/10/2018	< 3.32E-03 (MDA)	2.28E-02 ± 5.17E-03		
10/17/2018	< 3.47E-03 (MDA)	3.67E-02 ± 6.43E-03		
10/24/2018	< 3.44E-03 (MDA)	1.23E-02 ± 4.15E-03		
10/31/2018	3.71E-03 ± 2.42E-03	1.08E-02 ± 4.06E-03		
11/7/2018	2.93E-03 ± 2.09E-03	3.19E-02 ± 5.90E-03		
11/14/2018	4.27E-03 ± 2.57E-03	4.37E-02 ± 6.93E-03		
11/21/2018	< 3.36E-03 (MDA)	< 5.81E-03 (MDA)		
11/28/2018	< 3.52E-03 (MDA)	8.94E-03 ± 3.81E-03		
12/5/2018	< 3.27E-03 (MDA)	1.65E-02 ± 4.52E-03		
12/12/2018	< 3.51E-03 (MDA)	5.29E-03 ± 3.29E-03		
12/19/2018	< 3.44E-03 (MDA)	5.54E-03 ± 3.28E-03		
12/26/2018	2.39E-03 ± 1.89E-03	8.28E-03 ± 3.62E-03		

Table C-4 (Continued)
ODCM REQUIRED AIR SAMPLES: OIL WATER SEPARATOR (AM5)

Sample Start Date	Alpha Activity (pCi/m^3)	Beta Activity (pCi/m^3)	Composite Gamma Activity (pCi/m^3)	
			Co-60	Cs-137
12/28/2017	2.41E-03 ± 1.90E-03	1.26E-02 ± 4.19E-03	<1.31E-03 (MDA)	< 1.56E-03 (MDA)
1/4/2018	< 3.45E-03 (MDA)	7.36E-03 ± 3.55E-03		
1/11/2018	< 3.40E-03 (MDA)	1.01E-02 ± 3.87E-03		
1/18/2018	< 3.37E-03 (MDA)	8.23E-03 ± 3.60E-03		
1/25/2018	< 3.43E-03 (MDA)	6.62E-03 ± 3.44E-03		
2/1/2018	< 3.39E-03 (MDA)	9.00E-03 ± 3.74E-03		
2/8/2018	2.37E-03 ± 1.87E-03	1.38E-02 ± 4.28E-03		
2/15/2018	< 3.40E-03 (MDA)	8.31E-03 ± 3.64E-03		
2/22/2018	< 3.45E-03 (MDA)	4.15E-03 ± 3.08E-03		
3/1/2018	< 3.39E-03 (MDA)	5.84E-03 ± 3.30E-03		
3/8/2018	< 3.37E-03 (MDA)	< 5.85E-03 (MDA)		
3/15/2018	< 3.33E-03 (MDA)	5.73E-03 ± 3.23E-03		
3/22/2018	< 3.54E-03 (MDA)	3.90E-03 ± 3.12E-03		
3/29/2018	< 3.39E-03 (MDA)	1.84E-02 ± 4.78E-03	< 2.37E-03 (MDA)	< 2.14E-03 (MDA)
4/5/2018	2.34E-03 ± 1.85E-03	8.91E-03 ± 3.62E-03		
4/12/2018	< 3.31E-03 (MDA)	1.25E-02 ± 4.10E-03		
4/19/2018	< 1.93E-03 (MDA)	1.51E-02 ± 4.40E-03		
4/26/2018	2.25E-03 ± 1.78E-03	1.16E-02 ± 3.88E-03		
5/3/2018	< 3.45E-03 (MDA)	1.19E-02 ± 4.13E-03		
5/10/2018	< 3.19E-03 (MDA)	9.66E-03 ± 3.65E-03		
5/17/2018	3.62E-03 ± 2.36E-03	1.79E-02 ± 4.77E-03		
5/24/2018	< 3.30E-03 (MDA)	7.18E-03 ± 3.40E-03		
5/31/2018	< 3.30E-03 (MDA)	1.14E-02 ± 3.95E-03		
6/7/2018	< 3.26E-03 (MDA)	5.37E-03 ± 3.11E-03		
6/14/2018	2.40E-03 ± 1.89E-03	8.07E-03 ± 3.57E-03		
6/21/2018	< 3.82E-03 (MDA)[14]	8.72E-03 ± 4.01E-03[14]		

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
12/28/2017	< 3.46E-03 (MDA)	1.74E-02 ± 4.74E-03	<1.27E-03 (MDA)	< 1.11E-03 (MDA)
1/4/2018	< 3.40E-03 (MDA)	7.26E-03 ± 3.50E-03		
1/11/2018	< 3.97E-03 (MDA)	9.29E-03 ± 4.20E-03		
1/18/2018	< 2.95E-03 (MDA)	2.94E-03 ± 2.55E-03		
1/25/2018	< 3.40E-03 (MDA)	6.91E-03 ± 3.46E-03		
2/1/2018	< 3.40E-03 (MDA)	6.21E-03 ± 3.36E-03		
2/8/2018	< 3.40E-03 (MDA)	1.04E-02 ± 3.92E-03		
2/15/2018	< 3.38E-03 (MDA)	6.16E-03 ± 3.33E-03		
2/22/2018	< 3.41E-03 (MDA)	5.16E-03 ± 3.21E-03		
3/1/2018	< 3.33E-03 (MDA)	< 5.78E-03 (MDA)		
3/8/2018	< 3.40E-03 (MDA)	8.67E-03 ± 3.69E-03		
3/15/2018	< 3.40E-03 (MDA)	3.74E-03 ± 2.99E-03		
3/22/2018	< 3.39E-03 (MDA)	< 5.90E-03 (MDA)		
3/29/2018	< 3.41E-03 (MDA)	7.98E-03 ± 3.61E-03	< 3.04E-03 (MDA)	< 1.66E-03 (MDA)
4/5/2018	< 3.28E-03 (MDA)	1.14E-02 ± 3.94E-03		
4/12/2018	< 3.30E-03 (MDA)	8.25E-03 ± 3.55E-03		
4/19/2018	< 1.93E-03 (MDA)	1.62E-02 ± 4.52E-03		
4/26/2018	< 3.29E-03 (MDA)	3.31E-03 ± 2.80E-03		
5/3/2018	< 3.31E-03 (MDA)	8.27E-03 ± 3.56E-03		
5/10/2018	< 3.32E-03 (MDA)	< 5.75E-03 (MDA)		
5/17/2018	< 3.30E-03 (MDA)	1.07E-02 ± 3.86E-03		
5/24/2018	< 3.33E-03 (MDA)	1.01E-02 ± 3.81E-03		
5/31/2018	< 3.28E-03 (MDA)	7.14E-03 ± 3.38E-03		
6/7/2018	< 3.31E-03 (MDA)	< 5.73E-03 (MDA)		
6/14/2018	< 3.31E-03 (MDA)	7.20E-03 ± 3.41E-03		
6/21/2018	< 3.90E-03 (MDA)	1.06E-02 ± 4.30E-03		
6/27/2018	< 3.96E-03 (MDA)	5.25E-03 ± 3.58E-03	< 3.00E-03 (MDA)	< 1.64E-03 (MDA)
7/3/2018	< 2.80E-03 (MDA)	7.00E-03 ± 3.02E-03		
7/11/2018	< 3.32E-03 (MDA)	4.41E-03 ± 3.01E-03		
7/18/2018	< 3.31E-03 (MDA)	5.09E-03 ± 3.10E-03		
7/25/2018	< 3.31E-03 (MDA)	< 5.73E-03 (MDA)		
8/1/2018	< 3.31E-03 (MDA)	< 5.73E-03 (MDA)		
8/8/2018	< 3.30E-03 (MDA)	< 5.71E-03 (MDA)		
8/15/2018	3.52E-03 ± 2.29E-03	9.33E-03 ± 3.70E-03		
8/22/2018	< 3.47E-03 (MDA)	6.32E-03 ± 3.42E-03		
8/29/2018	< 3.51E-03 (MDA)	< 6.07E-03 (MDA)		
9/5/2018	< 3.27E-03 (MDA)	9.57E-03 ± 3.71E-03		
9/12/2018	< 3.31E-03 (MDA)	1.07E-02 ± 3.88E-03		
9/19/2018	< 3.47E-03 (MDA)	1.46E-02 ± 4.44E-03		
9/26/2018	< 3.47E-03 (MDA)	1.88E-02 ± 4.88E-03		
10/3/2018	< 3.46E-03 (MDA)	1.06E-02 ± 3.98E-03	< 2.58E-03 (MDA)	< 2.80E-03 (MDA)
10/10/2018	< 3.32E-03 (MDA)	1.78E-02 ± 4.68E-03		
10/17/2018	3.05E-03 ± 2.17E-03	2.21E-02 ± 5.19E-03		
10/24/2018	< 3.47E-03 (MDA)	4.89E-03 ± 3.21E-03		
10/31/2018	< 3.47E-03 (MDA)	6.68E-03 ± 3.47E-03		
11/7/2018	3.05E-03 ± 2.18E-03	1.89E-02 ± 4.89E-03		
11/14/2018	5.47E-03 ± 2.93E-03	4.28E-02 ± 6.86E-03		
11/21/2018	< 3.30E-03 (MDA)	7.18E-03 ± 3.41E-03		
11/28/2018	< 3.48E-03 (MDA)	8.50E-03 ± 3.72E-03		
12/5/2018	< 3.28E-03 (MDA)	1.27E-02 ± 4.08E-03		
12/12/2018	< 3.51E-03 (MDA)	5.30E-03 ± 3.29E-03		
12/19/2018	< 3.52E-03 (MDA)	6.04E-03 ± 3.41E-03		
12/26/2018	< 3.37E-03 (MDA)	5.43E-03 ± 3.21E-03		

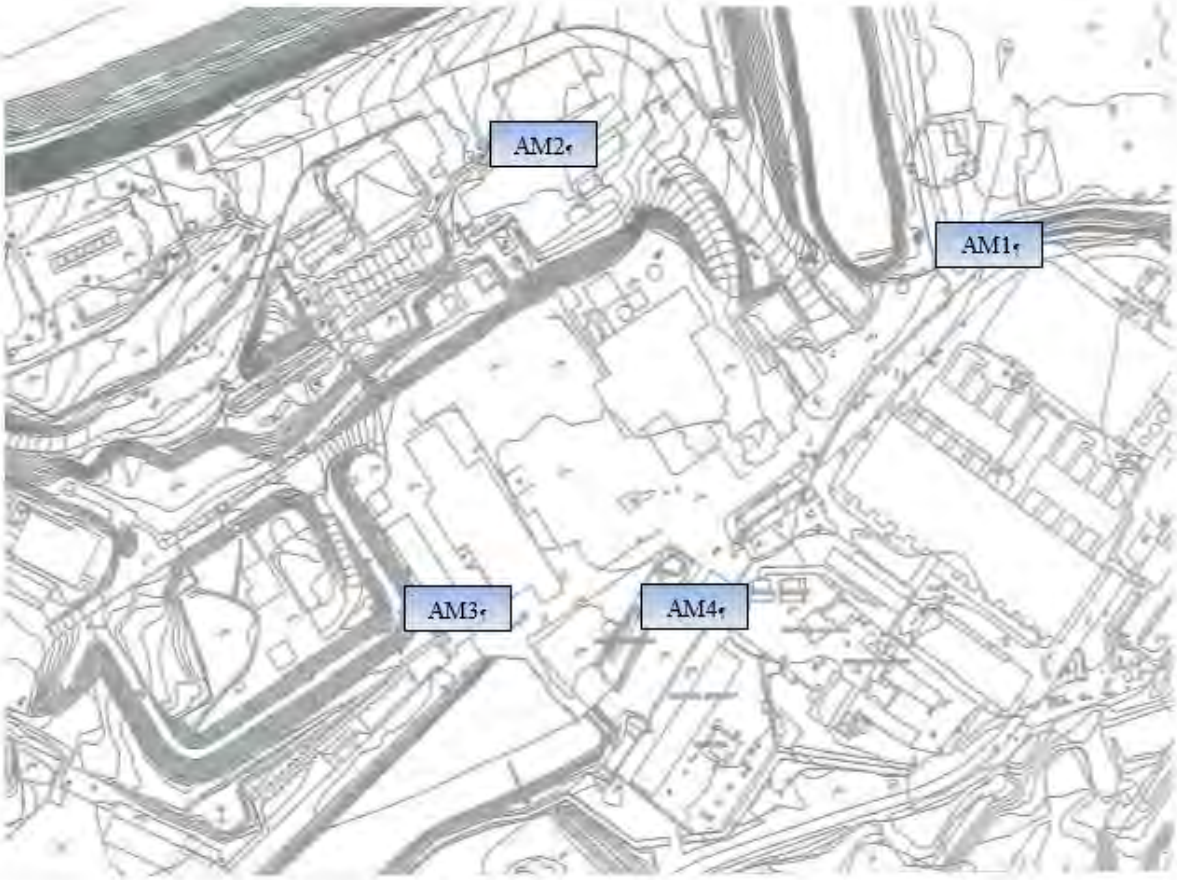
Table C-4 Notes

1. The AM2 air sampler formerly adjacent to Building 12 was found to be not operating on January 4, 2018, due to a tripped GFCI. The air sampler SAPN 1438309.
2. The AM3 air sampler adjacent to the Annex was turned off for 2.5 hours on January 13, 2018, due to a planned power outage for electrical maintenance activities. Actions documented in SAPN 1438739.
3. The East Fence air sampler (AM1) was powered down for 10 minutes on February 20, 2018, to allow relocation of the light plant that supplied power to the air sample pump. Actions documented in SAPN 1438430.
4. The East Fence air sampler (AM1) was powered off for approximately 20 minutes on February 26, 2018, due to electrical maintenance activities. Actions documented in SAPN 1438430.
5. The East Fence air sampler (AM1) was reported as not operating on April 3, 2018. The sample pump was changed out on April 4, 2018, and the totalizer reading was used to determine sample volume. During the time the sample pump was not running, there were no field activities that could have caused an airborne event. Actions documented in SAPN 1441219.
6. The GWTS air sampler (AM2) was discovered to be out of service due to a tripped breaker on April 9, 2018. Actions documented in SAPN 1441521.
7. AM2 was relocated to a corner of the GWTS 2.0 area on April 12, 2018, primarily due to electrical power supply issues. The down time for the filter was adequately documented in SAPN 1438430.
8. The East Fence air sampler (AM1) was shut down on April 25, 2018, to relocate the generator which powered the sampler. Actions documented in SAPN 1438430.
9. The East Fence air sampler (AM1) was found to be not operating on April 26, 2018, due to a tripped GFCI. The sampler was later shut down for approximately 10 minutes to switch generators. Actions documented in S1441799.
10. The East Fence air sampler (AM1) was found to be not operating on May 7, 2018. The sampler was restarted, and totalizer readings were used to determine sample volume. Actions documented in SAPN 1442270.
11. The East Fence air sampler (AM1) was found to be not running on May 18, 2018, most likely due to the generator tripping off line. Actions documented in SAPN 1442601.
12. The East Fence air sampler (AM1) was found to be not running on June 4, 2018. Actions documented in SAPN 1443150.
13. The East Fence air sampler (AM1) was relocated to the HBGS fence line on June 7, 2018. An extension cord from HBGS was used to power the sample pump. The air sampler was turned off during the relocation. Actions documented in SAPN 1438430.

Table C-4 Notes, continued

14. The O.W.S air sampler (AM5) located at the former location of the oily water separator was permanent powered down on June 27, 2018. The location had been deleted from the ODCM and the air sampler was no longer required. Actions documented in SAPN 1438430.
15. HBGS initiated a clearance on the power source of the East Fence air sampler (AM1) on July 3, 2018. The clearance was scheduled for several days. The decision was made not to attempt to power the air sampler by generator from July 3, 2018 to July 10, 2018. Because no work was planned during the time interval (site was shut down for the holiday week), the air sampler was not required to be run during nonbusiness hours. Actions documented in SAPN 1444106.
16. Due to a site wide electrical outage of approximately 8 hours on July 23, 2018, and problems encountered following the power outage, the Annex air sampler (AM3) and GWTS air sampler (AM2) could not immediately be returned to service. AM3 was returned to service on July 24, 2018, while AM2 was returned to service on July 26, 2018. Actions documented in SAPN 1444412.
17. On July 31, 2018, the Annex air sampler (AM3) was found to be unplugged with a totalizer run time of approximately 50 hours and 55 minutes. It appeared a worker may have tripped over the electrical extension cord, causing it to suffer a loss of power. The sampler was restarted and the totalizer reading used to determine the sample volume. Actions documented in SAPN 1444804.
18. The Annex air sampler (AM3) was without power for approximately 2 hours on August 7, 2018, due to a planned electrical outage. The GWTS 2.0 air sampler (AM2) was without power for approximately 30 minutes on August 8, 2018 due to a planned electrical outage. Actions documented in SAPN 1438430.
19. The Annex air sampler (AM3) lost power sometime around December 11, 2018. Actions documented in SAPN 1438430.

FIGURE A-1
HBPP ONSITE AIR SAMPLE LOCATIONS

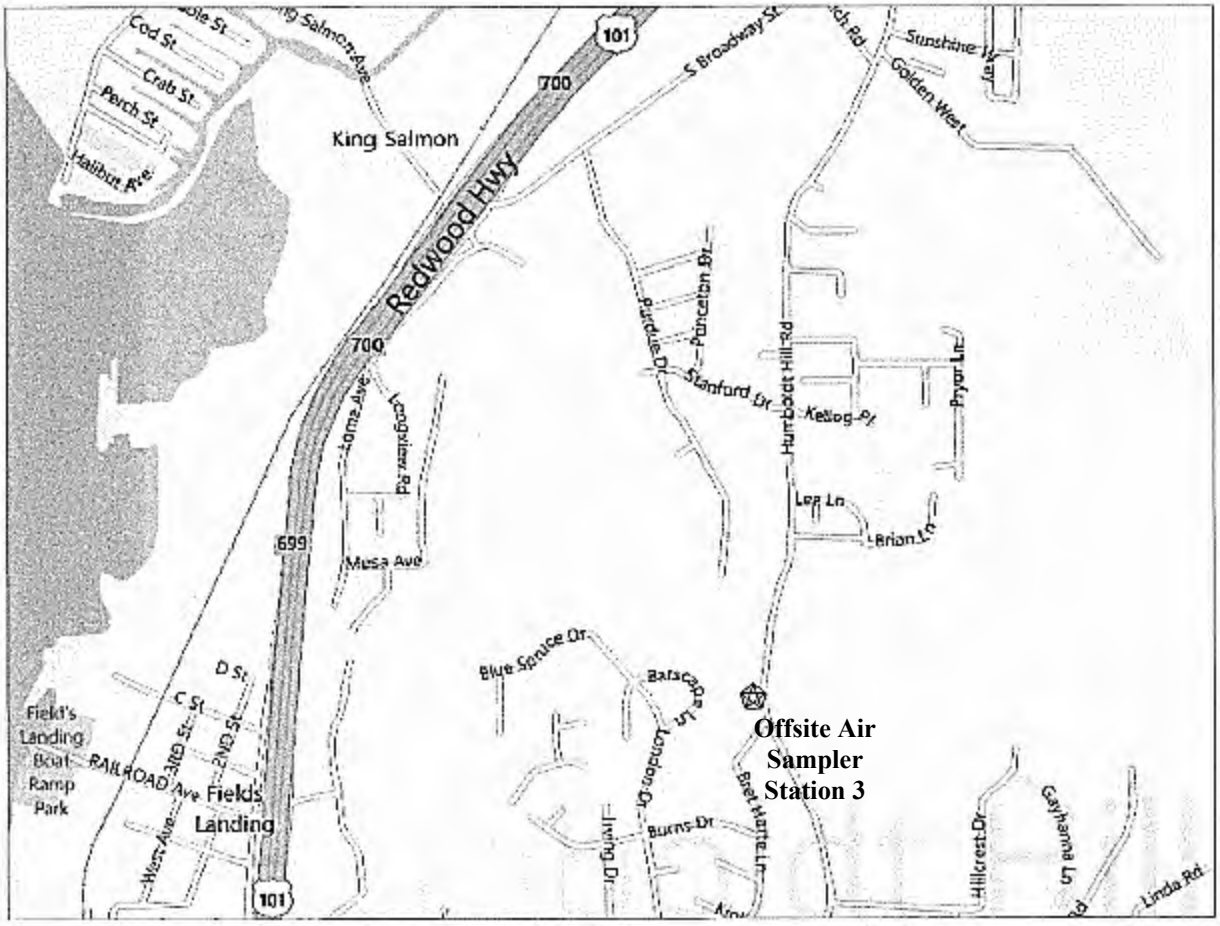


Location Number	GPS Coordinates (NAD83/NAVD88 CA. Zone 1	
	Easting*	Northing*
East Fence AM1	5949844	2161231
GWTS AM2	5949272	2161330
Annex Bldg. AM3	5949178	2160817
Relay Bldg. AM4	5949456	2160858

Figure A-1 Note:

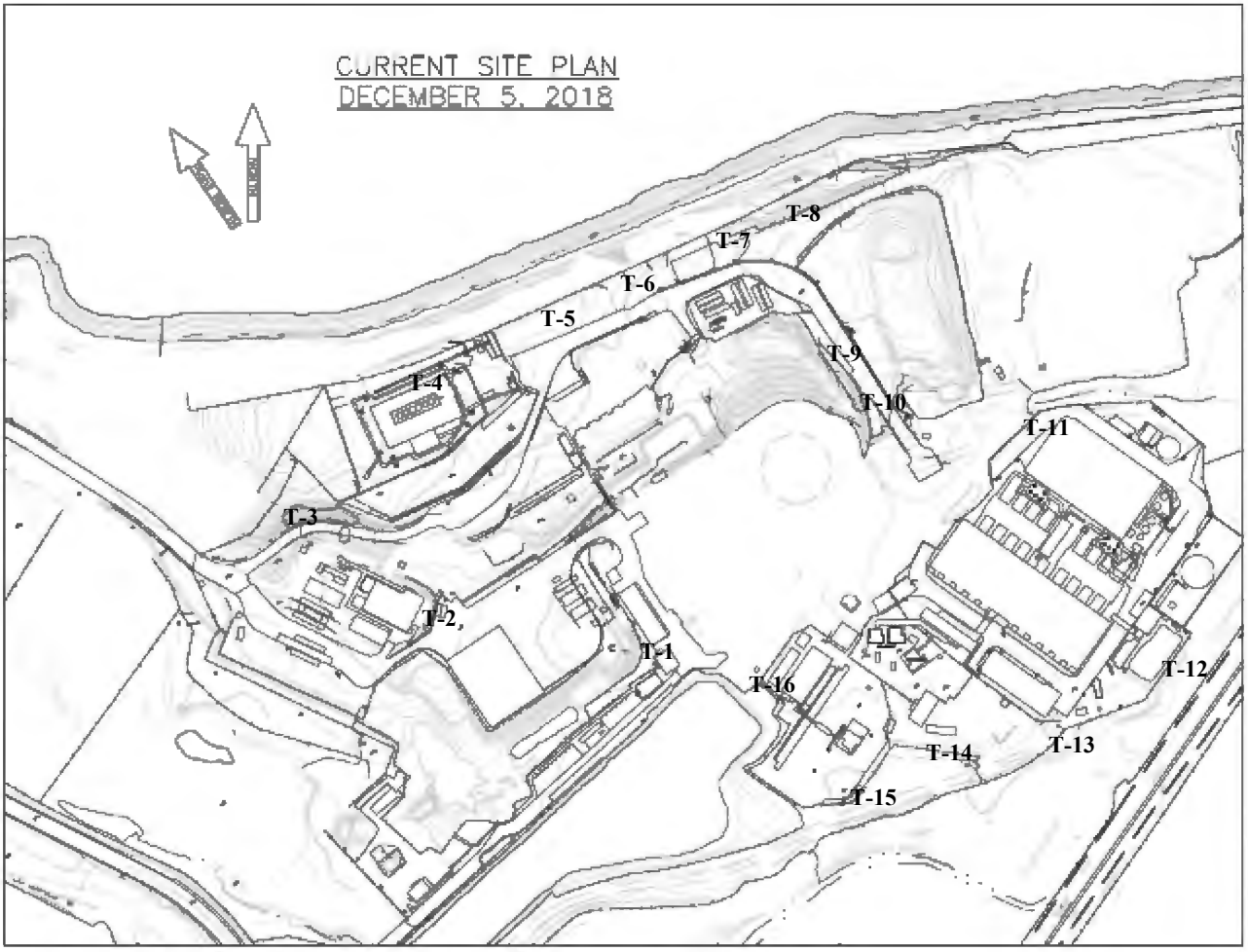
1. Humboldt Hill (Offsite) is also known as Station 3, East Fence is also known as AM1, GWTS (formerly Building 12) is also known as AM2, Annex is also known as AM3, and the Relay Building is also known as AM4.

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



GPS Coordinates (NAD83/NAVD88 CA. Zone 1)			Degree.Decimal	
Easting	Northing	el.	Latitude	Longitude
5951260.28	2155706.11	234.94	40.72676	-124.20274

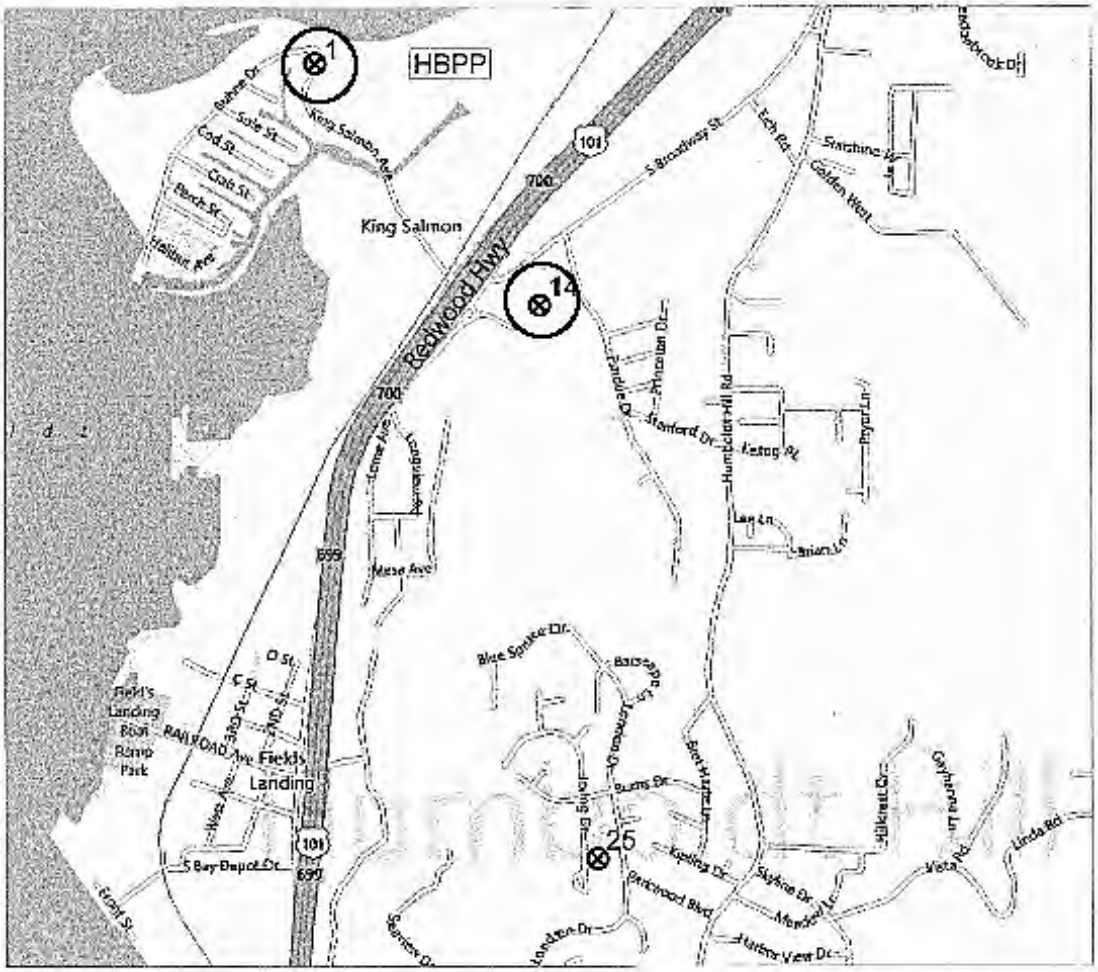
FIGURE A-3
HBPP ONSITE TLD LOCATIONS
Stations T1 – T16 (excluding T17)



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.

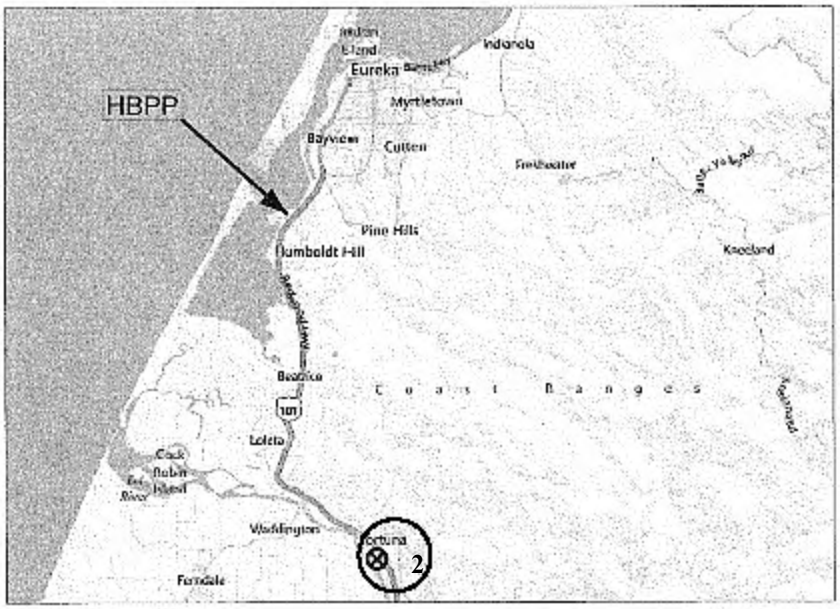
Location Number	GPS Coordinates (NAD83/NAVD88 CA Zone 1)		
	Easting	Northing	Elevation
T1	5949179	2160815	11
T2	5948794	2160911	17
T3	5948610	2161062	42
T4	5948779	2161270	44
T5	5949003	2161368	38
T6	5949160	2161437	36
T7	5949280	2161495	32
T8	5949147	2161564	21
T9	5949478	2161241	23
T10	5949519	2161199	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

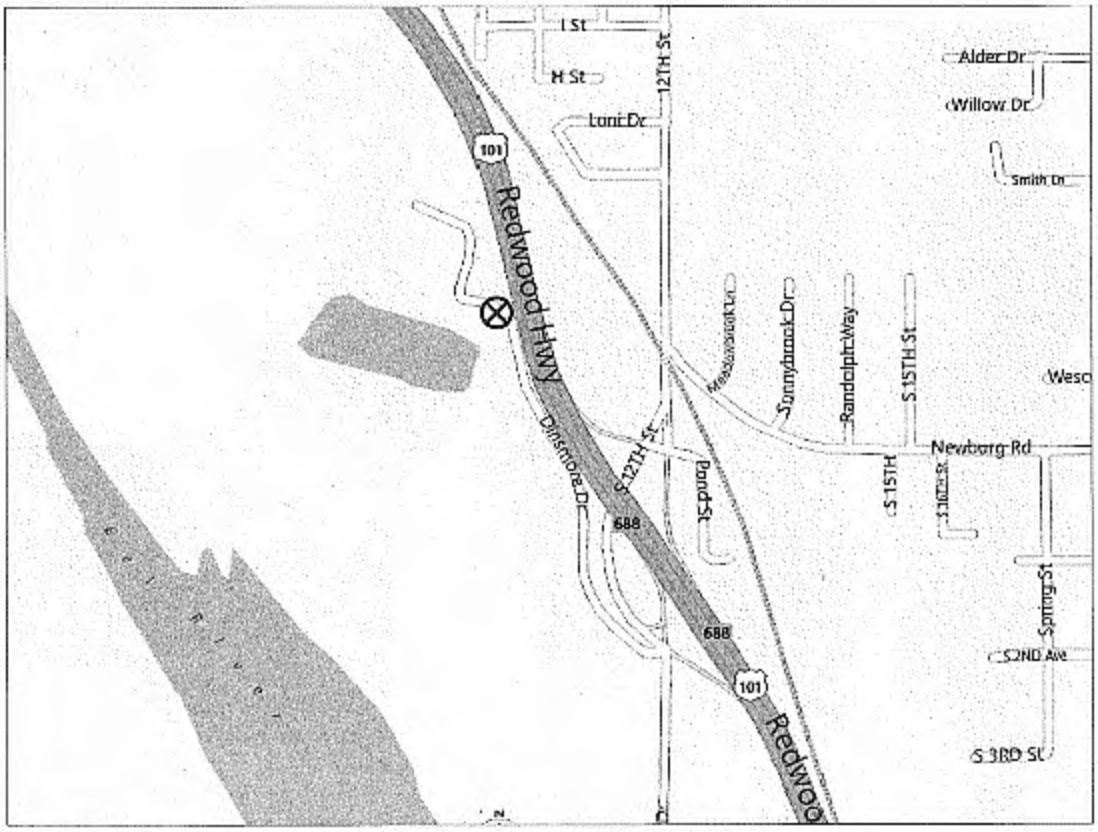
FIGURE A-4
HBPP OFFSITE TLD LOCATIONS
Stations (1, 14 & 25)



	GPS Coordinates (NAD83/NAVD88 CA. Zone 1)			Degree. Decimal	
	Easting	Northing	el.	Latitude	Longitude
1	5948026.52	2161183.79	11.38	40.74156	-124.21903
14	5949876.83	2158864.39	18.65	40.73533	-124.20802
25	5950247.30	2154214.18	229.22	40.72260	-124.20626

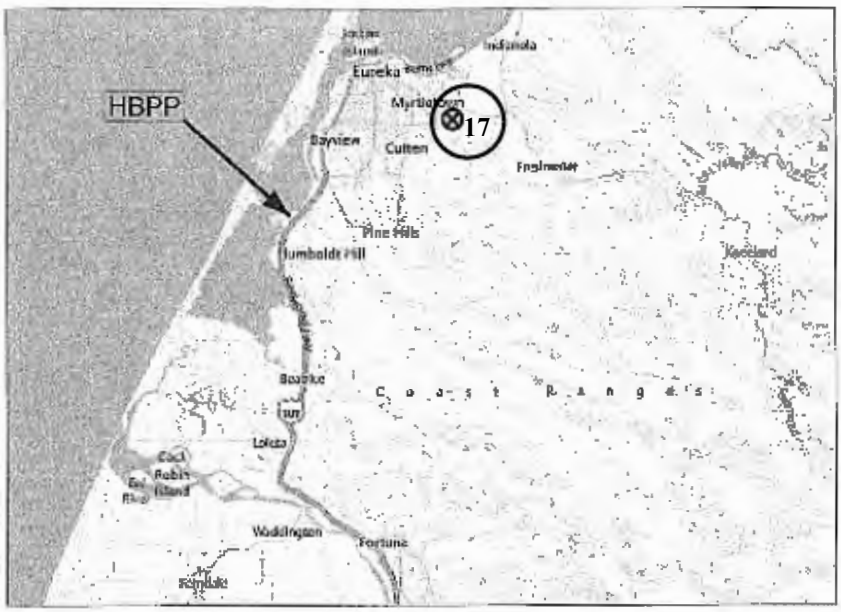
FIGURE A-4 (Continued)
HBPP OFFSITE TLD LOCATION
FORTUNA (Station 2)

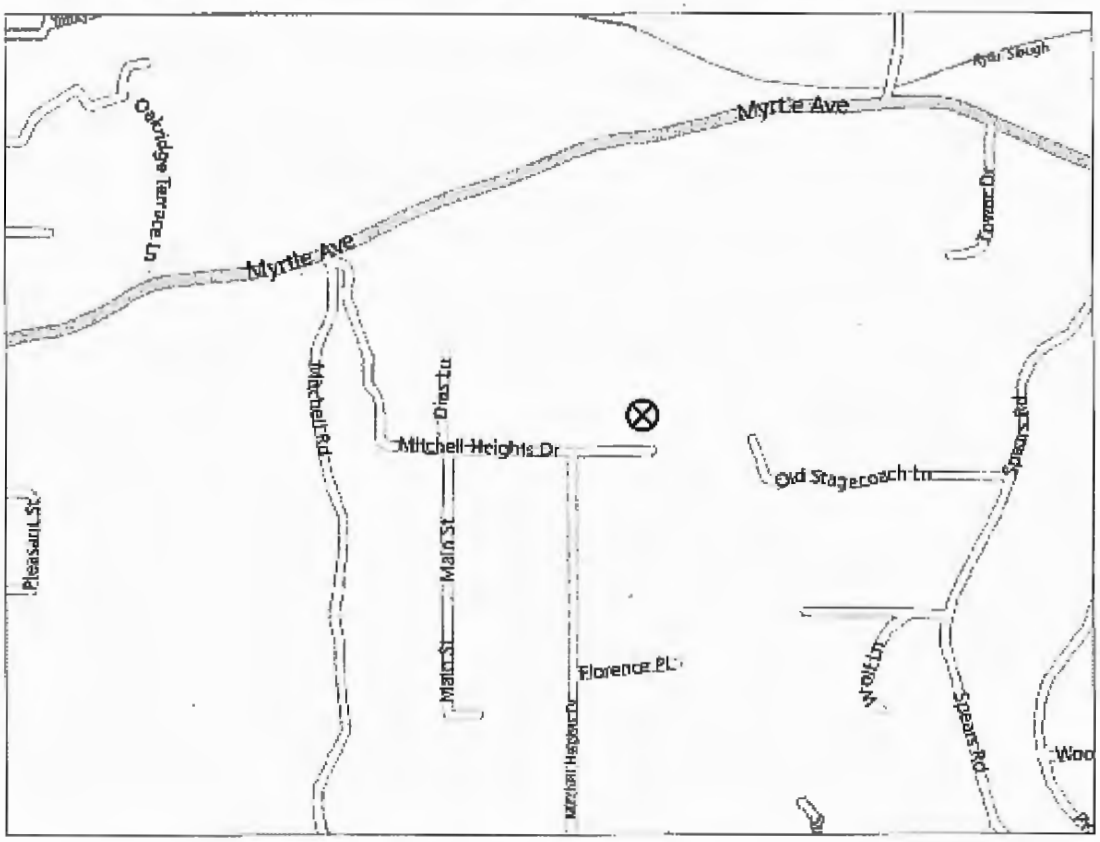




GPS Coordinates (NAD83/NAVD88 CA. Zone 1)			Degree.Decimal	
Easting	Northing	el.	Latitude	Longitude
5962583.86	2105797.82	35.53	40.59057	-124.15746

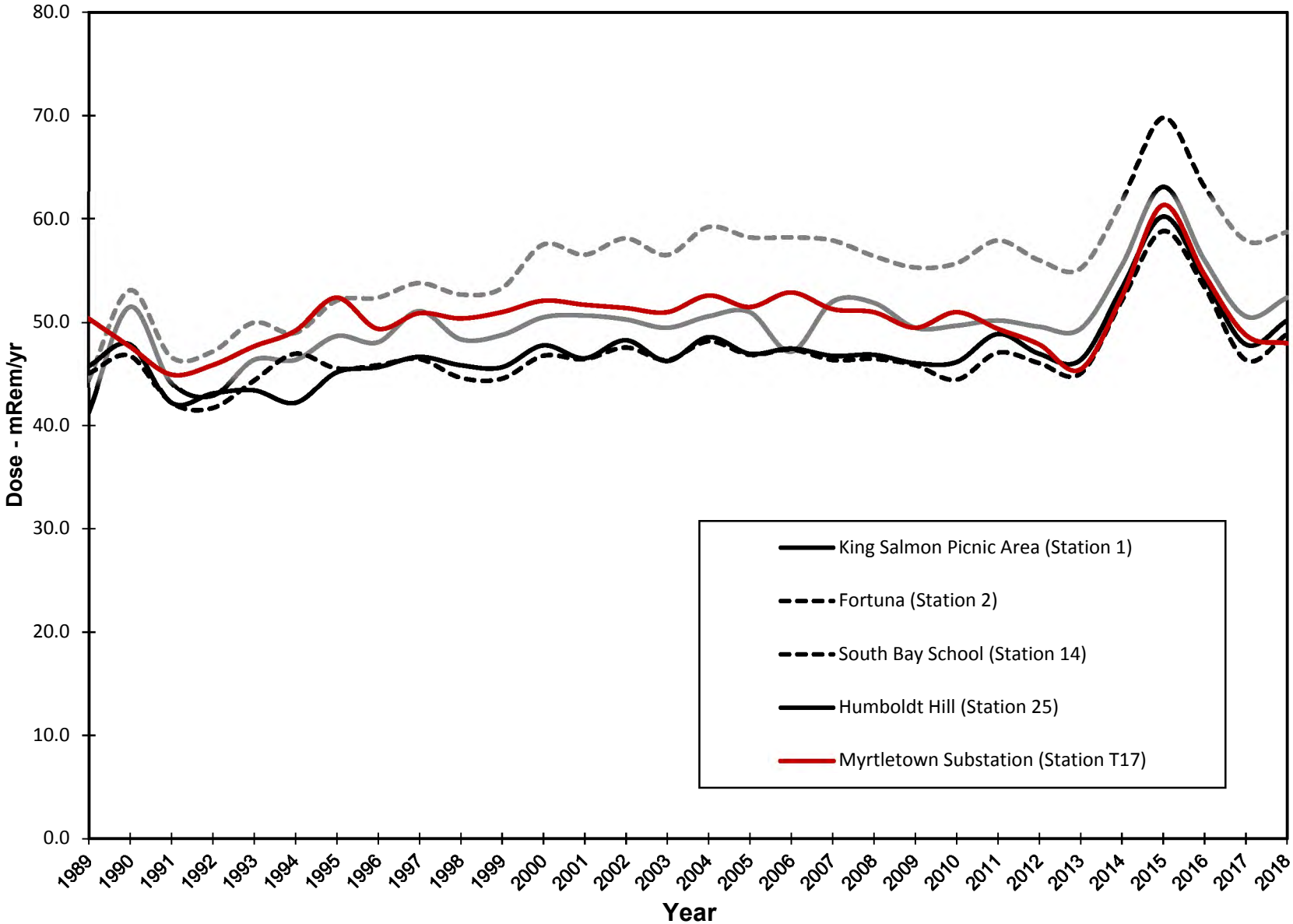
FIGURE A-4 (Continued)
HBPP OFFSITE TLD LOCATION
EUREKA (Control Location T17)





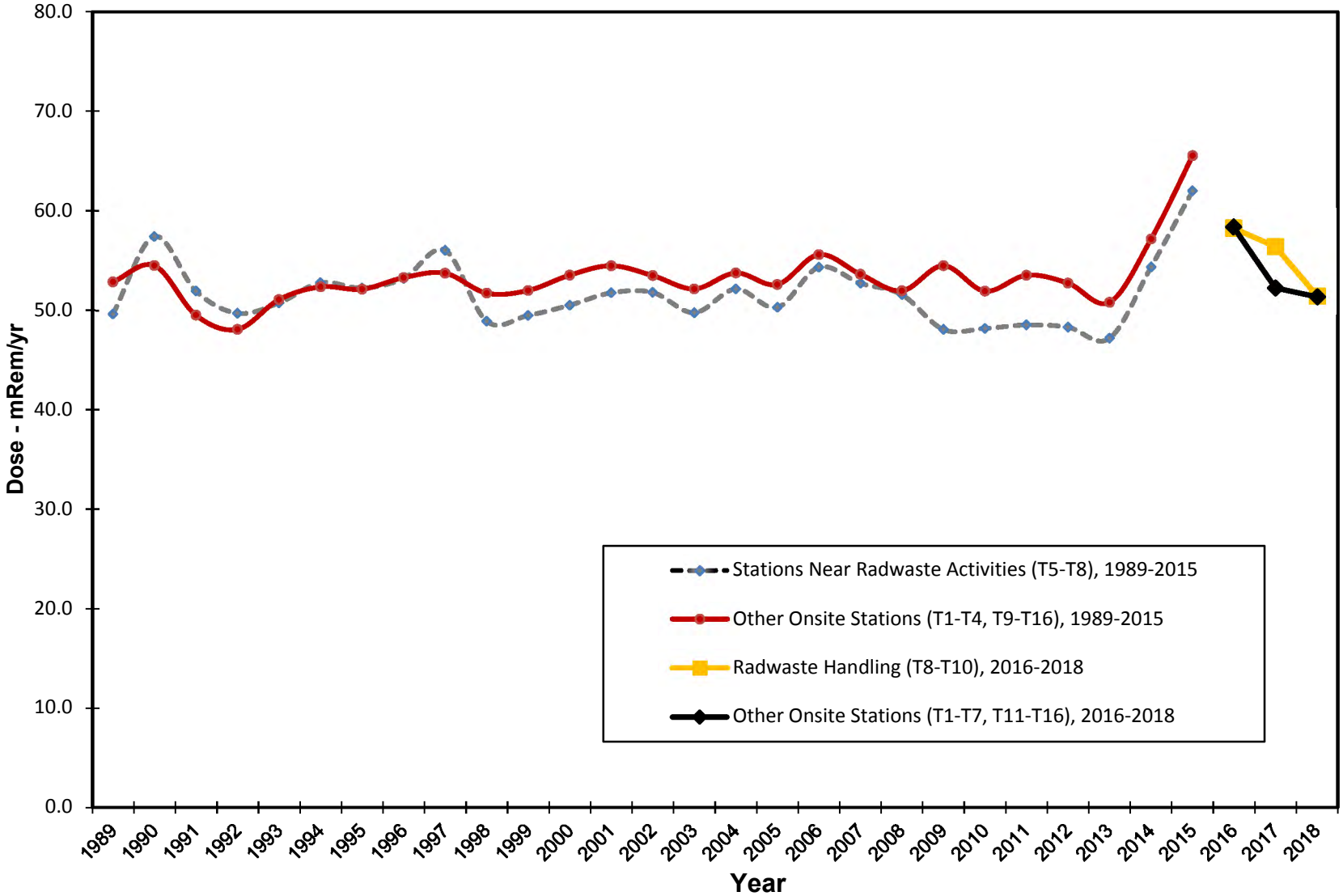
GPS Coordinates (NAD83/NAVD88 CA. Zone 1)			Degree.Decimal	
Easting	Northing	el.	Latitude	Longitude
5976549.55	2175490.19	164.85	40.78276	-124.11324

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. However, these values 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.

FIGURE B-2
ONSITE ENVIRONMENTAL RADIATION LEVEL TRENDS



The baseline values for the two areas were obtained by averaging the readings for each area from 1977 through 1983. However, these values 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.