

Cal Poly Humboldt

Digital Commons @ Cal Poly Humboldt

State & Federal Reports and Publications

Cal Poly Humboldt Sea Level Rise Initiative

4-28-2021

Humboldt Bay Power Plant Unit 3 Annual Radiological Environmental Monitoring Report

Eric P. Nelson

Follow this and additional works at: https://digitalcommons.humboldt.edu/hsuslri_state

Recommended Citation

Nelson, Eric P., "Humboldt Bay Power Plant Unit 3 Annual Radiological Environmental Monitoring Report" (2021). *State & Federal Reports and Publications*. 35.
https://digitalcommons.humboldt.edu/hsuslri_state/35

This Article is brought to you for free and open access by the Cal Poly Humboldt Sea Level Rise Initiative at Digital Commons @ Cal Poly Humboldt. It has been accepted for inclusion in State & Federal Reports and Publications by an authorized administrator of Digital Commons @ Cal Poly Humboldt. For more information, please contact kyle.morgan@humboldt.edu.

Cal Poly Humboldt

Digital Commons @ Cal Poly Humboldt

State & Federal Reports and Publications

Cal Poly Humboldt Sea Level Rise Initiative

4-28-2021

Humboldt Bay Power Plant Unit 3 Annual Radiological Environmental Monitoring Report

Eric P. Nelson

Follow this and additional works at: https://digitalcommons.humboldt.edu/hsuslri_state



Eric P. Nelson
Director
Nuclear Decommissioning

Diablo Canyon Power Plant
Mail Code: 252-2-NW
San Luis Obispo, CA 93424

805-545-4777
Internal: 691-4777
E-Mail: epn1@pge.com

April 28, 2021

PG&E Letter HBL-21-008

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 2020

Dear Commissioners and Staff:

In accordance with Section 4.1 of the SAFSTOR/Decommissioning Offsite Dose Calculation Manual (ODCM), Pacific Gas and Electric Company hereby submits the 2020 Annual Radiological Environmental Monitoring Report (REMP). The REMP, provided in the enclosure covers the reporting period from January 1 through December 31, 2020. The report contains material 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.

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

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

Sincerely,

A handwritten signature in black ink that reads "Eric P. Nelson". The signature is written in a cursive, flowing style.

Eric P. Nelson

Enclosure

cc: HBPP Distribution
cc/enc: Scott A. Morris, NRC Region IV Administrator
Amy M. Snyder, NRC Project Manager

HUMBOLDT BAY POWER PLANT UNIT 3
ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT
JANUARY 1 THROUGH DECEMBER 31, 2020

TABLE OF CONTENTS

A. RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM.....	1
1. Program Description	1
2. Monitoring Requirements.....	2
a. Offsite Environmental Monitoring	2
b. Onsite Environmental Monitoring	3
c. Other Monitoring.....	4
3. Interlaboratory Comparison Program.....	4
4. NEI Groundwater Protection Initiative.....	5
B. TRENDS, BASELINE COMPARISONS AND INTERPRETATIONS	5
1. General Comments.....	5
2. Direct Radiation Pathway	5
3. Airborne Pathway	6
4. Waterborne Pathway	6
a. Surface Water	6
b. Groundwater.....	6
5. Ingestion Pathway	7
6. Terrestrial Pathway.....	7
C. MONITORING RESULTS	8
1. Annual Summary	8
2. Direct Radiation Pathway	8
3. Airborne Pathway	8
4. Waterborne Pathway	9
a. Surface Water	9

TABLE OF CONTENTS (Continued)

b. Groundwater.....	9
5. Ingestion Pathway	9
6. Terrestrial Pathway	9
7. NEI Groundwater Protection Initiative Voluntary Reporting Results.....	9
8. Errata For Previous Years' Reports	10

LIST OF TABLES

Table	Page
A-1 HBPP RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM	11
A-2 DISTANCES AND DIRECTIONS TO HBPP OFFSITE SAMPLE LOCATIONS ...	11
A-3 GEL PARTICIPATION – INTERLABORATORY CROSS-CHECK PROGRAM....	
DATA.....	12
C-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL REPORT SUMMARY	13
C-2 ONSITE ENVIRONMENTAL TLD STATIONS.....	14
C-3 OFFSITE (Control) ENVIRONMENTAL TLD STATIONS	16
C-4 ODCM REQUIRED AIR SAMPLES.....	17

LIST OF FIGURES

Figure

	Page
A-1 HBPP ONSITE AIR SAMPLE LOCATIONS	18
A-2 HBPP ONSITE TLD LOCATIONS	19
A-3 HBPP OFFSITE TLD LOCATIONS	20
B-1 OFFSITE ENVIRONMENTAL RADIATION LEVEL TRENDS	23
B-2 ONSITE ENVIRONMENTAL RADIATION LEVEL TRENDS	24

**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, 2020**

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, 2020, 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 offsite contract 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 and 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. These results are 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), 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. ODCM Revision 32, effective in February 2020, removed all remaining onsite and offsite environmental sample locations, final TLDs were removed at normal quarter end interval on April 1, 2020. 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 ONSITE TLD LOCATIONS", and Figure A-3 "HBPP OFFSITE TLD LOCATIONS."

2. Monitoring Requirements

a. Offsite Environmental Monitoring

1. Airborne

The ODCM required zero (0) offsite environmental air sampling stations. ODCM revision 31, effective Q4 of 2019, removed all remaining offsite air sampling locations.

2. Direct Radiation

The ODCM required 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-3. These stations are considered to represent the offsite locations for the direct radiation pathway. ODCM Revision 32, effective February 2020, eliminated onsite and offsite TLD locations, however, final TLDs were removed at normal quarter end interval on April 1, 2020.

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 required 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 two air sampling locations generally represent two major compass sectors (N, S) and areas that are potentially approachable by a member of the public. The air samplers are run continuously, and samples are analyzed weekly for Gross Beta and Gross Alpha activity. Quarterly composited samples were not analyzed by station to facilitate demobilization of the onsite count lab. The number of onsite air sampling stations was reduced from two (2) to zero (0) during 2020 with ODCM Revision 32, effective February 2020, removed all remaining onsite air sampling locations.

2. Direct Radiation

The ODCM required 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 were used to satisfy this requirement. Stations T1 through T16 are shown on Figure A-2.

Each quarter the exposures from 16 stations are determined, which normally results in 64 analyses for a full year, however, this was reduced to one quarter of data collection in 2020. ODCM Revision 32, effective February 2020, eliminated onsite and offsite TLD locations, however, final TLDs were removed at normal quarter end interval on April 1, 2020. Each TLD station had 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.

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 2020.

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 one (1) Eckert & Ziegler individual environmental sample analyses in Q1 of 2020. All results met GEL's acceptance criteria (100 percent within acceptance).

With the demobilization of HBPP onsite count room, which commenced in Q4 of 2019, HBPP did not participate in the Eckert & Ziegler Interlaboratory Cross-Check Program in 2020.

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. No groundwater monitoring was performed in 2020. Formal closure of the ground water monitoring wells was initiated in 2017 and concluded in 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. PG&E has completed all Decommissioning Demolition Activities of Unit 3 end of 2019, as a result, performance of all radiological surveys was suspended for the monitoring period of 2020.

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 and/or 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. ODCM Revision 32, effective February 2020, eliminated onsite and offsite TLD locations, however, final TLDs were removed at normal quarter end interval on April 1, 2020. The maximum first quarter dose, was seen on TLD T1, corrected to the 67-hour/yr occupancy, Teen Shoreline Recreation Pathway from Regulatory Guide 1.109, and subtracting the average of the five (5) offsite TLDs, the dose to the maximum exposed individual from this source was approximately 0.02 mrem above background.

The Humboldt Bay 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 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 terminated in December 2013. Therefore, there were no discharges of liquid radioactive effluent to Humboldt Bay during the reporting period.

b. Groundwater

Groundwater sampling of the waterborne pathway ceased in the second quarter of 2017. There were no spills challenging the groundwater in 2020.

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. With demobilization of Ground Water Treatment System (GWTS) and demobilization of the HBPP count lab, both commencing in 2019, there was no need for, or onsite ability to, evaluate ground water/storm water radioactivity in 2020.

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. All decommissioning demolition activities of Unit 3 were complete at the end of 2019. ODCM Revision 32, effective February 2020, eliminated onsite and offsite TLD locations; however, final TLDs were removed at normal quarter end interval on April 1, 2020.

3. Airborne Pathway

Two onsite samples were collected and sent for offsite analysis for Gross Beta and Gross Alpha activity until ODCM Revision 32, effective February 2020, removed all air sample locations in the first quarter of 2020.

The required quarterly composited samples were analyzed for Gamma Isotopic by station. All air sample results for alpha and beta activity are provided in Table C-4. Onsite composite count capabilities ceased the fourth quarter of 2019 to facilitate demobilization of HBPP onsite count lab. The weekly samples were sent offsite to GEL and results for alpha and beta particulate met the effluent acceptance criteria in the ODCM. All LLD's were met for Gross Beta (required LLD $1.0\text{E-}02$ pCi/m³).

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 2020 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 2020 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 2020.

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

8. No Errata for Previous Years' Reports.

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) All decommissioning demolition activities of Unit 3 were complete end of 2019. The number of onsite and offsite sample / monitoring locations was scaled back to zero with implementation of ODCM Revision 32, effective February 2020, eliminated all airborne sample and TLD locations; however, final TLDs were removed at normal quarter end interval on April 1, 2020.

^(b) Gamma isotopic analysis means the identification and quantification of gamma emitting radionuclides that may be attributable to the effluents from the facility. Onsite composite analysis were not performed in 2020 to facilitate demobilization of the onsite count lab.

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	
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

Note: All decommissioning demolition activities of Unit 3 were complete end of 2019. ODCM Revision 32, effective February 2020, eliminated onsite and offsite TLD locations; however, final TLDs were removed at normal quarter end interval on April 1, 2020.

TABLE A-3
GEL PARTICIPATION – INTERLABORATORY CROSS-CHECK PROGRAM DATA⁽¹⁾

Sample/ Analysis	Radionuclide	Sample Number	Quarter 2020	Report Date	GEL Value (pCi/L)	Reference Value (pCi/L)	Ratio	Evaluation
Gamma Water	I-131	RAD-120	1st	2/24/20	3.18E+01	2.99E+01	1.06	Acceptable
	Ba-133	RAD-120	1st	2/24/20	5.92E+01	6.45E+01	0.92	Acceptable
	Cs-134	RAD-120	1st	2/24/20	2.15E+01	2.29E+01	0.94	Acceptable
	Cs-137	RAD-120	1st	2/24/20	2.17E+02	2.20E+02	0.99	Acceptable
	Co-60	RAD-120	1st	2/24/20	9.77E+01	9.12E+01	1.07	Acceptable
	Zn-65	RAD-120	1st	2/24/20	3.32E+02	2.98E+02	1.11	Acceptable
LSC ⁽²⁾ Water	Tritium	RAD-120	1st	2/24/20	1.77E+04	1.78E+04	0.99	Acceptable
GFP ⁽³⁾ Water	Sr-90	RAD-120	1st	2/24/20	3.83E+01	3.65E+01	1.05	Acceptable
	Gross Alpha	RAD-120	1st	2/24/20	6.71E+01	5.89E+01	1.14	Acceptable
	Gross Beta	RAD-120	1st	2/24/20	2.00E+01	2.10E+01	0.95	Acceptable

Note (1): In 2020 samples were sent to offsite lab for analysis. HBPP Lab was permanently closed fourth quarter of 2019 and did not participate in Eckert & Ziegler Interlaboratory Cross-Check Program in 2020.

Note (2): Liquid Scintillation Counter

Note (3): Gas Flow Proportional

TABLE C-1
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL REPORT SUMMARY

Name of Facility	<u>Humboldt Bay Power Plant Unit 3</u>	Docket No.	<u>50-133; License No. DPR-7</u>
Location of Facility	<u>Humboldt County, California</u> (County, State)	Reporting Period	<u>January 1 – December 31, 2020</u>

[illegible]

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

Medium or Pathway Sampled [Unit of Measurement]	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD) ^a	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., (1/6) means that 1 out of 6 samples contained detectable activity above the MDA, but below the LLD. The range of detected results is indicated in brackets; e.g., [23 to 34].

^c The two onsite air samplers were reduced to zero with ODCM Revision 32, effective February 2020. All samples were sent to GEL for offsite analysis to facilitate HBPP’s demobilized of the onsite count room.

^d ODCM Revision 32, effective February 2020, eliminated onsite and offsite TLD locations; however, final TLDs were removed at normal quarter end interval on April 1, 2020.

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	15.7 ± 2.1	Not Required	Not Required	Not Required
T2	14.3 ± 0.8	Not Required	Not Required	Not Required
T3	12.7 ± 0.9	Not Required	Not Required	Not Required
T4	14.0 ± 0.5	Not Required	Not Required	Not Required
T5	12.7 ± 0.9	Not Required	Not Required	Not Required
T6	13.0 ± 0.5	Not Required	Not Required	Not Required
T7	12.7 ± 0.9	Not Required	Not Required	Not Required
T8	14.3 ± 0.8	Not Required	Not Required	Not Required
T9	13.0 ± 0.5	Not Required	Not Required	Not Required
T10	13.0 ± 0.5	Not Required	Not Required	Not Required
T11	14.7 ± 1.1	Not Required	Not Required	Not Required
T12	13.0 ± 0.5	Not Required	Not Required	Not Required
T13	13.7 ± 0.1	Not Required	Not Required	Not Required
T14	13.3 ± 0.2	Not Required	Not Required	Not Required
T15	13.0 ± 0.5	Not Required	Not Required	Not Required
T16	13.3 ± 0.2	Not Required	Not Required	Not Required

Parameter	Calculated Parameters (mR)			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Average	13.5 ± 0.0	Not Required	Not Required	Not Required
Maximum	15.7 ± 2.1	Not Required	Not Required	Not Required

Table C-2 Notes:

1. All decommissioning demolition activities of Unit 3 were complete end of 2019. ODCM Revision 32, effective February 2020, eliminated onsite and offsite TLD locations; however, final TLDs were removed at normal quarter end interval on April 1, 2020.
2. The reported exposures do not have an average background or transient dose subtracted.
3. Not Required: Not required by the HBPP Unit 3 Technical Specifications or the SAFSTOR Offsite Dose Calculation Manual.

TABLE C-3
OFFSITE (Control) ENVIRONMENTAL TLD STATIONS

Station Number	TLD Exposure Measurements (mR)			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1	13.2 ± 0.5	Not Required	Not Required	Not Required
2	15.0 ± 1.8	Not Required	Not Required	Not Required
14	12.7 ± 0.5	Not Required	Not Required	Not Required
25	12.0 ± 1.2	Not Required	Not Required	Not Required
T17	12.7 ± 0.5	Not Required	Not Required	Not Required

Parameter	Calculated Parameters (mR)			
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Average	13.2 ± 0.0	Not Required	Not Required	Not Required
Maximum	15.0 ± 1.8	Not Required	Not Required	Not Required

Table C-3 Notes:

1. All decommissioning demolition activities of Unit 3 were complete end of 2019. ODCM Revision 32, effective February 2020, eliminated onsite and offsite TLD locations; however, final TLDs were removed at normal quarter end interval on April 1, 2020.
2. The reported exposures do not have an average background or transient dose subtracted.
3. Not Required: Not required by the HBPP Unit 3 Technical Specifications or the SAFSTOR Offsite Dose Calculation Manual.

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

Sample Start Date	Alpha Activity (pCi/m ³)	Beta Activity (pCi/m ³)	Composite Gamma Activity (pCi/m ³)	
			Co-60	Cs-137
12/31/2019	< 6.42E-04 (MDA)	8.13E-03 ± 1.43E-03	N/A	N/A
1/8/2020	< 5.78E-04 (MDA)	4.17E-03 ± 1.05E-03		
1/15/2020	6.71E-04 ± 5.50E-04	7.18E-03 ± 1.33E-03		
1/22/2020	< 4.56E-04 (MDA)	5.58E-03 ± 1.16E-03		
1/29/2020	< 7.25E-04 (MDA)	7.10E-03 ± 1.28E-03		
2/5/2020	< 5.26E-04 (MDA)	6.58E-03 ± 1.32E-03		

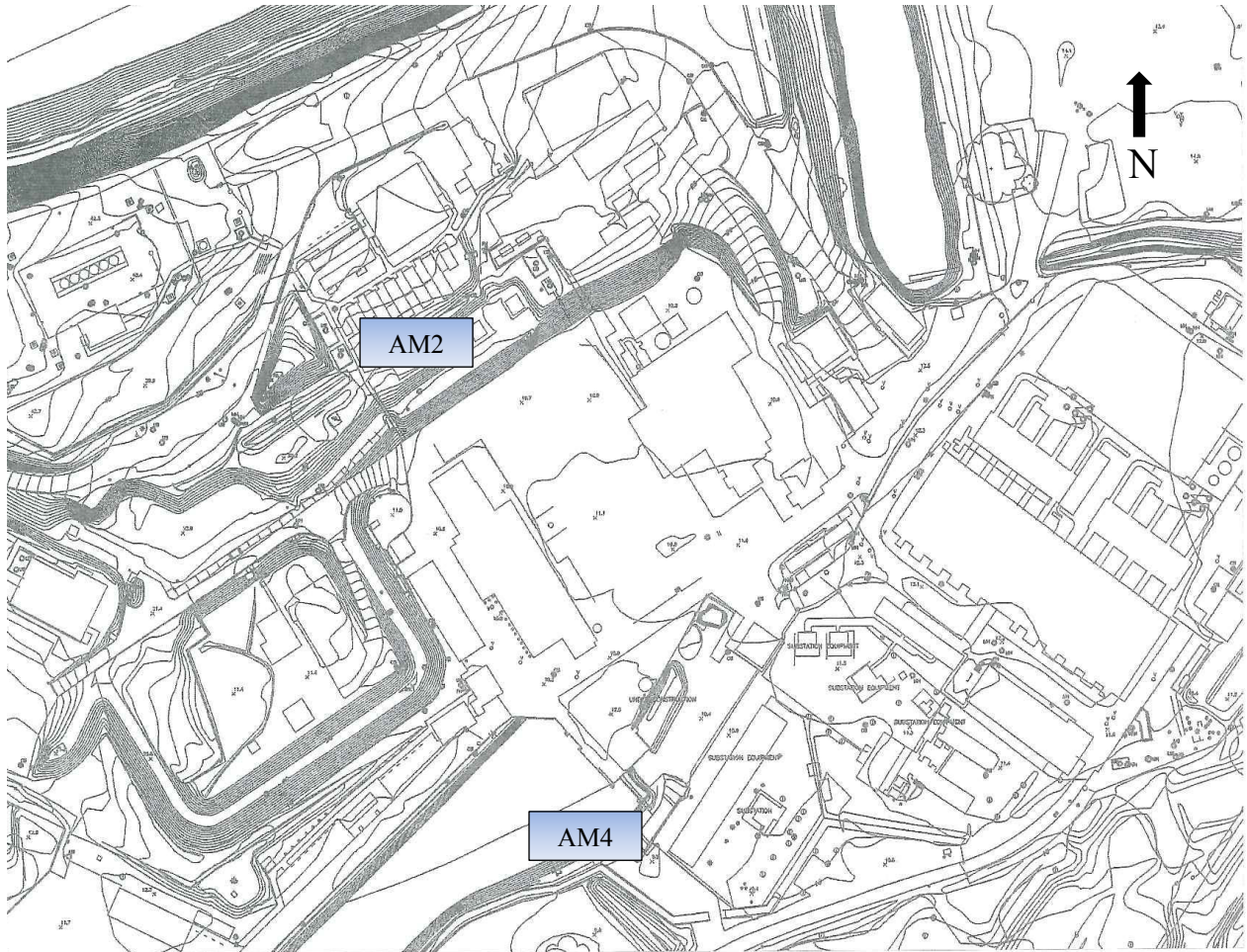
Table C-4 (Continued)
ODCM REQUIRED AIR SAMPLES: RELAY BUILDING (AM4)

Sample Start Date	Alpha Activity (pCi/m ³)	Beta Activity (pCi/m ³)	Composite Gamma Activity (pCi/m ³)	
			Co-60	Cs-137
12/31/2019	< 1.09E-03 (MDA)	5.89E-03 ± 1.26E-03	N/A	N/A
1/8/2020	< 7.25E-04 (MDA)	4.37E-03 ± 1.08E-03		
1/15/2020	< 7.35E-04 (MDA)	6.08E-03 ± 1.22E-03		
1/22/2020	< 8.89E-04 (MDA)	5.45E-03 ± 1.14E-03		
1/29/2020	< 5.50E-04 (MDA)	5.71E-03 ± 1.16E-03		
2/5/2020	< 4.39E-04 (MDA)	6.47E-03 ± 1.22E-03		

Table C-4 Notes

1. HBPP onsite count room building, and equipment are demobilized, beginning fourth quarter 2019, all Air samples were sent to GEL for sample analysis.
2. No quarterly composite samples were counted onsite due to demobilization of onsite lab fourth quarter of 2019.
3. ODCM Revision 32, effective February 2020, removes all remaining air sample locations.

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

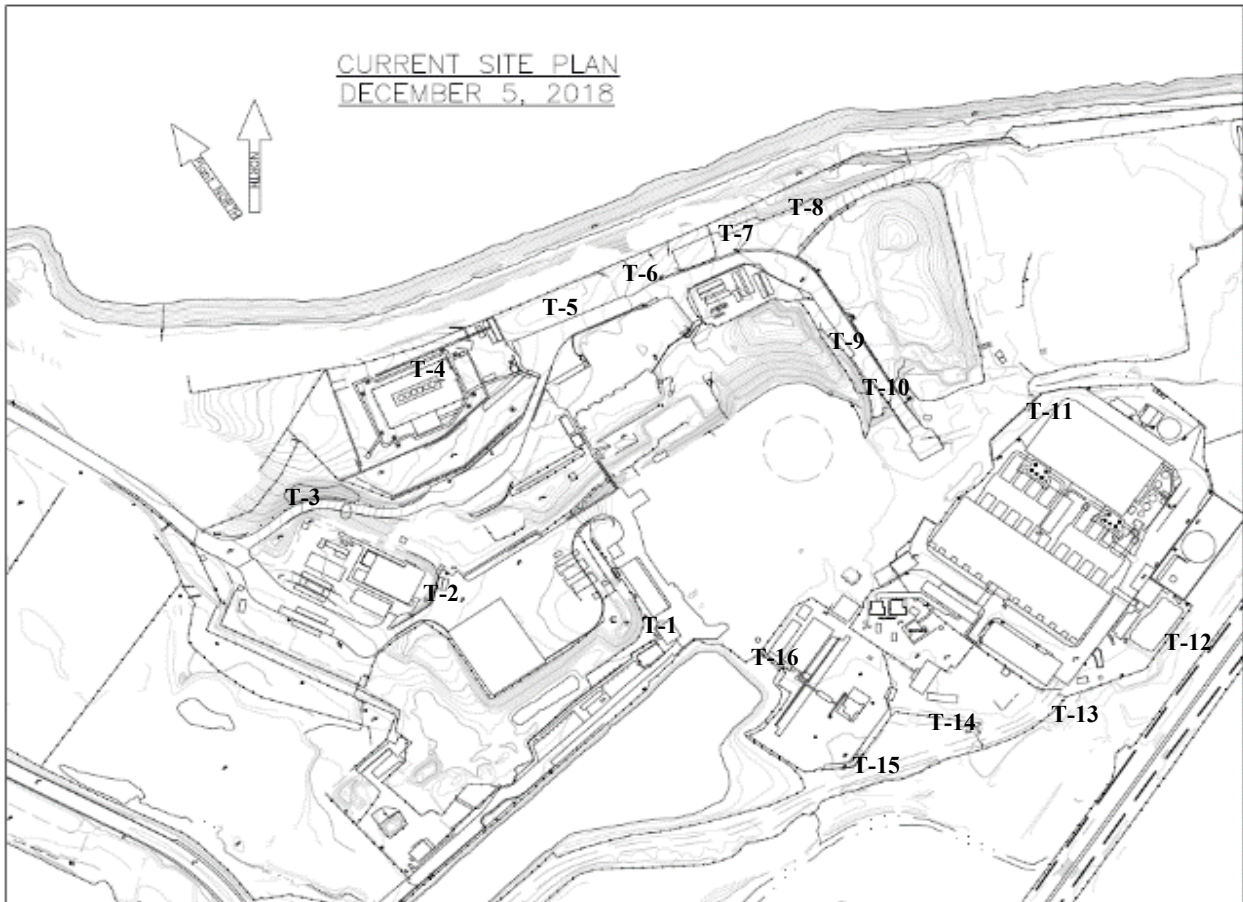


Location Number	GPS Coordinates (NAD83/NAVD88 CA. Zone 1)	
	Easting	Northing
North AM2	5949884	2161067
Relay Bldg. AM4	5949456	2160858

Figure A-1 Note:

1. ODCM Revision 32 (February 2020) removes all remaining air sample locations.

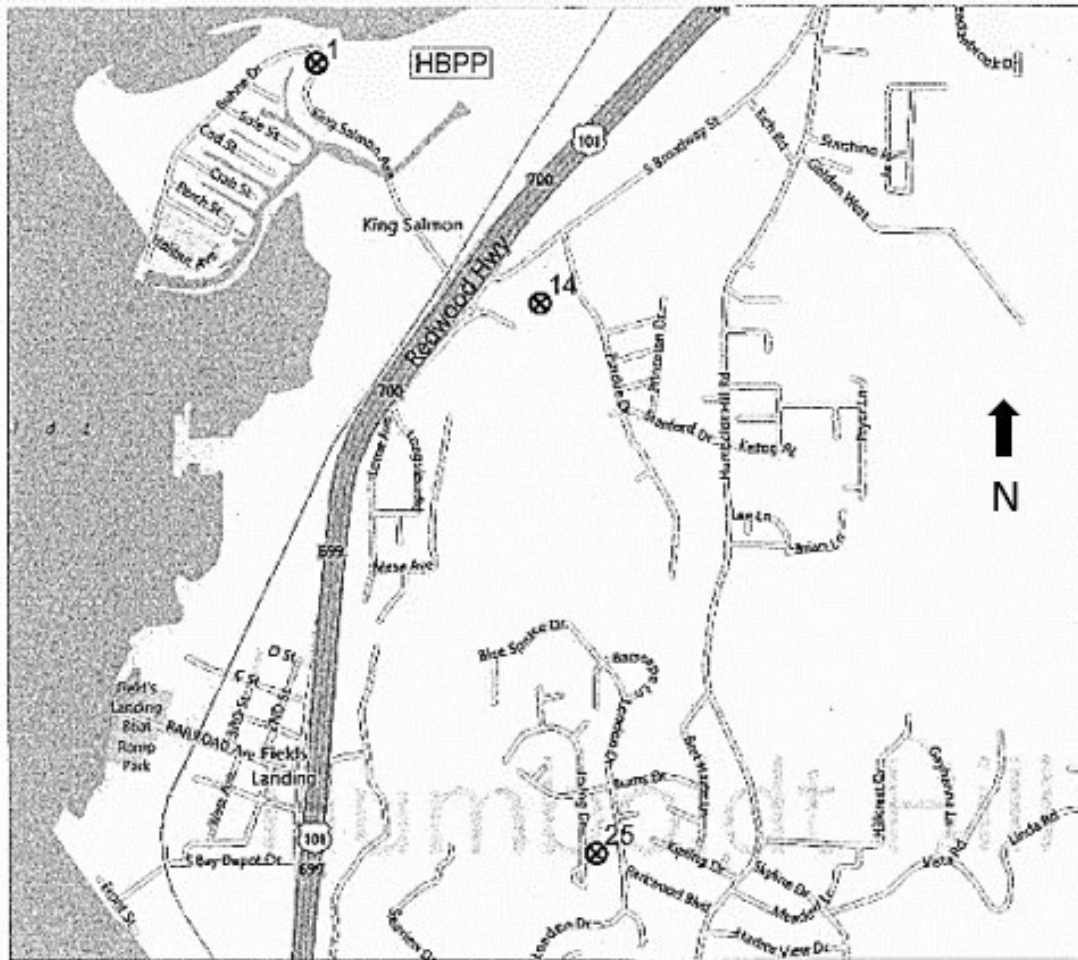
FIGURE A-2
HBPP ONSITE TLD LOCATIONS
Stations T1 – T16 (excluding T17)



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. ODCM Revision 32, effective February 2020, eliminated onsite and offsite TLD locations; however, final TLDs were removed at normal quarter end interval on April 1, 2020.

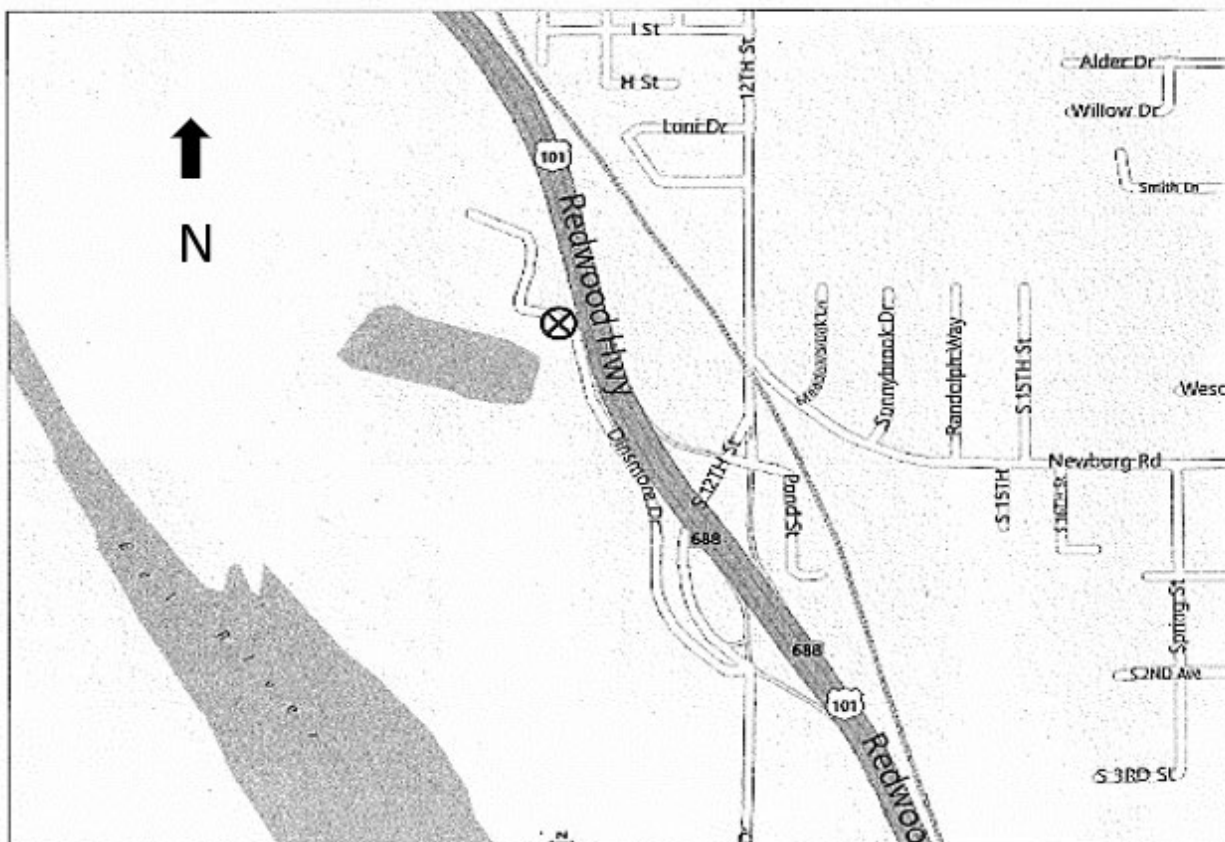
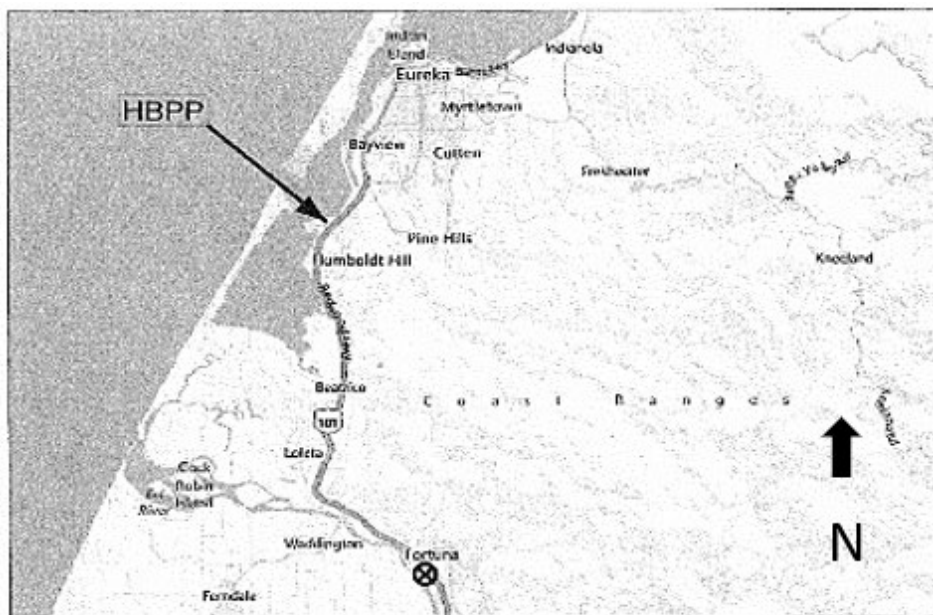
Location Number	GPS Coordinates (NAD83/NAVD88 CA Zone 1)		
	Easting	Northing	Elevation
T1	5949179	2160815	11
T2	5948794	2160911	17
T3	5948610	2161062	42
T4	5948779	2161270	44
T5	5948944	2161301	40
T6	5949140	2161433	36
T7	5949249	2161482	33
T8	5949428	2161435	28
T9	5949478	2161241	23
T10	5949519	2161199	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-3
HBPP OFFSITE TLD LOCATIONS
Stations (1, 14 & 25)



Station	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-3 (Continued)
HBPP OFFSITE TLD LOCATION
FORTUNA (Station 2)




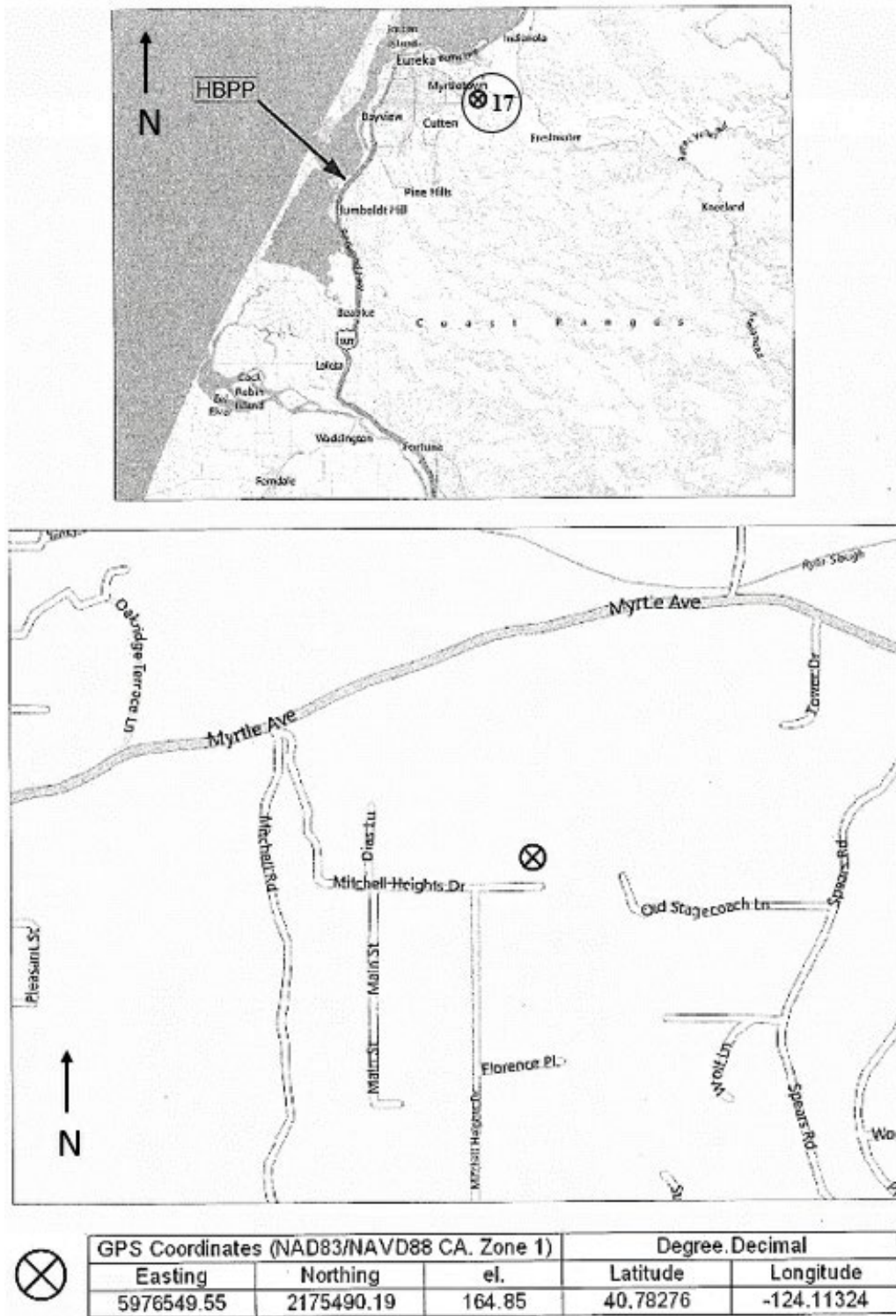
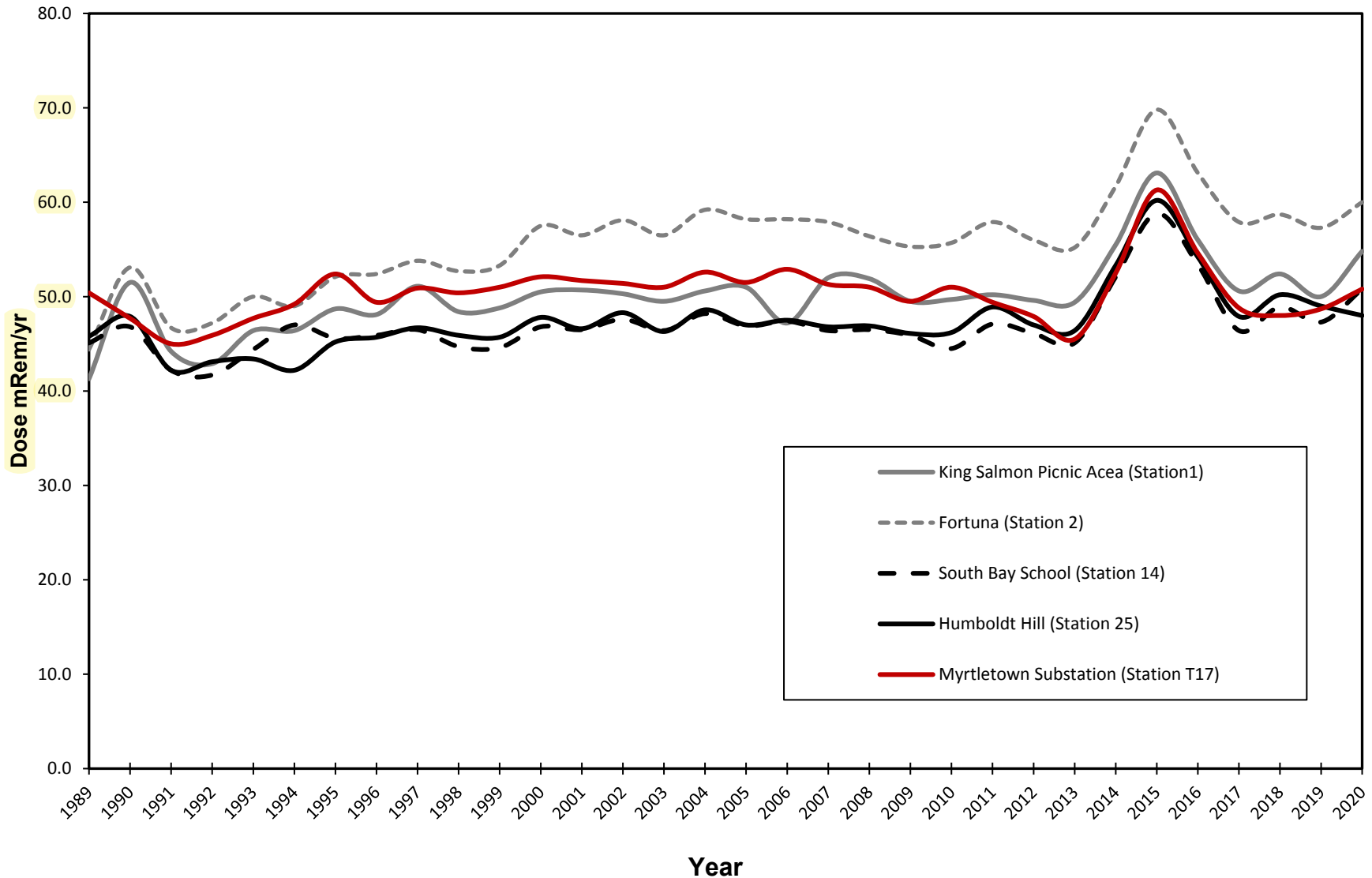
	GPS Coordinates (NAD83/NAVD88 CA. Zone 1)			Degree.Decimal	
	Easting	Northing	el.	Latitude	Longitude
	5962583.86	2105797.82	35.53	40.59057	-124.15746

FIGURE A-3 (Continued)
HBPP OFFSITE TLD LOCATION
EUREKA (Control Location T17)



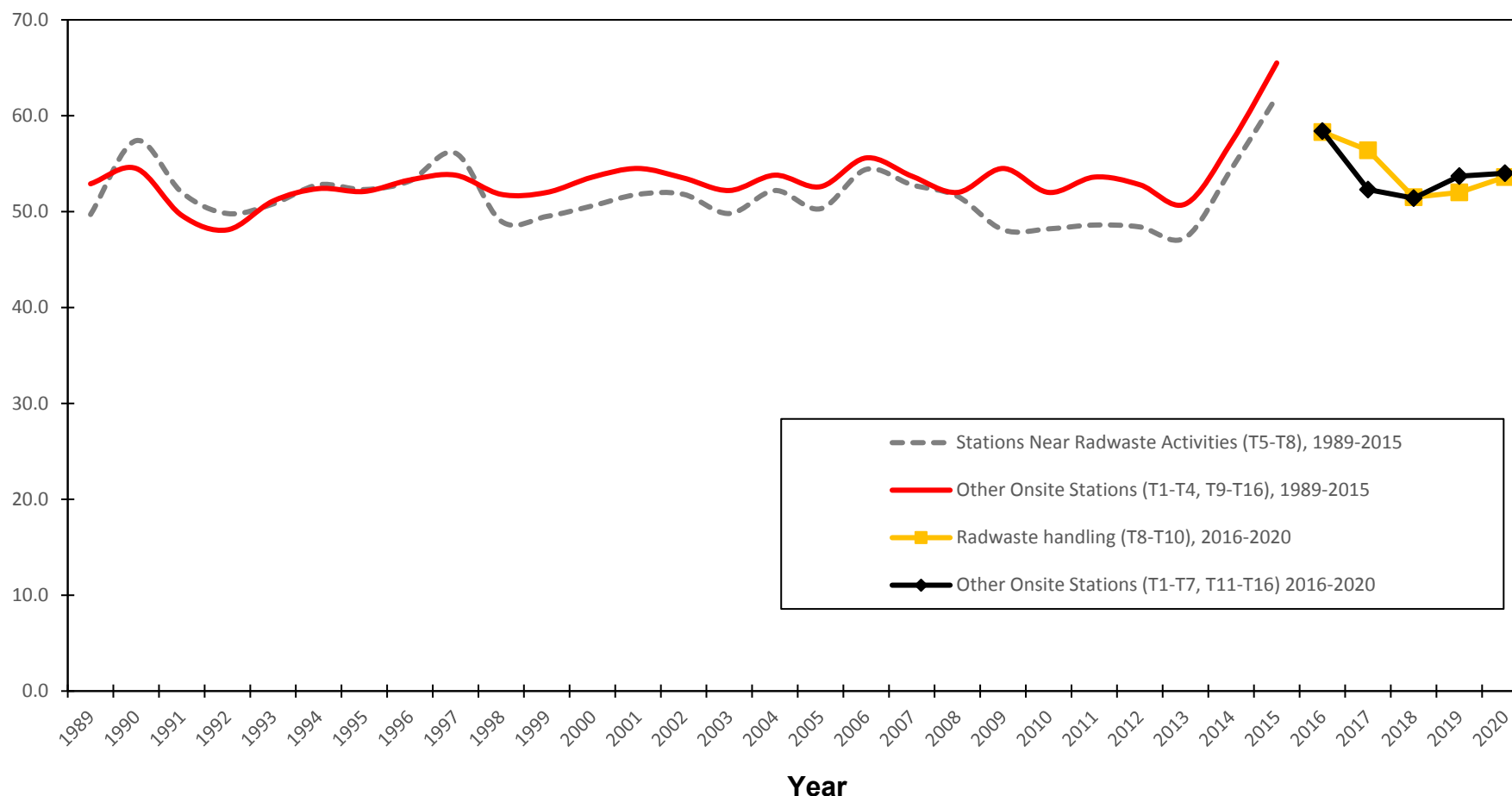
**FIGURE B-1
OFFSITE ENVIRONMENTAL RADIATION LEVEL TRENDS**



ODCM Revision 32, effective February 2020, eliminated onsite and offsite TLD locations; however, final TLDs were removed at normal quarter end interval on April 1, 2020. First quarter of 2020 TLDs results were multiplied by 4, as an estimate, for comparison to historical data and do not reflect actual measured yearly totals.

The baseline values for each location were obtained by averaging the readings at each location from 1977 through 1983. 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**



ODCM Revision 32, effective February 2020, eliminated onsite and offsite TLD locations; however, final TLDs were removed at normal quarter end interval on April 1, 2020. First quarter of 2020 TLDs results were multiplied by 4, as an estimate, for comparison to historical data and do not reflect actual measured yearly totals.

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