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DRC-2023-078524

December 12, 2023

CD-2023-247

Mr. Doug Hansen, Director
Division of Waste Management and Radiation Control
P.O. Box 144880
Salt Lake City, UT 84114-4880

Subject: Federal Cell Facility Application: Responses to the Director's Request for Information Request for Information - DRC-2023-003329

Dear Mr. Hansen,

EnergySolutions hereby responds to the Utah Division of Waste Management and Radiation Control's April 24, 2023, Request for Information (RFI) on our Federal Cell Facility Application.¹ A response is provided for each request using the Director's assigned reference number.

Appendix AB

Operational Period Modelling

AB-2: Calculation of potential radionuclide concentrations in the groundwater, surface water, biota, and air pathways are conducted for the Federal Cell Facility using the waste inventory and other applicable parameters from the Depleted Uranium (DU) PA v2.0. The modeling is performed using RESRAD OFFSITE version 4.0. Please clarify the intended purpose of the RESRAD modeling and include justification for why RESRAD was used instead of GoldSim if only radionuclide concentrations in groundwater, surface water, biota, and air are of interest.

NUREG-1199, section 6.1.3 calls for the license application to: "Provide a reasonable, yet conservative, assessment of radioactivity release into each of the most significant radioactivity transport mechanisms for each of the five periods of concern in the life of the disposal facility. The most significant radioactivity mechanisms include groundwater, air, surface water, direct radiation, and biotic pathways." The RESRAD-OFFSITE modeling was conducted in this context as a protective, screening-level evaluation of radionuclide concentrations from possible releases during an assumed 20-year operational period of the Federal Cell Facility. "Operational period", in this context, is conceptualized to be the time from initial waste placement within an area of the cell until the time final cover is completed for that area.

Considering more limited uncertainty associated with the short and closely monitored operational period compared with the 10,000-year post-closure period modeled in the DU PA, the additional infrastructure associated with a GoldSim model was excessive. The domain of the GoldSim model developed to support the Performance Assessment does not include the operational period, when an active disposal cell has no cover, nor the surface water retention pond that is maintained during operations. The RESRAD-OFFSITE code is suitable for addressing the transport pathways pertaining to the operational period and has

¹ Hansen, D.J. "Federal Cell Facility Application Request for Information." via DRC-2023-000525 from the Utah Division of Waste Management and Radiation Control to Vern Rogers of EnergySolutions, January 19, 2023.

been developed to support relatively simple screening-level evaluations. RESRAD-OFFSITE was the software selected for these reasons.

AB-3: *It is unclear how long of an operational period was modeled. For example, the Groundwater section on page 2 states "...within 50 years of operations..." and "...within an assumed 20-year operating period...", and the Pond Biota section states: "Over a 20-year modeling period..." Additionally, every graph included in the appendix appears to include data up to approximately 25 years. Please clarify what time period was assumed for modeling and include the correct time period in the graphs.*

An operational period of 20 years was assumed for the modeling, based on expectations of anticipated waste disposals provided by EnergySolutions. Since the length of time is uncertain, results are shown for a modeling period of 25 years.

AB-4: *The graph in the Groundwater section (page 2 of the Clive Operational Period RESRAD Analysis) does not adequately show the relevant information discussed in the preceding text. It is said that Tc-99 reaches groundwater at year 35, and that the well Tc-99 concentration is approximately 0.006 pCi/L at 40 years, however the x-axis does not reach these time periods, and the y-axis is excessively large.*

Per response to comment AB-3, the anticipated length of the operational period for the Federal Cell Facility is 20 years. Model results were generated and graphically displayed for a 25-year period. Because no radionuclides reach groundwater during the 25-year modeling timeframe the scale of the y-axis for well water concentrations was simply set as 0 to 1 pCi/L. The revised RESRAD-OFFSITE model applies the 1-ft clay layer (referred to as Liner Protective Cover in the facility design – specification 55 in the Federal Cell Facility Construction Quality Assurance / Quality Control Manual – Application Appendix C) that will be required above the 2-ft engineered clay liner, resulting in significantly longer times before any contaminants reach groundwater (assuming no cover exists and taking no credit for containers restricting release of radionuclides to groundwater).

AB-5: *Please provide the justification for assigning a leach rate of 0.01/yr for Tc99 and I-129 rather than using Kd values like the other modeled radionuclides. The second paragraph of page one states that using a leach rate of 0.01 for the other radionuclides (i.e., all but Tc-99 and I-129) would result in unrealistically high leaching from the contaminated zone, what is the justification for 0.01/yr not being unrealistically high for Tc-99 and I-129?*

Tc-99 and I-129 are the most soluble of the radionuclides modeled for the Federal Cell Facility, and therefore the most likely to impact groundwater. The rate of release of any radionuclide to the environment from the disposal cell is a function of the release rate from containers used for disposal. The rate of leaching from containers to groundwater for these soluble radionuclides was defined as a first-order process with a rate of 0.01/year applied to the activity remaining in the container at any time. Assigning this leach rate to less-soluble radionuclides, which have essentially no probability of impacting groundwater because of partitioning in the vadose zone, would reduce the amount of activity available for their release to the atmosphere and to surface water runoff. For a screening-level evaluation, it is more protective to use K_d -based leach rates for the less-soluble radionuclides because this

results in higher ambient air and retention pond concentrations than assuming that container releases are controlled by leaching.

In the revised modeling, K_d -based leach rates have been applied to all radionuclides. Practically, this means that no “credit” is taken for the effect of a container in controlling the availability of any radionuclide for release to the environment. If a container were assumed to delay release, groundwater concentrations would increase later in time.

AB-6: It appears that the waste is modeled to begin leaching immediately after placement. Please provide justification for this assumption.

This same protective assumption that has been required by the director for all of EnergySolutions' prior license-supporting performance assessments is invoked here because of uncertainty in the probability of container failure over time. No credit is taken for a presumed period of container integrity.

AB-7: A screening calculation of potential radionuclides in various pathways was conducted for the Federal Cell Facility using the waste inventory and other applicable parameters from the Depleted Uranium PA v2.0. Please provide the radionuclide inventory used in the model.

A table showing the derivation of the radionuclide inventory used in the RESRAD-OFFSITE model has been included for the revised modeling.

AB-8: A number of the values used in the RESRAD model are referenced as RESRAD default values in the RESRAD-OFFSITE v4.0 Clive Operational Period Model Parameter Values table. Please provide justification for how the RESRAD default values for the applicable parameters listed in the parameters table are descriptive/accurate for the site.

The RESRAD inputs table has been edited to provide explanations for the use of RESRAD default values for certain inputs.

AB-9: The dimensions for the Federal Cell in the Depleted Uranium PA are 374 m by 585 m, but in the RESRAD model the active area modeled was only 30.48 m by 30.48 m. Even though a smaller portion of the overall cell may be open at a given time for waste placement, an area larger than this will contain waste for a majority of the operating period. Please provide justification for the contamination dimensions.

The operational contaminated zone in RESRAD-OFFSITE was represented as a 100 ft by 100 ft (30.48 m by 30.48 m) disposal cell with a waste thickness of 1 m (roughly equivalent to the height of a container used for shipping DU). These dimensions pertain to the waste actively being placed within the embankment (assumed to be directly affected by transport via leaching, surface water runoff, and atmospheric dispersion with no influence of temporary or final cover). In the revised RESRAD modeling, the 2.4-m thickness of the completed disposal cell equivalent to that assumed in the DU PA has been applied. In addition to modeling of radionuclide transport from an assumed open disposal area of 100 ft by 100 ft, the effects of differing operational disposal practices is examined by modeling performed for varied open disposal areas of one-quarter, one-half, and 100% of the surface area of the Federal Cell.

AB-10: *A small pond (southwest corner pond) southwest of the facility was included in the RESRAD model. Please provide justification for the location and size of the modeled surface water body.*

The dimensions of the storm water retention pond are based on an existing permitted stormwater retention pond (i.e., the 2000 Pond referenced in Ground Water Quality Discharge Permit No. UGW450005). Any prior reference to the southwest corner pond, which is not permitted to receive water that has been in contact with waste, has been removed.

AB-11: *There are several citations included in the table of RESRAD parameters, but no reference list is provided. Please include a complete list of references cited in this appendix.*

The revised report, Clive Operational Period RESRAD Analysis, May 2023, includes a reference list.

AB-12: *The length parallel to aquifer is set to 30.48 m, however, for a majority of the Federal Cell's operational period, it is likely that a longer portion of the cell will contain waste. Please provide justification for this assumption.*

The operational contaminated zone in RESRAD-OFFSITE was represented as a 100 ft by 100 ft (30.48 m by 30.48 m) disposal cell with a waste thickness of 1 m (roughly equivalent to the height of a container used for shipping DU). These dimensions pertain to the waste actively being placed within the embankment (assumed to be directly affected by transport via leaching, surface water runoff, and atmospheric dispersion with no influence of temporary or final cover). In the revised RESRAD modeling, the 2.4-m thickness of the completed disposal cell equivalent to that assumed in the DU PA has been applied. In addition to modeling of radionuclide transport from an assumed open disposal area of 100 ft by 100 ft, the effects of differing operational disposal practices is examined by modeling performed for varied open disposal areas of one-quarter, one-half, and 100% of the surface area of the Federal Cell.

AB-13: *The clay liner unsaturated zone included in the model is set to a thickness of 1 foot, however, Section 1.2.3 of the application states the clay liner is 2 feet. Please provide justification for the clay liner thickness used.*

The revised RESRAD-OFFSITE model correctly applies the required 1-ft clay liner protective cover layer above a 2-ft engineered clay liner between the disposed waste and the native unsaturated zone.

AB-14: *Tc-99 reaches groundwater, which arrives in about model year 35. Please provide the depth below the bottom line of the cell to groundwater (water elevation) and the thickness of the unsaturated zone below the Federal Cell?*

The depth between the bottom of the cell liner and groundwater is 3.93 m thick. This also the thickness of the unsaturated zone below the Federal Cell.



Mr. Doug Hansen
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If you have further questions regarding the additional responses to the director's requests of DRC-2023-003329, please contact me at (801) 649-2000.

Sincerely,

Vern C.
Rogers

Vern C. Rogers
Director, Regulatory Affairs

Digitally signed by Vern C. Rogers
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ou=Waste Management Division,
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enclosure

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.