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Distribution: MJB JOB Linehan
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(Return to WM, 623-SS) May 8, 1986
MRK Justus

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

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

SUBJECT: OBSERVATIONS, COMMENTS AND RECOMMENDATIONS FOR THE PERIOD MARCH 29 TO MAY 2, 1986

TECHNICAL ITEMS

1. Waste Package--

a. Doe recently decided to revise the geologic repository operations area "advanced conceptual design" to include provisions for SRP defense waste and its respective waste package design. This change was occasioned by the decision of the President to not recommend a separate repository for defense wastes, but to include these wastes in the repository for commercial wastes.

The latest basic characteristics specified for the waste package designs for a basalt repository are contained in Attachment A to this memorandum. This Attachment does not contain the characteristics for the SRP waste package, however, the characteristics listed for the West Valley waste package would likely be similar to those to be specified for the SRP waste. The information in the Attachment was recently presented to a German delegation visiting Hanford.

b. The presentation made to the German delegation noted above contains other items concerning waste package design, of potential interest to the staff. This presentation was forwarded to Linehan via separate correspondence with the request to distribute appropriate sections to the respective cognizant staff.

1842

Specifically Attachment B contains a simplified logic diagram for waste package work and a specification of waste package functions and performance objectives. These are taken from the presentation noted in (a) and (b) above. The logic diagram, although potentially overly simplified, does not indicate the driving role candidate performance analyses should take in determining testing activities and "design" activities as the BWIP has labeled them. I believe the diagram reflects the Project's current, inadequate integration of performance analyses into the planning of other design activities, especially the R&D activities foremost of which is the preparation of the repository (i.e., the entire disposal system) conceptual design.

c. Attachment B identifies performance objectives which appear to translate the words, "substantially complete" from the waste package objectives in 10CFR60.113(a)(1)(ii)(A) to 90% reliability relative to meeting the 1000 year containment. BWIP has also identified the 90% reliability design objective for the 10,000 year release rate performance objective in 10CFR60.113(a)(1)(ii)(B). Neither of the reliability statements has an accompanying confidence statement which designers need as an appropriately specified design target in creating a conceptual design with appropriate plans for testing and analyses necessary to validate design procedures, including the key performance analyses. For example, a 90% reliability with a 50% confidence performance objective would involve a greatly reduced scope for R&D when compared to an R&D effort for a statement of 90% reliability with a 99% confidence. Without a specified target for confidence design will remain inadequately controlled.

d. I recommend that the Staff take positions relative to the performance objectives as to what are acceptable statements of reliability and confidence to support findings related to safety, for example, reasonable assurance of substantially complete containment at 1000 years. Without such guidance, DOE could continue to plan inadequately for their R&D, including site characterization. A proactive Staff position in this area may occasion DOE to consider appropriate specification of performance objectives and help surface differences, if there are any, at an early date. In any case this area of performance allocation warrants early critical Staff assessment to determine what is practical in way of long term reliability and confidence requirements for performance of engineered and natural structures, systems and components, including both barriers and auxiliary components, which are not barriers, but which are intended to act to establish and maintain conditions necessary for good barrier performance.

2. Repository Engineering--

a. Attachment E, The State of In Situ Stresses Determined by Hydraulic Fracturing at the Hanford Site, RHO-BW-ST-73P, of February, 1986, is a revision of an earlier document

RHO-BWI-ST-73 of November, 1985. I have requested a copy of the earlier document from DOE to understand the differences, if any.

b. Attachment E contains significant information on the in-situ stress at the RRL and its relation to the basalt's strength and regional tectonics. I recommend that Staff review this document and comment to DOE. This document may be used as a base to determine an acceptable, definitive relationship between rock strength, in-situ stress, and tectonic stability, which is closely related to siting criterion and geologic repository design criteria in 10CFR60.

As I emphasized during my recent quarterly meeting with Staff, I consider the issue of what is the magnitude and direction of in-situ stresses at the RRL and how these stresses relate to practical and acceptable conditions for geologic repository operations area siting, construction and operation, as well as, the geologic repository functional capabilities, of highest technical priority. I consider a quantitative Staff position in way of interpreting the requirements in 10CFR60 referred to above is warranted to assure consensus early in the project on this key issue.

c. The discussion in Section 2.2.3 of Attachment E deals with borehole spalling and indicates that the position of spalled areas of the borehole sidewalls are generally about east and west--i.e., on an axis normal to the maximum horizontal in-situ compressive stress. I consider this theoretical conclusion should be confirmed with a detailed analytical solution of the evolution of stresses in a brittle material simulating the basalt, initially subject to the expected in-situ stress pattern and subsequently subjected to the coring or boring operation which modifies the stress pattern around the borehole, leading to the failures observed. In this regard the reference to Zoback et al. (1985) (sic) may be pertinent. (I believe the last reference on page 67 is the intended reference.)

Although apparently incorrect, my intuitive judgement would indicate that the spalling would be in the direction of the maximum compressive stress, considering the deformation of the hole expected prior to failure and the assumption that the configuration taken on by the borehole in order to avoid further collapse would be an oblong hole in the direction of the maximum compressive stress. This subjective rationale is behind by suggestion to do a detailed stress evaluation to further understand the spalling phenomena and hydrofraturing process.

3. Geology--

a. Data from the Shell Oil Co. well on Saddle Mountain was released by the State in the middle of April. The State Geologist's office has been evaluating the data and informally indicated to me that substantial quantities of gas exist in

several zones beneath the basalts. A State representative is planning to present a paper on May 15 in Olympia concerning the State's assessment of the oil and gas potential in the Columbia Basin based on data from 5 or 6 deep wells drilled through the basalts, including the Shell well. I plan to attend the session and will report observations to Staff. Attachment C is pertinent to the State's conclusions and the meeting noted above.

b. Coring operations at DC-18 through the middle flows of the Wanapum, including the Sentinel Gap Flow, have been completed. Hydrochemistry and hydrologic data have been and are being gathered from this core hole. No in-situ stress measurements are being conducted, nor or they planned to my knowledge.

c. One observation I have for DC-18 is that an unusual tuff-like material, occurred in the zone between the Sentinel Gap Flow and the next flow above that flow. The material was nearly the color of the dark gray basalt making up the flow top and flow bottom of the adjacent basalts. I have not observed such dark tuff material in the past in observing core samples. It would appear warranted to further investigate the structure and chemistry of this material to establish its origin. If, for example, it were to be associated with the vents that produced the basalts themselves, it may be indicative of a relatively close vent system to the location of the DC-18 hole, considering that the basalt eruptions are not normally associated with large ash emissions. Such local vent or dike structures, if they exist, would substantially change concepts of structure of the basalt and the basement near the RRL.

d. A deep earthquake (mag. coda about 1) occurred west of the recent swarm to the south of the RRL. Its depth was about 20 km. I was told it was on about a 70 degree angle from the events occurring near the surface, south of the RRL in recent months.

4. Performance Assessment--

a. A new manager for performance assessment at RHO, Mike Arndt, has been assigned to replace Bob Baca.

b. Comments 1c and 1d above are pertinent to performance assessment issues.

c. Attachment F contains a summary of the current BWIP performance assessment activities. This is part of the presentation referred to above that was given to the German delegation. Of interest are the curves which address the release of selenium. As noted in by previous memorandum, Staff attention to this element is warranted considering its toxic as well as radiological hazards.

5. Geochemistry--

a. Hydrochemistry data from DC-18 Wanapum basalts is indicating very dilute water chemistry through the Priest Rapids and Rosa Members. However, some small amounts of methane gas is also present and is being measured during water sampling.

b. At DC-23GR relatively small quantities of methane (150 ppm) were observed in the Priest Rapids Member, when compared to concentrations in the RRL. The Grande Ronde Basalt flows are relatively tight, not producing enough water to even obtain uncontaminated water samples. I will forward data from these wells when it becomes available. Drilling at DC-23 is complete with the drill rig already moved to the DC-24 site. Water sampling from the Umtanum has not yet been tried and may not be practical.

c. Water sampling in DC-23 has revealed an unusual reduction in ionic strength and methane concentrations from the Priest Rapids Flow through the Sentinel Gap Flow to the Ginkgo Flow. The concentrations run from 150 ppm methane and 120 ppm chloride to 0 methane and 70 ppm chloride. This chemistry is considerably different (more dilute) than the chemistry found to the south at the RRL.

6. Site/Environmental--

a. To date I have not observed effort at BWIP to plan collection of baseline water chemistry data relative to clean water standards, and toxic waste environmental values. It appears that such data is necessary for an EIS, and its collection should be planned to coordinate with other site characterization work. DOE (Mecca) is aware of this issue per discussions with me in the past. Staff review of the DOE's defense waste DEIS should address this issue of baseline groundwater quality relative to existing environmental values since data presented or missing would appear directly pertinent to a repository EIS.

b. The discussion concerning in-situ stress in item 2 above is pertinent to site location for the BWIP geologic repository.

7. Hydrology--

a. A major report on the response of hydraulic heads was issued by RHO--Preliminary Evaluation of Piezometer Responses at DC-19, DC-20 and DC-22 During Construction of Dc-23, SD-BWI-TI-313, 3/86. Staff received a copy of this report directly from BWIP.

b. As noted above, the Grande Ronde Basalts in DC-23 appear to be relatively tight formations because of the lack of water. Hydraulic testing of various intervals may be held up pending action on the stop-work-order.

c. The large drill rig has been moved from the DC-23 location to the DC-24 pad. Drilling has not started however.

8. Quality Assurance--

a. Major actions took place in way of attempting to upgrade BWIP QA. Several QA audits, including an audit of the design control associated with the ES and repository design work at RKE/PB, was conducted by MAC for DOE. I requested MAC's audit reports on April 11, however, I have received none to date.

b. A general stop-work-order was issued by DOE covering all but six categories of RHO work. Attachment G is the letter which invoked the order. The reason for the order is general lack of adequate design control as evidenced by inadequate planning and conducting work without adequate procedures. Training of personnel was also noted by DOE to be deficient. In addition based on other observations I believe that a general desire of DOE/HDQRS to better understand and control work and to allow review and prioritization of items in the FY87 budget is also a major reason for the order. It is consistent with similar action recently taken at NTS.

c. Also connected with the BWIP order is an issue of effective management systems and qualified personnel, including managers' qualifications. I consider this issue is at the heart of the problem at DOE and RHO. Of particular concern to me is the lack of independence of DOE/RL's and RHO's QA managers and staff from project manager controls in both organizations. For example, in DOE/RL during the week of April 27 while the project manager, Olson, was out of town the QA manager, Saget, was acting for him.

It is my conclusion that the management system within DOE does not provide the independence in the QA manager required by 10CFR50, Appendix B, nor does it provide for direct line reporting to the top level manager having the authority to act decisively on major items, including DOE staffing and major prime contractor issues.

At RHO the BWIP QA manager is at a level in the effective managerial structure below the BWIP project manager, reporting to a RHO QA manager, who is not substantially involved in the day-to-day BWIP activities and who in turn reports to the General Manager RHO. Although the current arrangement would appear to provide desired independence, I do not believe it does, primarily because of the low relative status of the BWIP QA manager. Accordingly, I consider the reporting level of the BWIP QA manager also inconsistent with Appendix B requirements. I have discussed my observations and concerns recently and in the past with RHO and DOE/RL upper management.

d. During the subject period, I reviewed and prepared comments on a draft staff technical position concerning peer review activities. These comments are contained in Attachment D. An early draft of my comments were forwarded separately to Staff (S. Bilhorn).

MISCELLANEOUS ITEMS

a. Following issuance of DOE's letter to RHO forwarding and interpreting Appendix 7 to the NRC/DOE Site Specific Agreements, RHO management instituted a policy of prohibiting my review of weekly reports of operations issued by each manager to his respective next level manager. Although the policy is not universally observed by all RHO managers, it is observed by the drilling and test group managers and has made it more difficult to stay abreast of activities in that group. I have raised the issue with DOE (Mecca), however there appears to be no resolution as of now. I consider the RHO policy is inconsistent with the agreements in Appendix 7. RHO, has indicated that the weekly letters, classified "strictly private", may contain company proprietary information and hence are not for my viewing. I was told the position relates to RHO competition for the Hanford operational contract which is now being bid.

b. During the site representative's quarterly meeting (this quarter in Washington D. C.) we also met with DOE/HDQRTS representatives to discuss our observations for our respective projects. I identified issues pertaining to DOE/RL's inadequate compliance with the Appendix 7 Agreements, problems in QA within DOE/RL, as well as, RHO, and the siting issue of the high in-situ stress at the current reference repository location, (see item 2 above.) DOE indicated a desire to receive copies of our reports to you. It was agreed that we would send copies hence forth. In addition I sent Knight (DOE) copies of reports dated back to September, 1985. DOE inquired as to when the OR's would be transferred. We indicated there were no plans to transfer the OR's.

DOE stated that DOE/RL believes that my relationship with them is somewhat "adversarial". I agreed that some aspects of the job were what one might term adversarial, particularly the continuing issues which I raise concerning access to information and attendance at meetings, however, I prefer to think of them as merely arms-length interactions. I indicated that almost all disagreements could be related to DOE/RL's policy concerning "pre-decisional information" and its release to the public via the NRC PDR. I indicated it was NRC policy to make all information pertinent to our licensing activities, received from the outside, available to the public. I noted that my files in my office were open for the public to inspect and that this was consistent with recommendations from NRC's TMI site office

manager during training prior to setting up the on-site office at Richland. DOE (Knight) seemed to concur with the NRC policy.

F. Robert Cook

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

cf:
JOBunting
JJLinehan
JMHoffman
MRKnapp
JTGreeves
PHildenbrand
PJustus
MFWeber
HLefevre
DBrooks
KCChang
JTBuckley
WLilley
JMLibert
SGBilhorn
PTPrestholt
TRVerma
FRCook
I&E
DOE
OLOlson

ATTACHMENT: A

COMPARISON OF TYPICAL WASTE PACKAGES

WASTE PACKAGE CHARACTERISTIC [1]	15x15 W CONSOLIDATED [2]	15x15 W INTACT [2]	17x17LG W INTACT [3]	WVHLW CANISTER [2]
CONTAINER ID	37.1(14.6)	63.5(25.0)	66.0(26.0)	63.5(25.0)
CONTAINER OD	54.1(21.3)	80.5(31.7)	84.0(33.0)	81.3(32.0)
PACKING OD	87.1(34.3)	113.5(44.7)	119.6(47.1)	114.6(45.1)
SHELL OD	89.4(35.2)	115.8(45.6)	120.0(47.1)	116.8(46.0)
BOREHOLE ID	90.2(35.5)	116.8(46.0)	[4]	117.6(46.3)
CONTAINER LENGTH	401.2(157.9)	437.4(172.2)	508.0(200.0)	324.7(127.9)
OVERALL LENGTH	523.5(206.1)	538.5(212.0)	612.0(241.0)	425.9(167.7)
LOAD. CONT. WEIGHT	6.62(14.6)	11.0(24.2)	12.5(27.5)	8.63(19.0)
OVERALL WEIGHT	11.9(26.3)	18.7(41.3)	20.7(45.7)	15.2(35.5)

[1] Dimensions are in cm, and inches; weights are in kg (10^3) and pounds (10^3)

[2] Data is from the SCP CDR which shows an optimized waste package for each waste form studied

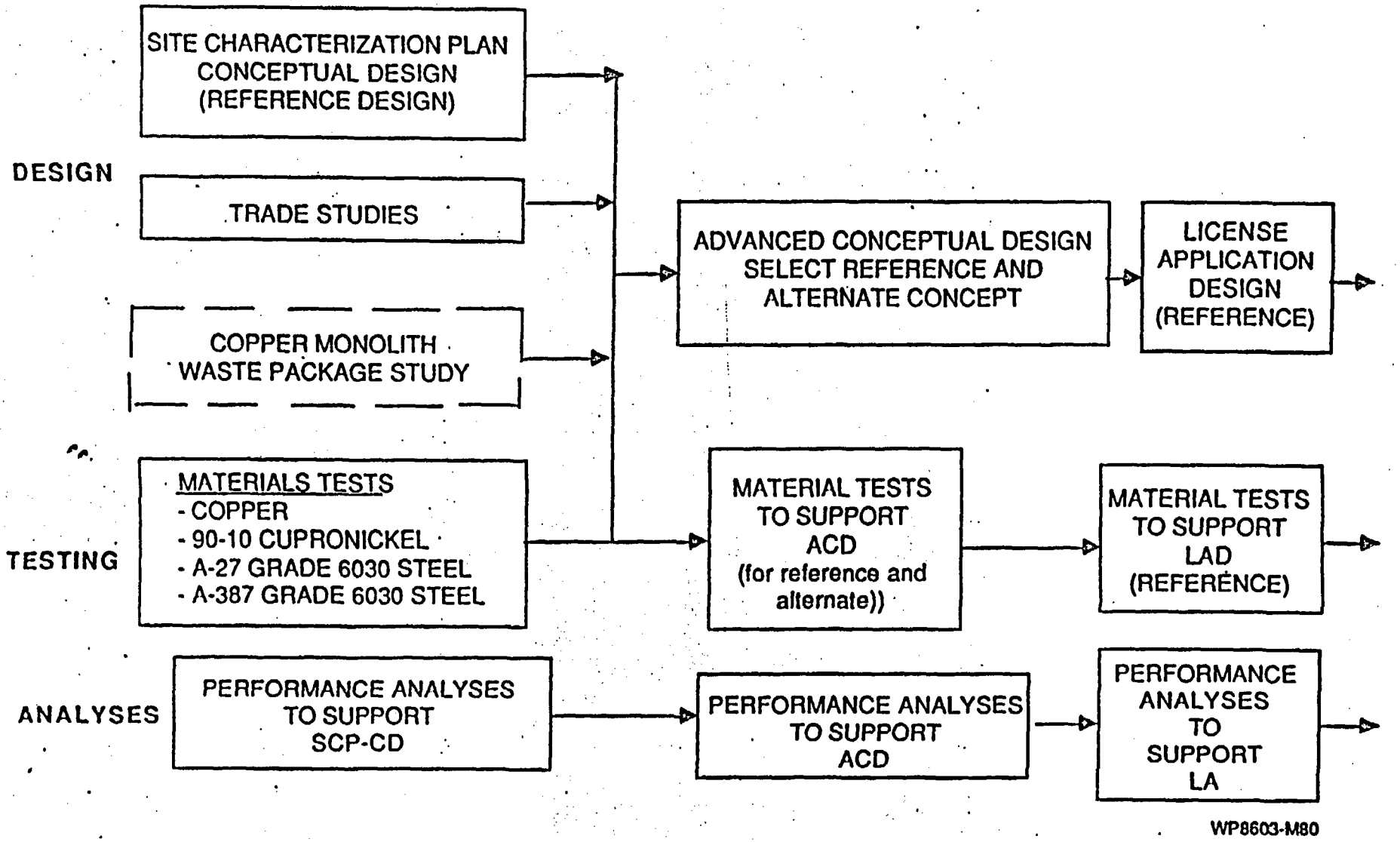
[3] Data is from Computational Brief No. 502 which calculates the maximum envelope that would be required for any waste package, the longest being the Westinghouse 17x17LG PWR configuration.

[4] Not calculated in the Computational Brief. The 0.8 cm (0.3") diametrical clearances between the OD of the shell and ID of the borehole used elsewhere may not be adaquate when practical tolerances are considered.

WP8603-M1-A

ATTACHMENT B

SIMPLIFIED LOGIC DIAGRAM FOR WASTE PACKAGE



ATTACHMENT B

WASTE PACKAGE COMPONENT FUNCTIONS

COMPONENT	FUNCTIONS
Container	• Contain radionuclides during handling, emplacement, and retrieval • Provide substantially complete containment for 1,000 years after emplacement
Packing	• Minimize container corrosion during containment period - Delay water contact - Minimize flow - Buffer O_2 content - Localize corrosion products • Delay radionuclide transport to host rock during the containment period in the event of premature container failure • Reduce radionuclide release after containment period
Shell	• Facilitate packing emplacement and container retrieval

WP8602-M16

ATTACHMENT B

WASTE PACKAGE PERFORMANCE OBJECTIVES

COMPONENT	INTERIM PERFORMANCE OBJECTIVES
Container	• Withstand handling, emplacement, and retrieval loads • Provide 1,000 years containment time with 90% reliability
Packing	• Limit total release to 1.0 EPA limit from the engineered barrier system over 10,000 years with 90% reliability • Limit annual release of each radionuclide to 10^{-5} of its inventory at 1,000 yr with 90% reliability (except for radionuclide with annual release less than 10^{-8} of total radionuclide inventory at 1,000 yr)
Shell	• Withstand handling and emplacement loads

WP8602-M15

ATTACHMENT B

REFERENCE ENGINEERED MATERIALS

WASTE FORM

- SPENT FUEL (BWR PLUS PWR)
- BOROSILICATE GLASS

CONTAINER MATERIALS

- CARBON STEEL, ASTM A27
- Fe9Cr1Mo STEEL (BACK-UP)
- CUPRONICKEL 90-10 (BACK-UP)
- HIGH PURITY COPPER (BACK-UP)

PACKING MATERIAL

(75% CRUSHED BASALT + 25% BENTONITE)

SHELL MATERIAL

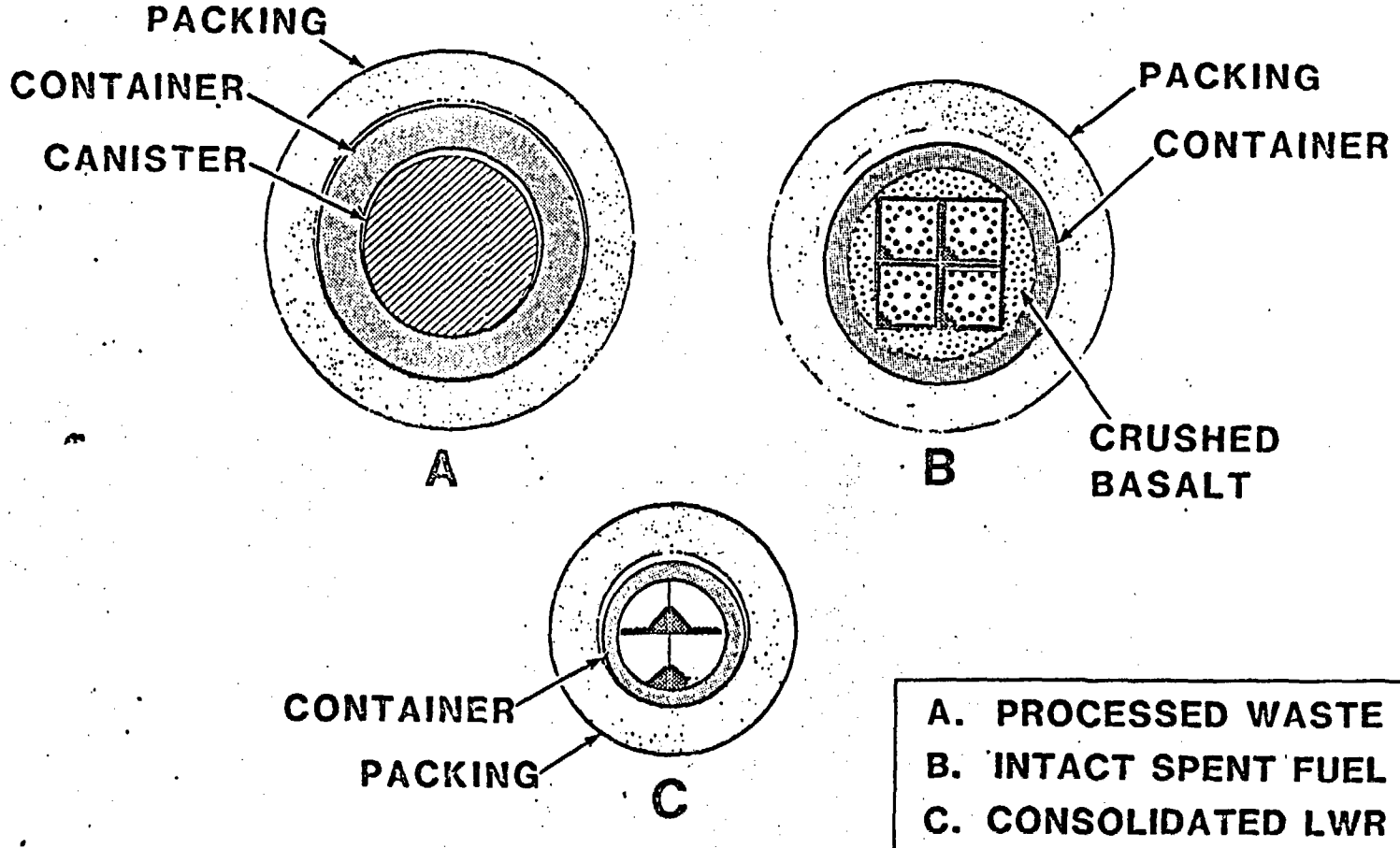
TBD

WP8509-82

ATTACHMENT B

WASTE PACKAGE DESIGN

WASTE FORM CONFIGURATIONS

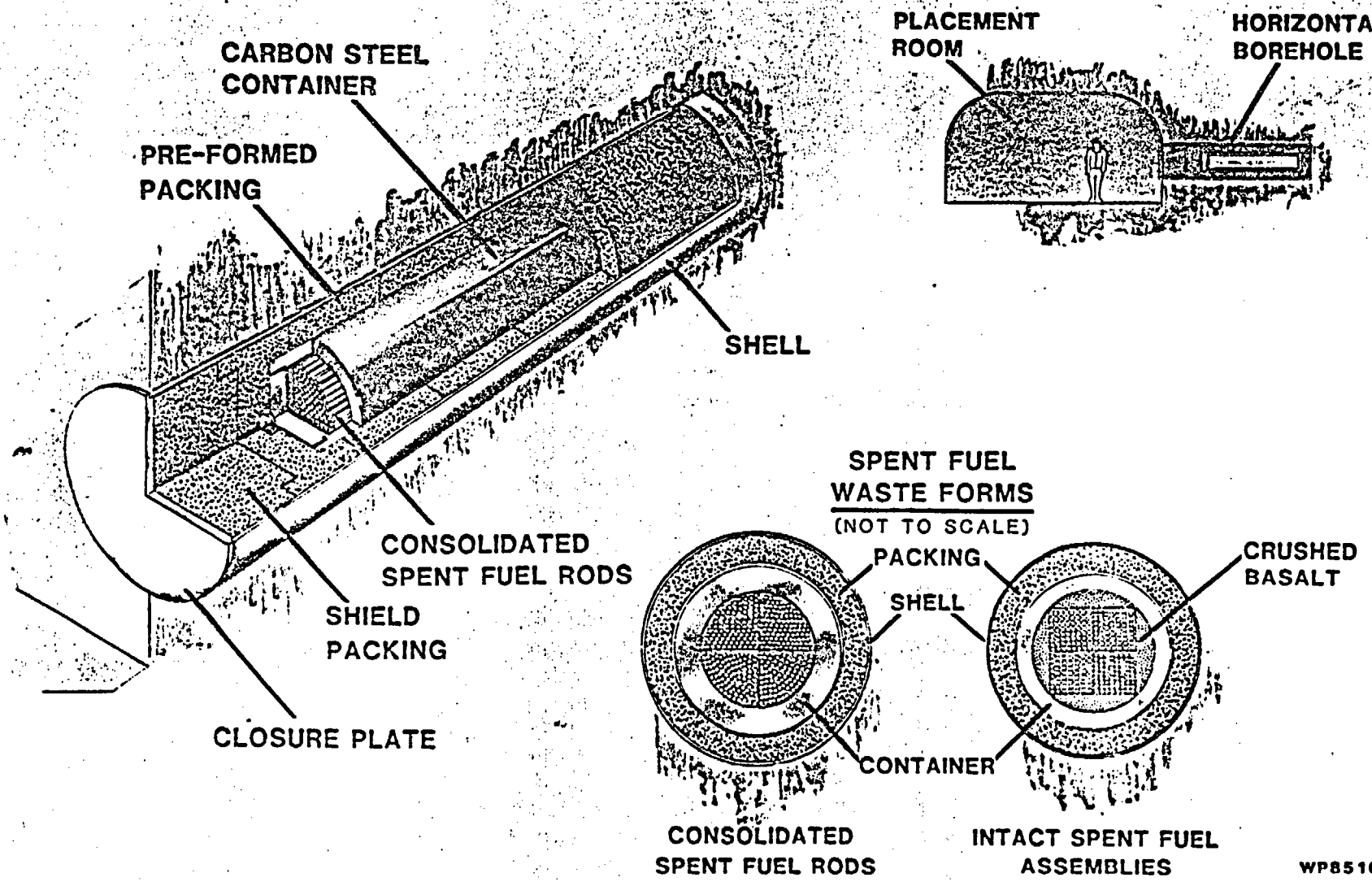


A. PROCESSED WASTE
B. INTACT SPENT FUEL ASSEMBLIES
C. CONSOLIDATED LWR FUEL PINS

WP8505-2

ATTACHMENT B

WASTE PACKAGE DESIGN CONCEPTS



ATTACHMENT: C

WASHINGTON STATE DEPARTMENT OF
Natural Resources

BRIAN BOYLE
Commissioner of Public Lands

OLYMPIA, WA 98504

Mr. Bob Cook
Nuclear Regulatory Commission
1955 Jadwin 310-A
Richland, WA 99352

April 30, 1986

Subject: Transmittal of documents related to the petroleum potential of the proposed high-level nuclear waste repository.

Dear Mr. Cook:

Attached with this letter are copies of a critique of BWIP Report BWI-TI-265 and of the abstract for the paper which Tim Walsh and I will present at the upcoming Northwest Petroleum Association meeting.

The paper we will present on May 15th is a progress report on our study of the petroleum potential of the Columbia Basin. The objective of this study is to determine order of magnitude, gas-in-place reserves which might be expected if a second discovery is drilled. The results of recent drilling which pertain to the petroleum potential of the basin, wireline log interpretation, mudlog interpretation, and geochemistry, will be discussed. We intend to evaluate several trap models in order to produce a reasonable range of possible reservoir volumes.

Please call or write if I can be of further assistance.

Regards,

William S. Lingley, Jr.
Deputy Oil and Gas Supervisor
Division of Geology and Earth Resources
Olympia, WA 98504

WASHINGTON STATE DEPARTMENT OF
Natural Resources

BRIAN BOYLE
Commissioner of Public Lands

OLYMPIA, WA 98504

Abstract for May 15, meeting of the Northwest Petroleum Association

Some comments on the petroleum potential of the proposed Hanford, Washington, high-level nuclear waste repository

by W. S. Lingley, Jr. and T. J. Walsh

Washington State Department of Natural Resources,
Division of Geology and Earth Resources

The proposed high-level nuclear waste repository lies within the 75,000 square mile Columbia Basin, a frontier exploration province. Only five (or six ?) wildcats have drilled through the Columbia River Basalt which covers the entire basin and into the underlying sedimentary rocks. These rocks are mostly Paleogene non-marine claystones, shales, siltstones, coals, and sandstones. Sandstones range from a few inches to greater than 60 feet in thickness and are commonly very argillaceous. Typical sandstone porosities range from 3 to 20 percent with DST-derived permeability measurements on the order of a few millidarcies. Thick impermeable sections isolate the reservoirs drilled to date. Gas was tested from three of the wildcats which penetrated the basalt. A maximum stabilized rate of 3100 thousand cubic feet of gas per day on a 10/64th inch choke with 3965 psi flowing tubing pressure was recorded in the Shell Oil Co. BN 1-9. This zone also produced 2 barrels of 30.2° API gravity condensate per million cubic feet of gas. This condensate has unusually low asphaltene and normal alkane concentrations. Thermal maturation indicators show that peak generation of petroleum liquids could occur between 8,000 and 14,000 feet in the Columbia Basin. The proposed repository is continuously flanked on the north by the Saddle Mountains anticline and on the south by the Rattlesnake Hills anticline. These complex folds are mostly asymmetric, verge to the north, range from 3 to 6 miles across strike, and are greater than 60 miles measured along trend. Prior to 1941, approximately 1.3 BCF of gas was produced from basalt at the Rattlesnake Hills Gas Field but the prospective pre-basalt section there is yet to be tested. The expected value of in-place gas reserves in the event of a discovery in or adjacent to the proposed repository is very large.

Department of Natural Resources
OLYMPIA, WASHINGTON
98504

BRIAN BOYLE
Commissioner of Public Lands

Dr. William Brewer
Technical Director
High-Level Nuclear Waste
Management Office
Lacey, WA. 98503

Feb. 19,1986

Subject: BWIP Supporting Document SD-BWI-TI-265 entitled, Stratigraphy and hydrocarbon potential of the northwestern Columbia Basin based on recent drilling activities by D. L. Banning and N. L. Campbell.

Dear Dr. Brewer:

I have been asked by Ray Lasmanis to comment on the Banning and Campbell BWIP report. I have also reviewed Leaming and Davis (1983) and correspondence between yourself and Mr. O. L. Olson of BWIP. Prior to my recent employment with the Division of Geology and Earth Resources, I had twelve years of experience in frontier exploration similiar in some respects to the Columbia Basin Tertiary gas play. Most recently, I was Chevron's Exploration Coordinator for Papua New Guinea.

The Banning and Campbell BWIP report contains an interesting discussion of possible stratigraphic trends under the Columbia River Basalt. Tim Walsh, of our office, reviewed this portion of the report. Except for a few questionable correlations and dates, the stratigraphic sequence Mr. Campbell proposes for rocks penetrated in the Shell wells is in general agreement with those generated by industry and by the Division of Geology and Earth Resourses.

Newell Campbell has made numerous and significant contributions to the geological knowledge of Washington State, particularly with regard to the late Tertiary stratigraphy of the Columbia Basin and adjacent areas. Therefore, it comes as a surprise that the discussion of the Columbia River Basin hydrocarbon potential given in the BWIP report is speculative and non-quantitative.. The report does not contain accurate descriptions of petroleum source rocks, levels of thermal maturation, sizes of potential traps, or reservoir characteristics of strata which are likely to be encountered if drilling occurs near the proposed repository site. In fact, almost none of the hard data needed to form a valid opinion as to whether storage of radioactive nuclides should hold primacy over petroleum exploration near Hanford are presented in this report. Most of the requisite interpretations

and data necessary to rectify the shortcomings of this report could have been obtained during a short time and at minimal cost.

In a study of this type, technical readers expect clear statements summarizing each variable needed to determine potential petroleum reserves of the basin. Examples of the type of statements which should have been included in the report are:

> -"Porosities in the lower Swauk and Teanaway sandstones penetrated in Shell's Yakima Minerals No. 1-33 range from 9 to 23 percent. Porous sandstones in this interval range from 2 to 25 feet in thickness. Clay volumes in these reservoirs, as determined by analysis of gamma-ray log response, ranges from 0 to 36 percent. Permeability is indicated in two zones by the Dual-induction invasion profile and by mudcake thicknesses exceeding 1 inch."

Casual examination of the Geologic map of Washington shows that very large anticlines are exposed in the Hanford area yet no mention of the possible trap volumes is given. The structural contour maps and detailed cross-sections used to ascertain dimensions of these anticlines at depth are not included despite the abundance of good quality data in the public domain. In fact, only two maps are included in the report and one of these is a location plat.

Two critical steps in assessing the potential of a basin are to identify the petroleum source rocks and to determine the levels of thermal maturation for each source rock interval. The BWIP report dismisses this subject with three speculative paragraphs containing no hard data whatsoever. There is no discussion of the geothermal gradients.

Laymen who rely on the BWIP report for knowledge of exploration in the Hanford area may reasonably ask themselves, "Why is Shell continuing their aggressive exploration program if the prospects are so bleak?" Additional comments should have been included in the report so that laymen are given a clear perspective of the exploration process. For example, the previous information could have been summarized as follows:

> -"The petroleum per unit volume which could be contained in these reservoirs compares favorably with producing intervals in many large Gulf Coast and Rocky Mountain oil fields.
>
> -"the Rattlesnake Hills anticline is a 'world class' fold which crosses the southern portion of the Hanford site boundary. Gas has been

produced from the Columbia River Basalt but, to date, no wells have penetrated the prospective sedimentary section within this anticline. This fold encloses an area about half that of the Gwahar Anticline which entraps the largest oil field in the world.

-"Many giant oil and gas fields in poor seismic record areas required numerous dry holes prior to the initial discovery. For example, the Bay Marschand structure in Louisiana was drilled nine times prior to discovery of this 1.5 billion barrel field. Ninety-one dry holes were drilled in the Idaho-Wyoming Thrust Belt prior to the discovery of four giant fields between 1975 and 1978. More than forty dry holes were drilled without a significant show prior to the discovery of several giant fields in the Alberta reef trend."

Last week I approved four new permits for seismic traverses located directly northwest and southeast of the Hanford site. One 424 channel crew is presently operating in the Hanford area and a second crew is being mobilized. This aggressive exploration program, undertaken during a severe recession for the industry, gives tangible proof of the potential for a major gas discovery in the vicinity of Hanford. However, if the Basalt Waste Isolation Project calls for a rigorous assessment of the petroleum potential of the Hanford site, a more thorough and credible study must be performed as the present BWIP report does not meet minimum industry standards.

For your information, I have attached an outline of the type of study which would determine the petroleum potential near the Hanford site. I understand that Rockwell has a petroleum geologist, Mike Parsons, who should be able to assist in a study on the potential of the Columbia Basin. If his services are needed for other projects, I would be happy to help with selection of competent petroleum geologists who can quantify the petroleum potential of the proposed repository site.

Regards,

William. S. Lingley, Jr.
Deputy Oil and Gas Supervisor
Division of Geology & Earth Resources
Department of Natural Resourses
Mail Stop PY-12
Olympia, WA. 98504

cc R. L. Lasmanis

Reference:

Leaming, G. F., and Davis, J. D., *in* Post, R. G., and Wacks, M. E., eds., 1983, Mineral resource analysis of the proposed site for underground storage of high-level commercial nuclear waste, Hanford, Washington. *Waste Management '83*: Proc. of the Symposium on waste management: University of Arizona, v. 2, p.235-241.

Determination of the Petroleum Potential of an Unexplored Basin

The procedure for assessing an unexplored basin normally includes most if not all of the following data acquisition and interpretation:

1. Regional stratigraphy. Biostratigraphy, especially quantitative palynology, is a key tool because basin-wide, non-marine, lithostratigraphic trends are commonly diachronous.

2. Descriptions of the reservoir strata including the porosities, permeabilities, thicknesses, lateral and vertical lithologic variations, and diagenetic histories.

3. Assessment of the petroleum-generative potential of the entire section. Pyrolysis, chromatography, total organic carbon content determinations, kerogen analyses, GCMS analyses, and isotopic analyses are used to determine oil or gas proneness, petroleum generated to date, and the remaining generative potential.

4. Quantitative assessment of petroleum shows and seeps. This work must be performed with care because, in the past, many reports of shows were understated or exaggerated in order to manipulate investment.

5. Petroleum- source correlations if possible.

6. Assessment of thermal maturation for each source interval using vitrinite reflectance, thermal alteration indices, carbon preference indices, and present-day geothermal gradients.

7. Interpretation of timing of migration. Burial history and/or geohistory are the techniques favored by industry at the present time.

8. Determination of the time(s) of structural development, depths of erosion at unconformity surfaces, and the degree of conformance between deep and shallow structure.

9. Structural contour mapping of doubly plunging and faulted anticlines. In poor record areas, the seismic interpretation is augmented or replaced with mapping of structure on the surface and, with computer-assisted interpretation of gravity, magnetic, and ERTS imagery. Magnetotelluric surveys are generally unreliable.

7. Studies of production within the area and in similar geological provinces in order to generate trap/source/maturation/migration models.

8. A play and prospect inventory is developed.

9. Economic analysis is performed for each play and prospect in order to determine threshold reserves and production rates necessary for commerciality. The probability for discovery of threshold reserves is determined.

10. A decision is made as to the petroleum potential.

The decision is usually made without the benefit of each item in each step because of excessive data acquisition costs. However, every effort is made to obtain a comprehensive interpretation so as to minimize exploratory risk.

ATTACHMENT: D

COMMENTS ON GENERIC TECHNICAL POSITION ON PEER REVIEW BY FORSCHER AND ALTMAN--4-86

1. The INTRODUCTION suggests that peer reviews are only intended to validate design procedures or the selection of materials for items to be constructed to fulfill functional objectives. This is too narrow, since peer reviews may be administered by organizations performing a quality assurance function to over check--verify--a validation activity accomplished by the organization responsible for design, including R&D. I propose the following revision of the first and second paragraphs of the subject draft GTP to clarify the appropriate use of peer reviews.

"The peer review process is usually employed as part of 'those planned and systematic actions necessary to provide adequate confidence,' and accomplished by persons and organizations performing functions of attaining quality objectives in the work under review. This "work" may be any design activity, including but not limited to preparation of (1) a plan; (2) a procedure for collecting raw data during research and development (including site explorations), construction and/or operational phases of a project, i.e., a test procedure; (3) a report containing interpretations of raw data, prepared without the benefit of a validated design procedure for the interpretive process; (4) a report concerning materials selection, and (5) contractual documents and other forms of direction between organizations, groups and individuals having authority to make or change design and/or to make or specify design decisions, design strategy, design margins, etc., generally affecting the quality of an activity or an item.

The major difference between peer reviews and other engineering and scientific reviews, for example, design reviews, readiness reviews and test completion reviews, is the degree of judgement that entered into the work to be reviewed--in general work not accomplished by detailed procedure. Thus, peer reviews generally are used to "validate" design procedures while other engineering and scientific reviews generally "verify" that work has been accomplished in accordance with procedures. However, peer reviews may also be used by an organization performing a quality assurance function to "verify" the "validity" of design procedures, just as design reviews may be used by organizations performing functions of attaining quality objectives in the first place, with no verification function intended or specified to meet quality assurance plan requirements.

As indicated in the discussion above, it is expected that peer reviews will be used in connection with a number of activities of

design, including preparation of procedures for site characterization, and performance assessment for geologic repositories. However, this Generic Technical Position (GTP) provides guidance to the Department of Energy (DOE) on methods which the NRC staff currently views as acceptable for the conduct of peer reviews, whether they be used for the verification of validation activities or validation itself. Other methods may be proposed, or used, and would be reviewed for acceptability by the NRC Staff on a case-by-case basis."

This technical position introduces and defines a term "technical review" (see the definitions below.) It is intended to provide a general term which encompasses other verification reviews of activities which are objectively accomplished in accordance with valid procedures. Technical reviews are hence, considered quality assurance functions and are to be distinguished from reviews which are intended to help attain quality objectives in the first place and would not constitute verification.

2. In the INTRODUCTION and elsewhere in the subject GTP the terms "geologic repository" and "repository" are used. Both are terms defined respectively in 10CFR60.2 and the NWPA and have somewhat different meanings. I recommend that the subject GTP use the term "geologic repository" exclusively to avoid confusion.

3. In the third paragraph of the INTRODUCTION in order to emphasize the fact that project specific nuclear power plant siting and design has involved minimal R&D, since most applicable design procedures have been validated prior to the power plant license application in the past, the following sentence should be added after the first sentence of paragraph 3.

"This is because generic R&D involving peer reviews and other equivalent subjective methodology, resulting in validated design procedures from pre-construction design activities, was accomplished by non-site-specific reactor designers whose R&D activities were not regulated per 10CFR50 Appendix B prior to the application for a construction permit at a specific site."

4. The draft GTP improperly uses the term "technical." (See usage in the INTRODUCTION for examples.) Specifically, the word "technical" connotes engineering and scientific meaning. It is inconsistent with common usage as identified in Webster's to imply by context that scientific reviews are not technical reviews.

5. Concerning Section II, REGULATORY FRAMEWORK, the second paragraph of the GTP appears to incorrectly delimit the application of Section 3.8 of the QA Review Plan to verification activities and, by inference, excludes validation activities. This is inconsistent with the INTRODUCTION of the draft GTP which notes that peer reviews are primarily used for validation, although verification of validation is also a potential use for

peer reviews as I noted in my rewrite of the first two paragraphs. I note that Section 3.3 of the QA Review Plan requires that organizational responsibilities for verification and validation be identified. (This provision is consistent with clearly distinguishing between "doer" and "checker" activities.) I consider that the the use of specific peer reviews per requirements of 3.8 must clearly be designated as a verification or validation function in accordance with requirements of Section 3.3. Section 3.3 should be sited in the REGULATORY FRAMEWORK in this regard. To resolve these concerns the second paragraph of REGULATORY FRAMEWORK should be revised as follows:

"The NRC QA Review Plan (June 1984) (Section 3.8) provides for the use of peer reviews in connection with certain design or design activities to comprise some of the planned and systematic actions necessary to provide adequate confidence that the geologic repository and its subsystems or components will perform satisfactorily in service. These peer reviews can serve a performing function of attaining the quality objective of valid design procedures and/or the quality assurance function of verifying the adequacy of validation activities.

In accordance with the NRC QA Review Plan (Section 3.3) organizational responsibilities are to be described for preparing, reviewing, approving verifying and validating design and design information documents. Since peer reviews may serve to either validate or verify, responsibilities for peer reviews must be clearly identified."

6. The last paragraph of the draft REGULATORY FRAMEWORK does not constitute regulatory framework since it refers to a DOE document in lieu of an NRC regulation or the review plan. In addition it adds nothing to the GTP. This paragraph should be deleted. If it is considered necessary to refer to requirements for audits and record retention and management or other QA requirements, the GTP should refer to appropriate sections of the NRC QA Review Plan.

7. Section III, DEFINITIONS should be eliminated and a reference made to the standard glossary for all the GTP's. As I recommended in my February 24, 1986 memorandum containing BWIP Site comments, observations and recommendations, I consider that "validation" and "verification" are both key terms requiring definition. However, the definitions suggested in Section III of the subject GTP are too general and do not relate to the independent roles of "doers and checkers" spelled out in Part 50 Appendix B, I Organization. Accordingly I recommend that the definitions contained in Attachment A to these comments be used. It is noted that Attachment A includes the definition of the term "design procedure" which I have used in my comments and proposed revisions to the subject GTP and which I have previously recommended be incorporated into the glossary.

8. If considered appropriate to retain the definition after reviewing the following comment, the definition of "Technical Review" should be expanded to cover its role of verification. Also the idea that technical reviews are intended to verify that activities controlled by procedures are in fact in compliance with those procedures and pertinent specifications, design bases, etc. should be included. The following definition is recommended.

Technical Review A documented single or multi-disciplinary review, intended to provide verification, performed by technically qualified personnel who are independent of the original work performed, consistent with quality assurance requirements. Technical reviews consist of analyses and evaluations of, for example, technical documents, records, and/or data--in general design--all of which have been produced in accordance with procedures. Technical reviews assess the technical applicability, correctness, adequacy and completeness of the design information reviewed and assure it was produced in compliance with requirements, and is otherwise consistent with, all applicable requirements and pertinent procedures. Technical reviews among other things determine the accuracy of work.

9. I note that the title of the subject GTP only covers "peer reviews." Considering the provisions specified concerning "technical reviews," see item 4 under the Staff Positions section, I recommend that the title be expanded to covered "technical reviews."

An alternative change would be to delete all reference to technical reviews, including deleting the definition. A separate GTP is warranted to cover these types of reviews and to incorporate all necessary requirements for these reviews. Item 4 is inadequate by itself. It does not comprehensively specify requirements for technical reviews. If this alternative is chosen, the last paragraph of the INTRODUCTION which I proposed above in comment 1 should be deleted.

10. The technical positions should be expanded to include the following items:

a. The application of the requirements should clarify which requirements are intended to apply to Q-list items at level one and which apply to other lower level activities.

b. The list of items which may be considered in a peer review, item 8 of the Staff Positions, should be expanded to consider the adequacy of verification steps specified in design procedures and the apparent qualifications of personnel and organizations, including the apparent objectivity of management, originally performing the R&D or other information or activity being reviewed. The adequacy of specified personnel qualifications should also be an area which peer reviews may cover.

c. A requirement that peer reviewers not become dominated by one or more members of the peer review group should be specified. The procedures for specifying a chairman for the peer review group and his functions and other procedures for interactions should assure that domination does not occur and that the independence of peer reviewers is maintained. Credibility should be provided through the requirement to comprehensively make and maintain records of all interactions and communications, direct or indirect (i.e., through a third party), between and among peer reviewers during the period the peer review is functional. In addition all communications or interactions between peer reviewers and project personnel in any way connected with the activity or information being reviewed should be recorded and retained. Up-to-date electronic means of recording interactions and communications should be required.

d. An additional requirement should be added that there be no real or apparent conflict of political, personal, financial or career interests of peer reviewers in the results of the peer review.

e. A requirement should be included that controlled notebooks be employed by each peer reviewer to record all pertinent activities, evaluations, rationale, conclusions, etc. Calculations and other information created for the peer review group by outside technicians, for example, computer operators, should be comprehensively incorporated into peer review records and retained.

f. A requirement should be added that peer reviews which serve a verification function should be under the direct control of the cognizant quality assurance manager with all peer reviewers having direct access to the quality assurance manager.

g. A requirement should be included that all records be incorporated into a records retention center or appropriate controlled storage facility within a month of date on which they were created.

11. The Section V, DISCUSSION appears to be largely unnecessary text since it duplicates information in the INTRODUCTION. I consider the section should be deleted.

12. A marked up copy of the subject GTP with additional editorial changes is included in this Attachment.

Attachment to Coments on GTP Concerning Position on Peer Review
Concerning Peer Review

1. The terms VERIFICATION or VERIFYING means (1) checking, auditing, and inspecting and other review of activities, subject to procedural control and performed by persons and organizations performing functions of attaining quality objectives; (2) checking, inspecting and other review of structure, system, and component, including barrier, characteristics which are safety-related; and (3) checking, inspection and other review of design, including the peer review of design procedures and/or design, but not including validation activities; all of which [(1), (2), and (3) above] are accomplished by persons or organizations assigned quality assurance functions as required by 10CFR50 Appendix B, Criteria I, "Organization". When used with reference to a computer code and as determined by context, VERIFICATION also means checking and review (accomplished by the persons or organizations responsible for creating or implementing the computer code, but not serving a quality assurance function included in (3) above) to demonstrate that the computer code performs the operations specified in a numerical model. The term VERIFY means to do verification as defined herein.

DISCUSSION:

This definition covers two common usages of the term VERIFICATION. The first definition is consistent with the connotation intended in Appendix B and standard QA usage. It is a "checkers" function and is related to checking specified functions or characteristics whether they be for hardware or design.
It also includes <u>over-checking</u> validation by use of peer reviews. Such an over-checking would be recognized to utilize a quasi-subjective process similar to the process which may have been used to accomplish the validation act in the first place. It is important to note that validation is a function of persons or organizations responsible for R&D. This is a key part of the definition of "validation" below. Verification of validation is to be accomplished, as necessary, by persons or organizations performing quality assurance functions.

In contrast to the definition for "validation" below, verification does not include the records themselves concerning the accomplishment of verification. These records are part of the records under the classification "Quality Assurance Records", discussed under 10CFR50 Appendix B, Criteria XVII.

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2. The terms VALIDATION or VALIDATING with reference to design means (1) the process, accomplished by persons or organizations responsible for obtaining quality objectives for design, confirming that procedures proposed for collecting, identifying and creating design, considering intended application, are sound, cogent, convincing and telling and having such rationale and being supported by data such as to compel acceptance as evidenced by consensus of technically competent scientists and/or engineers in the pertinent technical disciplines; (2) the documents and records, including design, which are pertinent to or the result of the process of (1) herein, including evidence of consensus where such consensus exists. When used with reference to a computer code and as determined by context, VALIDATION means the documents and records confirming that a model as embodied in the computer code is a correct representation of the process or system for which it is intended. The term VALIDATE means to do validation as defined herein.

DISCUSSION:

This definition is consistent with the common definition of the root word "valid". The idea that validation applies to <u>design procedures</u> and is in way of establishing and documenting their quality, considering the subjective assessment of competent engineers and scientists, is noted. The subjective part of their judgement <u>without documentation of their rational</u> does not constitute validation. Documentation is necessary to achieve validation for the record. The concept that the validation process is subjective only means that part of it is not controlled by procedure. Much of the validation process should be controlled by procedure, including such parts as the selection of personnel for peer review groups, document controls, requirements and procedures for producing records, and the identification and handling of data collected by validated design procedures. All aspects of validation can, however, be verified, including the subjective parts. These can only be verified by other subjective methods.

As can be seen in considering R&D purposes, the status of data--whether it has been collected or identified by validated procedures--is important for subsequent validation of proposed design procedures. Hence the need for using design procedures for site characterization and other R&D and the upgrading of existing data as necessary and possible becomes evident.

3. The term DESIGN means (1) specifications, plans, drawings, blueprints, and other items of like nature; (2) the information contained therein; or (3) the research and development data pertinent to the information contained therein. When used with reference to an activity or as a verb, DESIGN means, respectively, the activity or act itself as inferred from the context, involved in producing information listed under (1) and (2) herein.

DISCUSSION:

This definition is consistent with the definition in Sec. 11 (i) of the Atomic Energy Act of 1954 as amended. The inclusion of the part of the definition which covers activities is consistent with common usage which implies the meaning--collecting or creating design (information). In addition since the NRC's rules generally use terms in a manner consistent with the applicable laws, it would be assumed that it was intended that Part 60 also use the term in a consistent manner. This position is specifically implied in the Discussion (Section 3.0) of the NRC Review Plan for Quality Assurance Programs for Site Characterization of High Level Waste Repositories.

4. The term DESIGN PROCEDURE means the description in a document or record of a rational, validated, quantitative or qualitative procedure for collecting or creating design, allowing for appropriate verification of actions accomplished in accordance with the procedure, including procedures for (1) evaluating and assessing the performance of conceptualized and/or defined natural or engineered structures, systems and/or components, including barriers and facilities, (items) relative to their functional goals, objectives and requirements and any other specified requirements, and (2) for accomplishing research and development, including exploration during site characterization pertinent to the items. DESIGN PROCEDURES include computer programs, utilizing models, and other automated processes and procedures, any of which accomplish evaluations, assessments, and interpretations regarding items, including interpretation of data pertinent to the respective items.

DISCUSSION:

The use of this term is consistent with common usage in many engineering projects which do not have R&D phases and which start out with validated design procedures. In addition however, item (2) of the definition specifically identifies that use of validated procedures are considered pertinent to the R&D phase, since the collection of pertinent, valid data is necessary to develop validated procedures identified in (1) of the definition. This usage is rare since application of formal QA controls, meeting 10CFR50 Appendix B requirements, involving procedures for R&D, including exploration, has been rare.

It should be noted that per the definition, design procedures must be validated for their intended application before they become design procedures. The term does not apply to candidate, analytical evaluation and assessment procedures, using models which have not been validated in design procedures and other rationale applied to the assessment of conceptualized items during R&D, including site characterization. Finally, the definition is entirely consistent with the definition of "design" which includes the reference to activities for producing certain (design) information.

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Attachment to Comments on GTP Concerning Peer Review

The concept that activities under a QA program should be accomplished in accordance with procedures so that verification, including QC, can be accomplished is commonly held. Hence "design procedure" as defined above allows the wherewithal to accomplish verification of R&D during site characterization, as well as subsequent to R&D, for example, during construction. The fact that R&D and other design activities may be accomplished without the benefit of procedural control is recognized. The information so collected or created is still "design" for example, research and development data, but its validity is not established. Procedures for validating information to whatever extent possible, particularly raw data and interpreted data, for use in subsequent validation of design procedures are themselves design procedures. (See discussion associated with the definition of validation below for further elaboration of its role in design.)

Document Name:
DRAFT GTP/2

Requestor's ID:
NELLIE

Author's Name:
Forscher/Altman

Document Comments:

16716

For example work which is not accomplished by procedure.

GENERIC TECHNICAL POSITION ON

PEER REVIEW

contain interpretations of new data, accomplished without the benefit of a validated design procedure,

I. INTRODUCTION

The peer review process is usually employed as part of "those planned and systematic actions necessary to provide adequate confidence" in the work under review; where the "work" may be a design, a plan, a test procedure, a ~~(research)~~ report, a materials choice, or a site exploration. The major difference between peer reviews and other technical/scientific reviews, such as design reviews and technical reviews, is the degree of judgment that entered into the work to be reviewed. Thus, peer reviews are ~~meant~~ to "validate" while technical reviews "verify." It is expected that some form of peer review will be used in a number of activities connected with site characterization, ~~design~~, and performance assessment for ~~permanent~~ geologic repositories. This Generic Technical Position (GTP) provides guidance on methods which the NRC staff currently views as acceptable for the conduct of peer reviews. Other methods may be proposed, or used, and will be reviewed for acceptability by the NRC on a case-by-case basis.

The purpose of this GTP is to provide guidance to the Department of Energy (DOE) on the use of peer review as a means for providing adequate confidence in activities, data, and conclusions that will become bases for DOE's license application and NRC's licensing decisions. These activities include, but are not limited to the following: (1) development of plans, (2) development and choice of procedures and methodologies, (3) data taking and recording (data acquisition), (4) data analyses, (5) interpretations and conclusions based on the data, and (6) decision making.

Because of the inherent uncertainty of geotechnical data and their analyses, the need to make projections over thousands of years, lack of unanimity among experts, and the first-of-a-kind nature of repository-related technical issues for which standardized investigative procedures do not exist, more reliance is expected to be placed on the use of peer reviews as a means of establishing technical validity than has been the case in nuclear power plant siting and design. The NRC's regulatory basis for the assurance of quality ~~for the repository program~~ is found in 10 CFR 60, Subpart G. However, neither it nor other implementing standards provide guidance on the use of peer reviews. This GTP provides implementing guidance for what peer reviews are, determining when a peer review is appropriate, qualifications of peers, and guidance for the conduct and documentation of a peer review.

This GTP is applicable to reviews of a technical or scientific nature, and is not meant to be applied to issues of societal or economic nature.

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II. REGULATORY FRAMEWORK

The regulatory basis for peer reviews as a quality assurance measure is provided by 10 CFR 60, Subpart G, which states that the repository QA program is to be based on the criteria of Appendix B of 10 CFR Part 50 "as applicable, and appropriately supplemented by additional criteria as required."

The NRC QA Review Plan for permanent geologic repositories (June 1984) provides for the use of peer reviews to meet verification requirements (Section 3.8): "For...activities which involve use of untried or state-of-the-art testing and analysis procedures and methods, or where detailed technical criteria and requirements do not exist or are being developed, a peer review should be conducted. The procedures defining the selection process for a peer group, and the process by which the peer group conducts its review should be described."

DOE's Quality Assurance Management Policies and Requirements (October 1985) states that "an important aspect of quality achievement in the program is the ability to demonstrate the adequacy of technically significant data and documents"... by subjecting them to quality verification activities. "Quality verification activities are to include formal technical reviews, design reviews, peer reviews, and change controls, as appropriate... The results of such reviews [must] be auditable and retrievable from a records management system."

III. DEFINITIONS

Peer

A peer is a person knowledgeable in the subject matter to be reviewed (or a critical subset of the subject matter to be reviewed) to a degree at least equivalent to those who performed the original work.

Peer Review Group

A peer review group is an assembly of peers representing an appropriate spectrum of knowledge and experience in the subject matter to be reviewed, and will vary in size according to the subject matter and importance of the subject matter to safety or waste isolation.

Peer Review

A documented, critical review performed by personnel who are independent of the work being reviewed but have technical expertise equivalent to those who performed the original work. Peer review is an in-depth critique of assumptions, extrapolations, methodology, and acceptance criteria employed, and of conclusions drawn in the original work. Peer reviews determine the adequacy of work.

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Technical Review

A documented single or multidisciplinary review performed by technically qualified personnel who are independent of the original work performed. Independent technical reviews are analyses and evaluations of technical documents, material, or data that assess the technical applicability, correctness, adequacy, and completeness of documents, data, and conclusions. Technical reviews determine the accuracy of work.

Peer Review Report

A documented in-depth report of the proceedings and findings of a peer review.

Validation

The documented determination of the adequacy (acceptability) of the work under review.

Verification

The documented determination of the correctness (accuracy) of the work under review.

IV. STAFF POSITIONS

1. A peer review is required when:

validation of design

- the ~~validity of information~~ ~~(e.g., data, interpretations, test results, design assumptions, etc.)~~ or the acceptability of procedures and methods is essential to showing that the repository ~~system~~ meets or exceeds ~~its performance requirements with respect to safety and waste isolation;~~ and requirements of 10 CFR 60 and validation, geologic

- ~~the validity of this information~~ cannot be otherwise established through ~~accurate~~ adequate means such as testing, alternate calculations or reference to previously established standards.

- verification) Subjectively determined validation is agreed by QA plans.

2. ~~In general~~, the following conditions are indicative of situations in which a peer review is ~~appropriate or~~ necessary ~~to activate~~ to accomplish verifications.

   - Critical interpretations or decisions in the face of uncertainty.
   - Decisions or interpretations having significant impact on performance assessment conclusions
   - Novel or state-of-the-art testing, plans and procedures and analyses
   - Detailed technical criteria or standard industry procedures do not exist ~~or~~ are being developed in the Project's ~~RFQ~~ activities. and Design

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- Results of tests are not reproducible or repeatable.
- Data or interpretations are ambiguous
- Data validity is questioned--such data may not have been collected in conformance with an established QA program

3. A peer review is recommended when the validity of a critical body of information can be established by alternate means, but there is disagreement within the cognizant technical community regarding the applicability or appropriateness of the alternate means.

4. Work performed by DOE and its contractors, which is used in support of the license application shall be subject to technical reviews. Examples of such work are: data collection, development of test plans and procedures, and data analyses. This review also includes data and conclusions which are subsequently subjected to a peer review. For routine scientific and engineering work, technical reviews serve as the primary quality control measure to provide assurance of the quality of the work. Technical reviews should not be confused with peer reviews.

5. The number of peers comprising a peer group will vary with the complexity of the work to be reviewed, its importance to establishing that safety or waste isolation performance goals are met, the number of technical disciplines involved, the degree to which uncertainties in the data or technical approach exist, and other factors, including the extent to which differing viewpoints are strongly held within the applicable technical and scientific community concerning the issues under review. The collective technical expertise and qualifications of peer group members should span the technical issues and areas involved in the work to be reviewed. Technical areas more central to the work to be reviewed should receive proportionally more representation on the peer review group.

As a general rule, the size of the peer review group is less important than the professional stature of the peer reviewers, their ability to span the technical issues involved and represent major schools of scientific views, and independence.

6. Each peer reviewer should have recognized technical credentials in the technical area he or she has been selected to cover. The technical qualifications of the peer reviewers in their review areas of expertise should be at least equal to the technical qualifications of the persons who performed the work or analysis under review. The prestige of each peer, and hence of the peer review group as a whole, relates to the importance of the subject matter to be reviewed. Peers should represent a diversity of views, but must have recognized technical/scientific credentials that can be verified.

7. Members of the peer review group should be independent of the original work to be reviewed. Independence in this case means that the peer (a) was not involved as a participant or technical advisor in the work being reviewed, and (b) has no past, existing, or anticipated financial stake in the work being reviewed. The independence criterion is not meant to exclude eminent

scientists or engineers upon whose earlier work certain of the work under review is based, so long as a general scientific consensus has been reached regarding the validity of their earlier work. Nothing in this section is intended to impede full and frank discussions between the peer reviewers and the performers of the original work during the review.

8. The peer review process may vary from case to case, and shall be determined by the chairman of the peer review group, consistent with the guidance provided in this GTP. In meetings and/or correspondence the peer review shall evaluate and report on the following items, as appropriate:

   - Validity of assumptions
   - Alternate interpretations
   - Uncertainty of results
   - ~~Appropriateness and limitations of methodology and procedures~~
   - Correctness of application
   - Correctness of calculations
   - Validity of ~~conclusions~~

9. Procedures shall be developed for the peer review process to implement the guidance and staff positions in this GTP. ~~Written minutes~~ should be prepared of meetings, deliberations, and activities of the peer review process.

10. A written report documenting the results of the peer review ~~must~~ shall be issued. It is usually prepared under the direction of the chairman of the peer group, and is signed by each member individually. It should clearly state the work or issue that was peer reviewed and the conclusions reached by the peer review process (item 7 above), including minority positions. A listing of the reviewers and their qualifications should also be a part of the peer review report.

The report should also include individual statements by peer review group members reflecting dissenting views or additional comments as appropriate.

V. DISCUSSION

Peer review is a way of providing assurance that the work performed and data collected during site characterization will have an acceptable and demonstrable degree of quality. With routine day-to-day scientific and engineering work, assurance is normally achieved through design and technical reviews. However, due to the first of a kind nature of a repository, state-of-the-art testing, and inherent uncertainty in geotechnical and scientific work, peer review is a management tool whereby assurance can be reasonably achieved for certain technical and programmatic judgments.

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As stated in the NRC Review Plan (June 1984), "DOE has overall responsibility for achieving and assuring the quality of high-level waste repositories." Thus, DOE has the responsibility to have, conduct, and document the peer review process in accordance with the guidelines set forth in this GTP. Failure to demonstrate adequate quality could lead to serious problems and delays in the repository program. The ultimate test for data, materials, assumptions, technical documents, etc., will be during the licensing proceedings. The function of the quality assurance organization in the peer review process is to verify that a peer review was conducted, when appropriate and that a qualified peer review process was followed.

During the site characterization phase, the staff expects that the results of peer reviews will be used as aids to the decision making process associated with testing, analysis, and interpretations of the geotechnical investigations. As contrasted with testing of metals and other materials, standard and conventional test methods for testing of geologic media either do not exist or are severely limited. There is inherent uncertainty in making projections of performance over thousands of years. The host materials are not homogeneous, the testing methods are not simple and test and analytic results are not precise. These facts necessitate independent interpretations by people with specialized experience in order to provide an additional measure of assurance for critical design assumptions, data, or analytic results.

The intent of a peer review is to pass judgment on the technical adequacy of the work or data submitted for review, to identify aspects of the work on which technical consensus exists, to identify aspects on which technical consensus does not exist, and to identify aspects of the reviewed work which the reviewers believe to be wrong or which need amplification. A peer review provides assurance in cases where scientific uncertainties and ambiguities exist, but in which technical and programmatic judgments and decisions still must be made.

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ATTACHMENT: F

BASALT WASTE ISOLATION PROJECT

PERFORMANCE ASSESSMENT

OUTLINE

I. PERFORMANCE ASSESSMENT IN REPOSITORY DEVELOPMENT
   - ISSUES AND STRATEGIES

II. PROBABILISTIC APPROACH TO PERFORMANCE ASSESSMENT
   - WASTE PACKAGE
   - TRAVEL TIME
   - SITE

III. CURRENT ACTIVITIES

PERFORMANCE ASSESSMENT AT BWIP

PERFORMANCE ASSESSMENT IS THE PROCESS OF QUANTITATIVELY EVALUATING COMPONENT, SUBSYSTEM AND SYSTEM BEHAVIOR, RELATING TO CONTAINMENT AND ISOLATION OF RADIOACTIVE WASTES, TO SUPPORT THE DEVELOPMENT OF A HIGH-LEVEL WASTE REPOSITORY AND TO DETERMINE COMPLIANCE WITH THE NUMERICAL CRITERIA ASSOCIATED WITH 10 CFR PART 60

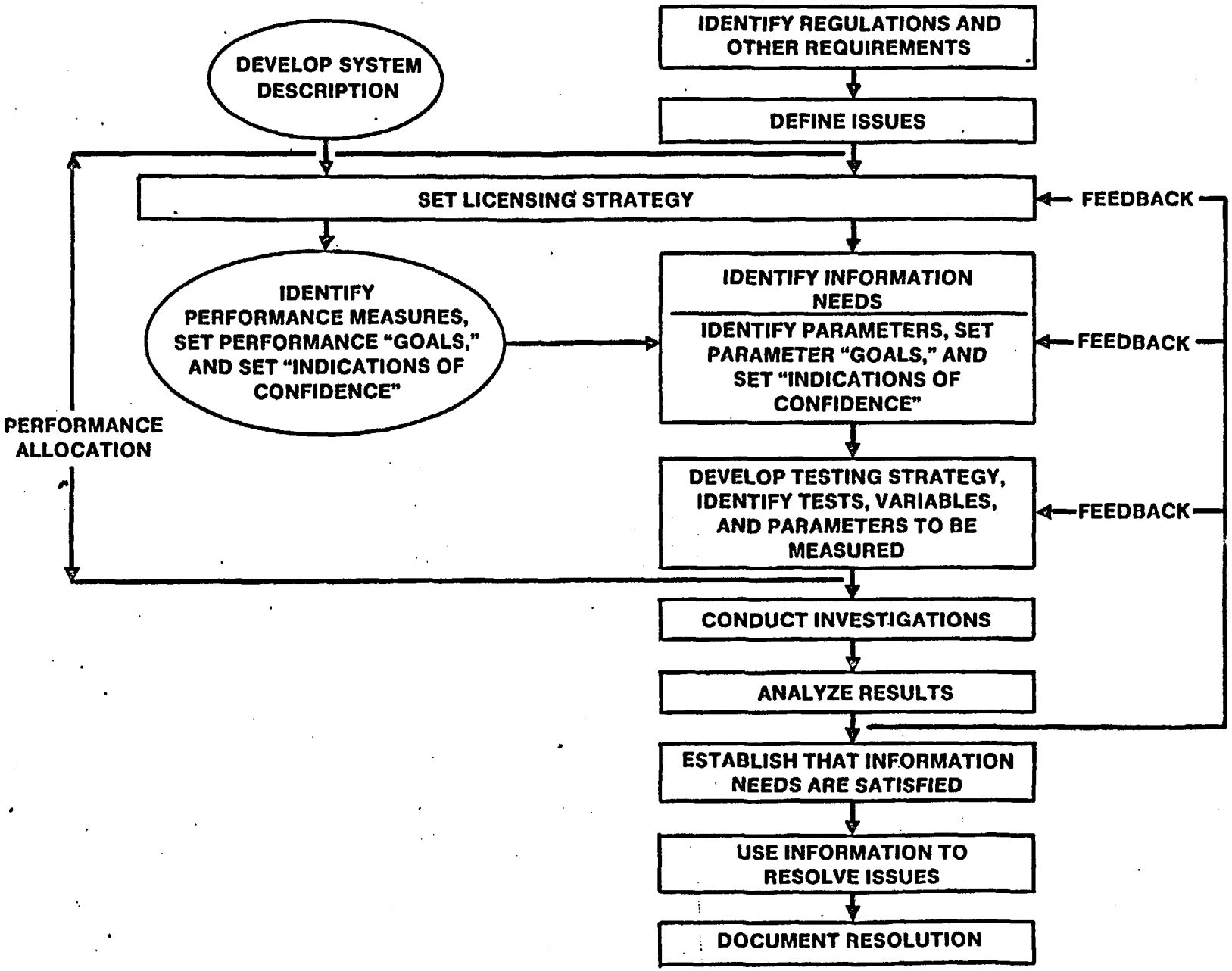
PERFORMANCE ASSESSMENT IN BWIP

- ISSUES ORIENTATION
- PERFORMANCE ASSESSMENT - DRIVEN

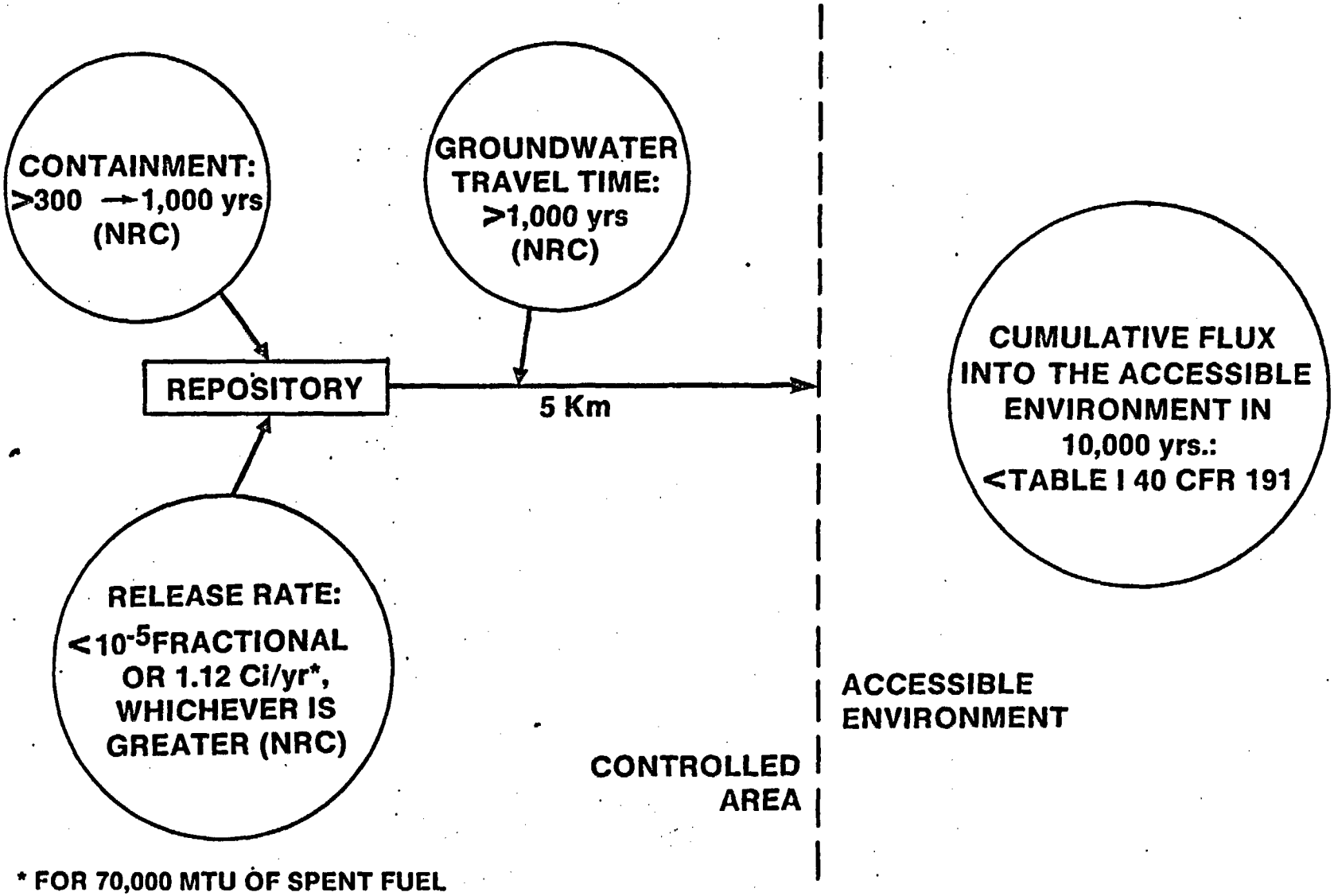
PERFORMANCE ASSESSMENT FUNCTIONS

- DEVELOP AND IMPLEMENT PERFORMANCE ASSESSMENT PLAN
- ANALYSIS OF SYSTEM SAFETY
- ANALYSIS OF ISOLATION CAPABILITIES
- SUPPORT COMPARISONS OF DESIGN ALTERNATIVES
- IDENTIFY AND PRIORITIZE DATA NEEDS

PERFORMANCE ALLOCATION/ ISSUE RESOLUTION STRATEGY



REPOSITORY PERFORMANCE CRITERIA



* FOR 70,000 MTU OF SPENT FUEL

LICENSING STRATEGY

- SELECTS BARRIERS TO BE RELIED UPON
- DEFINES ALTERNATIVE POSITIONS
  - IDENTIFIES LOWER PRIORITY INFORMATION NEEDS AND RESEARCH
- ESTABLISHES CRITERIA FOR ISSUE CLOSURE
- OUTLINES TECHNICAL STRATEGIES
- IDENTIFIES CRITICAL ASSUMPTIONS
- IDENTIFIES LOWER PRIORITY INFORMATION NEEDS AND RESEARCH

COMMON ISSUES HIERARCHY

- KEY ISSUES
  1. ISOLATION
  2. RADIOLOGICAL SAFETY
  3. ENVIRONMENT
  4. DESIGN
- DEFINE 16 PERFORMANCE ISSUES
  - RELATED REGULATION
- DEVELOP STRATEGIES AND CLOSURE CRITERIA
- DEFINE INFORMATION
- DEVELOP TEST PROGRAM

ANALYTICAL APPROACHES

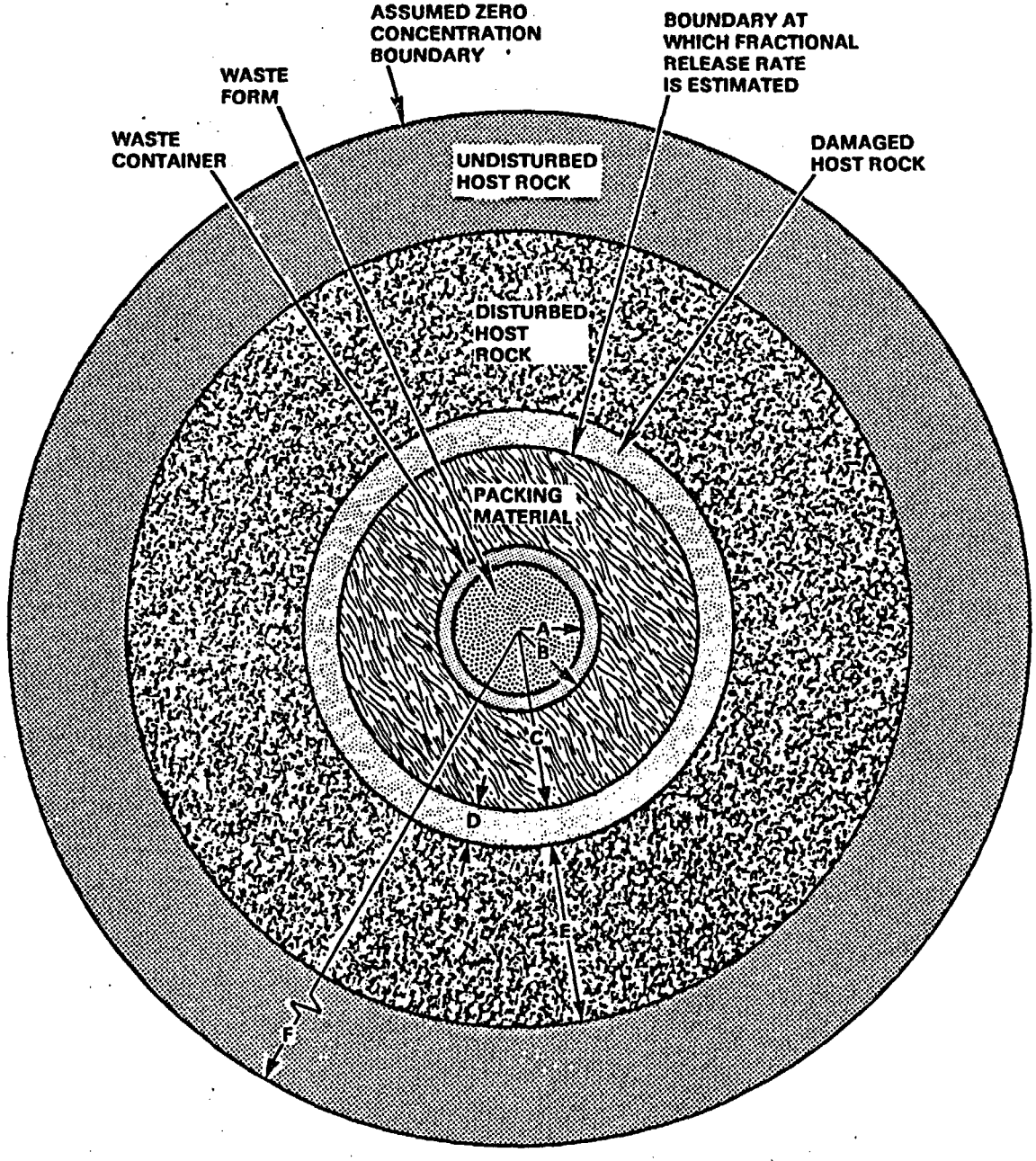
- TYPES OF ANALYSES
  - PROBABILISTIC
  - DETERMINISTIC
- MAJOR AREAS OF ANALYSIS
  - HYDROLOGY
  - GEOCHEMISTRY
  - GEOMECHANICAL
  - RADIONUCLIDE TRANSPORT
  - CORROSION

PROBABILISTIC ANALYSIS

- DIRECTLY ACCOUNT FOR PARAMETRIC UNCERTAINTY
- CONSERVATIVE ASSUMPTIONS IN MODEL FORMULATION AND FIXED PARAMETERS
- CONDUCTING EXTENSIVE SENSITIVITY AND UNCERTAINTY STUDIES
- DATA COLLECTION TO IMPROVE CONCEPTUAL UNDERSTANDING AND REDUCE UNCERTAINTY

WASTE PACKAGE PERFORMANCE ASSESSMENT ANALYSIS

CONCEPTUAL MODEL

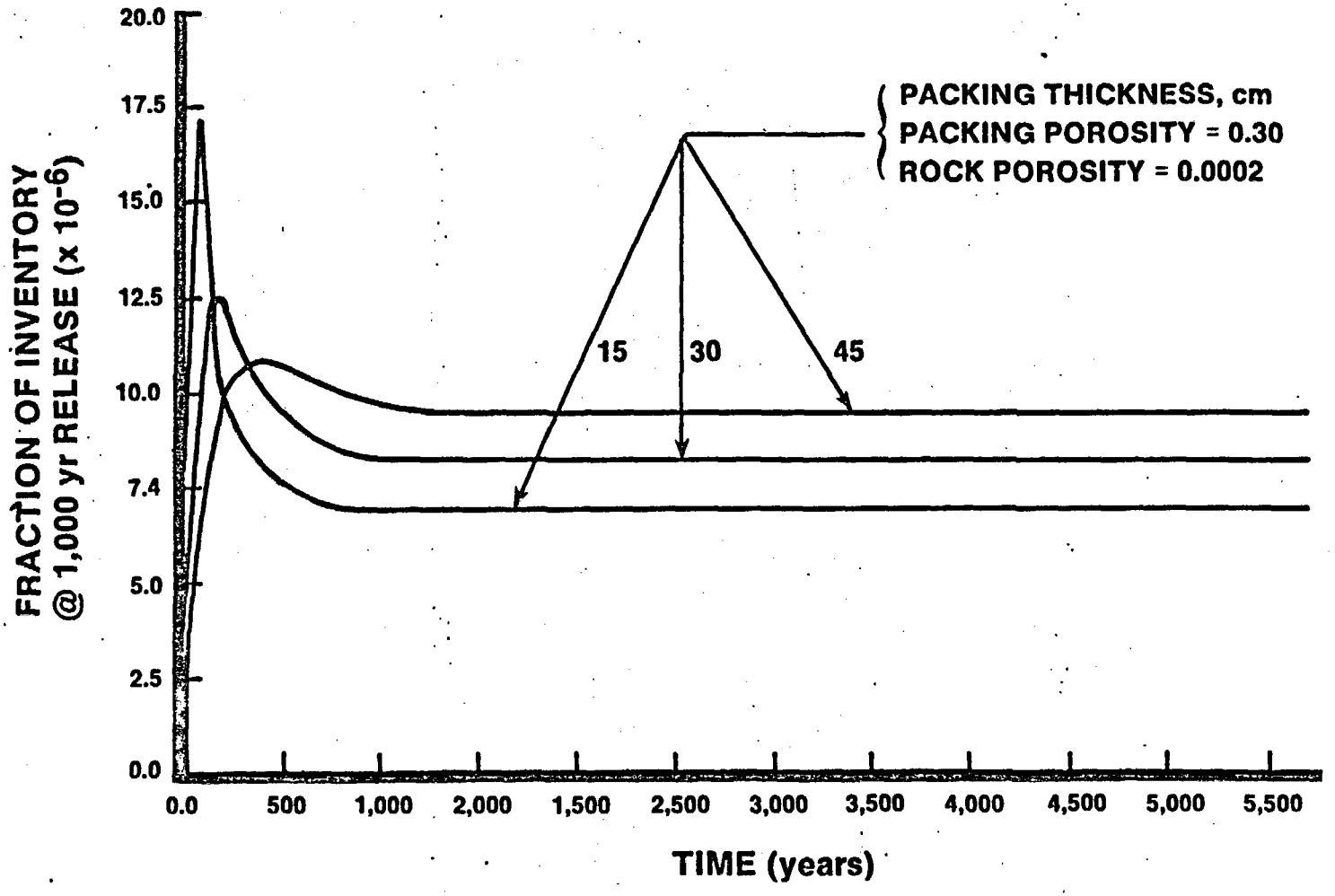


A = 16.8 cm (6.6 in.) C = 44.5 cm (17.5 in.) E = 44.5 cm (17.5 in.)
B = 25.2 cm (9.9 in.) D = 9 cm (3.5 in.) F = 760 cm (295.3 in.)

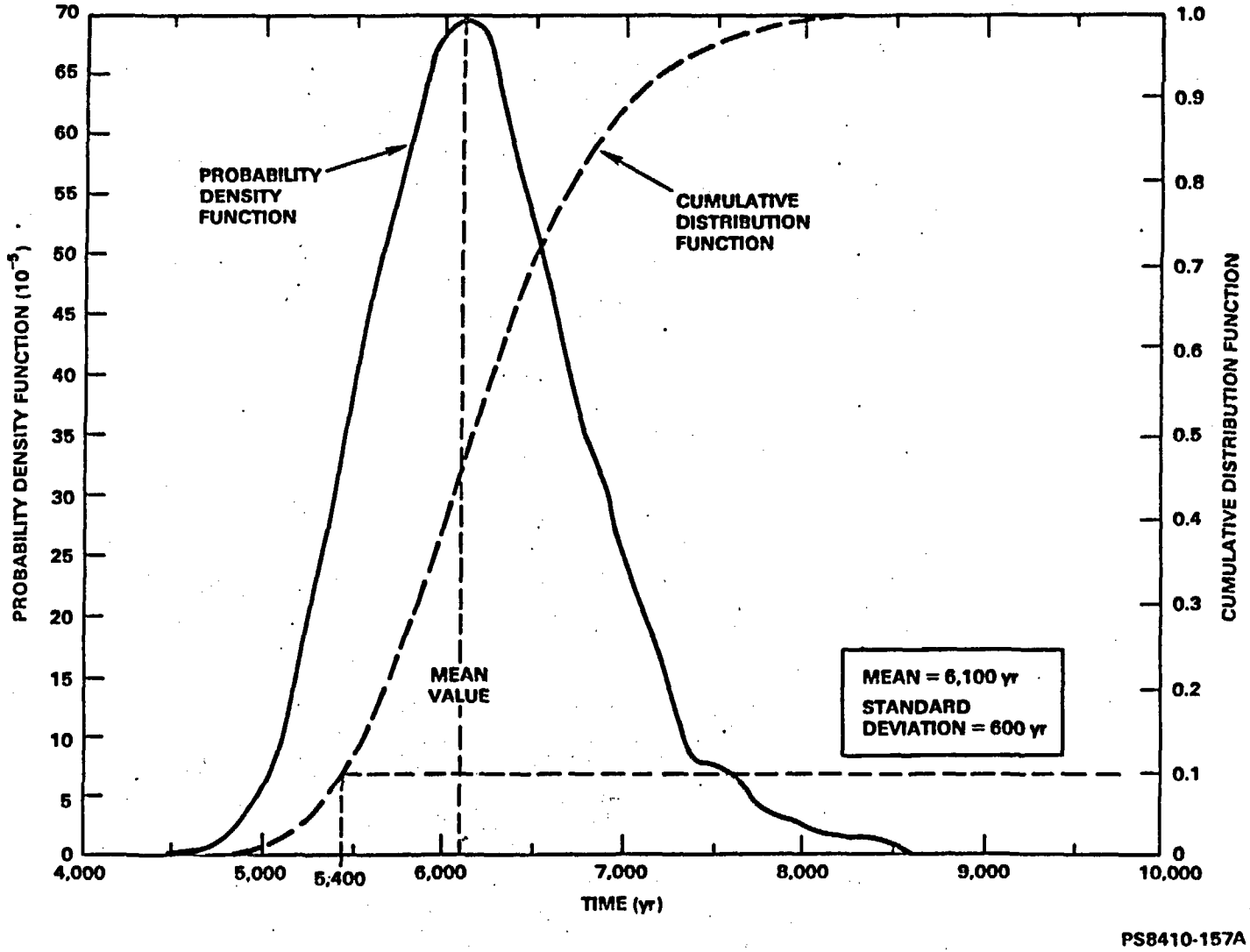
NOT TO SCALE

PS8410-163D

SELENIUM FRACTIONAL RELEASES
1-D CYLINDRICAL ANALYSIS

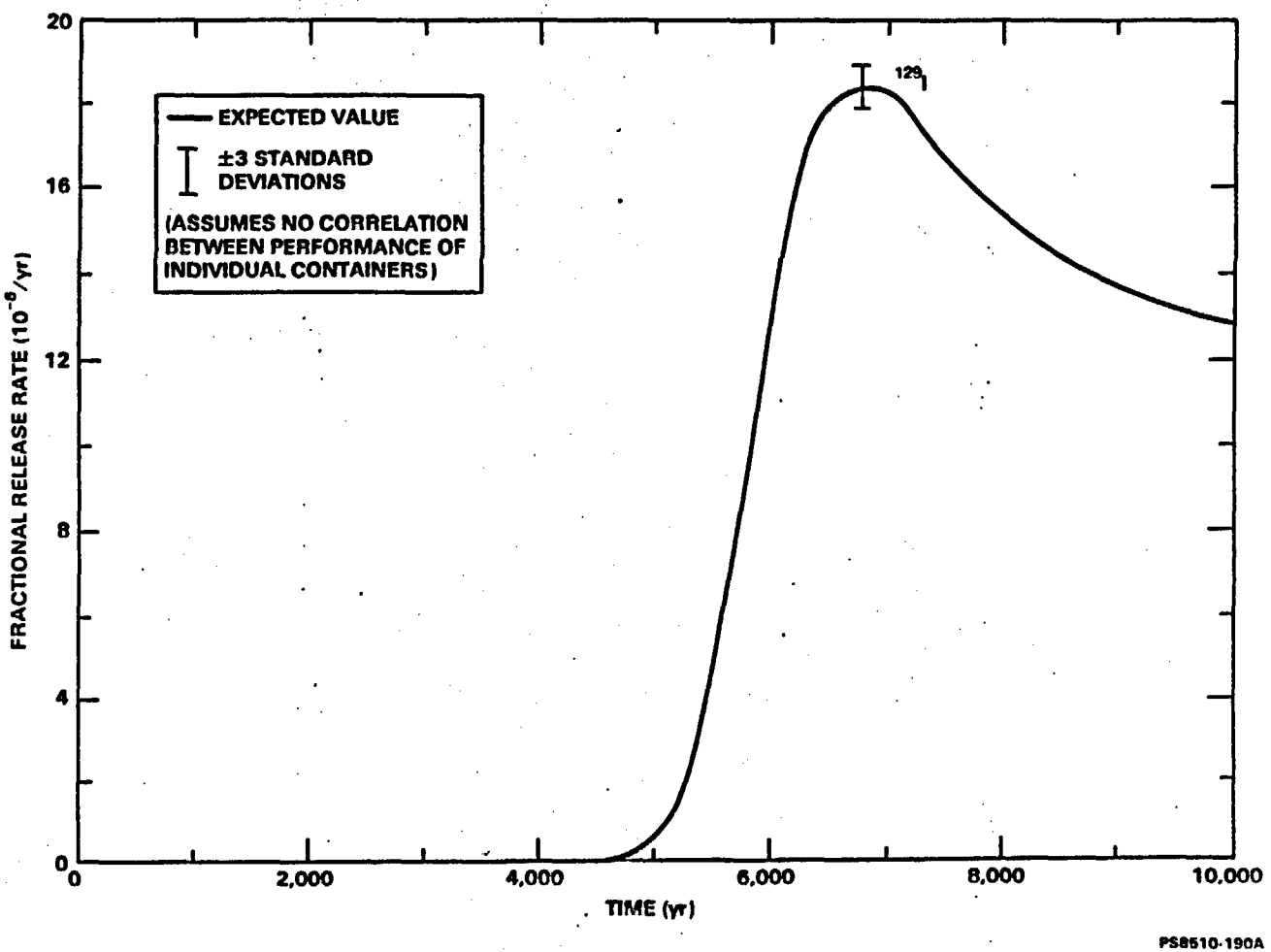


PROBABILITY CURVES FOR FAILURE OF A TYPICAL CONTAINER



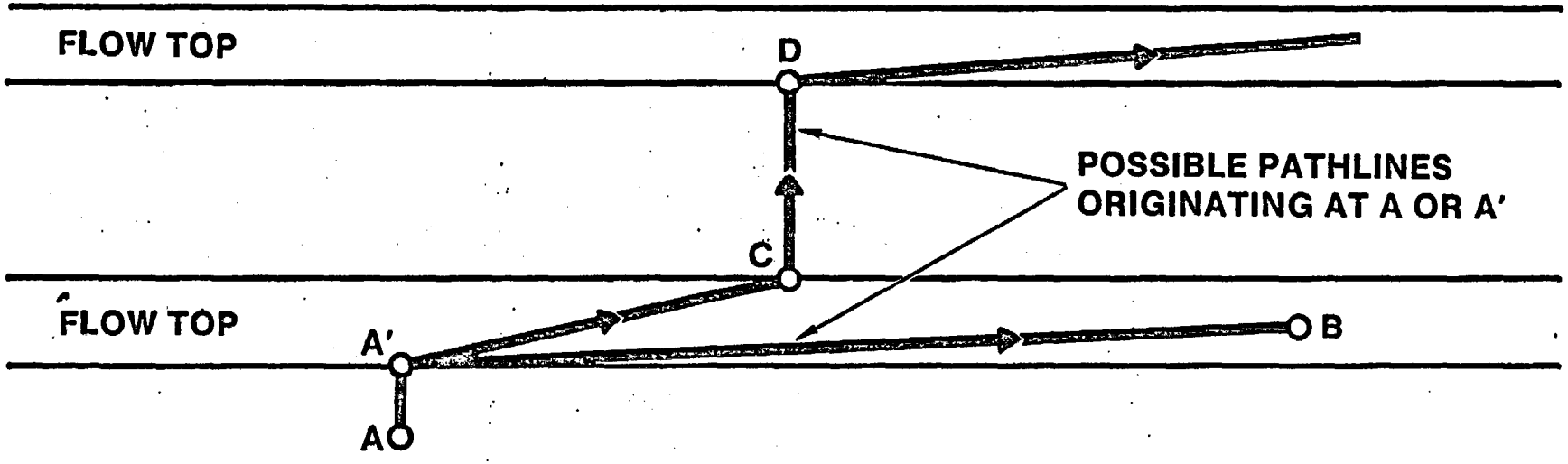
PS8410-157A

MAXIMUM FRACTIONAL RADIONUCLIDE-RELEASE RATES OF IODINE-129 AT THE WASTE PACKAGE SUBSYSTEM BOUNDARY



TRAVEL TIME PERFORMANCE ASSESSMENT ANALYSIS

MODELS 4 AND 5:
TRAVEL TIME IN A LAYERED BASALT SEQUENCE ABOVE COHASSETT FLOW INTERIOR



NOT TO SCALE

CROSS SECTION

PATHLINES IN MODEL 4 ORIGINATE AT A'
PATHLINES IN MODEL 5 ORIGINATE AT A

SUMMARY OF REQUIRED INPUTS FOR GROUNDWATER TRAVEL TIME MODELS

2-DIMENSIONAL HORIZONTAL

- TRANSMISSIVITY FIELD
- FLOW TOP EFFECTIVE THICKNESS
- BOUNDARY CONDITIONS FOR HYDRAULIC GRADIENT
- STRATIGRAPHIC THICKNESS

1 DIMENSIONAL VERTICAL

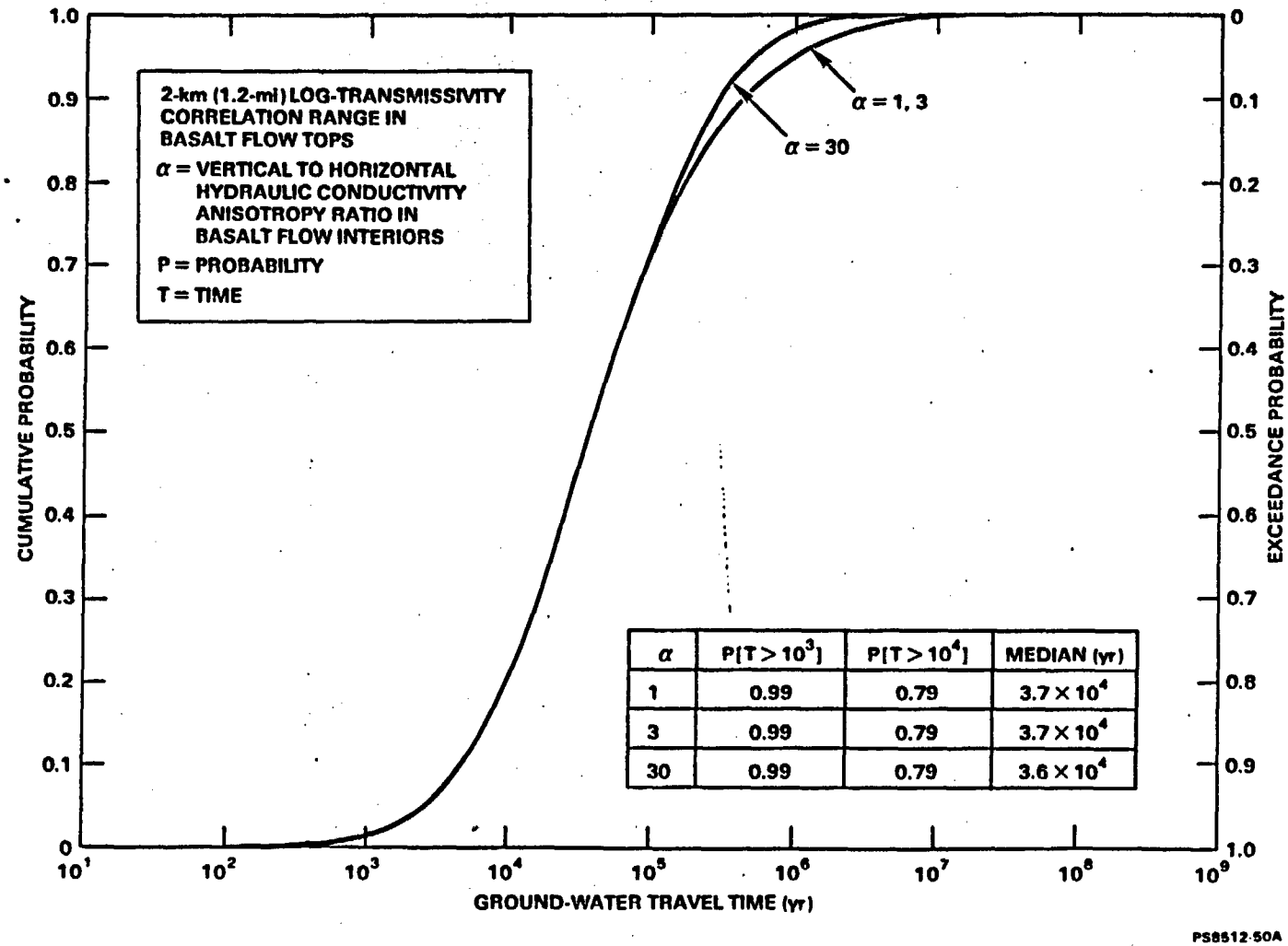
- HYDRAULIC CONDUCTIVITY
- EFFECTIVE POROSITY
- BOUNDARY CONDITION FOR HYDRAULIC GRADIENT
- STRATIGRAPHIC THICKNESS

VELOCITY TERM

$$V = \frac{\text{TRANSMISSIVITY}}{\text{EFFECTIVE THICKNESS}} \bullet \text{GRADIENT}$$

$$V = \frac{\text{CONDUCTIVITY}}{\text{EFFECTIVE POROSITY}} \bullet \text{GRADIENT}$$

PROBABILITY DISTRIBUTION OF GROUNDWATER TRAVEL TIMES FOR 2-KILOMETER (1.2 MILE) LOG-TRANSMISSIVITY CORRELATION RANGE, MODEL 4

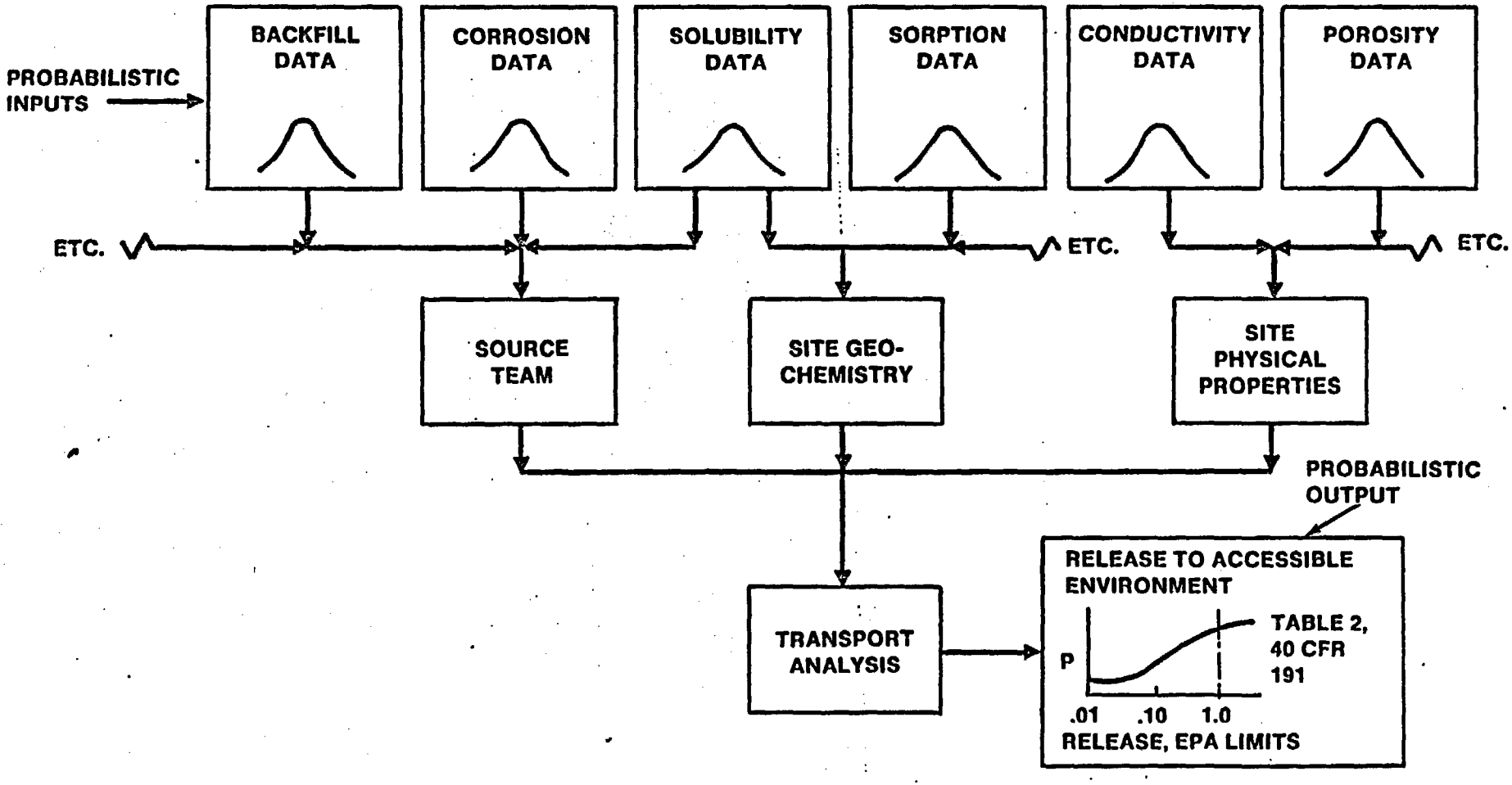


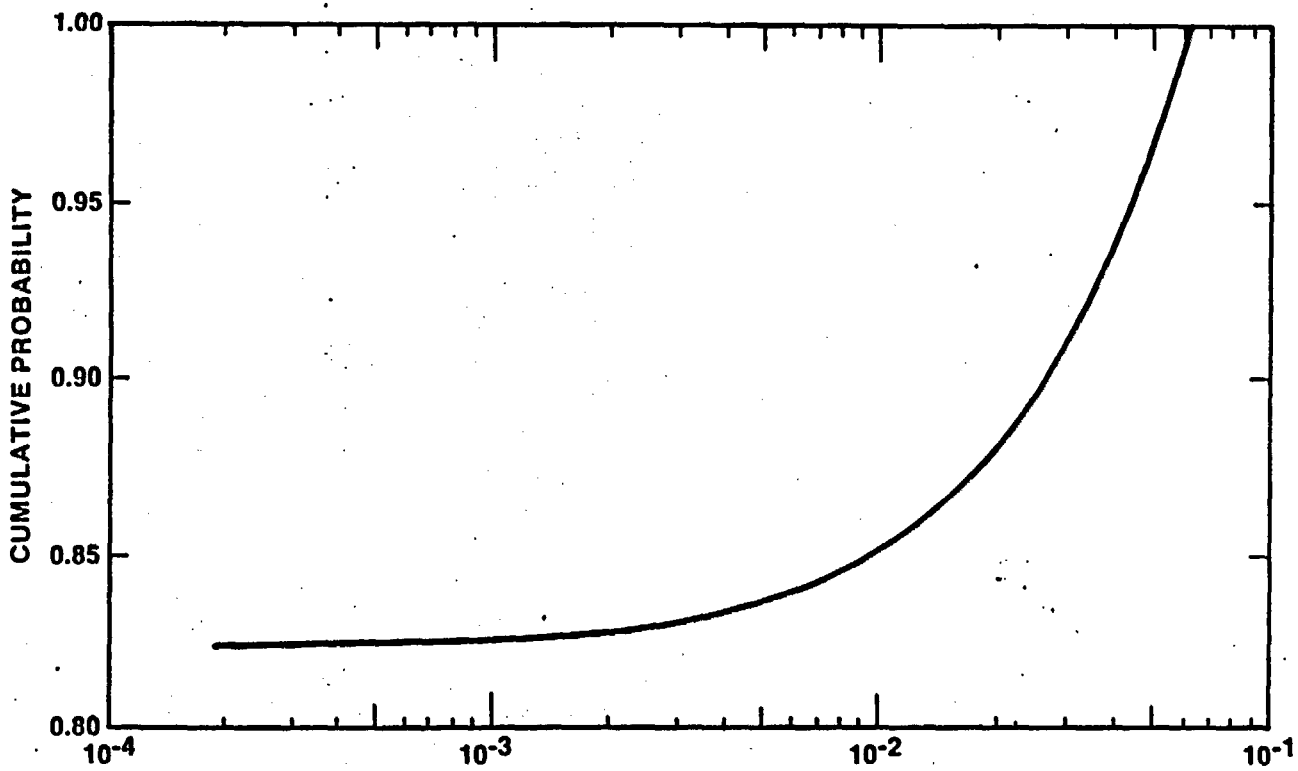
α	P[T > 10^3]	P[T > 10^4]	MEDIAN (yr)
1	0.99	0.79	3.7×10^4
3	0.99	0.79	3.7×10^4
30	0.99	0.79	3.6×10^4

PS8512-50A

SITE PERFORMANCE ASSESSMENT ANALYSIS

MONTE CARLO ANALYSIS OF SYSTEM PERFORMANCE





CUMULATIVE RADIONUCLIDE RELEASE DURING 10,000 YEARS FROM THE SITE SUBSYSTEM TO THE ACCESSIBLE ENVIRONMENT. (5000 TRIALS)

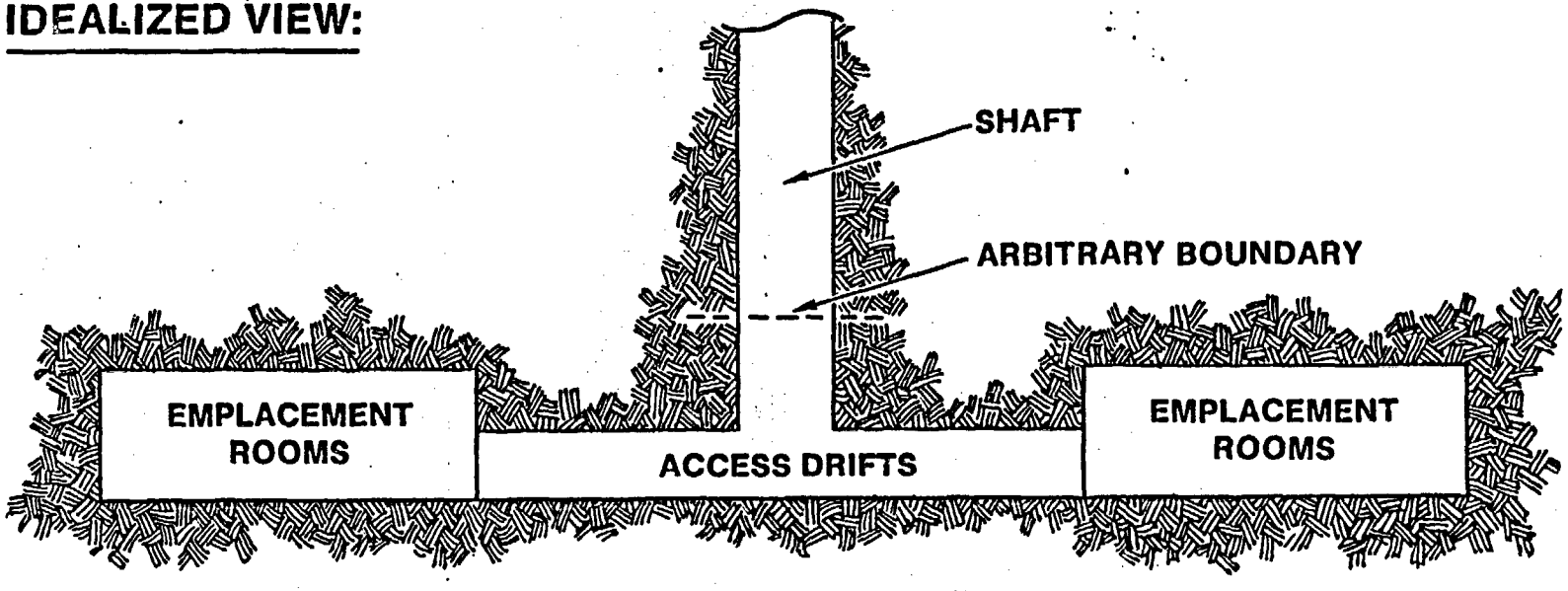
REPOSITORY SEALS PERFORMANCE ASSESSMENT ANALYSIS

PERFORMANCE ASSESSMENT OF SEALS SYSTEM

PURPOSE:

TO PREVENT THE SHAFTS FROM BECOMING A PREFERENTIAL PATHWAY

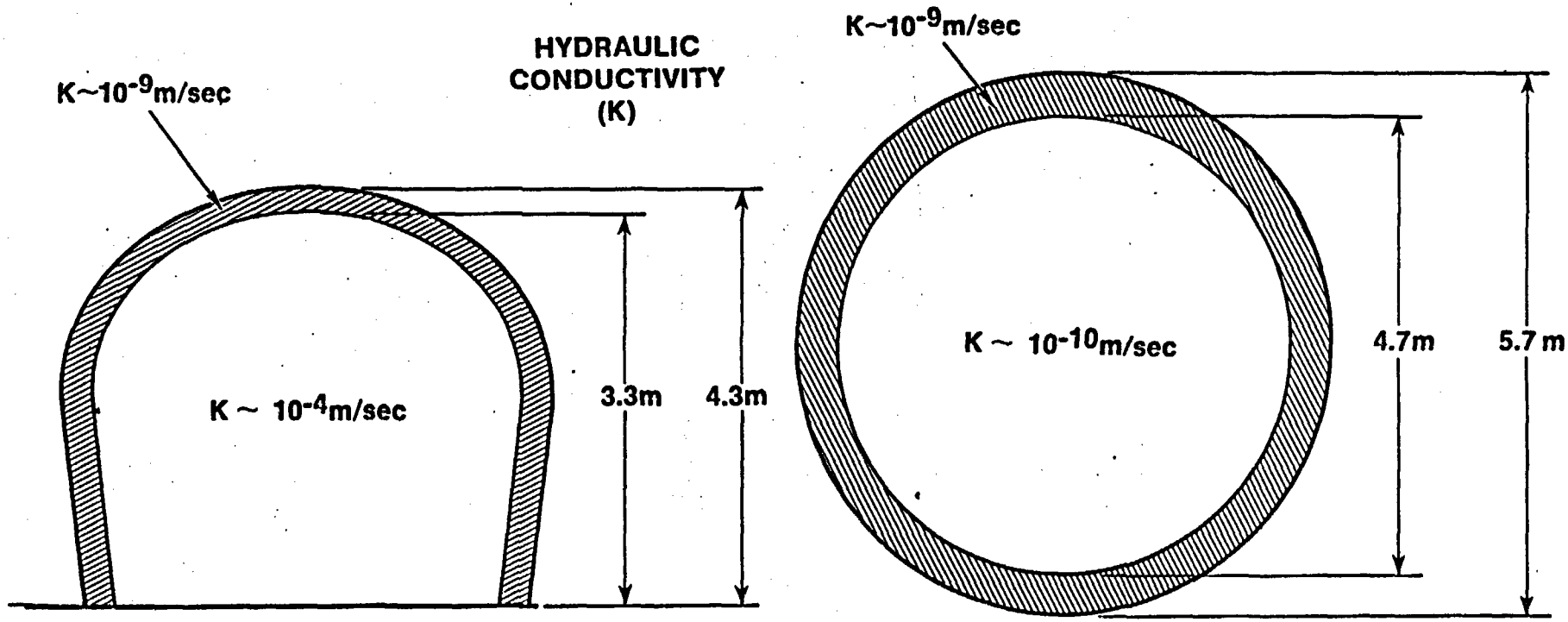
IDEALIZED VIEW:



PERFORMANCE GOAL:

1/100 OF TOTAL NON-SORBING RADIONUCLIDE INVENTORY ENTERS SHAFT

SEALS SYSTEM



DRIFT CROSS SECTION

SHAFT PLAN VIEW

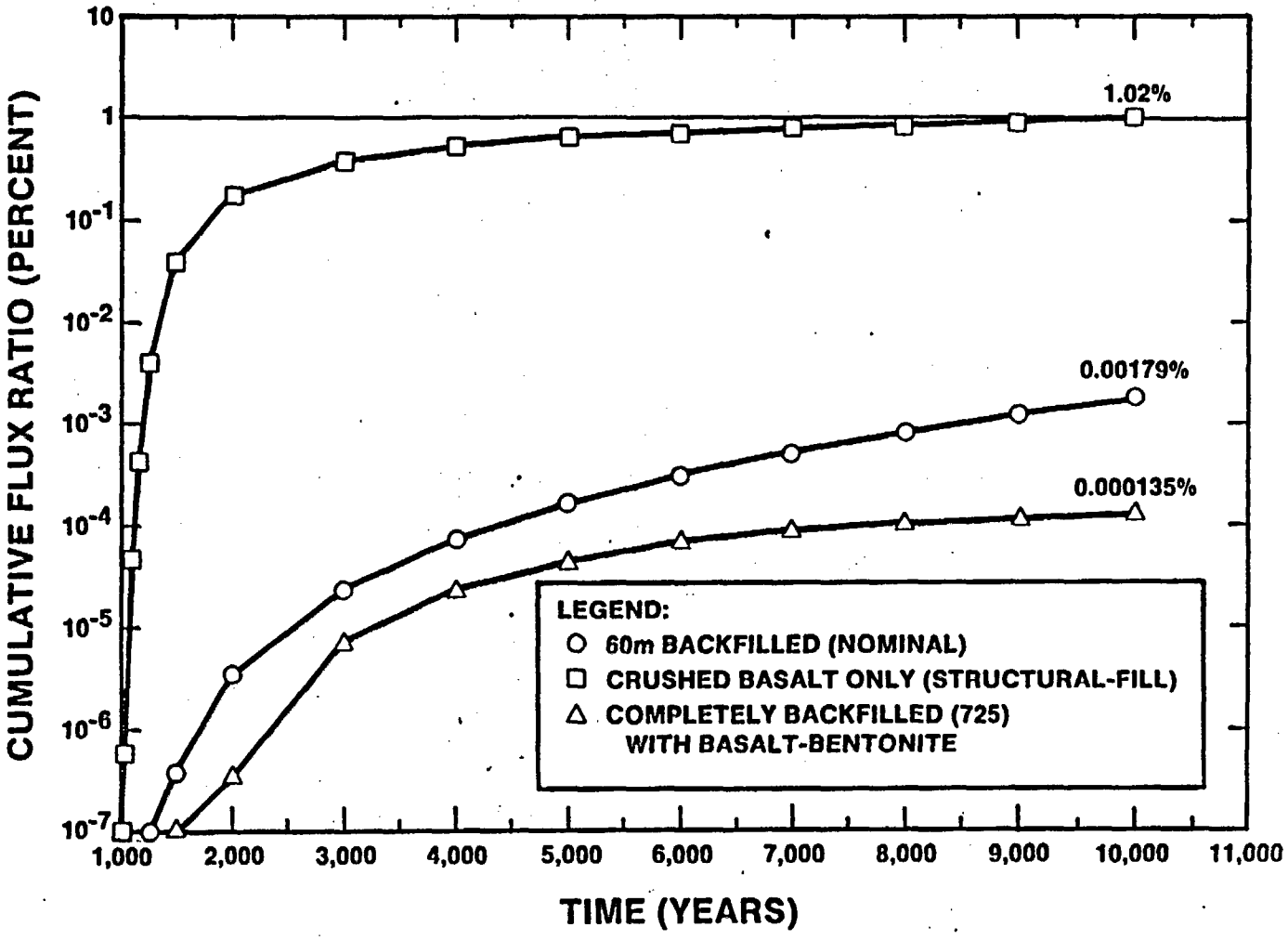
SEALS SYSTEM

ASSUMPTIONS:

- 1000 YR INSTANTANEOUS FAILURE OF CONTAINMENT
- ALL NON-SORBING RADIONUCLIDES IMMEDIATELY AVAILABLE
- ALL AREAS ARE SATURATED
- SHAFT FILLED WITH LOW PERMEABILITY BASALT-BENTONITE MIXTURE ($K \sim 10^{-10}$ m/sec)
- MODELED WITH A 2-DIMENSIONAL FINITE DIFFERENCE APPROXIMATION

  - COUPLED FLOW, HEAT AND MASS TRANSPORT

SEALS SYSTEM
CUMULATIVE FLUX RATIOS
BASALT-BENTONITE AND/OR CRUSHED BASALT



CURRENT STUDIES

- SEAL PATHWAY TRANSPORT
- PARAMETRIC STUDY OF DISCRETE FEATURES
- MECHANISTIC MODELING OF CONTAINER LIFE
- ASSESSMENT OF POROUS MEDIUM APPROACH TO MODELING
- ASSESSMENT OF FACTORS CONTROLLING RADIONUCLIDE RELEASE

ATTACHMENT: G

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

MAY 1 , 1986

General Manager
Rockwell Hanford Operations
Richland, Washington

Dear Sir:

BWIP WORK EVALUATION

Mr. O. L. Olson's March 14, 1986, letter, subject as above, requested that Rockwell assess the project's ongoing work to insure that appropriate management and technical prerequisites were in place to conduct project activities. The Rockwell response was provided on April 11, 1986, in a letter from Mr. L. R. Fitch to Mr. Olson, same subject. At a subsequent meeting on this subject, DOE/RL-BWI Division requested additional details on the work evaluation activities that were conducted by Rockwell to understand the bases for Rockwell's recommendations. Copies of the work evaluation sheets were informally transmitted to BWI shortly thereafter.

Since then, DOE-RL BWI has completed its review of Rockwell's April 11 response and the work evaluation sheets, and considers the overall assessment to be of insufficient detail to support the Rockwell conclusions. DOE's concern regarding the need to insure that appropriate management and technical prerequisites (e.g., QA procedures and training, etc.) are in place is further strengthened by the fact that most of the DOE audits performed to date on Rockwell activities have consistently identified lack of adequate procedures and training as findings. DOE does acknowledge Rockwell's subsequent informal recommendation to institute a Stop Work Order (SWO) and generally endorses this action. Accordingly, Rockwell is hereby directed to execute a general SWO on all ongoing BWIP activities with the following exceptions:

(1) Data gathering activities that are currently in operation and for which interruption could result in loss of significant data, e.g., seismic monitoring, piezometer well information, corrosion testing, etc.

(2) All activities, including procurements, which support upgrading the BWIP management, operating, or quality assurance program. This includes all work that is necessary to achieve adequate implementation of the BWIP QA program, i.e., procedure development, establishment of Quality Assurance Level assignments, correction of QA program deficiencies, etc.

(3) All activities which support existing safety or maintenance programs.

(4) All strictly administrative activities, i.e., planning, budgeting, staffing, space acquisition, reporting, etc.

(5) Site Characterization Plan (SCP) preparation.

(6) Activities that are essential for the project to continue or that are imprudent to stop at this time, e.g., actions resulting in delay costs or partial termination costs greater than that required for completion of the activity.

This suspension of work must be effected in an orderly manner to minimze schedule and cost impacts to the project and applies to all project participants. Also, where work stoppage would result in loss of technical expertise critical to project continuation, these resources should be redirected to correcting deficiencies that precipitated this suspension of work.

Based on the above directive, Rockwell is requested to submit, by May 12, 1986, for the review and approval of DOE/RL, a Plan of Action (POA) responding to this SWO. The POA should identify the specific tasks to be accomplished, establish priorities, and establish an aggressive schedule for implementation. In addition, the POA must contain the following information using the above categories, with each category cross referenced to the Work Breakdown Structure (WBS) task title and number:

(a) A listing of all exceptions to this directive taken by Rockwell (consistent with the above definitions), together with detailed justifications for those exceptions, controls/procedures currently being used, and descriptions of Rockwell's plans to review the acceptability of the results of these activities for site characterization.

(b) A listing of all other work activities which have been stopped.

(c) A listing of all currently planned DOE milestones or commitments which may be impacted as a result of these corrective actions with justification.

(d) A project-wide cost estimate and a detailed schedule for performance of the corrective actions to respond to this Directive.

For items a and b, above, identify those necessary management and technical prerequisites that must be in place to appropriately support each activity. These prerequisites must include such considerations as management and technical procedures to control the work; quality assurance programs and

ATTACHMENT: G

procedures to control the work; approved requirements traceable to project needs with appropriate performance allocation; personnel training and qualification; and equipment/facility records, checkout, qualification, and certification. Where procedures already exist, identify those which must be reviewed for acceptability, and upgraded if necessary, prior to work restart. Identify new procedures that may be required.

The conditions for lifting this suspension will be transmitted to Rockwell within the next 15 days. Except for the work that must continue as previously noted, achieving adequate implementation of BWIP QA Program requirements and other management and technical prerequisites is the highest priority of the BWI Project at this time. An unmitigated commitment to achieving this goal is clearly required. If you have any questions, please contact Mr. R. P. Saget of my staff on 6-7250.

Sincerely,

Robert D. Larson, Director
Procurement Division
Contracting Officer

BWI:RPS

cc: L. R. Fitch, Rockwell
R. Stein, DOE-HQ
J. P. Knight, DOE-HQ

bcc: BWI Record Cy
BWI Rdg File
AMC Rdg File
RP Saget, BWI
TH Davies File
DH Dahlem, BWI
JE Mecca, BWI
BL Nicoll, BWI
RD Larson, PRO
PE Rasmussen, AMO Manager

SEE ATTACHED PAGE FOR RECORD NOTE.

0928A

Marge 6-7334 ▶	BWI	BWI	BWI	BWI	BWI/AMC	PRO/AMO	PGR BWI
SURNAME ▶	Davies:mbv	Mecca	Dahlem	Nicoll	Saget / Anthonen	Larson / Rasmussen	Lawrence / Olson
DATE ▶	5/1/86	5/1/86	5/2/86	5/1/86	5/1/86	5/5/86	

ATTACHMENT: G

RECORD NOTE:

The April 11 Rockwell work evaluation response with supporting work evaluation sheets was found to be unsatisfactory for the following reasons:

- The assessment failed to provide or identify a basis for the recommendation, as was requested.
- The evaluation failed to identify quality levels for the evaluated activities. BWI considers that quality levels must be defined in order to establish necessary work prerequisites, which were also requested.
- Due to the inconsistent manner in which the evaluation forms were filled out, it was not clear that all activities were evaluated against the same guidelines.
- Numerous activities were recommended for stoppage during the Rockwell staff review process, as evidenced from the work evaluation sheets. However, many of these items were eliminated from Rockwell's formal work stoppage recommendation with no explanation/justification for the change.

This letter identifies 6 categories of activities for work that should not be stopped. The bases for not stopping these activities are: 1) certain data gathering needs to be continued or the data would be lost forever; 2) QA program implementation activities need to continue to resolve deficiencies; 3) activities are not considered to be level I activities (SCP); 4) the project is willing to accept some level of risk for proceeding with items that would be more expensive to shut down, or 5) activities that are not quality affecting such as planning, budgeting, etc.

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