Comments

E-0026/009

It [the EIS] fails to disclose the impacts of hazardous chemical waste buried with radioactive waste.

E-0047/031

SAC - SWEIS must include all the potential COCs of radionuclides and chemicals. The current approach is limited to uranium and technetium. Contaminants such as I-129, Pu, Cs, etc.

E-0053/002

Incredibly, USDOE's Performance Assessment – relied upon for the HSWEIS – totally ignores the presence of hazardous wastes in the Low-Level Burial Grounds.

L-0044/010

The EIS addresses risk in terms of the risk from release of radiochemicals only. No explanation or justification is provided for USDOE's omission of risk from nonradioactive chemical wastes. The risk assessment cannot therefore be considered to be complete, absent an evaluation of risk from those wastes.

L-0044/017

Appendix I/I.29- I.35: Only risk from radiochemicals is addressed. There should be an explanation why USDOE believes non-radiochemical hazardous waste is addressed in the analysis of HSW EIS alternatives. 1998. GUIDELINES FOR ECOLOGICAL RISK ASSESSMENT. USEPA EPA/630/R095/002F. 01 Apr 1998. U.S. Environmental Protection Agency, Risk Assessment Forum, Washington, DC, 175 pp.

L-0044/032

CRD, p. 3.90 (Re: Comment # 74) With the exception of uranium, ecological risks to nonradionuclide chemicals (e.g., carbon tetrachloride, PCBs, nitrate, metals) appear not to have been evaluated. At least for inorganics (e.g., heavy metals), rationale for this omission is lacking.

TRI-0001/011

Some of the hazardous wastes known to be present in the burial grounds but not disclosed and not discussed again are mercury, beryllium, nitric acid, phosphoric acid, sulfuric acid, dibutyl phosphate, carbon tetrachloroethylene, trichlorethylene, xylene and toluene. And we also have asbestos. None of these are described, nor the hazards of working around them, which is a necessary part [of the HSW EIS impact analyses].

TSE-0008/001

One [concern] is that the EIS states that only uranium is considered for nonradiological as well as radiological risk. But I think Strontium also should be included, because Strontium is very near calcium in the tables, in fact it is right above it, it replaces calcium in the bones, and even if it is not radioactive, it is dangerous. Another thing is I don't think light pollution considerations and smells were addressed at all. I think there is probably incredible amounts of light out there and effects it has on the circadian, circadian cycles of plants and animals, there is very little research on that, from what I can tell. And the last thing was that I don't think that there's, I didn't see any comment at all about the effect of the groundwater contamination on micro-organisms in the air. I think that should be dealt with, too.

TSP-0001/005

Unlined trenches. When I saw pictures from the 1940s and 1950s about just dumping cans, 50 gallon cans of chemicals and radioactive materials into ditches, I thought that was just absurd. I was surprised to learn that this process continues to be going on. As pointed out, this is not something that's acceptable with chemicals in your backyard. It's not accepted by cities. It's not accepted by states. But it somehow continues to be accepted by the federal government.

Impact Evaluation

TSP-0015/005

And then finally is the mercury and other elements that might be leaking into the soil. Those need to be included. Their assessments need to be included in the EIS, because not too many people are aware of this, but Spokane has the second highest M.S. caseload in the entire world, and they don't know why, but mercury just happens to have the exact same symptoms, mercury poisoning, as M.S. So that's something else for you to look at.

Response

The LLBGs contain over 100 radioactive and non-radioactive constituents that potentially could impact groundwater. Screening of these constituents considered a number of aspects that included (1) their potential for dose or risk, (2) their decay or degradation rates, (3) their estimated inventories, and (4) their relative mobility in the subsurface system within a 10,000-year period of analysis. Establishing the relative mobility of each contaminant, they were grouped based on their mobility in the vadose zone and underlying unconfined aquifer. Contaminant groupings were used, rather than the individual mobility of each contaminant, primarily because of the uncertainty involved in determining the mobility of individual constituents. The waste constituents were grouped according to estimated or assumed Kd of each constituent.

Based on an assumed infiltration rate and estimated levels of sorption and associated retardation, the estimated travel times of a number of constituents through the thick vadose zone to the unconfined aquifer beneath the LLBGs were calculated well beyond the 10,000-year analysis. Thus, these constituents were eliminated from further consideration. Of the remaining constituents, technetium-99, iodine-129, carbon-14, and uranium isotopes were considered of sufficient quantity and mobility to warrant detailed analysis of groundwater impacts. Selenium and chlorine, while mobile, were screened out because their total inventories were less than 0.01 Ci. Tritium and cesium were not evaluated because of their relatively short half-lives. Plutonium was screened out because of its lack of mobility.

Hazardous chemicals in MLLW have been characterized and documented since the implementation of RCRA at DOE facilities beginning in 1987. MLLW currently in storage, and MLLW that may be received in the future, would be treated to applicable state or federal standards for land disposal. Therefore, disposal of that waste is not expected to present a hazard over the long term because the hazardous constituents would either be destroyed or stabilized by the treatment. Inventories of hazardous materials in stored and forecast waste are either very small, or consist of materials with low mobility. See Volume II Appendixes F and G.

Inventories of hazardous chemicals in waste were not generally maintained by industries in the United States prior to the implementation of RCRA. Consistent with these general practices, inventories of hazardous chemicals in radioactive waste were not required to be determined or documented before the application of RCRA to radioactive mixed waste at DOE facilities in late 1987. Wastes placed in the LLBGs before late 1987 have not been specifically characterized for hazardous chemical content, but they have been evaluated in the EIS alternatives relative to their radionuclide inventories. In addition, preliminary estimates of chemical inventories in this waste have been developed for analysis in the HSW EIS, and a summary of their potential impacts on groundwater has been added to Volume I Section 5.3 and Volume II Appendix G.

In addition, the October 23, 2003 Settlement Agreement contains proposed milestones in the M-91-03-01 Tri-Party Agreement Change Package for retrieval and characterization of suspect TRU waste retrievably stored in the Hanford LLBGs (United States of America and Ecology 2003). As part of that agreement, DOE will manage the retrievably stored LLBG waste under the following assumptions: (1) all retrievably stored suspect TRU waste in the LLBGs is potentially mixed waste; and (2) retrievably stored suspect TRU waste will be managed as mixed waste unless and until it is designated as non-mixed through the WAC 173-303 designation process.

Interactions among different types of waste that could potentially mobilize radionuclides have also been considered as part of the HSW EIS analysis. However, such interactions typically require specific chemical environments or large volumes of liquid as a mobilizing agent, neither of which are known to be present in the solid waste disposal facilities currently in use (see discussion in Volume II Appendix G). Possible effects of this type could be mitigated by selecting candidate disposal sites to avoid placing waste in locations where previous contamination exists.

Waste sites and residual soil contamination remaining at Hanford over the long term, and which are not specifically evaluated as part of the HSW EIS alternatives, have been evaluated previously as part of NEPA or CERCLA reviews. In those studies, the risks associated with older solid waste burials, tank waste residuals and leaks, and contaminated soil sites were found to be very small, even for alternatives that considered stabilization of the waste in place (DOE 1987, DOE and Ecology 1996, Bryce et al. 2002). Further evaluation of tank wastes is anticipated in the "Environmental Impact Statement for Retrieval, Treatment, and Disposal of Tank Waste and Closure of Single-Shell Tanks at the Hanford Site" (68 FR 1052). The cumulative groundwater impacts analysis in the HSW EIS also includes those wastes, as described in Volume I Section 5.14 and Volume II Appendix L.

DOE plans to characterize pre-1970 inactive burial grounds and contaminated soil sites, as well as the active LLBGs considered in the HSW EIS alternatives, under the RCRA past practice or CERCLA processes to determine whether further remedial action would be required before the facilities are closed. As part of that process, the long-term risks from these wastes would either be confirmed to be minimal, or the waste would be remediated by removal, stabilization, or other remedial actions to reduce its potential hazard. In all cases, the impacts from these previously disposed wastes would be the same for all alternative groups considered in the HSW EIS, and would not affect the comparisons of impacts among the alternatives or the decisions made regarding disposal of waste received in the future.

Iodine-129 inventories have been estimated and included in the cumulative groundwater impacts analysis. See Volume I Section 5.14 and Volume II Appendix L.

Potential adverse impacts posed by future releases of contaminants to aquatic and terrestrial species known to occur in the Columbia River and its riparian corridor were analyzed in an ecological risk assessment framework. The risk assessments conducted for this analysis of impacts generally follow U.S. Environmental Protection Agency (EPA) guidance for conducting such assessments (EPA 1992, 1998) and the corresponding Hanford Site risk assessment methodology (DOE-RL 1995).

Comments

L-0055/023

Other radionuclides could similarly have an impact. However, they were not included in the analysis. For example, even though tritium is short lived, it does have an effect on living tissue. But this is but one of many that was not included in this EIS analysis. Thus it seems this EIS may be flawed and should be withdrawn.

L-0055/043

Many of the other radionuclides were not included in this EIS. It is our belief that this may even be an understatement of the number of fatalities that would result from the disposal of the MLLW and the LLW at Hanford.

Response

The LLBGs contain over 100 radioactive and non-radioactive constituents that potentially could impact groundwater. Screening of these constituents considered a number of aspects that included (1) their potential for dose or risk, (2) their decay or degradation rates, (3) their estimated inventories, and (4) their relative mobility in the subsurface system within a 10,000-year period of analysis. Establishing the relative mobility of each contaminant, they were grouped based on their mobility in the vadose zone and underlying unconfined aquifer. Contaminant groupings were used, rather than the individual mobility of each contaminant, primarily because of the uncertainty involved in determining the mobility of individual constituents. The waste constituents were grouped according to estimated or assumed Kd of each constituent.

Based on an assumed infiltration rate and estimated levels of sorption and associated retardation, the estimated travel times of a number of constituents through the thick vadose zone to the unconfined aquifer beneath the LLBGs were calculated well beyond the 10,000-year analysis. Thus, these constituents were eliminated from further consideration. Of the remaining constituents, technetium-99, iodine-129, carbon-14, and uranium isotopes were considered of sufficient quantity and mobility to warrant detailed analysis of groundwater impacts. Selenium and chlorine, while mobile, were screened out because their total inventories were less than 0.01 Ci. Tritium and cesium were not evaluated because of their relatively short half-lives. Plutonium was screened out because of its lack of mobility.

Iodine-129 inventories have been estimated and included in the cumulative groundwater impacts analysis. See Volume I Section 5.14 and Volume II Appendix L.

An expanded discussion of uncertainties associated with the HSW EIS impact analyses is included in Volume I Section 3.5.

Comments

TSP-0010/004

It seems unreal not to have some idea of the half-life of low-level waste before it's stored.

Response

The half-lives of radionuclides are shown in the Volume I Reader's Guide. The majority of curies in waste are from strontium and cesium. Ten half-lives is the general rule of thumb to calculate when radioactivity will approach zero.

Comments

TSP-0007/001

The Record of Decision. I think that it should have an input that recognizes the vulnerability of children, and I think there should be a table that very simply lists what are every chemical, every chemical that is involved in all of the kinds of waste. Don't ignore some. Just because they are awkward. Every chemical. Every radioactive, every bad material. And list what are the generally accepted limits. And then give information as to how the DOE is going to protect the children of America from these hazardous things.

Response

Chemical and radionuclide contaminants in waste streams are listed in Volume II Appendix F.

Estimates of cancer risk in populations represent composites that account for the range in sensitivities of various members of the population, including children as well as adults.

Design features built in to the alternatives and potential mitigation measures discussed in Volume I Section 5.18 are developed to protect all people, including children, and the environment. For further information on radiation risk results for children can be found in Volume II Appendix F Section F.1.8.

Comments

L-0044/039

CRD, p. 3.94 (Re. Comment # 88) Although the revised document is improved, it remains difficult (in some cases) to link health assessment methods (e.g., source term characterization, COPC identification) with risk results. For example, which nonradionuclide contaminants contribute to cancer risk and noncancer HQ results in Tables 5.30, 5.50, and 5.68?

Response

Chemical and radionuclide contaminants in waste streams are listed in Volume II Appendix F.

The text in Volume II Appendix F describes the deviations from the Hanford Site Risk Assessment Methodology (DOE-RL 1995) guidance. Specifically, the HSW EIS analysis was performed for a one-year period instead of the 30-year HSRAM period, and the HSW EIS used radiation dose factors and health effects conversion factors instead of the slope factors suggested for use in the HSRAM. These deviations were required in order to evaluate radiation doses on an annual basis.

Comments

E-0038/002

Please, take this opportunity to make the right decisions by considering the impact on human life, our animals, our water supply and our soil.

Response

DOE will consider the impacts presented in this EIS in making decisions about the proposed action and alternatives.

Volume II Appendix F describes the methods used to evaluate health impacts of the HSW EIS alternative groups. Volume II Appendix F describes normal impact assessment methods, accident assessment impact methods, intruder impact assessment methods, and long-term impacts from waterborne pathways.

Volume II Appendix I provides information about potential impacts to terrestrial and aquatic ecological resources that may result from implementation of HSW EIS alternatives. Potential impacts to terrestrial resources were evaluated in the near term (i.e., during waste management operations and under current conditions). Potential impacts would result primarily from surface disturbances associated with excavation and disposal activities. Potential impacts to Columbia River riparian and aquatic resources could occur in the long term, i.e., up to 10,000 years following the conclusion of waste management operations. These would be primarily the result of the eventual migration of radionuclides and other hazardous chemicals through the vadose zone to groundwater and on to the Columbia River.

Comments

THR-0021/001

And do you know what I find that is just totally amazing, is that they refer in their risk assessment to assume that the river is ever going to change over time. They refuse to assume that the dams are going to come out and there could be catastrophic flooding. So, when you think of the waste that they are digging down 15 feet and cleaning up the first part of the contamination, the next 20 feet that's still highly contaminated is going to be affected if there is catastrophic flooding or if the river changes in elevation constantly, because let's say they want to save a lot of salmon and they increase the flow. But in their modeling they refuse to assess that.

Response

In the event of a catastrophic flood, the impacts from the flood itself, would be greater on the human populations and the environment than the consequences of releasing radionuclides and chemicals from waste sites. Evaluations of catastrophic flood scenarios (glacial floods, Grand Coulee Dam failure) in the HDW EIS Appendix R, "Assessment of Long-Term Performance of Waste Disposal Systems" (DOE 1987) indicated that catastrophic flooding would not be a plausible release event for sites within the 200 East or 200 West Areas.

Comments

L-0041/019

Appendix F, Section F.1.6, page F.44 discussed the fact that the EIS analysis deviated from the Hanford Site Risk Assessment Methodology Report (DOE-RL 1995), but does not explain why.

Response

The text in Volume II Appendix F describes the deviations from the Hanford Site Risk Assessment Methodology (DOE-RL 1995) guidance. Specifically, the HSW EIS analysis was performed for a one-year period instead of the 30-year HSRAM period, and the HSW EIS used radiation dose factors and health effects conversion factors instead of the slope factors suggested for use in the HSRAM. These deviations were required in order to evaluate radiation doses on an annual basis.

Comments

L-0041/020

Page F.47, Section F.2, lines 12-18 states that adjustments in Safety Analysis Report accident scenarios were needed for this analysis but doesn't discuss what adjustments were made or why they were necessary for this EIS.

Response

Based on the existing safety analyses, additional information required for NEPA analysis was provided. See Volume II Appendix F Section F.2.

Comments

L-0044/034

CRD, p. 3.91 (Re: Comment # 80) It would be helpful to specify a systematic method for extrapolating a literature-based toxicity value to a usable LOEC [Lowest Observed Effects Concentration] or NOEC [No Observed Effects Concentration] (i.e., quantifying an appropriate "uncertainty factor").

Response

The toxicity value endpoint extrapolation techniques used in the HSW EIS are based on the techniques used by Dourson and Stara in their report "Regulatory History and Experimental Support of Uncertainty (Safety) Factors" (Dourson and Stara, 1983). They are also consistent with the methods used in the "Final Screening Assessment and Requirements for a Comprehensive Assessment - Columbia River Comprehensive Impact Assessment " DOE-RL (1998).

Comments

L-0044/035

CRD, p. 3.92 (Re: Comment # 82) Although the comment is addressed for uranium isotopes in a qualitative manner, a quantitative assessment is lacking for release of contaminants in cementicious waste.

Response

See Volume II Appendix G, Section G.1.3.3.1 for discussion of uranium release model and Volume II Appendix G, Section G.1.3.3.2 for discussion of cement release model for other radionuclides.

Comments

L-0044/036

CRD, p. 3.92 (Re: Comment # 84) Although the inventory for Hg may be small, a Kd specific to the various forms of Hg (e.g., divalent, methylated, etc.) should be used, if available.

Response

The mercury waste would be chemically stabilized, consistent with land disposal restrictions, prior to disposal. See Volume II Appendix G Section G.1.3.1.

Comments

L-0044/122

The HSW EIS must separate the results of SAC-SW EIS assessment from the other site wide assessments (these may include the solid waste sites, as well) so that one can compare and contrast its impact. At present the SAC- REV0 and the current approach of SW-EIS differs not only in terms of time frames (10,000 yrs. for SW-EIS vs. 1,000 yrs. for SAC Rev.0), but also in other input parameters such as the inventories, release mechanisms, number of contaminants (cemented vs. non cemented), etc.

L-0044/123

The SAC results in the HSW EIS must come up with a credible assessment to compare results with historical field data (history match) specific to solid waste origin. This will be very challenging considering the lack of data/knowledge gaps and what SAC can achieve at this time.

L-0044/124

The concept of "aggregated areal foot print" may not provide a conservative picture for the calculation. One must examine these inventories carefully, and see how they were released and its impact.

Response

The SAC, as a groundwater modeling capability, is being continuously refined. The initial SAC assessment (Bryce et al. 2002) demonstrated that a relatively small number of input parameters could determine most of the variability in calculated performance measures. SAC has been updated since the initial assessment and, for purposes of the HSW EIS, an additional 25 runs were made for this EIS using the more refined model. It was observed that when the performance measure is human dose, variability with regard to individual behavior and exposure affects uncertainty in the estimated dose more than variability in inventory, release, or environmental transport of the contaminants. Based on this observation, the HSW EIS evaluated several different exposure scenarios to address this uncertainty. Exposure scenarios included: drinking water, resident gardener, resident gardener with sauna/sweat lodge, and industrial worker.

Comments

L-0044/120

The main purpose of the cumulative impact assessment is to have a broad assessment of the total collective cumulative impact on the human health and the environment. While the System Assessment Capability (SAC) seems to be the right tool for this analysis, the analysis failed to provide the desired results of total cumulative impacts from the current and future waste of these burial grounds under different alternative scenarios. The current analysis simply illustrates how the tool could provide a meaningful cumulative impact taking uranium and technetium as an example. A complete analysis with the aim of total cumulative impact assessment using the SAC tool would provide a better understanding and should be attempted in the future. We request that USDOE make the following revisions in the total cumulative impact assessment that will help make the HSW-EIS results more understandable.

The EIS must include all of the radionuclides and chemicals that are potential contaminants of concern (COC's). The current approach is limited to uranium and technetium. Contaminants such as I-129, Pu, and Cs should be addressed. The analysis ignores the inventories and associated impacts of the huge amount of chemicals known to be disposed at the solid waste burial grounds (e.g., one report shows the disposal of about 6.2 tons of nitrate at solid waste burial grounds). The report does mention sufficient data on chemical inventories are not available (p. l-9, Appendix L.2.2) to carry out a broad assessment made by SAC. Ecology strongly disagrees with the approach and finds the current evaluation to be grossly inadequate. A complete collective cumulative assessment must include all known and expected waste inventories at the site. Ecology believes that there is significant impact on the human health and the environment not only from the inventories of radionuclides, but also from the chemicals. The cumulative impact of chemicals is expected to extend quite far from the facilities and the point of compliance, at least on a short term basis.

Response

The SAC, as a groundwater modeling capability, is being continuously refined. The initial SAC assessment (Bryce et al. 2002) demonstrated that a relatively small number of input parameters could determine most of the variability in calculated performance measures. SAC has been updated since the initial assessment and, for purposes of the HSW EIS, an additional 25 runs were made for this EIS using the more refined model. It was observed that when the performance measure is human dose, variability with regard to individual behavior and exposure affects uncertainty in the estimated dose more than variability in inventory, release, or environmental transport of the contaminants. Based on this observation, the HSW EIS evaluated several different exposure scenarios to address this uncertainty. Exposure scenarios included: drinking water, resident gardener, resident gardener with sauna/sweat lodge, and industrial worker.

The LLBGs contain over 100 radioactive and non-radioactive constituents that potentially could impact groundwater. Screening of these constituents considered a number of aspects that included (1) their potential for dose or risk, (2) their decay or degradation rates, (3) their estimated inventories, and (4) their relative mobility in the subsurface system within a 10,000-year period of analysis. Establishing the relative mobility of each contaminant, they were grouped based on their mobility in the vadose zone and underlying unconfined aquifer. Contaminant groupings were used, rather than the individual mobility of each contaminant, primarily because of the uncertainty involved in determining the mobility of individual constituents. The waste constituents were grouped according to estimated or assumed Kd of each constituent.

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Impact Evaluation

Plutonium was screened out because of its lack of mobility.

Hazardous chemicals in MLLW have been characterized and documented since the implementation of RCRA at DOE facilities beginning in 1987. MLLW currently in storage, and MLLW that may be received in the future, would be treated to applicable state or federal standards for land disposal. Therefore, disposal of that waste is not expected to present a hazard over the long term because the hazardous constituents would either be destroyed or stabilized by the treatment. Inventories of hazardous materials in stored and forecast waste are either very small, or consist of materials with low mobility. See Volume II Appendixes F and G.

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In addition, the October 23, 2003 Settlement Agreement contains proposed milestones in the M-91-03-01 Tri-Party Agreement Change Package for retrieval and characterization of suspect TRU waste retrievably stored in the Hanford LLBGs (United States of America and Ecology 2003). As part of that agreement, DOE will manage the retrievably stored LLBG waste under the following assumptions: (1) all retrievably stored suspect TRU waste in the LLBGs is potentially mixed waste; and (2) retrievably stored suspect TRU waste will be managed as mixed waste unless and until it is designated as non-mixed through the WAC 173-303 designation process.

Interactions among different types of waste that could potentially mobilize radionuclides have also been considered as part of the HSW EIS analysis. However, such interactions typically require specific chemical environments or large volumes of liquid as a mobilizing agent, neither of which are known to be present in the solid waste disposal facilities currently in use (see discussion in Volume II Appendix G). Possible effects of this type could be mitigated by selecting candidate disposal sites to avoid placing waste in locations where previous contamination exists.

Waste sites and residual soil contamination remaining at Hanford over the long term, and which are not specifically evaluated as part of the HSW EIS alternatives, have been evaluated previously as part of NEPA or CERCLA reviews. In those studies, the risks associated with older solid waste burials, tank waste residuals and leaks, and contaminated soil sites were found to be very small, even for alternatives that considered stabilization of the waste in place (DOE 1987, DOE and Ecology 1996, Bryce et al. 2002). Further evaluation of tank wastes is anticipated in the "Environmental Impact Statement for Retrieval, Treatment, and Disposal of Tank Waste and Closure of Single-Shell Tanks at the Hanford Site" (68 FR 1052). The cumulative groundwater impacts analysis in the HSW EIS also includes those wastes, as described in Volume I Section 5.14 and Volume II Appendix L.

DOE plans to characterize pre-1970 inactive burial grounds and contaminated soil sites, as well as the active LLBGs considered in the HSW EIS alternatives, under the RCRA past practice or CERCLA processes to determine whether further remedial action would be required before the facilities are closed. As part of that process, the long-term risks from these wastes would either be confirmed to be minimal, or the waste would be remediated by removal, stabilization, or other remedial actions to reduce its potential hazard. In all cases, the impacts from these previously disposed wastes would be the same for all alternative groups considered in the HSW EIS, and would not affect the comparisons of impacts among the alternatives or the decisions made regarding disposal of waste received in the future.

Impact Evaluation

Iodine-129 inventories have been estimated and included in the cumulative groundwater impacts analysis. See Volume I Section 5.14 and Volume II Appendix L.

Comments

E-0053/003

As noted earlier, the Maximum Concentration Limit (MCL) under the Safe Drinking Water Standard, utilized by EPA and Washington State for Superfund and MTCA standards, is based on a maximum dose of 4 mrem per year. At Table 4-22, USDOE provides "Radionuclide Dose Estimates for Groundwater Pathways". Doses exceeding 4 millirem per year are shown for: C14; Cl36; Tc99; I129; Se79; Np137; Pa231; U[.]

The total cumulative dose – not shown in the Performance Assessment – from the groundwater pathways would equal >9E+4 mrem/year. The MCL standard would be 4E+1. In plain language, the MCL will be exceeded by three magnitudes.

Response

Table 4-22 in the 200 West PA analysis provides an example of how doses are calculated for individual isotopes for a given set of assumed disposal conditions. An example calculation is provided in the following paragraph. For comparison with the 4-mrem/yr benchmark drinking water limit, the groundwater drinking water dose estimate for the total waste inventory currently disposed in the 200 West Area burial grounds is 0.22 mrem/yr, of which Tc-99 contributes 0.018 mrem/yr.

The groundwater doses in the Hanford Performance Assessment for the Disposal of Low-Level Waste in the 200 West Burial Grounds were calculated using a Unit Inventory Methodology, which can then be scaled to estimate doses for the actual LLBG inventory at any point in time. The Unit Inventory Methodology calculation for groundwater produced a dose of 76 mrem as listed in table 4-22 for TC-99, based on an assumed disposal of 1 Ci of Tc-99 with no mitigation credit taken for the waste form. To derive this value, one Ci of Tc-99 is assumed to be disposed in a 1 meter wide section of a trench with a Category 1 cover over the disposed waste which allows a 5 cm/yr infiltration rate. These conditions are described in the paragraph above the table on page 4-48. With these conditions assumed, the appropriate dilution factor is multiplied by the inventory (1 Ci) to determine the peak groundwater condition. Dilution factors for various disposal conditions are listed in several tables in Volume II Appendix D. For this example, the appropriate factor value is listed in Table D-2 for run 1a (page D-22). The dilution factor value is 7.96e-5 which means that 1 Ci of an isotope disposed in the facility results in a peak concentration of 7.96e-5 Ci/m^3 (7.96e+4 pCi/L).

To convert the peak concentration to a dose estimate, we assume that the exposed individual consumes 730 L/yr (also identified on page 4-48). If so, the individual ingests 5.8e +7 pCi in a year. The dose is determined by taking the product of activity ingested and the dose conversion factor for Tc-99 which is 1.3 e-6 mrem/pCi (page C-16). This yields the estimated dose of 76 mrem/yr.

Table 4-22 merely provides an example of how doses are calculated using the PA dose estimating methodology. The PA analysis evaluated numerous disposal conditions with this methodology, which is applicable to all disposal conditions considered. Actual disposal conditions (e.g., inventory, waste form performance, cover performance) are not represented by this table. However, this methodology has been and continues to be used to quantify dose estimates for actual conditions which remain in compliance with DOE Order 435.1 (DOE 2001b).

Comments

L-0044/137

Per WAC 197-11-440(6)(e), significant impacts on both the natural environment and the built environment listed in WAC 197-11-444 must be analyzed, if relevant. Ecology noted that the following areas lack the depth of analysis required to fully describe significant impacts:
• Groundwater movement/quantity/quality that would be affected by presence of chemicals known to have been buried in the Low Level Burial Grounds.
• Fragmentation or loss of habitat that could adversely affect both native vegetation and animals with the large areas designated as sites for modular combined use facilities.
• Use of a new waste treatment plant to treat wastes.
• Potential toxic air emissions resulting from the use of pulse driers to treat disposal facility leachate when ETF closes.

Response

An expanded discussion of impacts from chemicals in groundwater is included in Volume I Section 5.3 and Volume II Appendix G. Impacts on habitats are discussed in Volume I Section 5.5 and Volume II Appendix I. Impacts of constructing and operating the new waste processing facility are addressed in Volume I Section 5.11 and Volume II Appendix F. Impacts from air emissions are discussed in Volume I Section 5.2 and Volume II Appendix E. MLLW is treated to meet land disposal restrictions prior to disposal and toxic air emissions resulting from the use of pulse driers would not be a concern.

Comments

E-0043/071, EM-0217/071, EM-0218/071, L-0056/071, LM-0017/071, LM-0018/071

The HSW EIS accident analysis should include chemical waste and should not assume that all wastes are treated within land disposal restrictions.

Response

The accident analyses in the HSW EIS do address chemical constituents and do not assume all mixed wastes are treated (See Volume II, Appendix H).

Comments

E-0041/008

In response to a question about the long-term mutational effects of radionuclides, the answer makes clear that such a possibility has never been assessed.

Response

The human health impacts are discussed in Volume I Section 5.11 and Volume II Appendix F.

Comments

E-0041/009

A long answer about 'beyond design basis accidents' (Beyond DBAs) ends with the statement that 'Beyond DBAs are not evaluated for external events'; a foolhardy policy, and no mistake. Considering only the risks from sub-critical extraterrestrial impactors, for example, the Journal of the British Interplanetary Society has devoted several issues to assessing the likelihood and consequences of subcritical impactors (see, for example, the Dec 1998 issue—if you haven't access to a copy, let me know and I'll send you a copy of the table of contents via s-mail, and copy any requested articles.) These discussions make a casual dismissal of external risks unpardonable—Hanford is not in an alternate universe somewhere, after all—it's on Earth, and millions of people live in its shadow in the event of a catastrophic failure.

Impact Evaluation

Response

DOE believes it has evaluated the appropriate range of reasonably foreseeable accidents in the HSW EIS. See Volume I, Section 5.11 and Volume II, Appendix F.

Comments

L-0044/014

Ecology does not disagree with the USDOE's selection of the ILAW waste form with Tc-99 present; however, we would like to reiterate that the Tc-99 should be removed from the tank waste prior to vitrification. We have sent several letters to the Office of River Protection on this subject. If the Tc-99 is not removed from the waste, picking a ILAW disposal location in 200 West is not viable. Tc-99 is the contaminant of concern related to the ILAW as far as potential future groundwater impacts- it drives the groundwater risk.

Response

The HSW EIS evaluates, for all alternatives, a maximum inventory of Tc-99 in ILAW that assumes the Tc-99 is not removed prior to vitrification. For comparison, the preferred alternative evaluates both the maximum inventory of Tc-99 and a lower inventory of Tc-99 in ILAW that assumes the Tc-99 is removed prior to vitrification.

Comments

E-0044/004

It is deceptive to not clearly describe the risks portrayed and to include them as a part of the uncertainty analysis.

The SAC model includes a vast number of undocumented and untested assumptions. Each of these may drastically alter the results of the model.

The SAC model excludes the lessons learned from the detailed U-Code analysis of the groundwater model.

The risk analysis that forms the heart of the EIS is invalid and unreliable. The EIS should be withdrawn.

Response

DOE has embarked on an initiative to strengthen the technical defensibility of the site-wide groundwater flow and contaminant transport model. The initiative also involves developing a more robust capability to incorporate uncertainty into the models. One aspect of the initiative is developing and using a three-dimensional transient inverse model approach to estimate the hydraulic conductivities, specific yields, and other site-wide scale parameters, including their uncertainties. This is done by using data on the transient behavior of the unconfined aquifer system resulting from Hanford Site waste management practices since 1943.

The initial baseline transient inverse calibration effort (Cole et al. 2001b), which provides the basis for the model used in this EIS, substantially improved the capability of the baseline model over the prior model documented in Cole et al. (1997) in simulating historical trends in water-table changes over the entire site for the entire 1943-1996 period of calibration. The most notable improvements were in the historical trends of water table changes and mound building observed near major discharge facilities in the 200 West Area. The resulting baseline inversed model used in the HSW EIS assumes that the underlying basalt system provides an impermeable base to the unconfined aquifer. The inverse modeling analysis acknowledges the potential importance of the underlying basalt system to the overall flow system, and that quantification of this basalt leakage cannot be directly measured and is therefore uncertain.

More recent inverse modeling efforts (Vermeul et al. 2001) investigated the effects of inter-communication between the unconfined aquifer and the underlying upper basalt confined aquifer to determine whether the inclusion of basalt leakage could improve parameter estimates and results, and the overall model fit. Incorporating basalt leakage in the site-wide model was accomplished by adding the following intercommunication mechanisms to the baseline inverse model in steps designed to investigate each feature's sensitivity and relationship with other estimated parameters: (1) hydraulic head dependent, areal distributed leakage through the basalt confining layer; (2) increased leakage at an erosional window near Gable Mountain/Gable Butte; (3) increased leakage at a smaller erosional features near B-Pond; and (4) increased leakage along two fault zones.

Results of this inverse modeling effort showed that the simulated distribution of basalt leakage over the model domain was generally consistent with the conceptual model of basalt intercommunication described in Appendix B of Cole et al. (2001a), with downward leakage occurring throughout the area affected by the groundwater mounds resulting from 200 Area wastewater disposal activities and upward leakage occurring throughout the eastern portion of the site. The upward leakage throughout the eastern part of the site is consistent with the current conceptual understanding that the Pasco Basin represents a regional discharge point for the basalt system into the surficial sediments and eventually the Columbia River. Of the different types of basalt interaction mechanism, areal leakage was found to be the dominant intercommunication flux followed by the fault fluxes and the erosional windows flux. This is consistent with previous interpretations documented in Cole et al. (2001a).

It has been suggested in a comment on the HSW EIS that "the total volume of water upwelling through the basalt is approximately equal to the input from surface water infiltration, and that surface water infiltration is two to three times as large as had been previously believed." This is not consistent with the results of the model analysis. The time-weighted average basalt leakage flux contributing to aquifer recharge is only about 10 percent of flux associated with natural recharge (Vermeul et al. 2001). The flux for basalt interaction, which is dominated by areal leakage, ranged from 1,000 to 2,000 m3/d over the simulation period. The flux attributable to natural recharge over the modeled region is on the order of 25,000 m3./day.

Graphical and statistic comparisons illustrate that, over the entire prediction period, a slight measurable improvement in overall model fit was realized for the alternative conceptual model (ACM-1) with basalt interaction over that observed for the baseline inverse model. However, the most noteworthy improvements in the ACM-1 transient inverse calibrated model are not associated with overall model fit, but with incorporation of a more realistic conceptual model

The HSW EIS evaluates impacts using two alternative flow model conditions and a range of assumed flow conditions. DOE has used of this type of approach in previous analyses and intends to continue evaluation of additional alternative conceptual models for use in planned site-wide assessments such as the Composite Analysis. The baseline model was selected for use in the HSW EIS after it produced reasonable results of tritium plume transport when compared to historical tritium plume observations and interpretations in its application in the SAC Initial Assessment (Bryce et al. 2002). The ability of the alternative conceptual model incorporating intercommunication with the basalt system to simulate past tritium plume behavior is currently under evaluation. Comparisons of pre-Hanford water table conditions using the baseline model, and the alternative conceptual model with basalt interaction, suggest very similar flow conditions, and provide a general indication of expected post-operational Hanford water table conditions. See Volume II Appendix G.

Risk analysis is used throughout the HSW EIS. See Volume I Section 5 in the EIS and Volume II Appendices F, G, H, I and L.

An expanded discussion of uncertainties associated with the HSW EIS impact analyses is included in Volume I Section 3.5.