Enclosure to 3/7/85 distribution of the 2/15/85 Report of Activities

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MEMORANDUM FOR: Robert E. Browning, Director
Division of Waste Management

FROM: F. Robert Cook, Senior On-Site Licensing Representative, Basalt Waste Isolation Project (BWIP)

SUBJECT: REPORT OF ACTIVITIES , OBSERVATIONS AND COMMENTS FOR THE PERIOD DECEMBER 16, 1984 TO FEBRUARY 1, 1985

1. During this period I reviewed the BWIP Environmental Assessment. My comments were forwarded by separate correspondence dated January 30, 1985.

2. I attended briefings conducted by DOE for the public in Richland, for the Washington State Legislature in Lacy and for the various Indian nations and tribes affected by the project in Richland on January 15, 17, and 23 respectively. The major comments, questions and DOE responses have been discussed via telephone with various cognizant staff during the period of this report. Various State comments are presented in Attachment A.

3. On January 10 and 11, 1985 I attended a meeting chaired by Richard Craig of Kent State University under contract to Rockwell to prepare a section for the BWIP Site Characterization Plan concerning paleoclimatology. His task is to provide information suggested by section 5.2, "Long Term Climate Assessment", in NRC's Draft Regulatory Guide 4.17. I was invited to discuss the format for the SCP described in 4.17. I prepared my discussion in conversation with P. Justus and his staff. My discussion emphasized the importance of clearly illustrating how models will be hypothesized and what data will be used and/or collected to validate these models. I also noted that planning to collect data needed as parametric input to the models to predict future climatic conditions and related effects should, desirably, link data to the respective models. I noted that it would be useful to indicate planned key quality assurance actions in conjunction with planned model development and data collection.

Various documents which were provided at the meeting are attached.

Observations from the meeting and related discussions with meeting participants follow:

a. Richard Waitt, Jr. of the USGS at Vancouver, Wa., discussed

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recent evidence which suggests that there were 80 or more catastrophic floods following the last glacial period. The evidence is mostly from sediments in valleys on the fringes of the flood zones. Such a zone includes the Burlingame Ditch area to the Southeast of Pasco. This area has not been prominently discussed in recent RHO documents to my knowledge. This erosional ditch, up to 400 feet deep, reveals some 60 odd separate zones of sediments, separated by eolian deposits according to Waitt. This information together with similar sediments on the northern boundaries of the flood zone and sediments from Lake Missoula are used to idnetify the 80 or more separate flood episodes.

Waitt suggests that the flooding resulted from undermining the glacial lobe which dammed Lake Missoula at its northwestern end, allowing the lake to drain until the weight of the remaining ice redammed the lake. The period between floods was on the order of 30 to 50 years, the time it took to refill the lake from melting glacirers to the North. As the ice lobe diminished in size, progressively smaller floods occurred since it took less water pressure to undermine the ice dam. This theory is consistent with the progressively thinner sediment zones observed in Burlingame Ditch and elsewhere.

b. The effects of the flooding on the hydrology was considered in the meeting discussions. The deep ponding in the Pasco basin, Lake Lewis, during each recent flood was noted to likely have some significant, calculable recharge on the Hanford Site. Also pressurized recharge of glacial melt water under the glaciers was discussed, with a possible effect on deep aquifers being recharged at the fringes of the basalt flows. These discussions were aimed at identifying models which would be needed to assess the hydrology resulting from future climate changes, for example, a likely future glacial and subsequent post-glacial period.

c. I asked a question about the existence of evidence of flooding in the sediments in the Ocean around the mouth of the Columbia River. Apparently no one has looked at these sediments for evidence of such flooding. Given the extraordinary flows and hydraulic effects, I speculated that there must be observable effects way out into the Ocean beyond the normal surface disturbance and effects of normal river discharges. The record of the floods for the most recent floods as well as older floods is waiting to be read in the existing Ocean cores. Good differential times would be available in this record as well as flood water volumes and possibly sediment origins.

d. Related to the question of flooding, is the origin of the Ringold Formations at the Site and their age. The Ocean cores discussed above could also reveal evidence (or lack of evidence) of large scale flooding potentially associated with these deposits. Based on discussions with RHO personnel, RHO appears to conclude that the deposits were laid down over a long period of time by a river or rivers changing their channels. The age of the Ringold is important when attempting to determine the time when offsets in these deposits occurred, the magnitude of the displacement and the rate of displacement.

4. RHO informed me that they were considering the desirability of depressurizing the aquifers above and below the reference repository horizon by hydrologic pumping inorder to improve worker safety, reduce costs associated with establishing practical ambient conditions in the repository, as well as safety provisions otherwise potentially necessary, and to improve the long-term isolation capability of the disturbed zone through the creation of a hydrologic sink.

The practicallity of the idea depends upon the magnitude of the vertical conductivity of the basalt layers above and below the Cohassett flows. I have discussed the idea with RHO (Ash) and DOE (Lamont) and emphasized the importance of resolving the issue early so that SCP planning could be modified to take into account the pumping which would be accomplished. I asked about the scheduling to further investigate the idea and was informed that there would be a meeting planned in February among RHO personnel to discuss the idea. I will plan to attend this meeting and will inform you of its results.

I emphasize the importance of this item considering its potential major beneficial impacts on safety (both mining and radiological), environment and costs. I recommend that the staff independently evaluate the pros and cons of this idea so as not to delay assessment of a potential future SCP and to be able to take an informed position on how the pumping could be used beneficially in characterizing the Site.

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cf: (without attachments)
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Attachment A

Questions and Comments Concerning the
Draft Environmental Assessment
Hanford Site, Washington

The following questions and comments have been prepared by Raymond Lasmanis, Washington State Geologist with the assistance of several staff members from the Geology and Earth Resources Division of the Department of Natural Resources. R. Lasmanis is a designee on the Nuclear Waste Board for Brian J. Boyle, Commissioner of Public Lands.

The questions and comments cover EA Chapters 1 through 6 inclusive (as of January 28, 1985). Additional comments on Chapter 7 will be forthcoming by mid-February. The purpose of this presentation is to give the staff of the High Level Nuclear Waste Management group time to consider the various points and allow the concerns to be incorporated into the list of issues being prepared by our consultant, Envirosphere.

The order of the questions and comments does not signify priorities. For ease of review, they are grouped under major headings as follows:

A. Natural resources - gas

1. It is stated on page 10 that the Hanford site is not favorable for the commercial production of natural gas. Yet, the Rattlesnake Hills field at Hanford produced 1.3 billion cubic feet of gas from 1929 to 1941. Why was this not seriously considered? See also page 6(vi).

2. On page 6-139 there is a discussion about natural gas. It is more likely that methane is migrating up into the basalts from coal beds underlying the flows and not from the interbeds.

3. The structural traps for gas underlying the Columbia Basalt are not necessarily related to anticlines as stated in the EA. The reason that anticlines are drilled is that the basalt cover is thinner at those locations. The potential target traps are more likely angular unconformities totally unrelated to synclines or anticlines in the basalt. Thus, the Cold Creek syncline cannot necessarily be ruled out as unfavorable for natural gas (comments also apply to pages 6-142, 143 and 146).

4. If commercial natural gas is discovered in the near future, the $98 per inhabitant value (page 6-140) for 11 counties of the Columbia Plateau is grossly underestimated. Considerable natural gas was found by Shell in their well on Saddle Mtn.

B. Site restoration/reclamation

1. On page 12 of the EA there is a brief note that the site will be restored. Also on page 5-41 there are details on how this is to be done. However, the EA does not take into account the fact that blasted rock from the repository has a swell factor (volume increase) of 5 to 33% with 18% on the average. After closure, this will leave a large rock pile on the surface. How will it be reclaimed?

2. On pages 6-44, 6-77 and 6-78 it is stated that deep aquifers have a high salinity and fluoride content. On page 4-20 it says that pump tests would discharge such saline water on the surface. On page 5-40 it says that saline and fluorine-rich waters from shaft drilling will be discharged on the surface. Does the statement on page 6-43 imply that shallow ground water can be degraded by salt on the Hanford reservation?

C. Transportation

1. On pages 22 and 24 radiological safety is discussed. Safety is related to distance traveled in terms of risk. Why did DOE only consider the risk from the ports of entry into Washington State? Shouldn't the entire road network be considered? For instance, don't the nuclear wastes have to be transported across the Rocky Mtns. where all kinds of adverse physical conditions exist (p. 6-53)?

2. Why weren't specific routes considered and evaluated instead of just a generic review?

3. Shouldn't routes from power plants (shown on page 6-50) to Hanford be considered? Page 6-46 says the routes cannot be predicted.

4. If commingling of defense waste is considered, how does this effect the transportation plan? Shouldn't it be in the EA?

5. On page 6-49 it says "favorable condition is not met for inland, waterways." Yet, other DOE documents show that barge shipments are being considered. Which is it?

D. Repository operation and closure

1. Ground water protection is important in this state. The use of grout to seal bore holes drilled into aquifers and to cement in shaft liners appears throughout the report (i.e. page 6-43 and others). On page 6-191, under repository conditions, grout will be used to seal probing drill holes that could have pressurized water with a temperature of 124° F. Justification for using grout is given as mining (page 6-216) and dam construction (page 6-106). However, no mine or dam is built to last 1,000 or 10,000 years. How long will grout last as a seal under repository conditions?

2. On page 16, pages 6-187 to 190, and elsewhere methane in ground-water is mentioned. How will heat effect the release of methane into a repository? This is not discussed in the EA.

3. 10 CFR 960.5-2-9 states that rock bursts can lead to significant safety risks and could even disqualify a site. See pages 2-66, 73; 5-67; 6-164, 185-186, 197, and 200-201. Doesn't Hanford have a potential for rock bursts? Did the W. Blake report of 1984 discount that danger? Was the effect of heat considered? Could earthquakes trigger rock bursts?

4. Fracture minerals are discussed in chapters 4.1.1.5, 4.1.1.5.4, 6.3.1.2.5 and 6.3.1.3.6. The occurrence of minerals that release water upon heating seems to be discounted. Thermal effects will cause some minerals to loose water, lubricating fractures and causing ground support problems. How is this addressed? On page 6-100 there is a statement that fractures would seal themselves. Is this true if water is released? Chapter 6.3.1.2.9 seems to gloss over the problem by only mentioning clay minerals. Yet, in Chapter 6.3.3.2.8 it says: "Thermal-induced fracturing and hydration and dehydration of thin infillings in joints are possible. . . This potentially adverse conditions can be mitigated by the use of standard practices." What are those standard practices?

5. Why on page 5-31 and 6-107 is there no discussion of fractures generated due to differential stress created around a mine opening? This could be critical due to the thin nature of the dense interiors. How does heat effect the formation of stress fractures?

6. Evidence of constructibility on page 6-174 should not include undrilled shafts. The closest example is Amchitka where a 7½ ft diameter shaft was drilled through 500 ft of basalt. The next best example is a 6½ ft diameter hole drilled through 20 ft of Columbia basalts from 60 ft to a total depth of 80 ft at Summer Falls, Wash. Interestingly enough the Summer Falls example gives the diameter as 1.98 meters in table 6-20 and 2.29 meters in table 6-21. Which is it? Not really very convincing evidence for drilling much larger diameter shafts through a 3000 ft plus of basalt at Hanford.

7. On page 4-40 and subsequent pages there are descriptions on how the 9.2 foot diameter and larger shafts will be drilled to below 3,000 feet. This is a technological first. What is the probability of success? What is the fall back plan?

8. On page 4-15 it states that the exploration shafts could be "preserved for other uses." What are the other uses? Why are they not specifically noted?

9. Why do diameters and numbers of shafts change from Table 5-1 (page 5-5) to Table 5-6 (page 5-30) to Table 5-8 (page 5-33)?

10. Why is the Federal Safe Drinking Water Act (SDWA) 42 U.S.C. § 300 h left out of Table 6-2 on page 6-27?

11. On page 4-12 DOE states that a 1,000 foot horizontal hole will be drilled within the dense interior. What technology will be used to keep a hole perfectly horizontal for 1,000 feet? A deflection of 0 degrees 17 minutes will put the end of the hole into a flow top at 1,000 feet.

12. If the dense interior is less than 100 feet thick, explain how would it be possible to mine out a repository over a 2 square mile area and still stay in the middle of the dense interior without encountering the flow top or bottom? Geology is never that uniform.

13. On page 6-281 lava tubes are cited as possible hazards to a repository. Where in the EA is mitigation discussed?

E. Ground water - hydrology

1. On the bottom of page 1-17 and similarily on page 2-72 and 80 there is a statement: "Ground water drainage is to the Columbia River or its tributaries." Yet, at the top of page 10, page 3(ii) and page 3-78 you state that the location of ground water discharge is not known. Which is it?

2. Relating to ground water, on page 2-31 you state that there is ground water mixing across different basalt horizons. Evidence for vertical ground water flow is given on page 6-94. Yet, in most of the EA vertical ground water flow is discounted. How do you reconcile these differences?

3. Thermal gradients can affect the movement of ground water. How is this addressed in the EA? It is not mentioned on page 3(ii). Why is it not discussed under ground water page 3-72 or described in detail on page 6-76?

4. On page 6-64 (Table 6-3) there is such a broad spectrum of ground water travel times that one conclusion might be that the hydrology cannot be modeled or characterized.

5. If the plan (page 6-76) is to put the respository in the central vesicular zone of the Cohassett Flow, wouldn't there be a potential for the heat to expand the fluid filled vesicles, fracture the vesicle walls, and create additional permiability changing the geohydrological conditions? Hasn't all the testing done to date been directed at dense interior type basalts and not vesicular basalt?

6. It is stated that flows tops serve as aquifers. Therefore, only the dense interiors have any signficance in isolating nuclear waste. Why is it that throughout the entire EA flow thicknesses are used? Isn't this giving a misleading impression that there are four suitable flows?

F. Radionuclide migration

1. On pages 6-87 and 88 a positive qualifying statement is given about the Eh conditions. Yet, NRC questions the test results as they pertain to Eh (page 9-96). Shouldn't the statements be labeled conditional or speculative till the system is characterized?

2. Tests done for radionuclide sorption are given on pages 6-67 to 89. The tests were done on crushed basalt which offers a large surface area for reactions. In case of canister breach, wouldn't tests done on sorption capabilities of a flat basalt surface (like a fracture) be more representative?

G. Radiological safety

1. Preclosure radiological safety is discussed on pages 6-55 to 57 (Chapter 6.2.2). Isn't there contaminated soil in the vicinity of the site that through wind blown dust can be ingested into the lungs by surface construction workers at the repository?

H. Climate

1. On page 6-86 it is stated that the climate would not change for the next 100,000 years. Yet on page 6-116 there is a prediction that the next glacial ice advance will occur 15,000 years from now and continue for 10,000 years.

2. On page 6-118 it says there is little chance for glaciation in the next 10,000 years. How firm is Craig's (1983) model for predicting an ice advance 15,000 years from now? Is there a possibility it could occur sooner?

3. It is stated the climate would not change for 100,000 years. Was the warming of our atmosphere considered due to a build up of CO_2 caused by fuel consumption?

I. Structure and tectonics

I find this one of the weaker subjects described by the EA as a result of reluctance by DOE to admit that faults are present at the repository site (pages 6-106 to 109). Specific comments and questions follow.

1. The chapter on structure starting on page 3-45 makes no mention of faults at the repository location. Faulting is a potentially adverse condition (pages 6-78 and 129) and on page 6-126 it says "all evidence will be used including geophysical seismic surveys." Why was not all evidence used? Examples are:

   a. Seismic reflection report No. SD-BWI-TI-177 for DOE dated 12-16-83 shows numerous faults.

b. Evidence for vertical ground water flow on page 6-94.

c. Why is the Cold Creek north-south barrier ignored in Chapter 3.2.3 (Structure and Tectonics) starting on page 3-45? The Cold Creek north-south barrier is conclusive evidence of a major fault (pages 3-2, 3-90).

d. On page 3-54 earthquakes are discussed. Don't earthquake swarms next to the repository indicate ground movement along faults hidden by thick-post Ringold sediments?

e. Core disking in exploratory drill holes.

2. There are at least three tectonic models for the origin of the Yakima Fold Belt. See recent papers by Moseley and Farooqui (May 1984), E.H. Price (1982), S.P. Reidel (1984), Prescott and Savage (1984), and Barrash et al (1983). Shouldn't the three models be presented in the manner of ground water models?

3. On page 6-210, the location of WNP-2 nuclear power plant (11 miles away) is given as evidence that there is no faulting at the repository site. This is false logic. At WNP-2 they were searching for active faults that displace the thick sands and gravels. The nuclear power plant location does not rule out faults located in basalt at the repository site. Only site specific information has any bearing on fault locations.

4. It states in the middle of page 6-136 "Therefore, major consideration was given to siting the reference repository location away from areas of known or <u>suspected</u> faulting." This statement is not true as geophysical surveys and other evidence listed in (1) above indicate that faults are known or suspected.

5. How do you reconcile north-south compression as being the dominant force throughout the EA when on page 6-132 it is stated that two earthquake events indicate that a east-west compression is taking place?

6. On page 3-52 it is stated that the Rattlesnake-Wallula alignment has strike slip displacement. Would this not superimpose a differential stress regime over the north-south field?

J. <u>Candidate horizons</u>

The Hanford site was selected before the Nuclear Waste Police Act was passed in 1982. Since no other basalt sites were considered in any serious way, we are locked into considering what we have, namely the Columbia River basalt flows under the Hanford site. Some of the formations are major aquifers. Subsequent drilling shows the flows to be relatively thin to serve as a host to a two square mile mining operation. It appears to me that the EA is used to justify and qualify four candidate horizons with weak and in some cases contradicting arguments. The EA seems self serving and misleading. My comments and questions follow in support of the above statements.

1. The key to DOE's qualification of four candidate horizons is contained on pages 6-154 and 155. There, a statement is made that a minimum 70 ft of dense interior is needed for the waste panels and a minimum 86 ft for the shaft pillar area. Did the minimums take into account that the flow tops could be aquifers? How can you mine on a level grade for two miles and keep in the middle of a undulating 70 ft thick horizon? It is my opinion that at a 3,000 ft depth 70 ft and 86 ft respectively is not sufficient to allow for orderly development without excessive engineered barriers and ground support systems. There would be only 30 ft of protection above a repository with the above minimums.

2. The availability of four candidate flows is demonstrated by DOE on pages 6-155 to 163 using statistical analysis. It is my opinion that the use of statistical analysis to predict dense interior thicknesses of flows is improper (as used in the EA) for the following reasons:

   a. For confidence limits and other conclusions, a large number of representative samples are needed. This is not the case. Only six holes penetrate the candidate flows at the repository.

   b. Using data from holes or outcrops from 5 to 10 plus miles away has no significance in evaluating the thickness of flows at the repository site. Absolute values from holes RRL-2, 6, 14 and DC-1/2, 3, 4/5, drilled within the repository boundaries, are the only numbers of significance. The distant data points only indicate lateral continuity of flows, not thickness at the repository site.

3. Chapter 6.3.1.3.3 (page 6-99) requires that thickness as well as lateral continuity is to be discussed in the EA. Although lateral continuity is demonstrated, the thickness of the dense interior of the four flows is not [see (2) above]. The lack of thickness is dismissed in the EA by the statement: "waste isolation would be assured even if the waste source term originated directly in the flow top of the preferred candidate horizon."

   a. Is the above statement supported by evidence?

   b. How about ground support and other rock mechanic problems associated with flow tops.

   c. Wasn't the plan to place the repository in the dense interior of a flow? The entire gound support chapter (6.3.3.2.4) starting on page 6-157 deals only with the dense interior of a flow. All the testing done to date was aimed at the dense interior of a flow.

4. Throughout the EA and on page 6-43 it is stated that repository construction would take place within the dense basalt flow interior. Further on page 6-153 and elsewhere the Cohassett Flow is identified as the preferred horizon. However, the Cohassett Flow has two dense interiors separated by a vesicular zone (page 3-24). Is it DOE's intention to place the repository in the vesicular zone? Doesn't this make all the testing done to date on the dense interior not applicable to the central portion of the Cohassett? See also my comments under paragraph E-5.

5. On pages 3-20 and 3-22 the McCoy Canyon flow is discussed. Hole DC1/2 shows the dense interior to be only 85.9 feet thick. On page 6-195 it says that half of the McCoy flow at one location consists of pillows that may produce water inflows. On page 3-20 it says that the McCoy Canyon flow is approximately 30 meters or 100 feet thick. Data shown on page 3-14 for two holes within the repository boundary dispute this figure. Why the discrepancy? Besides the lack of thickness, on page 3-20 it is stated that the flow is sporadically interrupted by vesiculation reducing available dense interior. How can the McCoy Canyon flow qualify as being suitable?

6. Hole DC 4/5 shows that the dense interior of the Rocky Coulee flow is 89 feet thick and the intra flow structures are so variable that the flow cannot be correlated from one drill hole to the next (page 3-24 and 3-25). How does the Rocky Coulee flow qualify as being suitable?

7. On page 3-18 as well as in Chapter 6, the Umtanum Flow is described. In the center of the repository, hole RRL-2 shows the dense interior of the Umtanum to be only 25.3 meters or only 83 feet thick. This leaves only a 35 foot safety margin above and below the repository. It is my opinion, that is not sufficient protection in case the vesicular top of the flow is an aquifer.

8. Since a repository was planned for the dense interior, why is it that through much of the EA total flow thicknesses are used for discussion purposes. Isn't that misleading, by giving the reviewer a more optimistic picture of flow thicknesses. For example: on page 3(i) a range of thickness is given for each flow. Would it not be more pertinent to list the thickness of the useable dense interior of a flow?

9. On page 5-27 design features are discussed as they relate to flow thicknesses. They are listed in table 5-5 (page 5-29) for the Umtanum and Cohassett. Why is a dense interior of 215 feet used for the Umtanum when it is only 83 feet thick? Why is 223 feet used for the Cohassett when thinner dense interior data is indicated by drilling?

Raymond Lasmanis
January 29, 1985
Designee - Nuclear
Waste Board

See Pocket 5 for Enclosure

2/15/85

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

2/15/85

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