

**Nuclear Regulatory Commission's  
Request for Additional Information  
on the Draft  
Waste Incidental to Reprocessing Evaluation  
for Waste Management Area C  
at the Hanford Site**

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U.S. Nuclear Regulatory Commission (NRC)

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Richland, WA

# NRC's Role at the Hanford Site

- NRC provides independent technical consultation in an advisory manner based on an interagency agreement with DOE.
- NRC is not part of the Tri-Party Agreement (DOE, EPA, and the State of Washington).
- NRC's consultation typically includes:
  - Scoping meetings or technical exchanges
  - Document Review (WIR Evaluation, Performance Assessment (PA), etc.)
  - Requests for Additional Information (RAI)
  - NRC Technical Evaluation Report (TER)
- NRC does not have a regulatory nor a monitoring role at the Hanford Site

# Criteria for Determining Reprocessing Waste is WIR (i.e., not HLW)

## From DOE Manual 435.1-1

- Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical; and
- Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*
- Waste will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste

# Other Considerations for the Review

- DOE indicated although the entire draft WIR evaluation is subject to consultation, DOE requested emphasis on criteria 2 (performance objectives) over criteria 1 (removal of key radionuclides).
- DOE requested that NRC determine if DOE demonstrated a reasonable expectation of compliance with the performance objectives for 1,000 years.
- Model results to 10,000 years provided to support risk-informed decision-making.

# Review of WMA C WIR Evaluation

- Scope of Review
  - Review addresses the stabilized residuals which will remain in the 16 WMA C waste tanks and ancillary structures at the time of WMA C closure.
  - Does not address other facilities or systems, waste removed from the waste tanks and ancillary structures, or the contaminated soil and groundwater from previous leaks or unplanned or planned releases
  - Review accounts for previous NRC concerns regarding the closure of Tank C-106

# Review of WMA C WIR Evaluation

## ● How Review is Conducted

- Staff developed an independent model to develop risk insights.
- Risk-informed
  - Non-risk significant comments will be included in TER
  - Evaluated risk is specific for WMA C
- Basis for requests for additional information is provided.
- A TER is developed to document the results of the review.

# Summary of NRC's Role

- NRC is an independent federal agency whose decision is based solely on the merits of the materials provided.
- NRC strives to provide a clear and technically-sound basis for findings.
- Documents can be accessed through ADAMS, enter docket number PROJ0736 in the search box.

<https://www.nrc.gov/reading-rm/adams.html>

# Removal of Key Radionuclides to the Maximum Extent Practicable

**RAI 1-1** Comment: An insufficient basis was provided that removal of waste from plugged pipelines is not necessary in order to satisfy removal of key radionuclides to the maximum extent that is technically and economically practical.

- Plugged pipelines represent one of the potential highest risks from residual waste that would be left in place.
- The inventory in plugged pipelines was assumed; the actual inventory is unknown.
- Technical and economical arguments for leaving the pipelines in place were not provided.



# Removal of Key Radionuclides to the Maximum Extent Practicable

**RAI 1-2** Comment: An insufficient basis was provided for terminating waste removal activities for some tanks.

- Charts demonstrating the limits of technology were reached were not provided for all tanks.
- Key radionuclide removal efficiencies were not provided.
- Additional technical concerns associated with particular tank cleaning campaigns were noted.

# Removal of Key Radionuclides to the Maximum Extent Practicable

**RAI 1-3 Comment:** An insufficient basis was provided that pits, diversion boxes and pipelines were well-flushed, thereby removing waste containing key radionuclides to the maximum extent technically and economically practical.

- Flushing of equipment after use is an operational practice at Hanford.
- Specific conditions and equipment noted in the RAI basis indicates that it would have been difficult to flush.

# General Technical Analyses Considerations

**RAI 2-1** Comment: An insufficient basis was provided that demonstrates that procedures were effectively implemented to ensure proper quality assurance (QA) of the Draft WIR Evaluation and supporting analyses.

- A risk-informed review is dependent on the correctness of the results.
- NRC acknowledges that a performance assessment is a large effort with numerous inputs, calculations, and thousands of pages of supporting documentation.
- A number of discrepancies were noted in the NRC review.
- Most of the discrepancies are not believed to be significant.

# Future Scenarios and Conceptual Models

**RAI 2-2** Comment: The description of how viable alternative conceptual models or alternative future scenarios are identified is insufficient.

- DOE's current safety function methodology would not appear to be able to identify interdependencies and interrelationships between features, events, and processes (FEPs) that could result in plausible alternative conceptual models or alternative future scenarios.

# Radionuclide Inventory and Release Rates

**RAIs 2-3, 2-4, 2-5, 2-6, 2-7** Comment: An insufficient basis was provided for the inventory assigned to the C-301 Catch Tank, 244-CR Process Vault and pipelines.

- Assumptions regarding residual inventories are not consistent with operational history.
- Assumption of 90% waste removal for Catch Tank and Process Vault. Accounting for historical sludge layers.
- The concentration in plugged pipelines is unlikely equal to that of the current waste.
- The operational history of pipelines that were abandoned or replaced is not clear.
- No characterization plan for plugged pipelines.

# Flow and Transport in the Unsaturated Zone

**RAI 2-8** Comment: The amount, type, and impact of chelating agents in waste residuals were not provided.

- Organic compounds were present in some waste and were introduced as chelating agents.
- Sorption is a key process to limiting the transport of radionuclides to the aquifer, and sorption can be impacted by chelating agents.

# Flow and Transport in the Unsaturated Zone

**RAI 2-9** Comment: An insufficient basis is provided for the assignment of the H2 sand hydraulic properties to the degraded grout infill for the grout infill degradation sensitivity case analyses.

- DOE conducted sensitivity analyses to assess the impact of grout degradation that would allow advective flow of net infiltration through the waste tanks. The degraded grout is assigned the hydraulic properties of the H2 sand.
- However, the contrast of hydraulic properties between the H2 sand-like grout and the surrounding materials results in the modeled infiltration basically flowing around, rather than through the waste tanks.

# Flow and Transport in the Saturated Zone

**RAI 2-10** Comment: Additional information is needed to support a technical basis for using a relatively high hydraulic conductivity value for the unconfined aquifer.

- The WMA C PA document shows that the saturated zone Darcy flux is an important parameter.

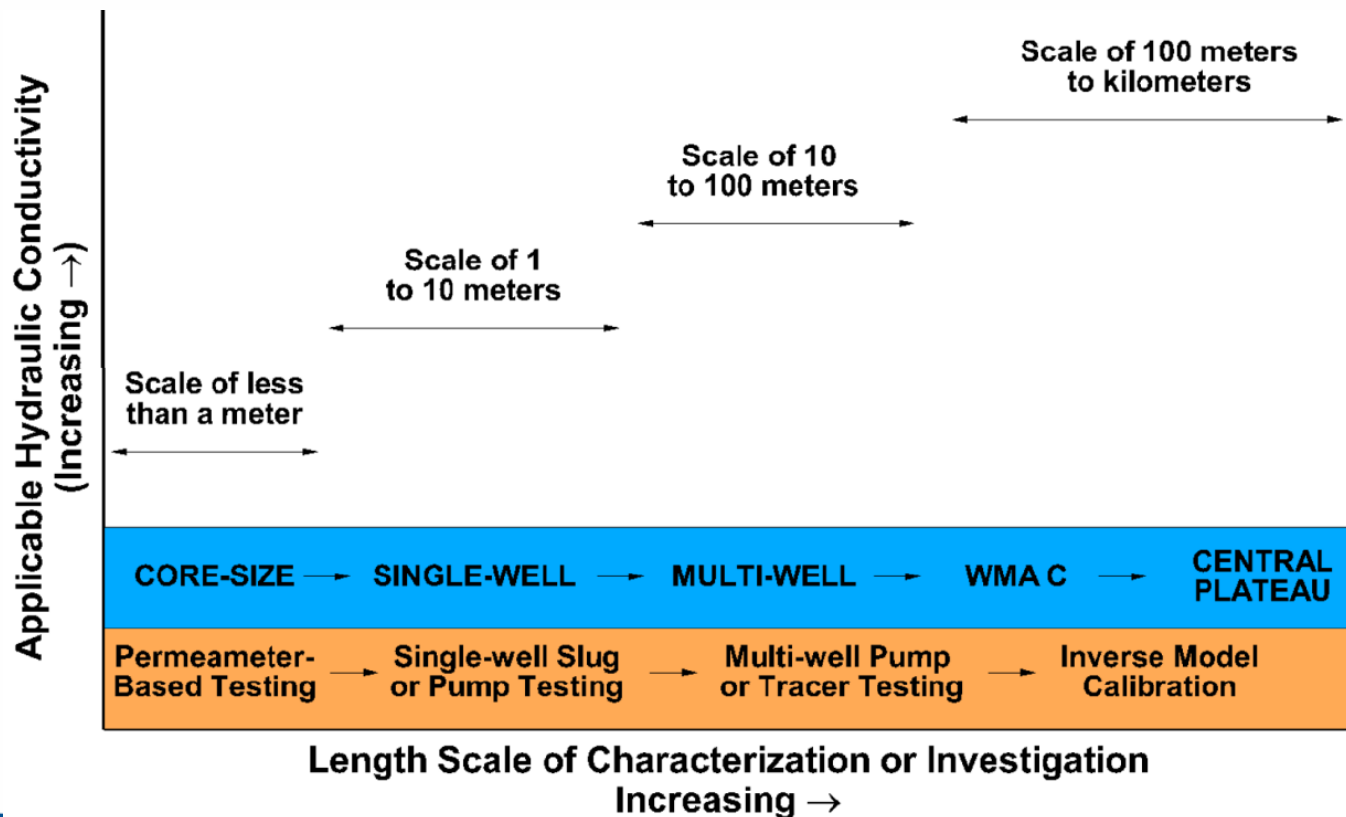


Figure C-1 from the WMA-C PA

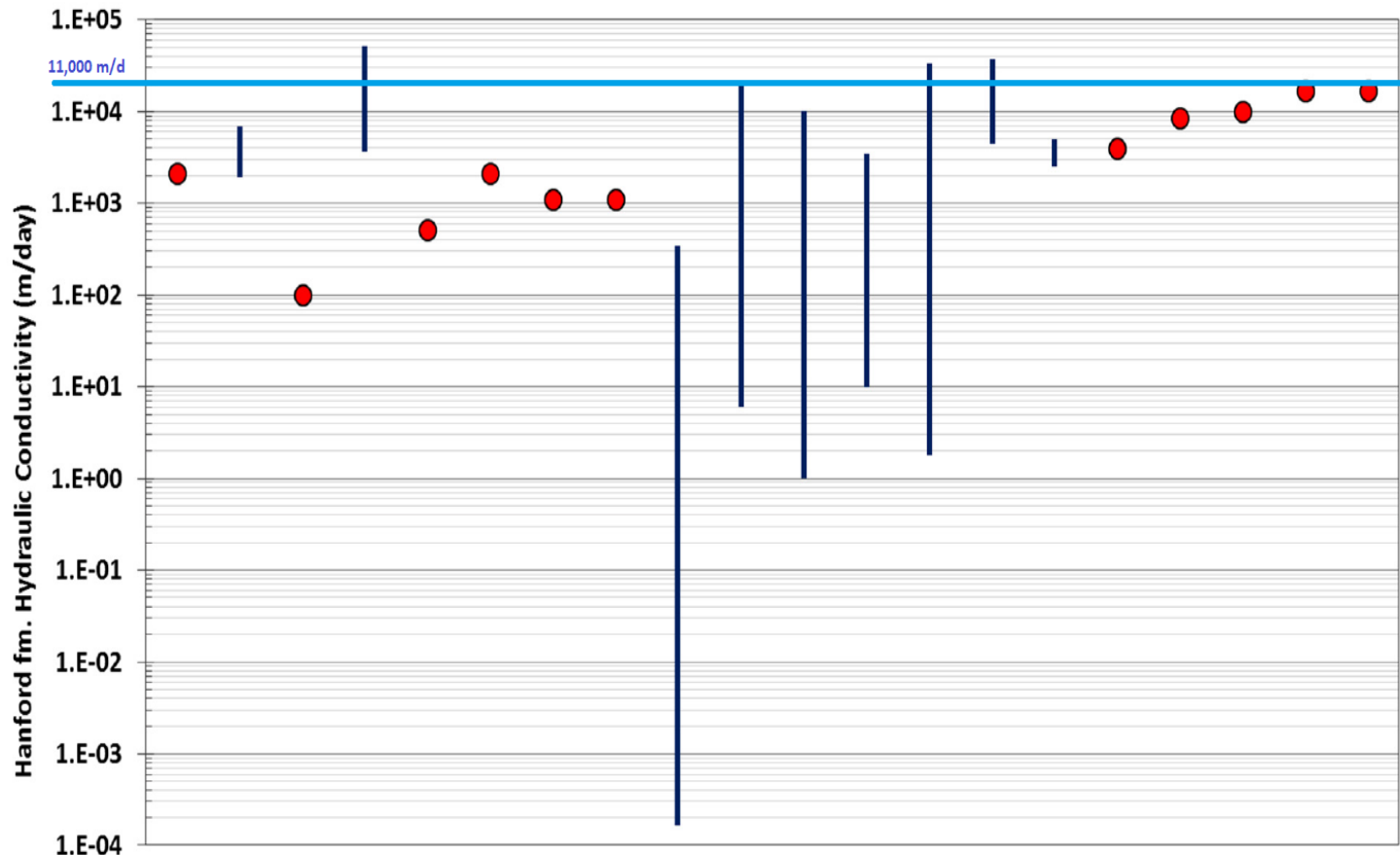


# Flow and Transport in the Saturated Zone

## RAI 2-10 Comment continued

- Previous sources provided a lower range of hydraulic conductivity values compared to the current average WMA-C PA value of 11,000 m/d.

Figure C-6 from the WMA-C PA



# Biosphere Characteristics and Dose Assessment

**RAI 2-11** Comment: The mass loading and soil ingestion parameters assigned to the acute intruder exposure scenarios may not be appropriate for the Hanford site.

- The mass loading and inadvertent soil ingestion values may not be appropriate for an arid site such as Hanford.
- Doses to acute intruders can be strongly influenced by the inhalation pathway.
- Values must be assigned appropriate for expected activities.

# Numerical Model Development and Assessment

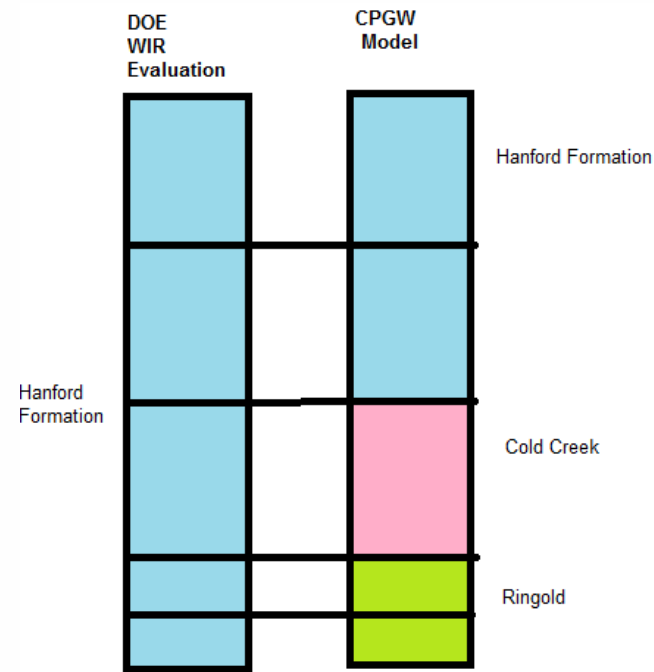
**RAI 2-12** Comment: An insufficient basis was provided to demonstrate that the WMA C PA model is a valid representation of the system. It has not been demonstrated that the simplified WMA C PA model includes the real-world features in a sufficient or conservative manner to support decision-making.

- In order to perform a risk-informed review the model must be a valid representation of the system.
- Examples of real-world observations were provided that are not included in the WMA-C PA.

# Numerical Model Development and Assessment

**RAI 2-13** Comment: Differences in the conceptual hydrogeological models near WMA C between the regional Central Plateau Groundwater (CPGW) model and the WMA C STOMP model are considerable and some of the techniques for abstracting information and data from the CPGW model to the STOMP model require additional information.

- Differences in the hydrogeological units between the STOMP model in the WIR Evaluation and the CPGW model (see example figure).



# Sensitivity and Uncertainty Analyses

**RAI 2-14** Comment: The approach to sensitivity and uncertainty analyses does not provide a complete assessment of uncertainty and variability.

- DOE used a deterministic base case model with best estimate parameter values.
- Sensitivity analyses were performed with a probabilistic system model, however that model did not include all sources of uncertainty (described in the NRC RAI).
- DOE evaluated other uncertainties with one at a time evaluations.
- Because Hanford has a large number of uncertainties, the global impact including the combined effect of uncertainties was not provided.

# Sensitivity and Uncertainty Analyses

**RAI 2-15** Comment: The approach to inventory uncertainty does not reflect all important sources of uncertainty in the estimates of radionuclide inventory remaining in waste residuals.

- The uncertainty associated with the representativeness of waste samples was not included in inventory uncertainty estimates.
- The uncertainty associated with using the HDW model for the inventory of some isotopes was not included in the inventory uncertainty estimates.

# Inadvertent Intrusion

**RAI 2-16** Comment: DOE did not provide the acute intruder doses from disturbance of a plugged pipeline, or from intrusion into diversion boxes. The thickness of waste used to assess the inadvertent intruder in the 244-CR Vault appears to be too low. Intruder dose calculations may need to be revised pending resolution of other requests for additional information.

- Acute intruder doses from disturbance of a plugged pipeline may be the limiting scenario.
- Other intruder doses may be underestimated because of the parameters assigned.

# Assessment of Waste Concentration and Classification

**RAI 3-1** Comment: DOE's basis for concluding that the waste will be incorporated into a solid physical form is insufficient.

- Some wastes remaining in the system are in liquid form, and DOE did not provide their basis for determining those wastes would be incorporated into a solid physical form.



# Assessment of Waste Concentration and Classification

**RAI 3-2** Comment: DOE's calculations that demonstrate the waste residuals do not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR 61.55 were incomplete. All components remaining in WMA C were not classified.

- The DOE approach, based in part or wholly on a lack in clarity of NRC guidance, may have used a ratio of intruder dose results to waste concentrations that resulted in lower than anticipated waste classification concentrations to determine which components may be greater than Class C.