SAFETY EVALUATION BY OFFICE OF FEDERAL AND STATE MATERIALS

AND ENVIRONMENTAL MANAGEMENT PROGRAMS

RELATED TO REQUEST FOR 10 CFR 20.2002 ALTERNATE DISPOSAL APPROVAL

AND EXEMPTIONS FROM 10 CFR PARTS 30 AND 70

FOR DISPOSAL OF HUMBOLDT BAY POWER PLANT WASTE

AT THE U.S. ECOLOGY IDAHO FACILITY

PACIFIC GAS AND ELECTRIC COMPANY

HUMBOLDT BAY POWER PLANT, UNIT 3

DOCKET NO. 50-133

Background

On May 2, 2012, Pacific Gas and Electric Company (PG&E) submitted a request for NRC approval of alternate disposal of waste from the Humboldt Bay Power Plant (HBPP) at the US Ecology Idaho (USEI) facility in accordance with 10 CFR 20.2002 (ML12135A295). On July 16, 2012 PG&E submitted answers to NRC staff's questions on the request as well as revisions to the original submittal (ML12241A273).

This request is similar to requests made by PG&E on April 1, 2010 (ML101170554, ML102290019) and June 7, 2011 (ML11160A211, ML120330349) that were approved by the NRC on November 2, 2010 (ML102870344) and April 25, 2012 (ML120620450), respectively. The first 20.2002 request consisted of 200,000 ft^3 (5663 m^3) of waste that was primarily from the non-nuclear Units 1 and 2. The second 20.2002 request was for 2,000,000 ft^3 (56,634 m^3) of waste generated during the demolition of structures at Unit 3 and non-nuclear Units 1 and 2. The current 20.2002 request consists of 100,000 ft^3 (2800 m^3) of soil, concrete, steel, insulation, roofing material, gravel and other debris and 50,000 ft^3 (1400 m^3) of water associated with the decommissioning of Unit 3. The water will be solidified with clay at USEI prior to disposal. Additionally, a small portion of the soil/debris waste (approximately 10%) will also require stabilization treatment prior to disposal. The waste will be transported by truck from HBPP in Eureka, California to the USEI facility Grand View, Idaho in the Owyhee Desert over a minimum of two years. The USEI facility is a Resource Conservation and Recovery Act (RCRA) Subtitle C hazardous waste disposal facility permitted by the State of Idaho. The USEI facility is not an NRC-licensed disposal facility.

To obtain approval for 20.2002 alternate disposals, the NRC requires the licensee to demonstrate that doses will be maintained as low as reasonably achievable (ALARA). The NRC has determined that for 20.2002 alternate disposal approvals this limit requires a licensee to demonstrate that the dose to a member of the public (including all exposure groups) is no more than "a few millirem per year" (see SECY-07-0060, Attachment 1, and NUREG-1757).

To permit disposal at a non-licensed disposal facility, that facility must either obtain an NRC license or an exemption from the NRC licensing requirements. In accordance with the 30.11 and 70.17 exemption provisions, "The Commission may, upon application by an interested person or upon its own initiative, grant such exemption from the requirements of the regulations…as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest."

Source Term

The waste included in the current disposal request contains fission products, activation products, and special nuclear material (SNM) nuclides resulting from operations at Unit 3. The concentrations of radionuclides in the waste were determined through sampling and analysis. The radionuclide concentrations used in the dose calculations were based on the assumption that all of the waste is shipped to the USEI facility at the concentrations listed in Table 1.

Table 1. Source Term Concentration of Radionuclides

Radionuclide	Concentration pCi/g (Bq/g)
Ag-108m	1 (0.037)
Am-241	10 (0.37)
C-14	2 (0.074)
Cm-243	2 (0.074)
Cm-244	2 (0.074)
Co-60	5 (0.185)
Cs-137	15 (0.555)
Eu-152	1 (0.037)
Eu-154	1 (0.037)
Fe-55	20 (0.74)
H-3	100 (3.7)
Ni-63	10 (0.37)
Pu-238	4 (0.148)
Pu-239	4 (0.148)
Pu-240	4 (0.148)
Pu-241	150 (5.55)
Sr-90	5 (0.185)
Tc-99	10 (0.37)
U-234	2 (0.074)
U-235	2 (0.074)
U-238	2 (0.074)

Scenarios, Modeling, and Results

PG&E supplied dose assessments for different possible exposure scenarios for various members of the public. These exposure scenarios include dose to the transportation and USEI workers, post-closure dose to the general public, and intruder scenarios. These dose assessments are similar to those provided by PG&E in the previously approved 20.2002 requests.

Transportation and Worker Doses

The worker scenarios considered in this 20.2002 request are the same as those evaluated in the previously approved requests: truck drivers who transport the waste from HBPP to USEI, surveyor, stabilization cell workers, and waste cell operators.

The shipment of waste from HBPP to USEI is scheduled to occur over two years using a minimum of eight trucks. The soil and debris will be transported in IP-1 intermodal containers loaded on chassis trailers, though some intermodal containers (IMCs) and oversized debris may also be shipped on flatbed trailers. The wastewater will be transported in 5000 gallon (19 m^3) tanker trailers. The transport of the waste to USEI will take approximately 125 IMC shipments for soil and debris (63 shipments per year) and 80 tanker shipments for the wastewater (40 shipments per year). The distance for the trip from HBPP to USEI is approximately 659 miles (1061 km), and the trip is estimated to take 13.18 hours based on an assumed speed of 50 mph (80 km/hr). The conveyances will be verified by the licensee to be in compliance with Department of Transportation external loose surface contamination limits prior to shipping, so it is assumed that there is no internal dose to the driver or members of the public during shipment of the waste. The potential external dose to members of the public during transportation is bounded by the dose to the truck driver since the time of exposure is longer for the truck driver.

The licensee, in consultation with USEI, calculated the dose to three different types of USEI workers. These workers included a surveyor, a stabilization cell worker, and a waste cell operator. The surveyor surveys the waste when it is received at the site. The waste is then taken to the stabilization building for treatment of RCRA hazardous constituents. It is conservatively assumed in this analysis that all waste from HBPP will be stabilized, although only about 10% of the soil and debris will require stabilization and all of the water will be solidified with clay soils. In this scenario the waste is stabilized in a steel lined concrete tank that is located in a building that has a negative pressure system that exhausts air leaving the building through HEPA filters. The stabilization cell worker, who operates an excavator while performing the stabilization work wears a respirator and is in an enclosed cab. After the waste is stabilized, the stabilization cell worker moves the waste from the stabilization tank to trucks for transport to the disposal cell. Once the waste is brought to the disposal cell, the waste cell operator spreads and compacts the waste using a bulldozer. The waste cell operator wears a respirator and is in an enclosed cab.

Table 2 summarizes the job function scenario assumptions. The estimated times of exposure are for one person to perform each function one time. In this analysis, it is assumed that a specific number of workers per year will be available to carry out each of the job functions, and the total dose for the job function is divided equally among all workers within a job function group.

Table 2. Job Function Scenario Assumptions

Job Function	Number of Workers in Group	Time (hrs)	Number of Repetitions per year
IMC Truck Drivers*	8*	13.2	63
Tanker Truck Drivers*	8*	13.2	40
Survey Workers	4	0.08	100
Stabilization Cell Workers	6	0.75	43
Waste Cell Operators	2	0.25	43

* Note that the same drivers may be used for the IMC trucks and the tanker trucks

The method and parameters used by PG&E to calculate the internal dose for the stabilization worker and the truck driver are the same as those used in the previously approved 20.2002 requests. In this assessment, PG&E calculated the internal dose to the stabilization worker from the inhalation of contaminated dust based on an assumed concentration of dust in the building of 0.23 mg/m^3, an assumed inhalation rate of 1.2 m^3/hr, the concentrations of radioactivity in Table 1, and the Environmental Protection Agency's Federal Guidance Report 11 inhalation Dose Conversion Factors (DCFs). The most conservative DCFs were used for all radionuclides except for the plutonium radionuclides. The internal dose calculated for the stabilization cell worker was assumed to bound the inhalation dose for the waste cell operator because the exposure time is longer for the stabilization cell worker and because the stabilization cell worker performs his work indoors. The workers in the stabilization building and disposal cells are required to wear respirators. Credit for the respirators was not taken in the calculation of the internal dose from the inhalation of dust, so the actual inhalation dose would likely be smaller than was calculated. The inhalation dose to the truck drivers and surveyors was assumed to be zero because the waste is going to be transported in a strong-tight container that is verified to be in compliance with Department of Transportation (DOT) external loose surface contamination limits.

PG&E used MicroShield 7.02 to calculate the external doses for the workers. The parameters used to estimate the external dose were identical to those used in the analysis provided in response to the Requests for Additional Information (RAIs) for the June 7, 2011 request (ML120330349) except for:

- the orientation of the stabilization operator in relation to the waste; and
- the area of the waste that the cell operator is exposed to (i.e., the size of the lift).

The NRC staff performed a sensitivity analysis to determine the effect of these changes and found that neither of these changes has a significant effect on the calculated dose. In both cases, PG&E stated in its RAIs response for the current 20.2002 request (ML12241A273) that it believes that the revised parameters are more appropriate.

The internal, external, and total doses estimated for the workers from the waste in this 20.2002 request are presented in Table 3.

Table 3. Annual Dose per Person for Individual Job Function

Job Function	Internal Dose mrem/yr (mSv/yr)	External Dose mrem/yr (mSv/yr)	Total Dose mrem/yr (mSv/yr)
IMC Truck Driver*	0 (0)	7.85×10^{-2} (7.85×10^{-4})	7.85×10^{-2} (7.85×10^{-4})
Tanker Truck Driver*	0 (0)	2.11×10^{-1} (2.11×10^{-3})	2.11×10^{-1} (2.11×10^{-3})
Surveyor Worker	0 (0)	1.81×10^{-2} (1.81×10^{-4})	1.81×10^{-2} (1.81×10^{-4})
Stabilization Cell Worker	1.59×10^{-2} (1.59×10^{-4})	1.57×10^{-2} (1.57×10^{-4})	3.16×10^{-2} (3.16×10^{-4})
Waste Cell Operator	1.59×10^{-2} (1.59×10^{-4})	9.67×10^{-3} (9.67×10^{-5})	2.56×10^{-2} (2.56×10^{-4})

* Note that the same drivers may be used for the IMC trucks and the tanker trucks, so these doses may be additive

NRC staff performed independent calculations of the external doses using MicroShield 5.05 and obtained results within 5% to 10% of the licensee which demonstrates the acceptability of the licensee's calculations. In addition, NRC staff performed independent calculations of the internal dose and obtained results within 5% to 10% of the licensee, which again demonstrates the acceptability of the licensee's calculations. Additionally, the NRC staff performed an independent assessment of the internal dose using the more conservative DCFs for plutonium. The NRC staff found that the dose calculated using these DCFs was still much less than one millirem.

Since the disposal of the waste included in the previously approved 20.2002 requests for HBPP is still ongoing, there is some potential for the USEI workers to receive a dose both from the waste in the previously approved 20.2002 requests and the current 20.2002 request during the same year. Because the truck driver dose is the maximum dose to a worker in this request and in the two previously approved requests, the maximum dose to a worker from all three is limited by the number of shipments that can be made with the same eight drivers. PG&E estimated that the maximum number of shipments that can be made with eight drivers is 400. PG&E anticipates that with eight drivers there would be a maximum of 60 water shipments per year and a maximum of 340 soil/debris shipments per year. Based on this, PG&E estimated that the maximum dose to the truck drivers would be 0.6 mrem/ yr (6.0×10^{-3} mSv/yr). In its current request, PG&E noted that adding any additional shipments would require more drivers, so the dose per individual driver would not increase.

The NRC staff notes that the doses to the truck drivers estimated by PG&E are all less than one millirem, so even if a truck driver could receive the whole dose from the waste in all three 20.2002 previously approved and current requests in one year, the dose would still be consistent with the "few millirem" criteria. Similarly, if any of the USEI workers were to receive the whole dose from all three in one year, the dose would still be less than one millirem. Therefore, based on the results of the dose assessment for the USEI and transportation

workers in the current 20.2002 request, as well as the results in the previously approved HBPP 20.2002 requests, the NRC staff finds that the dose to the workers will be within the "few millirem" criteria.

Post-Closure Dose

PG&E evaluated the post-closure dose to a member of the public at the USEI site using RESRAD Version 6.5. This analysis used the resident farmer scenario and the pathways modeled included external gamma exposure, inhalation, and plant, meat, milk, drinking water, and soil ingestion. The parameter values used in this assessment were the same as those used in the previously approved HBPP 20.2002 requests.

In the current assessment, PG&E performed two analyses for the post-closure dose to a member of the public. In the first assessment PG&E assumed that all of the waste in this 20.2002 request is spread over the entire landfill (i.e., an area of 88,221 m^2 and a depth of 33.6 m). In the second assessment, PG&E assumed that the waste was concentrated in a smaller portion of the disposal site, resulting in less dilution. In this assessment, PG&E assumed that the waste was shipped over a period of two months instead of two years, and the waste was diluted over the total waste expected to be disposed at USEI over a two month period. The NRC staff notes that the calculation of the dilution factor for the concentrated scenario provided in this submittal did not include the inventory from the waste water disposed. However, the dilution factor for the concentrated scenario was also calculated based on a volumetric dilution instead of on a mass-based dilution, which would be more appropriate for diluting mass-based concentrations. These two issues approximately counteract each other, so the effect on the dilution factor used in this request submittal was not significant.

The maximum dose PG&E calculated using RESRAD for the first scenario was 3.82×10^{-2} mrem/yr (3.82×10^{-4} mSv/yr) which occurred 247 years following closure of the facility. The maximum dose calculated for the concentrated scenario was 1.59×10^{-1} mrem/yr (1.59×10^{-3} mSv/yr) which occurred 246 years after the facility closed. NRC staff performed independent RESRAD calculations and obtained results within 5% to 10% of the licensee, which demonstrates the acceptability of the licensee's calculations.

The total peak post-closure dose to the member of the public from the waste in this 20.2002 request and from the previously approved HBPP requests is from the groundwater-dependent pathways. Therefore, there is some potential for the member of the public to receive the dose from all three previously approved and current disposal requests. However, the predicted doses in all three are much less than one millirem, so the combined dose would also be less than one millirem and is consistent with the "a few millirem per year" criteria.

Inadvertent Intruder Dose

PG&E calculated the potential dose to a post-closure intruder using the methods in NUREG-0782. For these calculations, PG&E used the intruder construction scenario, which assumes that a house is constructed on the site in the future and that the waste is contacted during excavation of the basement and placement of utilities. Since the thickness of the cap is more than 3 meters, it is unlikely that the excavation for construction of a house with a basement would be deep enough to result in intrusion into the waste, so the well driller

construction scenario is more likely for the inadvertent intruder at this site. However, the dilution of the waste would be higher for the well driller scenario, so the dose from the well driller scenario is bounded by the intruder construction scenario. PG&E used pathway dose conversion factors (PDCFs) from NUREG/CR-4370 in these calculations and did not take credit for the dilution of the waste in the disposal cell. Based on this analysis, PG&E estimated the post-closure dose to an inadvertent intruder to be 3.44 mrem/yr (3.44 x 10^{-2} mSv/yr). The NRC staff performed independent calculations of the intruder dose using the same methodology and obtained similar results. However, in reviewing the current 20.2002 request, the NRC staff discovered that there was an error in the intruder dose spreadsheet that the NRC staff did not find during the two previous reviews. The reported intruder doses in the previous requests were 0.134 mrem/yr (1.34 x 10^{-3} mSv/yr) and 0.147 mrem/yr (1.47 x 10^{-3} mSv/yr), but the correct intruder dose for these previous requests is approximately 1.5 mrem/yr (1.5 x 10^{-2} mSv/yr) for each request.

NRC staff performed an independent sensitivity analysis of the dose for an intruder resident farmer scenario. In this scenario, a resident farmer receptor was assumed to drill a 100 m well through a one foot lift of the waste. The material in these drill cuttings was assumed to be spread on the surface, and the receptor was assumed to live and farm on soil containing the cuttings. The calculate dose for this scenario was less than one millirem per year.

In the inadvertent intruder scenario, an individual would only receive a cumulative dose from the waste in this request and the previously approved HBPP requests if the individual intruded into all three sets of waste during the same year, which is not a likely scenario. However, the dose would still be within the few millirem per year limit even in the unlikely event that an intruder intruded into all three sets of waste.

As a result of the calculations described above, NRC staff finds that the potential dose to an inadvertent intruder is consistent with the “few millirem per year” requirement.

Criticality Safety Assessment

NRC staff reviewed the criticality safety assessment for PG&E’s request. PG&E demonstrated subcriticality of the proposed alternate disposal by comparison to previously approved material to be disposed of at the USEI facility. The concentration of fissile material expected to be present in the HBPP Unit 3 Decommissioning Project waste material is less than 1.0 g/m^3, of which more than 99% is ^{235}U; less that 1% is ^{239}Pu and ^{241}Pu. This concentration is more than 100 times less than the 0.1 g/L value previously approved for disposal of decommissioning waste at USEI. The staff finds that this concentration of Special Nuclear Material will be adequately subcritical under all disposal conditions, and that alternate disposal of HBPP Unit 3 Decommissioning Project waste at the USEI facility is appropriate from a criticality safety perspective.

10 CFR 30.11 and 70.17 Exemptions

In accordance with the 30.11 and 70.17 exemption provisions, “The Commission may, upon application by an interested person or upon its own initiative, grant such exemption from the requirements of the regulations…as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest.”

When evaluating exemption requests in conjunction with 20.2002 alternative disposal requests, the NRC has applied a similar standard to the both reviews. As discussed above, the NRC applies a dose standard of "not more than a few millirem per year" to any member of the public to its 20.2002 alternate disposal reviews. In this case, the NRC has found that the disposal of this waste at USEI would meet the criteria for 20.2002 alternative disposal. Therefore, the NRC concludes that granting an exemption to USEI to accept this material for disposal is authorized by law, poses no danger to public health and safety, does not involve information or activities that could potentially impact the common defense and security of the United States, and it is in the public interest to dispose of wastes in a controlled environment such as that provided by the licensed, state-regulated landfills. Therefore, to the extent that this material authorized for disposal in this 20.2002 authorization is otherwise licensable, the NRC is granting USEI an exemption from the licensing requirements in 10 CFR Parts 30 and 70 for the receipt and possession of the radioactive material described in PG&E's 20.2002 alternative disposal request.

Conclusions

PG&E requested that NRC approve alternate disposal, in accordance with 10 CFR 20.2002, for 100,000 ft^3 (2800 m^3) of soil and debris and 50,000 ft^3 (1400 m^3) of water associated with the decommissioning of HBP Unit 3 at the USEI facility near Grand View, Idaho. PG&E has provided an adequate description of the waste to be disposed of and the proposed manner and conditions of waste disposal.

NRC staff has evaluated the potential doses associated with transportation, waste handling and disposal as a part of the review of this 10 CFR 20.2002 request. As described above, NRC staff found that the projected doses to individual transportation and USEI workers have been appropriately estimated and are demonstrated to meet the NRC's alternate disposal requirement of contributing a dose of not more than "a few millirem per year" to any member of the public. Independent review of the post-closure and intruder scenarios confirmed that the maximum projected dose over a period of 1,000 years is also within "a few millirem per year". As described above, the potential cumulative dose from the waste in this disposal request plus the dose from the waste in the previous disposal requests is also within a "few millirem per year."

NRC staff also concluded that, in accordance with 10 CFR 30.11 and 10 CFR 70.17, this material for disposal will not endanger life or property or the common defense and security and disposal is otherwise in the public interest.

Accordingly, pursuant 10 CFR 20.2002, 10 CFR 30.11 and 10 CFR 70.17, the approval and exemption are granted and effective immediately.

Principal Contributors: Karen Pinkston, FSME
Andrew Barto, NMSS
John Hickman, FSME

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