DISPOSAL OF HANFORD DEFENSE WASTE

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ABSTRACT

An Environmental Impact Statement (EIS) on the disposal of Hanford Defense Waste is scheduled to be released near the end of March 1986. This EIS will evaluate the impacts of alternatives for disposal of high-level, tank, and transuranic wastes which are now stored at the Department of Energy's Hanford Site or will be produced there in the future. In addition to releasing the EIS, the Department of Energy is conducting an extensive public participation process aimed at providing information to the public and receiving comments on the EIS.

BACKGROUND

For 40 years nuclear wastes from U. S. Department of Energy (DOE) Defense missions have been stored at the Hanford Site near Richland, Washington. Hanford defense wastes continue to accumulate today and more are expected to be produced through the year 2010. There is enough defense waste at Hanford to fill one-fifth of the Kingdome in Seattle. From another perspective, if all Hanford defense waste were to be placed on a football field, it would rise approximately 95 meters high.

Since 1983, Pacific Northwest Laboratory (PNL) which is operated by Battelle Memorial Institute for the U. S. Department of Energy, has been preparing an Environmental Impact Statement to evaluate the impacts of options for disposal of Hanford Defense Waste. In the course of preparation of the EIS, Rockwell Hanford Operations has provided much of the data on the current status of defense waste and the facilities which might be required for disposal. The draft EIS is expected to be available near the end of March 1986. We had hoped that the draft EIS would have been released in time for Waste Management 1986 and that this paper could focus on projected impacts of the options evaluated. Although the draft EIS has not yet been approved and we will limit our discussion to the scope of the document and the public review process, there are a number of unique features in our draft EIS and public review process that should be of interest to those attending Waste Management 1986.

Before discussing the draft EIS, it is important to distinguish between Hanford defense wastes covered in the draft EIS and the geologic disposal program being conducted pursuant to the Nuclear Waste Policy Act. The geologic disposal program will primarily dispose of spent fuel and vitrified waste, both of which are well-characterized and relatively easy to handle. By contrast, Hanford defense wastes are not all well-characterized and some of it presents significant handling problems. We have not made a decision whether wastes will be disposed in a deep geologic repository or in-place at Hanford, but there is no question that the wastes are at Hanford now. Perhaps the most important comparison between commercial and Hanford defense wastes is the activity per unit volume. By the year 2000, the volume of defense high-level waste stored at Hanford is expected to be about 10 times greater than the cumulative volume of spent fuel from commercial nuclear power reactors. However, the radioactivity in Hanford's defense high-level waste is projected to be about 80 times lower than the commercial spent fuel. On the basis of activity per unit volume then, Hanford's defense high level waste would be about 1/1000th that in commercial waste spent fuel. This, combined with the arid climate at Hanford, suggests that different solutions for commercial and Hanford defense wastes are worth considering.

EIS SCOPE

The draft Hanford Defense Waste EIS evaluates impacts of options for the disposal of high-level, tank, and transuranic wastes. Note that we include a category called tank wastes which are existing wastes in single-shell tanks and existing and future wastes in double-shell tanks. We chose the term "tank wastes" since waste in these tanks could be processed into high and low level streams prior to disposal.

The high-level, tank, and transuranic wastes are split into six categories for the draft EIS. These six categories are:

1. Existing tank wastes in single and double shell tanks.
2. Future tank waste in double shell tanks.
3. Pre-1970 transuranic contaminated soil sites.
4. Pre-1970 transuranic contaminated buried solid wastes.
5. Retrievably stored and newly generated transuranic solid waste.
6. Strontium and cesium capsules.

Beginning with 27 alternatives, PNL, in consultation with DOE and taking into consideration public comments received by DOE, narrowed the list of disposal alternatives to three and included a no action alternative which must be considered. The four alternatives are:

1. Geologic disposal where at least 98 percent of the waste by activity is processed for placement in repositories.
2. In-place stabilization and disposal where all waste is disposed near surface with a protective barrier and marker system.
3. Reference or combination alternative where readily retrievable waste is processed for

placement in repositories and hazardous to retrieve waste is stabilized in-place with a protective barrier and marker system.

4. No disposal action where DOE continues storage and maintenance. For purposes of analysis, it is assumed that institutional control of the site is lost in the year 2150 as is done for the other alternatives.

For each of these alternatives, the following types of impacts were assessed:

1. Near-term impacts including new facility construction, facility operations, facility decontamination and decommissioning, transportation, and placement of wastes in a repository. Where applicable, both normal operations and accidents were considered.

2. Long-term impacts of waste left at Hanford. These impacts arise almost totally from leaching of wastes from the waste site, transport some 50-80 meters through a dry (vadose) zone to the unconfined aquifer below, transport through this aquifer to the Columbia River, and finally by numerous pathways to the individual. We did not include long term impacts at a repository after closure of the repository. We felt this was the responsibility of those who conduct the repository programs and that the impacts would probably be very low.

3. Intrusion onto the Hanford Site by those who recognized the marker system and stayed away from the disposal site boundaries, and those who ignored the marker system and entered the disposal site boundary. Some of the scenarios included were a well drilling scenario where well drillers and land occupants are exposed to wastes brought up with drilling mud, a drinking well scenario, and a full garden scenario where water from the unconfined aquifer is used for drinking as well as irrigating crops.

EIS METHODOLOGY

The calculation of radiological impacts over a period of 10,000 years and beyond has been a challenge. New analytical tools have been developed to supplement PNL's library of codes for pathway analysis, dosimetry, and conversion of dose to health effects. The new analytical tools developed are primarily in the area of waste source release and geohyrodologic transport.

In the preparation of these new models and the data used in the analysis, there were some cases where we did not have all the data required to perform a rigorous analysis. We have been careful in the draft EIS to note where this is the case and to also state early in the document that we would not proceed with implementation decisions until the data are available for confirmatory analyses and review by the public.

In lieu of definitive data, PNL, with DOE's concurrence, adopted a bounding technique to provide assurance that estimated impacts to the public as presented in the draft EIS would be greater than or equal to impacts calculated after follow-on confirmatory analyses. Of course the burden is on DOE to complete confirmatory analyses and subject them to public scrutiny before making decisions to implement disposal. If the confirmatory analyses show that impacts are greater than presented in the final EIS, it is possible that the final EIS would need to be supplemented or that another EIS would need to be prepared.

At this point, there is bound to be a question to the effect of why DOE would want to issue an EIS that would require future confirmatory analyses. There are two reasons for this approach. First, DOE would be ready to begin implementation in some areas depending on the disposal alternative selected. For example, if either the geologic or reference (combination) alternative were selected for double shell tank wastes, DOE would be ready to proceed with design and construction of a waste vitrification plant when funding is provided. Second, areas where DOE would not be ready to begin implementation were included in the EIS to provide an assessment of Hanford defense waste in one document and to help focus future research and development down a limited number of paths as opposed to conducting research and development on all possible alternatives.

Getting back to the analytic methodology, it is important to note that we have built in conservatisms to the data and methodology so that the estimated impacts are bounded. Where reasonably good data are available, we have used them. While it is possible that certain parts of the analysis might not be conservative, it is expected that sufficient conservatism has been built into other parts of the analysis so that the end results, which are largely multiplicative, will bound the impacts on the conservative (high) side. Required future research and development will be performed to confirm this.

As an example of a case where we have built in conservatism, there are some uncertainly as to the distribution of strontium 90 between single and and double shell tanks. The total tank inventory of strontium 90 is well known on the basis of burnup calculations to be about 60,000,000 curies. Of the 60,000,000 curies, 40,000,000 curies are known to be in single-shell tanks. The additional 20,000,000 are assigned to single-shell tanks and, at the same time, 20,000,000 curies are assigned to double-shell tanks. While technically irrelevant, this "double-counting" of the 20,000,000 curies guarantees a conservative treatment of this and similar source term uncertainties.

PROTECTIVE BARRIER

In terms of long-term performance assessment, a protective barrier is the key to minimizing impacts where defense wastes would be disposed of near surface at Hanford. All three potential alternatives make use of a protective barrier in varying degrees although its performance is more important to the reference (combination) and in-place stabilization and disposal alternatives which make the most use of it. The purpose of a protective barrier is to reduce the likelihood of water infiltration, wind erosion, and plant, animal, and human intrusion. Perhaps the key item there is water infiltration (rainfall) since water transport to the groundwater some 50-80m below the waste site leads eventually to transport to the Columbia River and exposure to the downstream population.

The protective barrier design used in the draft EIS analyses consists of a 1.5m deep layer of revegetated soil as an upper surface underlain by about 4m of basalt riprap. A 0.3m thick graded rock/gravel layer separates the soil from the riprap and aids in minimizing the sifting of fines into riprap interstices. A 5m wide edge (or berm) of large riprap is provided for slope protection.

The barrier is envisioned to work much like a dry sponge to trap moisture. According to the outflow law, water will not move from soil into an open cavity until the water pressure is atmospheric or greater. For layered soils, this means that water will not move from fine soil into the coarse soil until the fine soil near the boundary between the two soil layers is virtually saturated. In a dry climate such as experienced at the Hanford Site, saturation of the fine soil near the boundary would rarely occur if ever, thus preventing rainfall from infiltrating the underlying wastes.

To account for a change to a wetter climate, a range of precipitation is considered in the draft EIS. To account for unforeseen events which could result in discrete saturation events or other barrier breakthroughs, a barrier failure scenario is also evaluated in the draft EIS.

Future research and development is planned on potential designs for a protective barrier to verify performance parameters. Other areas such as waste characterization, modeling of transport through unsaturated soil, and waste retrieval are also candidates for future research and development to be conducted over the next five to ten years.

PUBLIC PARTICIPATION PROCESS

Both in the near term for the draft EIS and over a longer period while research and development is to be conducted, DOE will be actively working to solicit input from the public, state agencies, and other federal agencies. Following the release of the draft EIS, there will be a 120-day comment period which substantially exceeds the minimum 45-day comment period. Prior to the release of the draft EIS, DOE will be conducting Open Houses in seven Northwest cities. The open houses are intended to provide the public with background information on Hanford, storage of defense waste at Hanford, radiation and the environment, and options for disposal of Hanford defense waste and the public participation process. Following issuance of the draft EIS, workshops will be conducted in eight Northwest cities to answer questions on the EIS. Toward the end of the 120-day public comment period, hearings in four Pacific Northwest locations will be conducted to receive comments on the draft EIS.

This active public participation process is vital to DOE. Aside from the need to subject our analyses to scrutiny by the public and other agencies, it is likely that some level of federal, state, and public consensus will be required before Congress will be willing to commit between two billion and 11 billion dollars to implement one of the waste disposal options. It is not expected that there will be unanimity on the decisions to be made because there are trade-offs to be considered. For example, geologic disposal results in the highest short-term risks, but has the lowest long-term risks. It also requires the most transportation of wastes on the highways. Some communities appear to be opposed to transportation while others want assurances that long-term risks will be minimized. Without getting into a lot of detail, all three disposal options are estimated to result in radiological impacts well below applicable standards and radiological impacts from natural sources of radiation. With three alternatives with low impacts, six different categories of waste, and numerous waste sites, it is quite possible that the alternative selected after public comment and issuance of the final EIS will be different than any of the three disposal alternatives in the draft EIS. This wide range of alternatives and the need for consideration of trade-offs is a clear invitation to the public to become involved.

SUMMARY

Although we regret not being ready to discuss the impacts in detail, this paper has presented a number of unusual features of interest. The issuance of a draft EIS with no preferred alternative may not be unique in itself, but it is unusual to see a wide range of what could be acceptable alternatives. We have also noted that we are attempting to provide for a comprehensive assessment of waste disposal options even though we would not be ready to proceed with implementation of disposal in all cases. This approach has resulted in what we believe will be a bounding of potential impacts. Finally, DOE is initiating a unique and extensive program to provide for public participation in the decision process.

We appreciate the opportunity to present our program to you and hope that you will invite us back again next year after we have completed much of the process and can give you feedback on how well it has worked to then.