Dr. Robert E. Browning
MS 623-SS

PDR-1
LPDR-WM-10 (2)

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

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87 Apr. 20 P1:27

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WM Project 10
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April 15, 1987

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

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

SUBJECT: OBSERVATIONS, COMMENTS AND RECOMMENDATIONS FOR THE PERIOD JANUARY 17 TO APRIL 3, 1987

TECHNICAL ITEMS

1. Waste Package--

a. Development activities at Argonne Laboratory for RHO are being conducted on carbon steel samples to determine the effects of irradiation on the corrosion of this material, an alternative material being considered for the waste package container. The conditions created in the test apparatus simulate conditions expected in a basalt repository. A major difference is that the vessel used in conducting the test is a closed vessel which allows accumulation of hydrogen. In general the hydrogen which accumulated was greater than in unirradiated control tests, however, it may not be representative of the repository environment considering the "open system" character of the repository. The corrosion rate observed on the samples was greater than observed on the control (unirradiated) samples. Methane included in the test environment did not polymerize as has been observed in previous testing without waste package materials present.

I have requested from DOE a monthly report submitted by Argonne from which the information reported above was taken. I will forward this item upon its receipt. The information has been in existence for many months--clearly beyond the 45 day commitment for release of such information--and should be released immediately, if not already available in a data package.

b. Quality assurance functions connected with the testing at Argonne were not reported significantly in the monthly progress report noted in "a" above. DOE has raised the question of the

2486 87050029

adequacy of the quality assurance being applied to this contract. This issue is discussed further under item 8 below.

2. Repository Engineering--

a. Attachment B contains a summary of key events recently completed or scheduled for the near future in the category of repository engineering. As can be seen, this schedule calls for start of the first exploratory shaft (ES) 24 months hence. Comment "b" below addresses what is meant by the beginning of the ES construction, i.e., drilling into the basalts.

b. DOE conclusions have affirmed the need for a second exploratory shaft. The shaft diameter is currently set at 10 feet. This entails a bore hole of about 12 to 14 feet in diameter. Considerations are being given to boring both ES bore holes at the same time to shorten the schedule for the underground exploration activities. In addition it is being considered expedient and potentially technically acceptable for site characterization to start the main shaft bore holes in the sediments and proceed to the top of the basalt prior to completion of large scale hydrologic testing. Attachment D contains the major DOE assumptions as of March 1987 controlling site characterization.

c. Two RHO reports, one concerning rock stress and the other concerning design methodology, have been delayed. I plan to obtain copies of these reports following completion and will forward them to staff for their review.

3. Geology--

a. Estella Leopold completed a review of the pollen assemblages reported for the Rattlesnake Mountain well RSH-1 in BNWL 776. This report is enclosed as Attachment C. Her review tends to confirm the interpretation of the age of the coal deposits in that well as being older than the generally accepted age of the Columbia River Basalts--about 17 million years. However, she notes that the omission of Compositae from the assemblage does not necessarily indicate an age greater than the mid Miocene age associated with the basalts. She noted that assemblages from samples in the lower part of RSH-1 are similar to assemblages in the Wenatchee Formation which is from the Oligocene Period.

b. The USGS under the cognizance of Washington State geologist, Bill Brewer, completed a side looking radar survey of the area around the Hanford Reservation as well as the Reservation itself. Mr. Brewer has indicated that enhanced images of the survey will be completed in May, 1987. They are expected to indicate fault lines and other structures potentially not observed in the morphology heretofore.

c. During the period I reviewed the the history of swarm earthquakes near the reference repository location and compared the discussion in the Draft SCP chapter with this history. Attachment E is pertinent to this history. Also of importance is the swarm at Rattlesnake Springs in November 1985. The two swarms are important to recognize because of their proximity to the RRL and the nature of the swarm described in Attachment E as the Cold Creek Swarm Events. The analysis associated with this swarm, Attachment E, indicated the mechanisms were primarily thrust with only minor right-lateral strike-slip components. Both swarms appear to be associated with the Yakima Ridge structure immediately south and southwest of the RRL.

4. Performance Assessment--

a. Strategies for, for example, the waste package performance, are not yet resolved by DOE. Definitions are still being derived for such terms as "degree of confidence" and other qualitative terms which provide no usable design basis. In light of this situation it appears that the objective of allocating performance to the various components of the repository and specifying quantitative functional design criteria with appropriate quantitative reliability and confidence statements has not progressed significantly beyond the qualitative discussions of the past.

5. Geochemistry--

a. Work is being conducted at Temple University to investigate the mobility of radioisotopic species in basalts through analog studies in Icelandic basalts. I have requested a summary report of results of this work and will forward it to staff upon receipt.

b. A comprehensive report of I-129 levels in the groundwater together with Hanford history concerning release of this isotope and it's monitoring is nearing completion and should be available within a couple months. The groundwater radiochemical data collected during this study is also being incorporated into the data base being used by BWIP for ready access by analysts. The review accomplished in preparing this report has influenced the preparation of the hydrochemistry plan for the BWIP site characterization and will provide significant background for Staff review of this plan as well as other plans related to geology and hydrology heretofore not available. Such items as monitoring at DB-15 in the Frenchman Springs unit to obtain up-to-date I-129 data and the levels of helium in the water at DB-15 and DB-7 are planned to further understand the origin of the I-129 in these wells. The existence of elevated helium would be indicative of a uranium and/or thorium source nearby.

6. Site/Environmental--

a. BWIP is preparing an Environmental Field Study Plan. This plan is scheduled to be completed in August 1987. Planning for the Draft EIS and Final EIS is consistent with the schedules presented in the Revised Mission Plan. PNL has the lead for DOE regarding environmental tasks.

b. DOE and Indian representatives met during the period to plan the work scope for environmental and socioeconomic work in the rest of FY 1987. I have requested a copy of this work scope, which is still being revised to reflect Indian/DOE agreements, and will forward it to the staff for their information upon receipt. A single copy of a proposed draft of the work plan was forwarded to staff (Linehan) via. separate correspondence.

7. Hydrology--

a. During the period I reviewed assessments regarding potential failures in nested piezometers. A report by Golder Associates, addresses this concern. It is entitled Preliminary Evaluation of the Adequacy of Piezometer Seals and is dated February 1987. It was forwarded to staff via. separate correspondence and is part of the package DOE presented to program participants for preparation for the DOE/NRC hydrology workshop in April.

I recommended that the issue regarding piezometer integrity be addressed during the hydrology workshop from the view point of the quality assurance being applied to the instrumentation design and checkout. I note that the integrity of the instrumentation will affect the determination of the baseline hydrologic potential as well as affet the determination of other hydrologic parameters during pump testing.

b. During the period DOE/HQ in conjunction with Weston and supported by RHO and DOE/RL personnel, developed the strategy for the hydrologic test program for the BWIP. This does not cover detailed test plans. I note that the workshop noted above only addressed general strategy--not the details of the testing to be pursued. However, details should be available shortly, since the most recent scheduling efforts include the beginning of the DC-24 bore hole drilling in June 1987.

If mini audits or participation in readiness reviews are to be conducted by the staff, planning should anticipate the early start of drilling in June. It is my observation that many of the controls particularly those of a managerial nature that are planned and which affect quality will not be in place by June. Comments under item 8 below address this situation at DOE and RHO.

8. Quality Assurance--

a. In my last memorandum I reported on the audit of Pacific Northwest Laboratory (PNL). A closeout meeting was conducted by

DOE with senior PNL management in March. PNL management appeared to understand and accept the DOE/MAC comments concerning PNL's control of program requirements and clear specification of responsibilities and authorities through a classical project manager for the BWIP work. Also the point that the management controls are part of the controls that are needed to obtain quality and hence an integral part of the quality assurance program was highlighted by the MAC auditor.

Although corrective actions were recognized as required by the PNL management, senior PNL management attitude in support of a sound quality assurance program was apparent. Their stated commitment should be borne out by their actions to design and apply satisfactory quality assurance functions to the area of management controls.

b. During the period I attended a weekly readiness status among DOE and RHO representatives in which DOE indicated to RHO that various administrative or management controls, some of which are intended to obtain and/or assure quality in the various technical products being produced by BWIP, were required prior to a general restart of technical activities. This appeared as a surprise to RHO representatives since the controls were not considered as part of the "quality assurance program" and hence not a necessary prerequisite for restart of technical work.

This general consideration, seemingly widely held among the local DOE contractors and DOE, appears to be the result of determinations and policy of DOE to categorize management and/or administrative system requirements and the respective procedures outside the umbrella of the quality assurance program required by Appendix B of 10CFR50 and, hence, outside the specter of NRC review and regulatory cognizance from the DOE view point. It is this determination that is confusing the contractors, RHO and PNL alike, and has resulted in the in the low priority of actions in this vital area of procedure development and implementation of quality assurance program requirements. It continues to contribute to the lack of acceptance of responsibility for necessary assurance actions by PNL, RHO and DOE quality assurance managers in this realm of project activities.

To correct this situation I consider that the hierarchy of requirements documents should clearly list the quality assurance program requirements at the top with lower tier management requirements and procedures and systems engineering requirements and procedures as subsidiary documents. Hence basic orders which DOE specifies for the BWIP, for example, DOE 5700 series orders, should be considered as part of the project's quality assurance program required by the rules of Part 60, assuming the various DOE orders do not conflict with the NRC rules. (Currently there may be conflicts between the requirements of the DOE orders and the requirements of Part 60/50 Appendix B, particularly in so far as these orders specify various quality assurance requirements

contained in NQA-1 at a level above the Appendix B requirements as supplemented by the QA Review Plan. Attachment F identifies the current hierarchy of requirements for DOE/HQ and DOE/RL, marked-up to reflect the possible correction noted herein.

Also it should be noted that the requirements stemming from the Mission Plan appear in the hierarchy presented by DOE at a higher level than the quality assurance plan. Since the Mission Plan is in part a scheduling document, which schedule results from coordinating funding restraints and technical requirements and procedures in order to achieve quality in the technical products of the project, it is incorrectly placed in the hierarchry as indicated in the mark-up of Attachment F. In particular the schedular part of the Mission Plan should not appear to the participants as a requirement, if quality of the technical products is to be preserved.

c. Currently DOE/RL is in the process of revising draft procedures for the development of schedules and funding baselines which are consistent with technical baselines for necessary work. The procedures are intended to achieve quality in the technical products. (The procedures are not considered part of the Quality Assurance Program--they fall under the heading of Project Management Plans identified in Attachment F--even though they are intended to achieve quality in the technical baseline of activities.) Planning does not include verification and audit by <u>quality assurance personnel</u> procedures at discrete, planned, points in the process, this being consistent with the DOE/RL concept that the activities are outside the scope of the Quality Assurance Plan. Staff Review of these procedures and the respective requirements documents is warranted in connection with any future mini-audit or quality assurance workshop. In addition the QA Review Plan revision should include an item which addresses this aspect of a quality assurance program for BWIP.

As a related observation, it is not apparent how the overall DOE/RL--DOE/HQ procedural control in this area is being developed to achieve quality and provide the required quality assurance. Procedural identification of the interfaces between the DOE/RL--DOE/HQ and their contractors with procedural specification of comprehensive control and recording of information exchanges at these interfaces is of key importance to achieve the desired control with quality and to facilitate assurance actions. The comment above concerning the placement of the "schedular requirements" contained in the Mission Plan is related to this item and suggests an area where controls with appropriate quality assurance actions are indicated.

DOE actions during and subsequent to a recent meeting (which I was restricted from attending after having been informed of it in advance) on March 25, 1987 among DOE/RL, DOE/HQ and RHO personnel would be pertinent in reviewing the effectiveness of controls in this area. The meeting addressed modifying schedules for the

hydrologic test program and apparently resulted in action to initiate the drilling operations at DC-24 and DC-25 prior to the general restart of data gathering activities, which as of the March 17, 1987 restart briefing discussed below was not planned until September or October, 1987. Attachment H is pertinent to the planning discussed in the March 17 briefing. I am only partially aware of the actions and expedited schedules resulting from the March 25 meeting. Although I have requested information concerning this meeting from DOE has not been forthcoming with such information, indicating that there is no record of the meeting.

d. On March 17, 1987 I attended a briefing concerning actions to prepare requirements and invoke procedures which control technical and administrative actions that affect quality. NRC (Kennedy) attended the briefing and has a copy of the materials distributed to the participants. The concern described above in comment 8b, regarding the scope of the quality assurance program, was identified to DOE at the briefing. In addition concerns which I have noted in the past regarding the grading of activities and categorization on the Q-List was described to DOE/HQ (Knight) who indicated he understood the issue following my discussion with him.

To date I am not aware of steps being taken to provide for the grading of actions pertinent to Q-Listed items or actions. A recent list of actions concerning the hydrology drilling program presented at the hydrology workshop--Attachment G--still includes only one grade of actions for Q-Listed items and actions. I consider various other items and actions on the list should be appropriately Q-Listed. For example, materials for the piezometers, fluid circulation monitoring, cleaning the hole, developmental logging, bore hole geologic logging, etc., identified in Attachment G as QA Level 2 and 3 items are not Q-Listed and, by definition, would not be of concern at licensing and hence outside the scope of NRC's cognizance now and then. It is apparent to me that these items and actions are of potential importance at licensing and should be on the Q-List even though reduced control and quality assurance actions may be acceptable as suggested by Attachment G.

MISCELLANEOUS ITEMS

a. DOE Inspector General personnel completed an investigation, started in the Spring of 1985, into matters associated with monitoring I-129 in the environment at Hanford in the past. I read this report which was dated April 1, 1987. I was informed the report was sent to NRC/OI by the DOE Inspector General Office (IG). I notified NRC/OI of this item and other information regarding the IG report and the current I-129 data review discussed in item 5b above. I noted to OI that I considered that the current review effort was satisfactory and would most likely bring forth the existing information pertinent to licensing a

repository at BWIP, this objective being the basis of my original interest in the subject matter. I noted the IG report indicated no problems in the previous handling of the I-129 information.

In this regard the IG report noted that general on-reservation and off-reservation I-129 information had been published in BNWL-CC-1800 83 of June 1972. This document was declassified in December 1972. In addition information concerning on-reservation groundwater I-129 was published in BNWL SA 4478 of January 1973. These documents were not cited in subsequent information generally available to the public, for example, the EIS for the waste management operations published in December 1975, and it received limited distribution (22 copies) within DOE/Contractor organizations. It was not made available to me in 1985 when I requested this type of information in a published form.

b. DOE initiated a weekly meeting among myself, 6 to 8 DOE personnel, generally lead by J. Keating, the on-site CERT (Indian) representative, a Washington State representative and a GAO representative. The intent is to review and identify issues, actions complaints etc., i.e., a scheduled forum for communicating among all the participants. It is at these meeting that I summarize the concerns I have identified in the previous week. I believe the meetings are serving a useful purpose for all attendees.

c. State and Indian cognizances of activities at the site are increasing. They are showing an ever increasing awareness of and desire for review of all types of site activities. Attachment A illustrates this evolving condition. GAO also has two nearly full time representatives assigned to overviewing BWIP activities. I consider my interface with these various representatives mutually satisfactory.

d. During the subject period I attended the ASQC quality assurance conference in Las Vegas. Issues stemming from that conference were discussed with NRC Staff who also attended the conference, including Bell and Kennedy.

e. No action has occurred to involve me in the training sessions for RHO personnel regarding the agreements of Appendix 7 and interaction with on-site representatives as previously committed to by DOE (Anttonen). DOE/HQ has tabled the issue although the need for such training at RHO is still evident and resolution of disparate interpretations of Appendix 7 wanting.

F. Robert Cook

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

Distribution for April 15, 1987 memorandum:

cf:	JTBuckley	JOBunting	DLChery RES
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Attachment A

ESTABLISHED BY THE
TREATY OF JUNE 9, 1855
CENTENNIAL JUNE 9, 1955

CONFEDERATED TRIBES AND BANDS
Yakima Indian Nation

POST OFFICE BOX 151
TOPPENISH, WASHINGTON 98948

GENERAL COUNCI
TRIBAL COUNCI

March 24, 1987

Mr. John Anttonen
Assistant Manager for Nuclear Waste
U.S. Department of Energy
Basalt Waste Isolation Project
Richland Operations Office
P.O. Box 550
Richland, WA 99352

Dear Mr. Anttonen:

The Yakima Indian Nation, in cooperation with the Confederated Tribes of the Umatilla Indian Reservation, the Nez Perce Tribe, and the State of Washington and the Nuclear Regulatory Commission (NRC), plan to review the records of well bores in and around the Hanford Reservation. The records are located in the RRL trailer office and are contained in several safes and bookshelves in the library area. Limited examination of one of the bore hole records was made a few weeks ago by Abdul Alkezweeny, the CTUIR and Nez Perce Tribal On-Site Representative, and Bob Cook of NRC. A team of reviewers consisting of one person from each of the affected parties and the NRC, headed by Curtis Canard, a geologist with the Council of Energy Resources Tribes, is planning to conduct the reveiw during the period of May 11 to May 15, 1987.

We are requesting your assistance in helping the reviewers carry out their assignment. They will require the aid of personnel to facilitate use of library area and the physical access to the information in the safes noted above. The reviewers may desire copies of records for retention. However, these will be identified and requested formally. Finally, the names of the reviewers and other information required for obtaining badges will be sent to the proper DOE office for processing.

Thank you in advance for your cooperation. We are looking forward to hearing from you.

Sincerely,

Russell Jim

Russell Jim, Manager
Nuclear Waste Program

cc: Bill Burke, CTUIR
Ron Halfmoon, Nez Perce
Bob Cook, NRC
Curtis Canard, CERT
Terry Husseman, Washington
Dr. Georges V. Abi-Ghanem, EWA, INC.

Attachment B

BASALT WASTE ISOLATION PROJECT

MILESTONE LOG PROJECT SUMMARY

MARCH 5, 1987

TITLE	BASELINE	FORECAST	ACTUAL
Repository			
Rod Consolidation Study to HQ	12/86	03/87	
Retrievability Compliance Strategy Plan to HQ for review	12/86	03/87	
Issue Site Characterization Plan (SCP - Conceptual Design Report (CDR) to HQ for review and acceptance	01/87	03/87	
Final FY 1989 Project Validation Material to HQ	03/87	03/87	
Draft Repository Subsystem ACD Requirements to HQ for review	04/87	04/87	
Initiate Repository ACD	02/89	02/89	
Exploratory Shaft			
Draft ESF Design Basis Study Report received at HQ for review	01/87	04/87	
Final FY 1989 Project Validation Material to HQ	03/87	03/87	
Recommendation on ESF Design change as received at HQ for review	03/87	06/87	
Submit Draft Exploratory Shaft Facility Design Requirements for final design received at Richland and HQ for review and approval	05/87	07/87	
Draft ESF Design Requirements for Final Design Report received at HQ for approval	07/87	09/87	
Start First Shaft (ES-1) Construction	04/89	04/89	
Submit Draft Final Design Report to HQ for review and acceptance	05/88	01/89	

Attachment C

2/20/87

F.R.Cook
Senior On-Site Licensing Representative
Nuclear Regulatory Commissiion
Washington D.C. 20555

Dear Mr. Cook,

I have read with interest the pollen section in the report by Raymond and Tillson (1968) on "Evaluation of a thick Basalt sequence in S. Central Washington...", and I thak you for sending me the copy. The fossil pollen work was done by a collegue who has more experience with the Tertiary pollen of Washington state than anyone I know. He was a student of Robert Tschudy (USGS), who was a top authority in Cenozoic palynology.

I am happy to report that the work seems to be exceedingly well done, and the conclusions seem faultless as far as we understand the stratigraphic ranges of the forms present. I will give you my own interpretation of the pollen evidence:

The appearance of Larix/Pseudotsuga is of special interest, as with my experience in the USGS, we found the earliest forms at Florissant, Colo., where the basal Oligocene is perhaps best known) by pollen) in the U.S. The form ranges upward to the present, but I have never seen it in pre-Oligocene beds. It appears above 3500' in the Rattlesnake Hills well. Another telling form is Jussiaea (Onagraceae or evening primrose family). This is the same story: no pre-Oligocene occurrences are known to me.

A number of forms are not restricted to the Oligocene, but are typical in Oligocene and younger beds in the Northwest: one of these is Cedrus, which is present in the deepest sample. Most of the angiosperm pollen reported from the lower samples are also typical of Oligocene (though they do range outside of that interval). Grass pollen is in the same category.

In summary, an Oligocene age seems to be the case, based on knowledge from leaf and pollen floras of the Pacific Northwest. Newman's reasoning that the age (including the lower beds) may be late Oligocene makes sense to me. We can expect that the early Oligocene is more tropical is backed up by a variety of reports, including Coos Bay, Oregon, and other sites in Oregon and California. His reasoning that the absence of the Miocene and younger pollen of the Compositae (daisy) family indicates a pre-Miocene age,(I would add at least a pre-late Miocene age) is founded on broad evidence in the western states and Northwest. I would agree that perhaps the upper parts of the well might be as

young as Miocene, assuming that in some environments Compositae is somehow not well represented even in Miocene time.

It looks good to me. I am wondering what this means in terms of the Hanford site plans. Guess this awaits a further discussion with you or our Olympia geologists, like Bill Brewer.

Sorry for the delay in this letter and report.

Sincerely,

Estella B. Leopold

Estella B. Leopold
Botany KB-15
University of Washington
Seattle WA 98195

cc. Bill Brewer

P.S. In case someone at NRC wonders on what basis I write this letter, may I state that I spent 21 years working for USGS on Cenozoic pollen, with particular emphasis on Eocene and younger sediments of the western United States. In the Pacific Northwest I have done some work on the Miocene and Pliocene including sediments of the Vantage beds, Ellensberg Fm. and the Wenatchee Fm (Oligocene?), which in many ways the lower part of the Rattlesnake Hills well assemblage resembles. A grad student of mine did her thesis on the Weaverville flora (Oligocene?) of northern California. I am quite familiar with the fossil leaf literature of this region, since I teach a course on that topic.

Attachment D

Attachment D

Basalt Waste Isolation Project
FY 1989 Budget Submittal
Assumptions

Non-Technical

- Program priorities contained in DOE-RL Guidance letter of January 22, 1987 used in planning.
- All outyears are planned using escalated dollars, per the DOE-RL escalation guidance.
- A minimum of twenty (20) days prefinancing.
- DOE-RL Budget Guidance for PETT, Robotics Grants, Support Service Contract, and Environmental/Socioeconomics used in planning.
- Defense Waste funding provided in separate section and is not included in the Project Summary.

Technical

- Program based on current DOE-RL and Mission Plan requirements.
- Planning will proceed on the basis of using one drill rig. The advantages and cost impact of using a second rig will continue to be examined.
- ES-2 is a 10-foot diameter shaft rather than 6 feet.
- Hydrology Program constrains the drilling of the Exploratory Shaft into the basalt.

Attachment D

Attachment D

Basalt Waste Isolation Project
FY 1989 Budget Submittal
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- Hydrology Program constrains the drilling of the Exploratory Shaft into the basalt.

Attachment E

N12-060529

SHEET 1 OF 1

ENGINEERING ORDER
Rockwell Hanford Operations
Richland, WA 99352

CHANGE CATEGORY	EO TYPE	ORIGINATOR
-	Release - New	BWIP Geosciences Group

PROJECT NO.	W.O./W.R. NO.	PROGRAM PHASE	BLDG. NO.	CEI	UCN	PRIORITY	RESPON. ENG.
		WBS L331					A. C. Rohay

SYM	PART / DOCUMENT NO.	SHEET NO.	REV NO.	INDEX	NEXT ASSEMBLY PART NO.	DISPOSITION
	RSD-BWI-DP-016	1-16	A000		BWIP Data Package- Earthquake Swarms in the Hanford Region	

ORG. CODE	PHONE	DATE
10110	6-2809	7/2/80

Geosciences A. C. Rohay 7/2/80

Geosciences S. M. Price 7/2/80

Geosciences [illegible] 7/2/80

Scientific Tech. [illegible] 7/2/80

S. Integrator [illegible] 7/18/80

Systems Integration R. N. Surlay 7/30/80

PRODUCTION SUPPORT

QUALITY ASSURANCE [illegible] 7/30/80

LEVEL N/A

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M. D. Alford	CBB	700
D. Abramson (Original)	DBB	700
R. J. Bielefeld	TAN	700
D. J. Brown	TAN	700
J. A. Caggiano	TAN	700
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SUPPORTING DOCUMENT	Number	Rev. No.	Page 1 of 16
PROGRAM: Basalt Waste Isolation Project	RSD-BWI-DP-016		

☐ CONTROL ☐ PROJECT

Function Name:

Document Type: Data Package

Document Title: BWIP Data Package
Earthquake Swarms in the Hanford Region

Work Package No.

Work Order No.

Original Release Date

Prepared by	Date
A. C. Rohay	7/2/80

Phone	Room	Bldg.	Area
6-2809		TAN	700

Approvals

☒ Program Office

☐ Research and Engineering

☐ Production Operations

☐ Production Support

☒ Systems Integration

Approvals

☐ Program Business Management

☐ Health, Safety and Environment

☐ Quality Assurance 7/18/80

☐ Training

☐

Abstract

This data package contains a discussion of the character of earthquake swarms occurring in the Hanford region. The swarms have been detected over the past 10 years using a seismic monitoring network currently being operated by the University of Washington. The descriptive text is supplemented by two figures which summarize the locations, magnitudes, and time distribution of these earthquake swarms.

Reserved for Proprietary / Legal Notice

BWIP DATA PACKAGE - EARTHQUAKE SWARMS IN THE HANFORD REGION

DATA SOURCE

Quarterly and annual reports on the seismicity of Eastern Washington are provided to the Department of Energy by the University of Washington. A seismograph network installed by the U.S. Geological Survey in 1969 has been operated since 1975 by the University of Washington. This network provides the raw data used to determine the earthquake parameters. A uniform redetermination of all earthquake locations and magnitudes was published in the University of Washington's 1979 Annual Report. Two figures from this report are included to summarize the earthquake swarm activity in the Hanford region. An additional source is a dissertation which studied in detail a swarm at Wooded Island in 1975. This study was included in the University of Washington's 1978 Annual Report.

DATA LIMITATIONS

Swarms of small earthquakes in Columbia River Basalt were discovered only after installation of a network of seismometers. Instrumental data are available for only the last ten years. The distribution of earthquakes during this time may not be representative of the distribution over the last hundred to thousand years. At the present time, the earthquake location threshold (for which all events can be located) is about 1.5 (M_L) in the immediate Hanford region, and is somewhat poorer, about 1.8 (M_L), in the whole of Eastern Washington. Thus, some of the events smaller than this value go unlocated. Swarm activity concentrated in the vicinity of Hanford does appear to be real, however, for the time period considered. Detailed studies of swarms using dense, temporary arrays have reduced the location thresholds to about magnitude 0 during their operation, usually for two to three month periods.

Location accuracy depends upon the size of the events, the distribution of the seismic stations, and the seismic velocity model used in the location computations. In general, the horizontal coordinates (epicenters) are accurate to better than two or three kilometers, while the depth of the events is less accurate and more dependent upon the velocity structure of the basalts. Hypocenters may be as much as 5 or more kilometers in error as a function as station distribution and data quality.

SYSTEMS INTEGRATION CONTACT

M. D. Alford
Rockwell Hanford Operations
P. O. Box 800
Richland, Washington 99352

FTS - 444-6246
376-6246

Data Package: Earthquake Swarms in the Hanford Region

EARTHQUAKE SWARMS IN THE HANFORD REGION

Earthquake swarm activity is characterized by a spatial and temporal clustering of many small earthquakes with no outstanding single event. This type of earthquake sequence is typical of shallow events near the Hanford area, and indicates stress release on many small slip planes instead of a single main fault. The distribution of the best located earthquakes for the 1969-1979 instrumental period is plotted on the attached map (Figure 1). The events plotted are shallow, less than six kilometers deep. The regions of swarm activity have been enclosed in boxes. The temporal distribution is plotted on an accompanying figure (Figure 2) (the dots at the top of some of the histograms indicate an event greater than magnitude 3). The best example of swarm activity is located at Wooded Island, where swarms have occurred in 1969 and 1975. The earthquake sequence at Royal in 1973 appears to be a main-shock-aftershock sequence in contrast to the typical pattern of swarms in which a main shock can not be clearly defined.

Most of the swarm earthquakes are too small to allow calculation of the orientation of the possible slip planes. It is sometimes possible to select groups of events for such studies. The focal mechanisms of the swarm earthquakes indicate that they occur in response to gentle north-south compression but the direction of extension (vertical or east-west) seems to vary.

The events which occur in earthquake swarms are too small to be felt in most cases and would not be expected to damage structures. Their distribution may, however, indicate that fracturing is occurring in the basalt flows. Thus, the concentration of swarms on the northern flank of the Saddle Mountains indicates fracturing and deformation is occurring. This fracturing is likely to have hydrologic implications in terms of underground nuclear waste storage. As shown in Figure 1, the actual Hanford Site has large areas which have been free of swarm activity during the period of study.

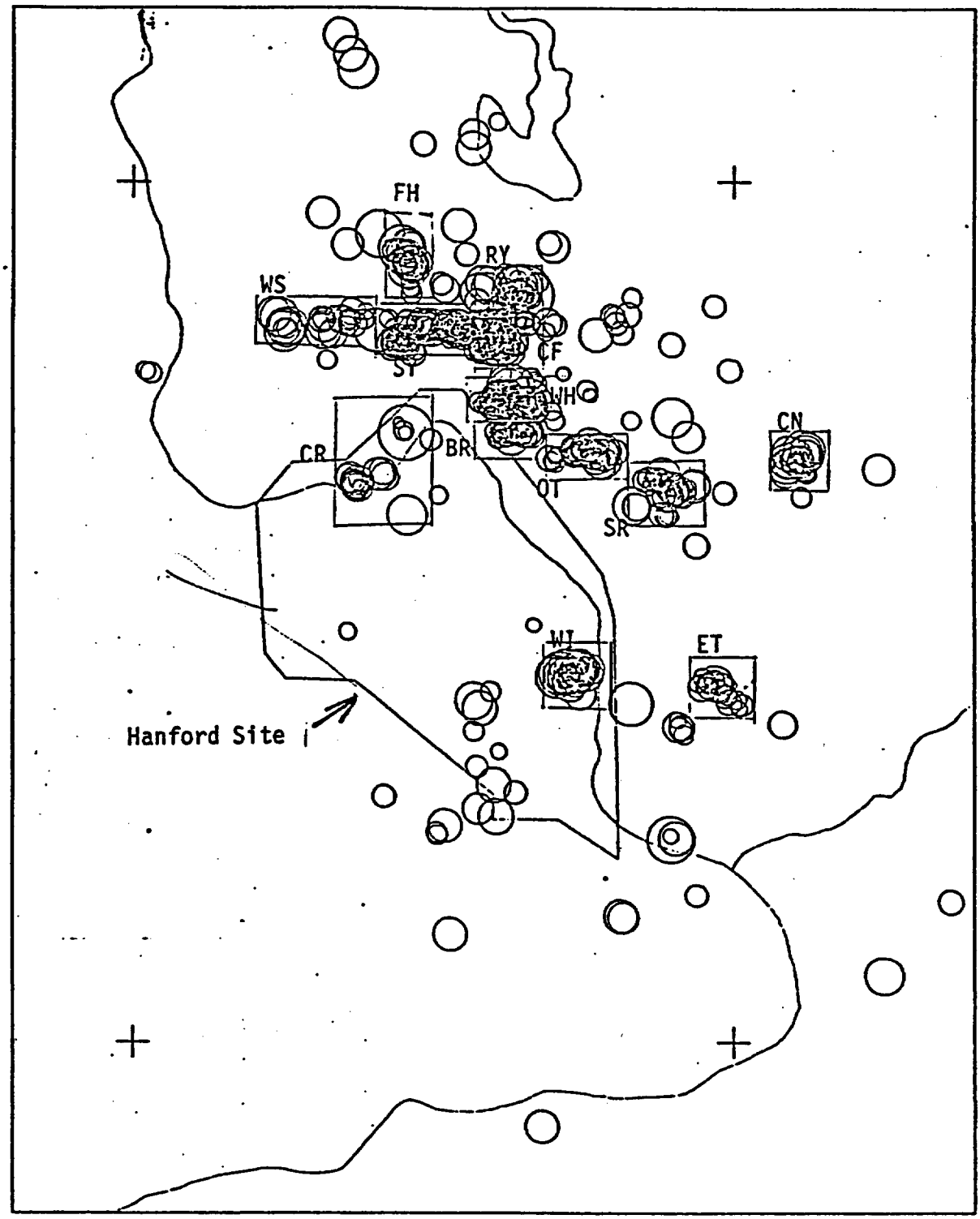
Also included as Attachment 2 and 3, are two previously prepared papers concerning earthquake swarm activity at Hanford. These papers contain information in addition to that discussed in the above paragraphs.

REFERENCES

Malone, S. D., Rothe, G. F., and Smith, S. W. (1975), Details of Micro-earthquake Swarms in the Columbia Basin, Washington, Bull. Seis. Soc. Am., V65, #4, pp. 855-864.

Malone, S. D., 1978, Annual Technical Report on Earthquake Monitoring of the Hanford Region, Eastern Washington.

Malone, S. D., 1979, Annual Technical Report on Earthquake Monitoring of the Hanford Region, Eastern Washington.



WELL LOCATED SHALLOW EARTHQUAKES 1969 - 1979
CENTER OF MAP IS 46.50 N 119.40 W

MAGNITUDE KEY (Richter Scale) 0.0 1.5 3.0 4.5

Figure 1. Locations of Earthquake Swarms

From: Malone, 1979

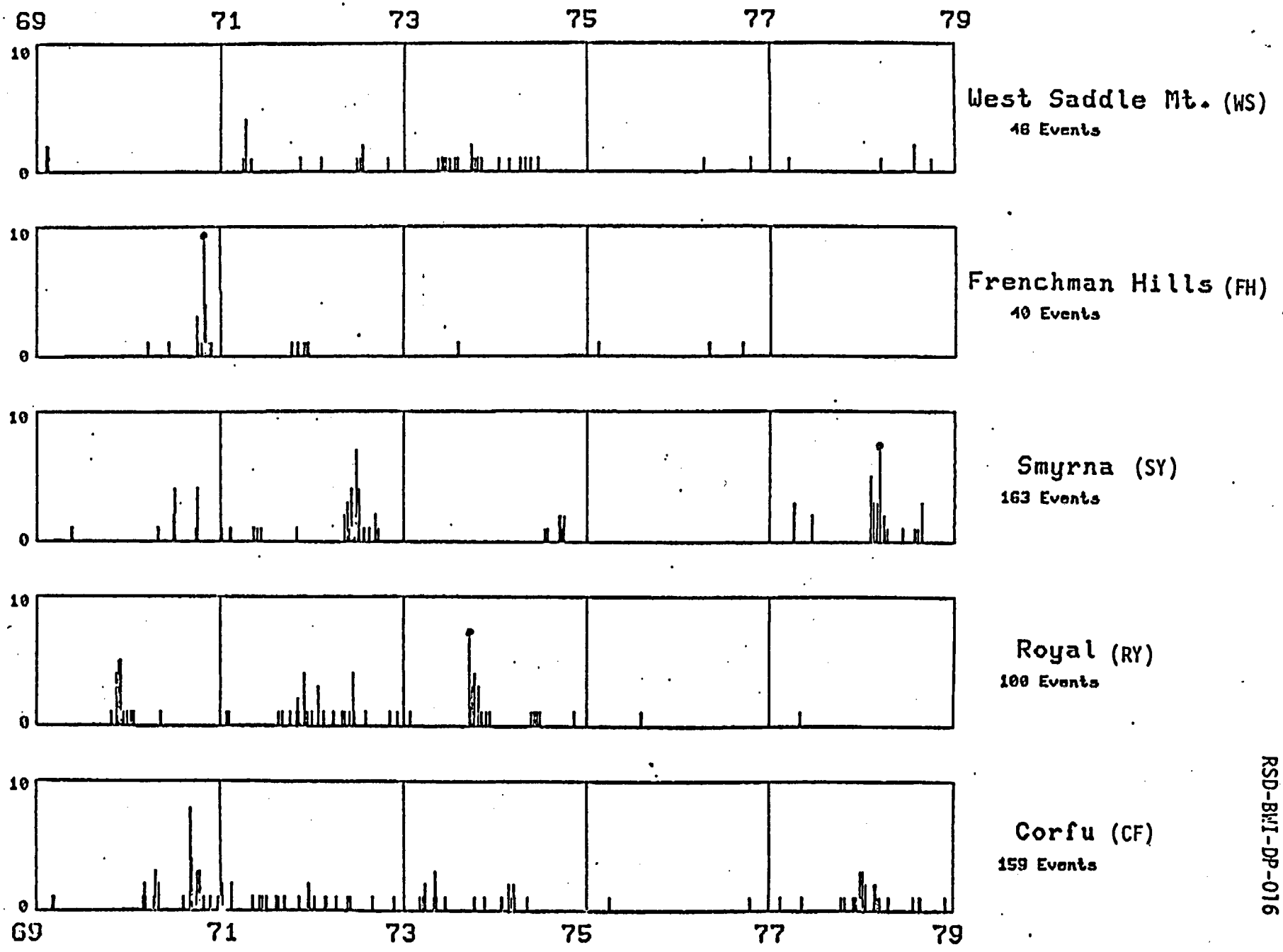


Figure 2. Temporal Clustering of Events Within Swarm Areas
(See Figure 1 for locations.)

From: Malone, 1979

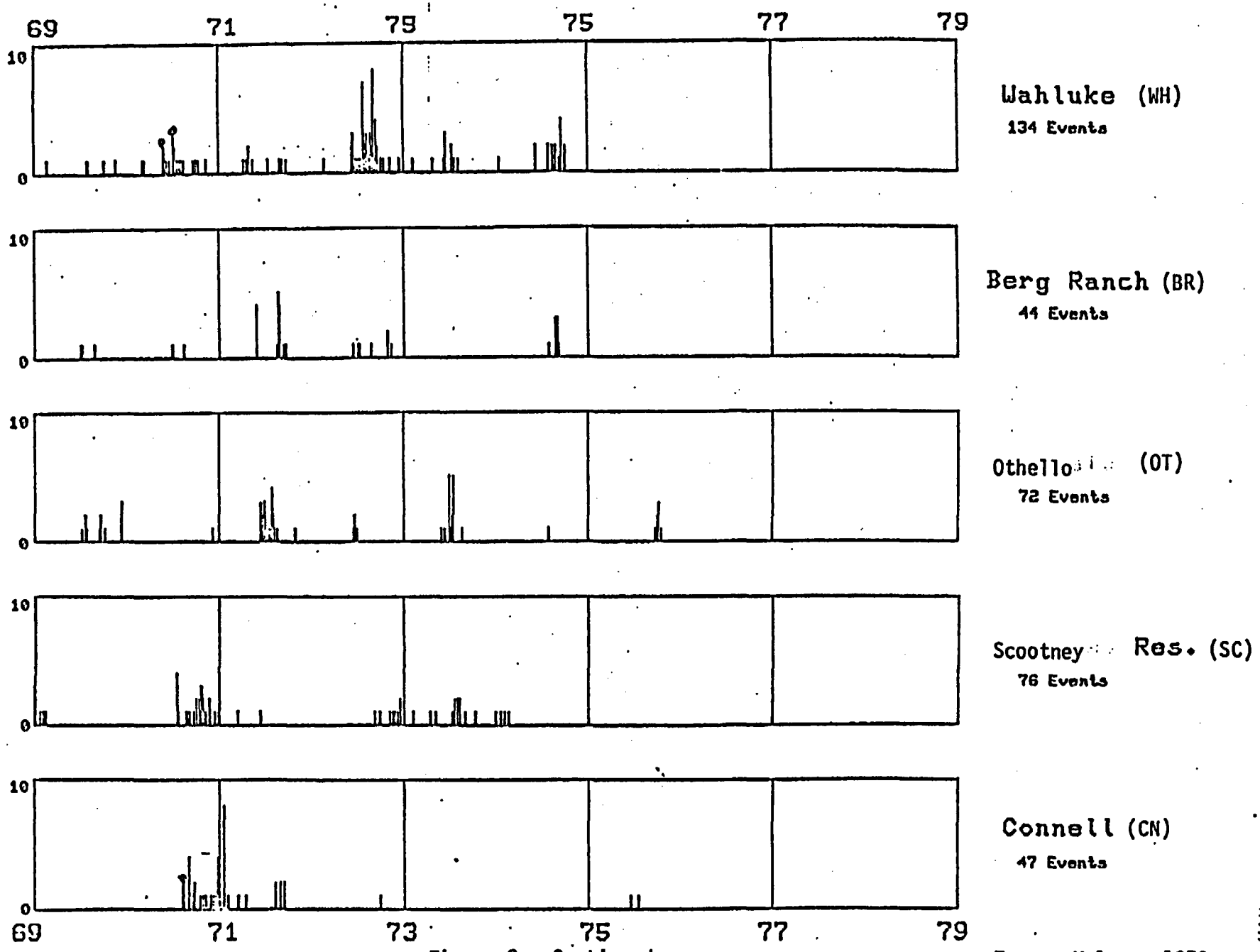


Figure 2. Continued

From: Malone, 1979

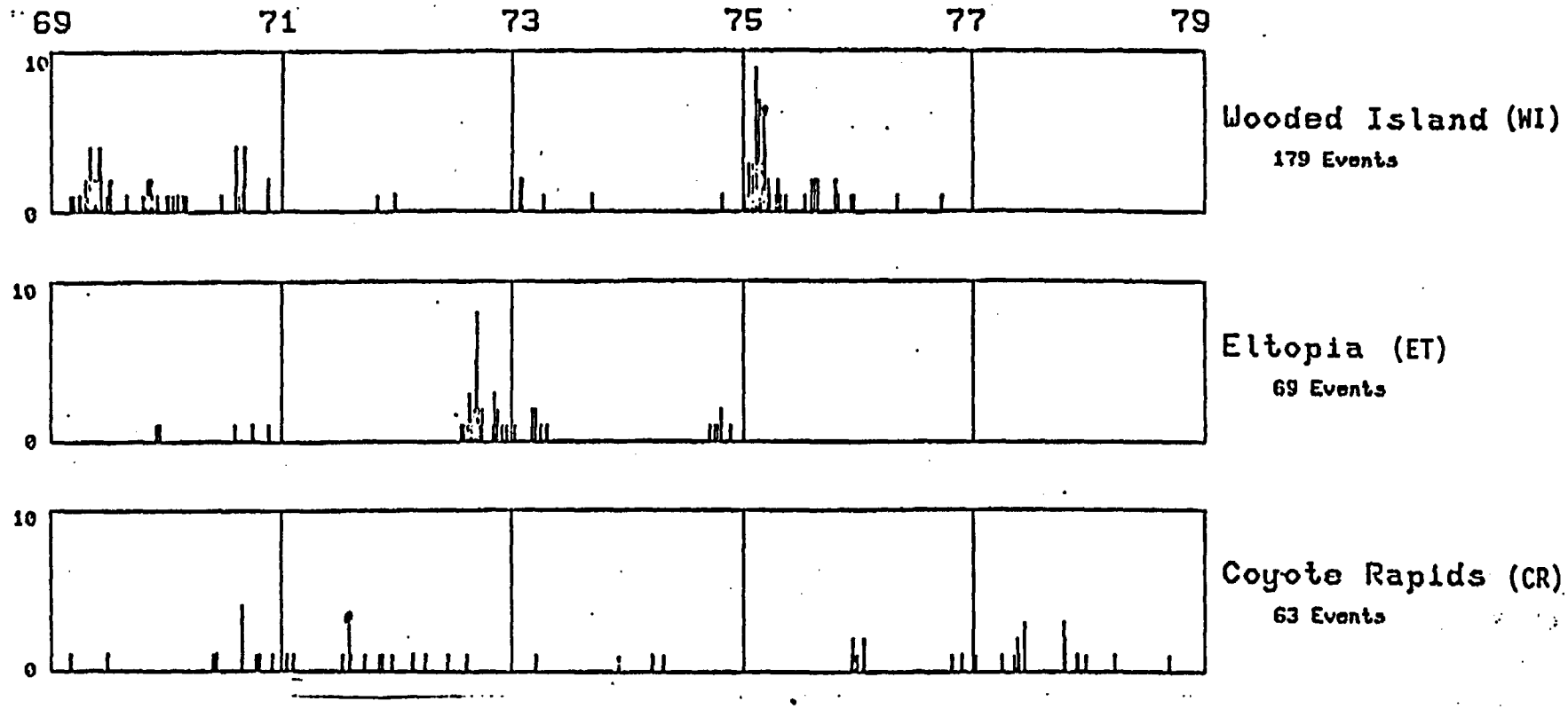


Figure 2. Continued

EARTHQUAKE SWARMS

Historical Background

Prior to the installation of the six station array in 1969 by the U.S. Geological Survey, earthquakes in eastern Washington and the area of the Hanford Site were monitored by a few seismographs of limited sensitivity located in Spokane, Seattle, Corvallis, and Victoria. The threshold for detection by such an array was about magnitude 4.5. With the exception of events large enough to be felt in non-instrumented areas, relatively few earthquakes were detected and even fewer were located with any precision. With such detection capabilities, few of the events recorded in the past 10 years by the eastern Washington network would have been detected, and almost none would have been located.

Based on a record of felt earthquakes, the area of eastern Washington is one of few earthquakes and relatively low seismic risk. The only exception to this observation would be a few moderate earthquakes that were felt at Corfu (November 1, 1918), Umatilla, Oregon (March 1892) and Milton-Freewater (July 15, 1936). These few events led Algermissen to place eastern Washington in a Zone 2 on his seismic risk map of the United States.

The Hanford/Eastern Washington Array

Under terms of an inter-agency agreement, the U.S. Geological Survey installed and operated a seismograph network from 1969 to 1975 when the responsibility of the net was transferred to the University of Washington. The initial six stations were deployed on and along the borders of the Hanford Site, but by 1972, there were 24 stations operating in southeastern Washington. When the network responsibility was assumed by the University of Washington, more stations were added bringing the total to about 36 in all of eastern Washington. There are currently about 40 stations operating throughout eastern Washington. The threshold for event detection and location in the area of the Hanford Site is about magnitude 1.5, although smaller events have been detected and located if they occur where they can be recorded by three or more stations. The threshold for detection and location for the remainder of eastern Washington is about magnitude 2. Events smaller than these thresholds may be recorded on one or two stations, but they can not be located and thus never appear in catalogs.

Seismicity of the Hanford Site 1969 to Present

The pattern of stress release is much better understood now than it was prior to 1969, but the collection of much additional data has also raised some perplexing problems. Earthquakes recorded in the area of southeastern Washington are all confined to the crust and indicate continued relief of stress at very low levels. To date, there is no obvious correlation of earthquakes with mapped geologic structure and no obvious alignment of earthquakes in planar zones that would suggest that relief of stress is concentrated along unmapped structures. Most earthquakes occur at very shallow depths (less than 5 km) in the area of the Hanford Site, but some do occur at depths up to about 28 km.

The occurrence of earthquakes in shallow swarms was one of the early significant discoveries by Mitch Pitt who ran the net for the U.S.G.S. Swarms are characterized by tens to thousands of small events that occur over a period of weeks to months at shallow depths in a very limited volume of rock (up to about 150 cubic kilometers of rock). Few events in a swarm will be larger than magnitude 2; many will be magnitudes less than one so that they can be detected

but not accurately located. With few exceptions, there is no increase in numbers or size of events building up to a main shock and a subsequent dying away of activity after such an event. A swarm will begin and stress will continue to be relieved with no obvious pattern of numbers and sizes of earthquakes. Activity has been shown to migrate, but not in any systematic way. Swarm areas are generally elongate in an east-west direction. Reasonably accurate information on focal depths can only be obtained with station spacing that does not exceed focal depth.

Deployment of portable arrays during swarms at Wahluke, Royal Slope, Eltopia, Corfu, and Wooded Island indicate that most activity occurs at depths of three kilometers or less, and is apparently restricted to the basalt. The localities where swarms occur have been restricted over the first 10 years to areas along the north and south flanks of the Saddle Mountains and at Wooded Island. Several areas where swarms have been detected have been affected by such activity more than once in the 10 year period of record. In fact, swarm areas were thought to be rather well defined until recently when a new area was found along the Cold Creek Syncline near its intersection with the Olympic Wallowa Lineament.

Source Mechanisms

The source mechanism and the origin of the stress that is being relieved in swarms are not understood at present. Individual events are generally too small to get sufficient data that would allow the calculation of a focal mechanism solution for any single event. Therefore, using groups of similar records that presumably result from the same mechanism, composite focal mechanism solutions have been determined for several groups of similar events. There is no agreement as to the attitude of the slip plane suggesting that rupture is occurring on steeply dipping planes of several orientations, but generally oriented east-west and arising from a nearly north-south, nearly horizontally directed principal stress. Rothe, in his dissertation on the Wooded Island swarm, suggested that rupture was occurring in thick, competent basalt flows and that slip was occurring along columnar joints. Composite focal mechanism solutions for events in the Wooded Island swarm suggest rupture along nearly east-west planes that dip steeply to the north.

If Rothe's hypothesis is supported by further work, it has interesting ramification for the Basalt Waste Isolation Project. First, it suggests that stress accumulates to higher thresholds in thick competent flows than in thinner, more broken flows. Thus, thick competent flows would acquire a negative aspect in contrast to hydrologic aspects. Second, if the slip is taking place on columnar joints, these are limited in areal extent by the thickness of any flow. Since earthquake size is determined by the area of rupture, the size of earthquake that occurs in the basalt might be controlled by the maximum area of rupture and thus the maximum thickness of any flow. Since the basalt is jointed everywhere, the concentration of stress release by Rothe's mechanism is not a satisfactory explanation as it does not explain why stress release is concentrated and confined to small areas when all basalt is jointed.

The recurrence relation of earthquakes described by Richter is related to the source mechanism by which they arise. A frequently used plot in seismology relates earthquake magnitude to the log of the number of events of a given size ($\log N = a - bM$). The slope of such a line is referred to as the b value. Plots of earthquakes from elsewhere in the world suggest that tectonically produced earthquakes at and near plate boundaries are characterized by b values of about .75 to .90; non-tectonic events are characterized by b values greater than 1. Recurrence plots of swarm events in Columbia River Basalt reveal a b value greater than one, suggesting that they are similar to other swarm events in other areas that arise from unknown non-tectonic causes.

Data from the first ten years, and especially the first seven years, suggest that earthquake activity (i.e., total numbers of events) peaks in January and declines to a minimum in July. With due allowance for lag time, such a temporal cycle of activity suggests a relationship with irrigation as a possible cause of activity. Recent swarm activity has occurred in areas that are not irrigated and has begun at times when irrigation has been inoperative for several months. Increased load due to water, and/or increased pore pressure in shallow rocks may be a factor in microearthquake activity, but it does not appear to be the only causative factor. A relationship to lunar and solar generated earth tides has as yet to be pursued as a potential trigger for microearthquake activity.

Are Earthquake Swarms Restricted to the Hanford Site?

The sensitivity of the earthquake network at Hanford means that far more smaller events will be detected near Hanford than in other parts of the plateau. Some swarms have included events that are all below magnitude 2, and such swarms would probably only be detected in an area with close station spacing and high sensitivity. However, most swarms include events between magnitude 2 and 3; therefore, these swarms should be detected anywhere in the plateau. Ten years worth of data suggest that swarm activity is characteristic of the Hanford area, but not other areas of the plateau. If swarms in other areas of the plateau are restricted to very small events (maximum magnitude of 1 to 1.5), it is possible that such activity occurs and goes undetected because of network sensitivity.

Summary

Ten years worth of data suggest that swarms of temporally and spatially restricted small shallow earthquakes are characteristic of the Hanford area. Other events do occur at depths of 5 to 28 km, but more than 75% of the earthquakes occur in less than 5% of the area. The mechanism of the events is not understood, but the earthquakes do tend to occur in elongate east-west areas with slip on steeply dipping planes oriented nearly east-west and resulting from nearly horizontal north-south compression. With a threshold of detection and location of magnitude 1.5 events near Hanford in contrast to a threshold of magnitude 2 elsewhere in the plateau, many more small events near Hanford are recorded and located. Under such circumstances, it is possible that swarms of very small earthquakes could occur elsewhere in the plateau but go undetected. However, since most swarms include several events greater than magnitude 2, this possibility seems unlikely.

Since the mechanism of the swarm earthquakes is poorly understood, it is not possible at this time to say whether the conditions leading to microearthquake at Hanford are duplicated at any other locality in the plateau.

Although the mechanism of swarms is not understood, there have been no events recorded in the 10 year history of the Hanford array that could not be accommodate by appropriate design techniques. The significance of the swarms as an indication of the potential for larger events over the design life of a repository remains to be determined.

ATTACHMENT 3

COLD CREEK EARTHQUAKE SWARM

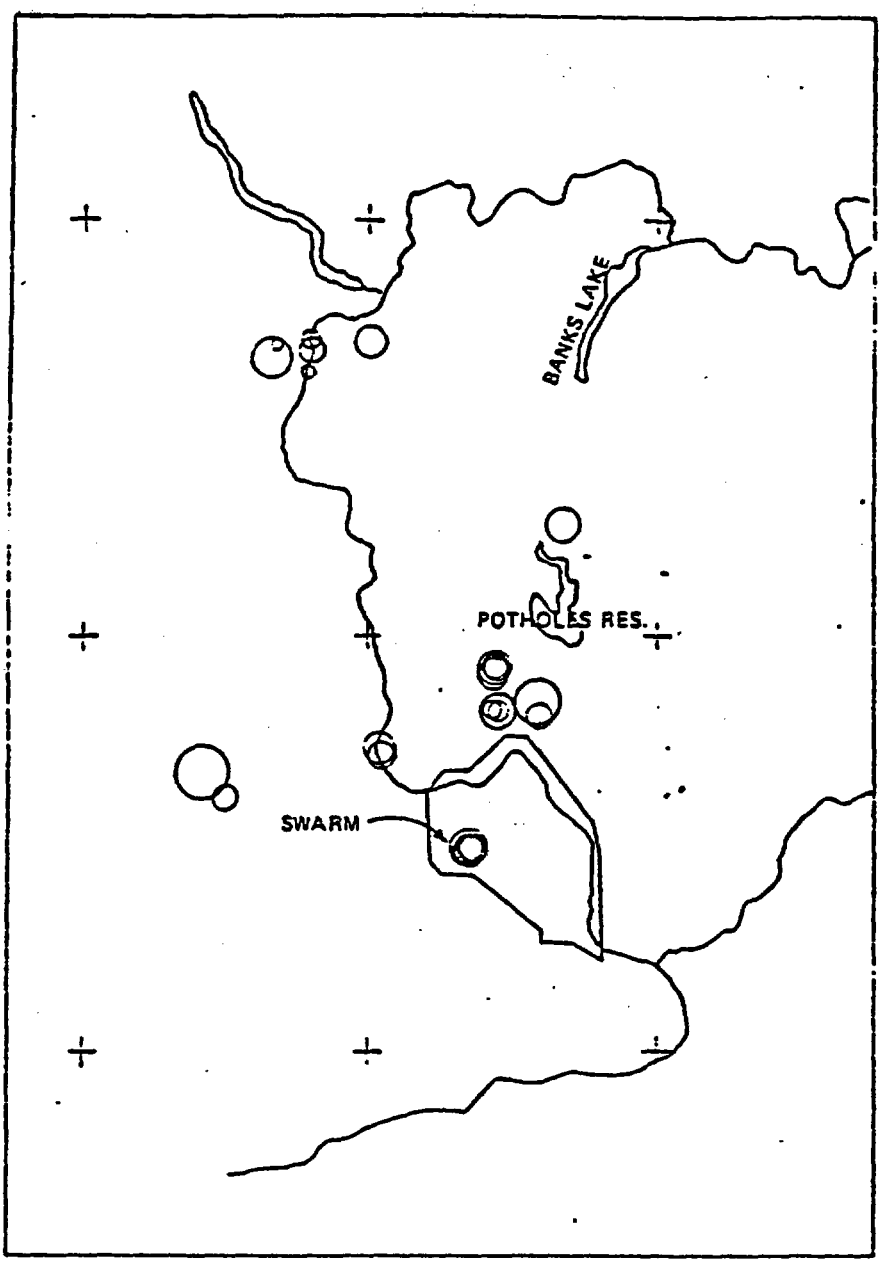
A swarm of small earthquakes occured in the Cold Creek syncline area on 9/8/79. Seven events occured in a three hour period with the largest event (magnitude 2.4) followed by six smaller events (magnitudes 1.2 - 1.8). This region has not had any located earthquakes since two small events in late 1977 and early 1978. The recent swarm was preceded by events three days, one month, and two months earlier. A magnitude 2.1 event occured the following day, and another small earthquake occured one month later.

All of the events were located between 1.4 and 4.3 km depth. However, periodic studies of swarm activity using local arrays has indicated that the routine hypocenter locations are slightly biased to deeper locations. Spatially, the entire sequence is bound in a rectangular area 2 X 3.5 km, elongate in an east-west direction. The three hour swarm is contained in a much smaller region (1 km^2) in the center of the rectangle. The depths of these central events were on the average located deeper than those in the outlying regions. Activity apparently began in the outlying regions, migrated into the central region, and then migrated outward again.

Focal mechanism plots indicate that different events within this swarm produced differing polarities at individual station. This indicates some degree of variability in the planes of faulting. Consistent polarities at several stations indicate roughly north-south compression. The rest of the first motion data (which were variable) are best fit by nodal planes placed as close as possible to the take-off directions represented by the variable first motion data. Small random variations in the fault parameters could then explain the differences. The plotting of the data is itself dependent upon the location (especially the depth) and ultimately upon the velocity model. Consideration of these inaccuracies can also explain some of the inconsistencies in this data set.

The focal mechanisms determined consistently indicate a thrust mechanism. Extremal solutions can be produced with maximum compression near horizontal (plunge 10° to 30° south) oriented from north to north-west azimuths. Tension is near vertical, plunging 10° to 30° west. Possible

slip surfaces inferred from the composite plot are either nearly horizontal (dipping 20° to $30^{o}$to the north or north-west), or near vertical (60° to 70° to the south or south-east), with the strike of the fault planes being east to north-east in either case. All the mechanisms are primarily thrust with with only minor right-lateral strike-slip components. The spatial distribution of the events is scattered, and does not help to determine which of the two general planes slip has occured on.



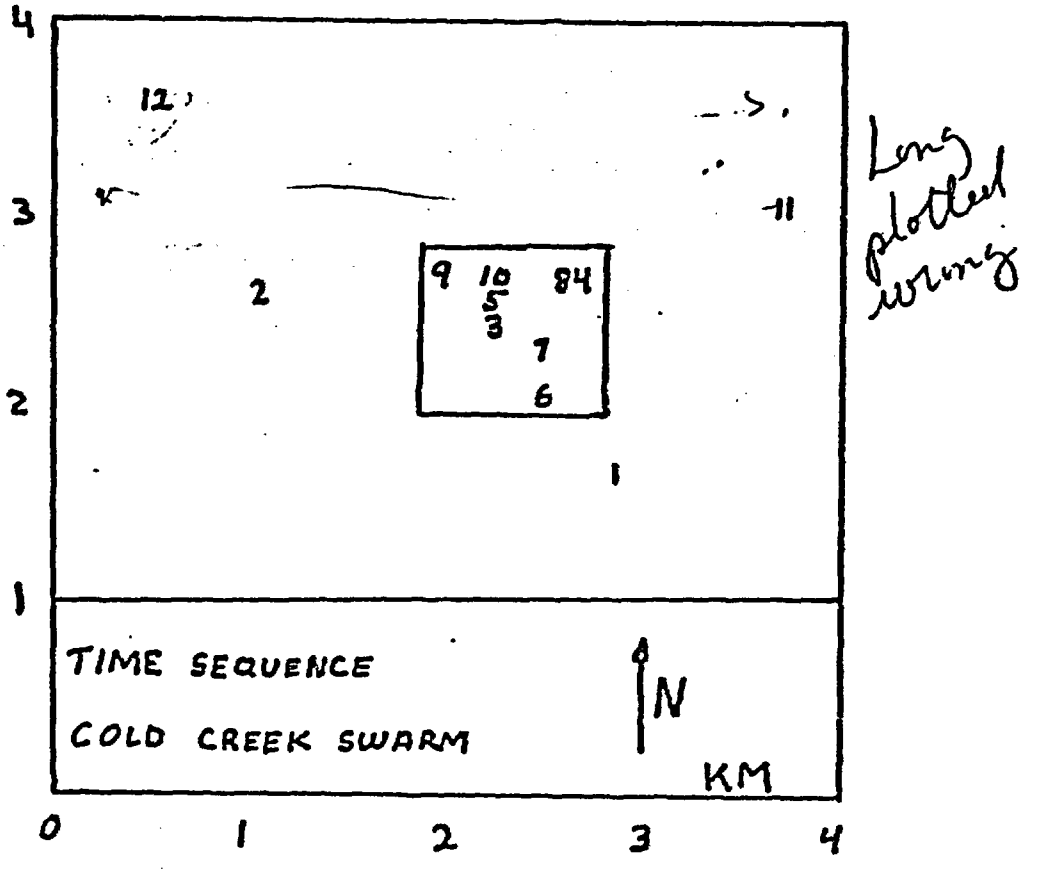
EASTERN WASHINGTON EARTHQUAKES JULY – SEPT, 1979 (AFTER MALONE' 1979c)
CENTER OF MAP IS 47.00 N 199.75W

MAGNITUDE KEY 0.0 1.3 2.7 4.0

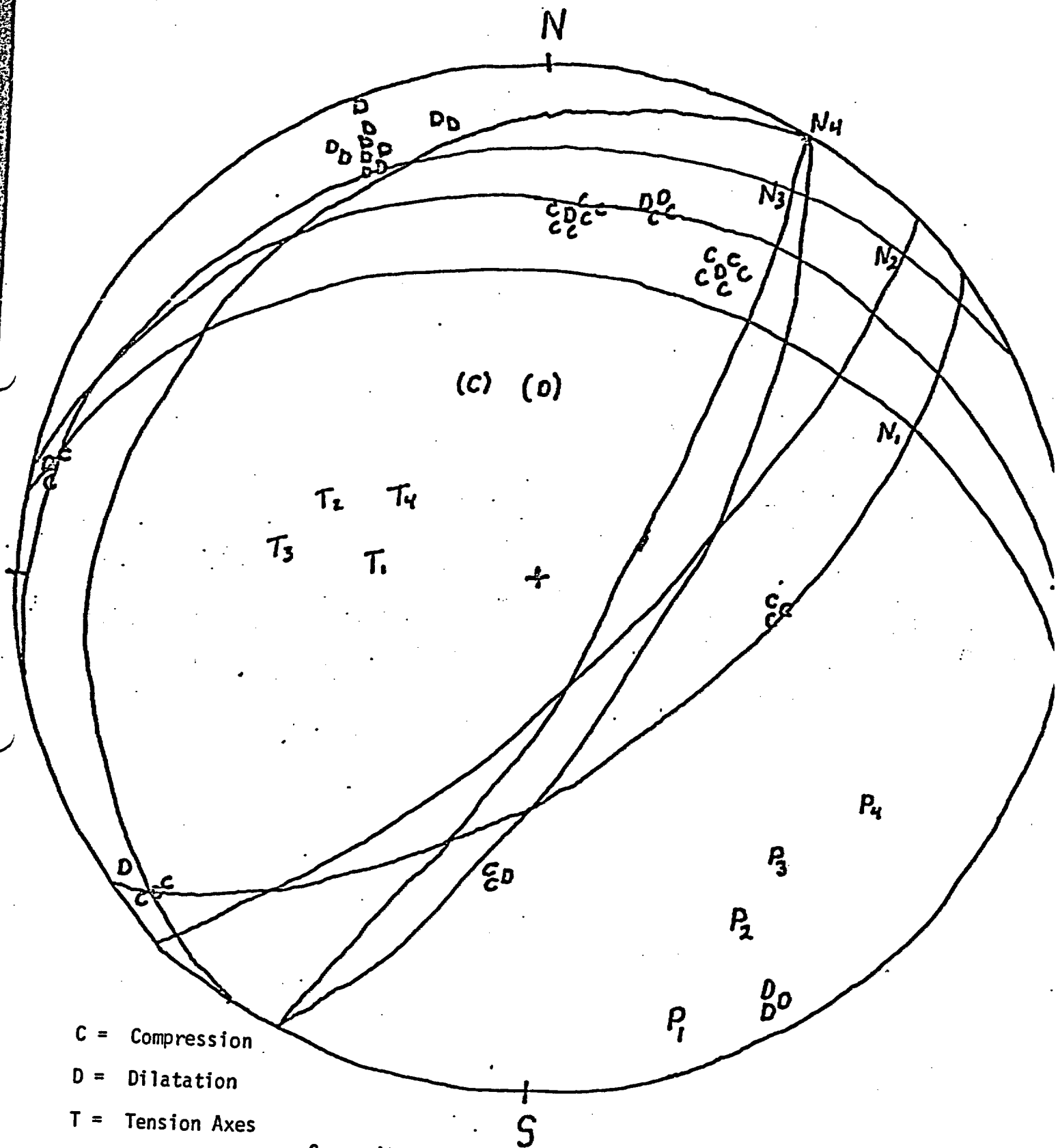
(Richter Scale)

Project No. 13891C	WASHINGTON PUBLIC POWER SUPPLY SYSTEM	SHALLOW MICROEARTHQUAKE SWARM OF 2 AUGUST 1979	
Woodward-Clyde Consultants			

Number	DATE	DAY	TIME	LAT	LONG	DEPTH	MAG	#	Q	TYPE
1	7/ 8/79	189	[illegible]:32.7	46-28.91	119-39.22	[illegible].0	1.7	9	C	
2	8/ 2/79	214	740:35.0	46-29.41	119-37.83	3.0	1.1	7	C	
3	9/ 5/79	248	227:18.1	46-29.33	119-38.75	2.6	1.5	6	C	
4	9/ 8/79	251	621:59.4	46-29.45	119-39.07	2.8	2.4	10	B	
5	9/ 8/79	251	643: 1.8	46-29.34	119-38.66	4.3	1.2	6	B	
6	9/ 8/79	251	726:11.0	46-29.12	119-38.94	3.7	1.4	6	B	
7	9/ 8/79	251	845:33.7	46-29.26	119-38.92	3.3	1.8	9	B	
8	9/ 8/79	251	854:16.1	46-29.44	119-39.01	3.8	1.6	8	B	
9	9/ 8/79	251	855:25.8	46-29.46	119-38.57	3.2	1.3	6	B	
10	9/ 8/79	251	925:41.3	46-29.42	119-38.74	1.4	1.4	8	C	
11	9/ 9/79	252	15 1: 8.9	46-29.66	119-39.86	2.5	2.1	12	B	
12	11/ 4/79	308	1158:40.5	46-29.94	119-37.41	3.2	1.5	10	B	



Locations and Magnitudes of Cold Creek Swarm Events



C = Compression

D = Dilatation

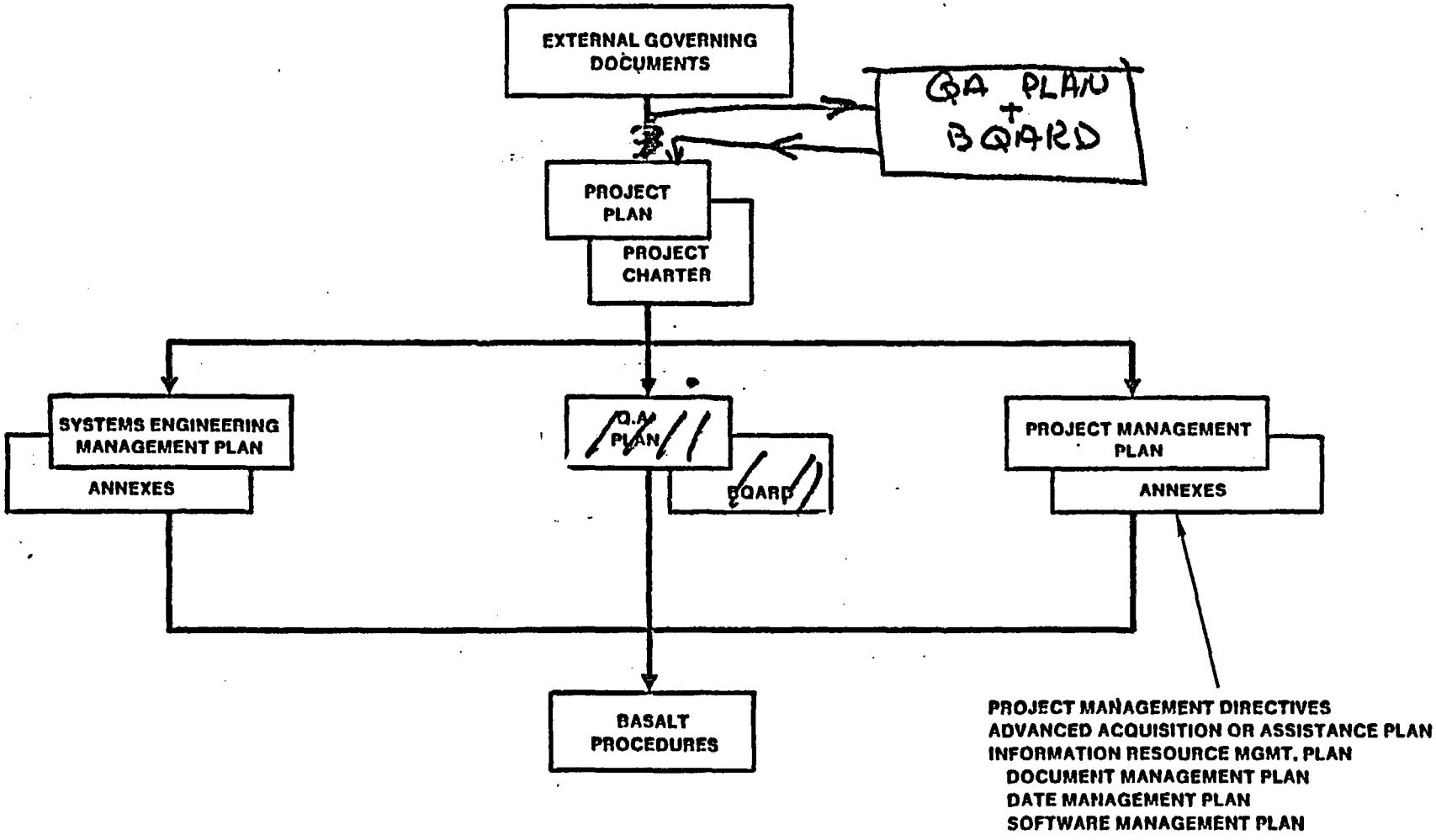
T = Tension Axes

P = Compression Axes

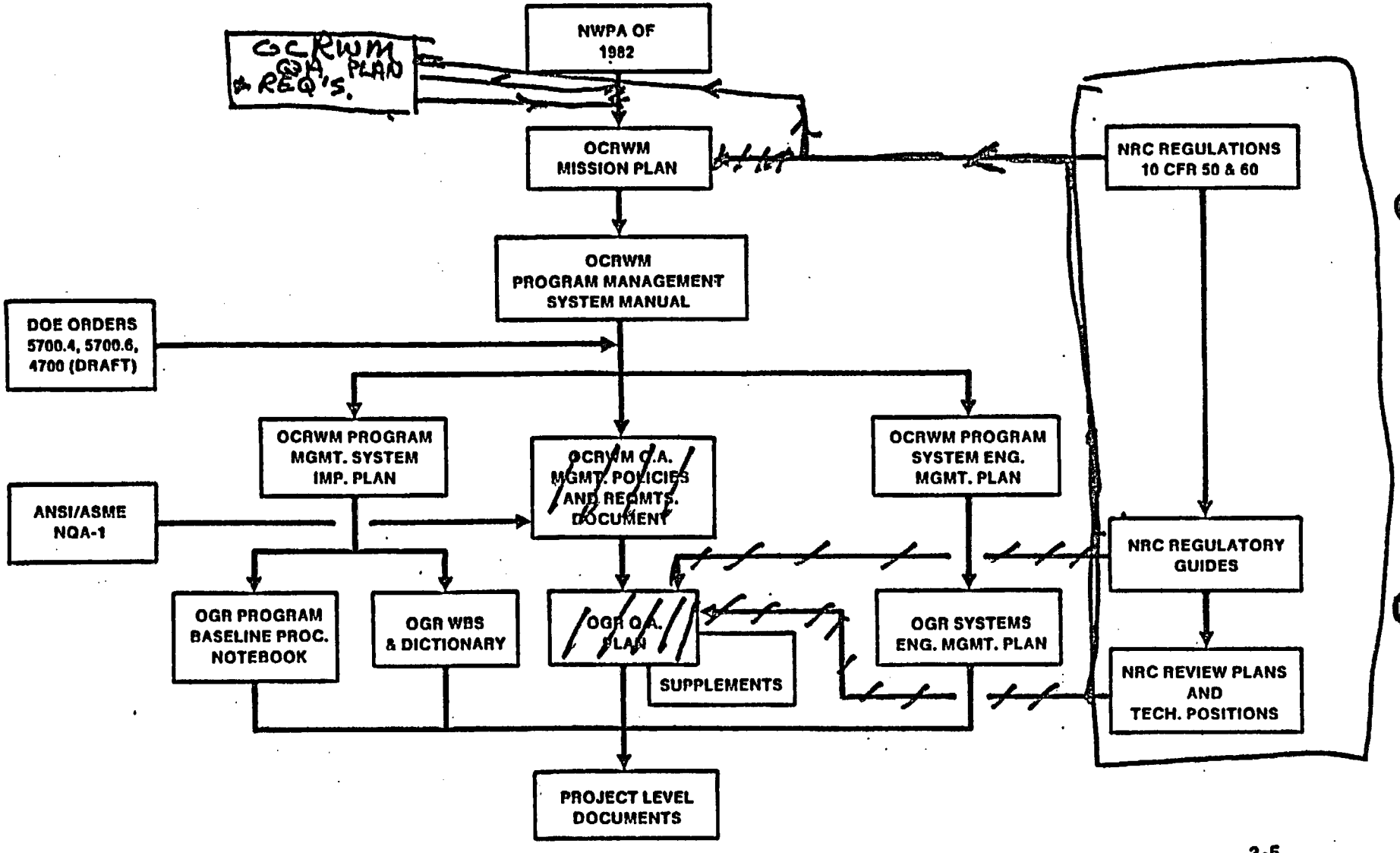
N = Intermediate Axes

Composite Fault Plane Solution for Cold Creek Swarm
(Lower Hemisphere Projection)

DOE-RL
PROJECT MANAGEMENT CONTROL SYSTEM



EXTERNAL GOVERNING DOCUMENT



Attachment G

FACILITY DESIGN
DC-24CX, DC-25CX, DC-32CX, AND DC-33CX

TABLE 1

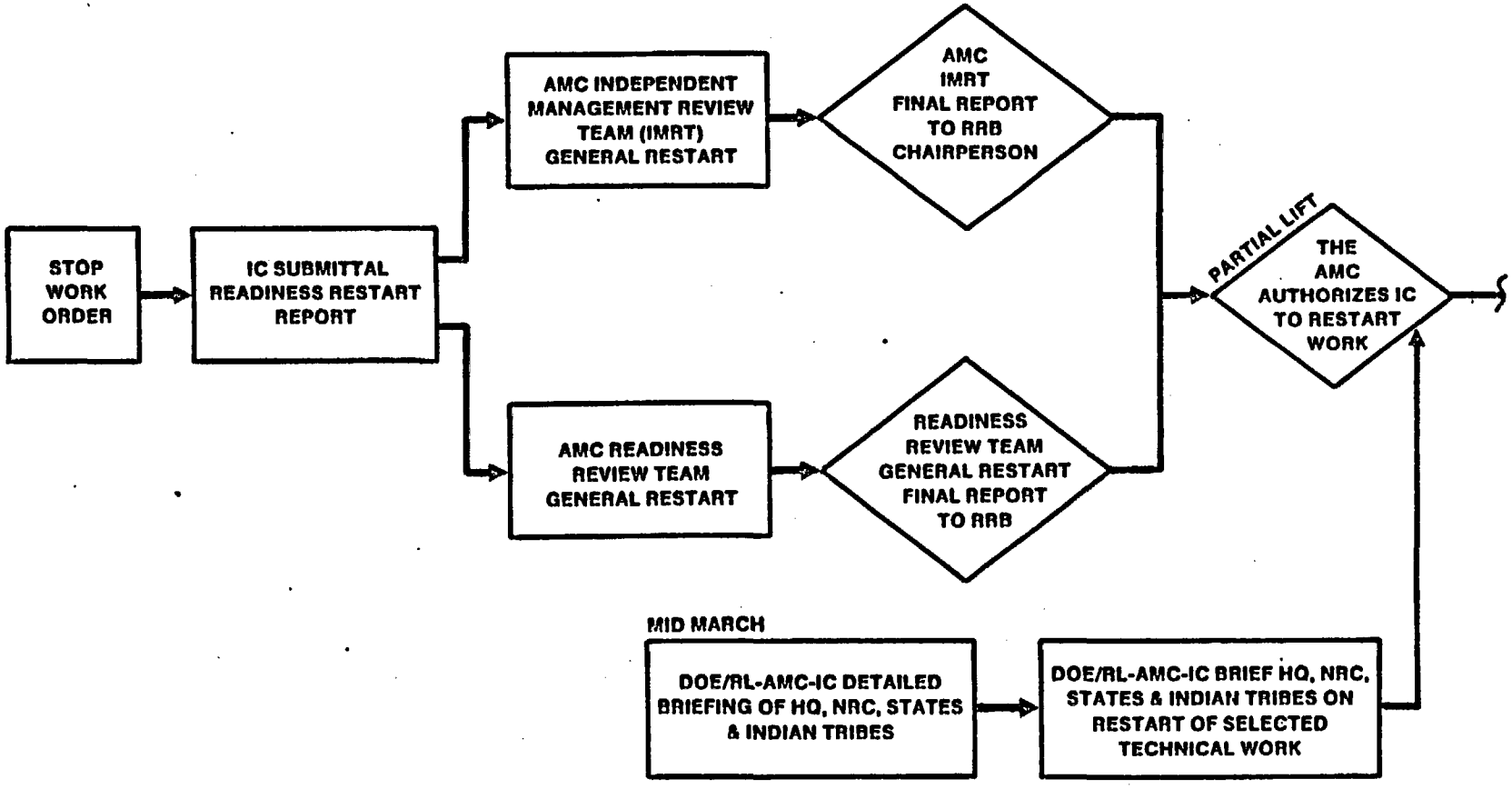
ITEMS IDENTIFIED AND
QUALITY ASSURANCE LEVEL ASSIGNMENT

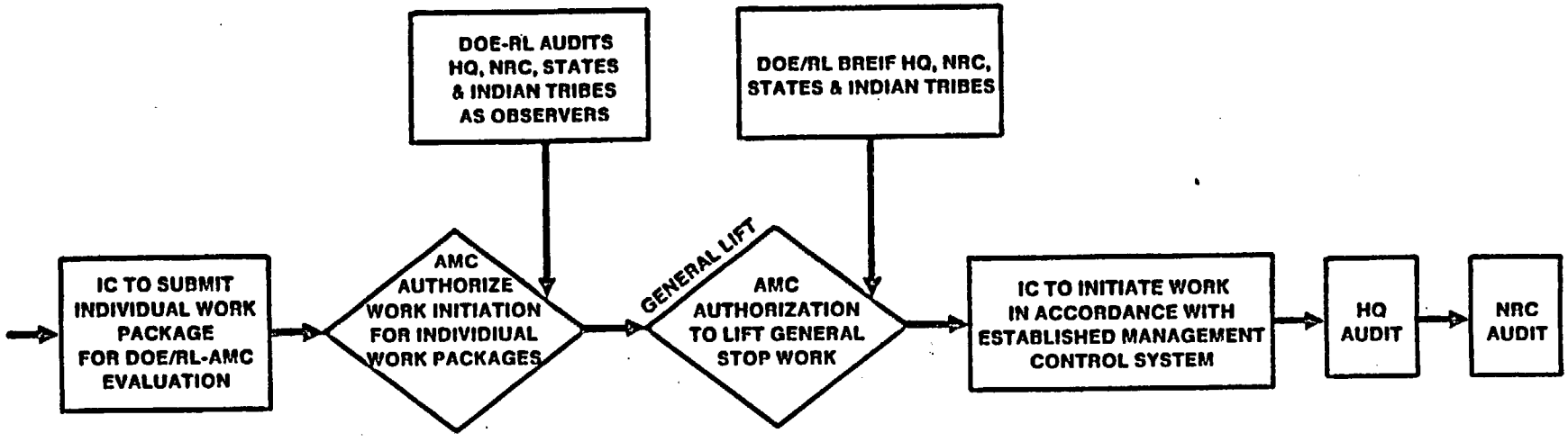
ITEM	QA LEVEL
Site Evaluation and Preparation (BHL-001)	
Site Excavation	3
Survey Borehole Coordinates	1
Drilling (BHL-002)	
Mobilization/Demobilization	2
Cable Tool Drilling	2
Set Conductor Pipe	2
Rotary Drilling	1
Spot Cementation	2
Set Casing/Cement	2
Fluid Circulation Monitoring	3
Drill Cuttings	1
Workover Rig	2
Set Pump - Clean Hole	3
Piezometer (BHL-003)	
Set Cement Plug (Top and Bottom)	1
Assemble, Measure, and Place Piezometer (Includes Welding Centralizers)	1
Tubing Test (Joint and Composite Test)	1
Filter Pack Placement	1
Develop Piezometer	1
Install and Monitor Transducer	1
Materials	3
Geologic/Geophysical Logging (BHL-004)	
Open and Cased Hole Logs	1
Developmental Logs	3
Borehole Geologic Logs	3

Attachment H

OFFICE OF ASSISTANT MANAGER FOR COMMERCIAL NUCLEAR WASTE
BASALT WASTE ISOLATION PROJECT

FLOW CHART
STOP WORK ORDER BSWO-86-004
GENERAL RESTART PROGRAM





LEGEND:
IC - INTEGRATING CONTRACTOR
AMC - OFFICE OF ASSISTANT MANAGER FOR COMMERCIAL NUCLEAR WASTE
RRB - READINESS REVIEW BOARD

D. Sandra Hassler
MS 623SS

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

April 15, 1987

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

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

SUBJECT: OBSERVATIONS, COMMENTS AND RECOMMENDATIONS FOR THE PERIOD JANUARY 17 TO APRIL 3, 1987

TECHNICAL ITEMS

1. Waste Package—

a. Development activities at Argonne Laboratory for RHO are being conducted on carbon steel samples to determine the effects of irradiation on the corrosion of this material, an alternative material being considered for the waste package container. The conditions created in the test apparatus simulate conditions expected in a basalt repository. A major difference is that the vessel used in conducting the test is a closed vessel which allows accumulation of hydrogen. In general the hydrogen which accumulated was greater than in unirradiated control tests, however, it may not be representative of the repository environment considering the "open system" character of the repository. The corrosion rate observed on the samples was greater than observed on the control (unirradiated) samples. Methane included in the test environment did not polymerize as has been observed in previous testing without waste package materials present.

I have requested from DOE a monthly report submitted by Argonne from which the information reported above was taken. I will forward this item upon its receipt. The information has been in existence for many months--clearly beyond the 45 day commitment for release of such information--and should be released immediately, if not already available in a data package.

b. Quality assurance functions connected with the testing at Argonne were not reported significantly in the monthly progress report noted in "a" above. DOE has raised the question of the

adequacy of the quality assurance being applied to this contract. This issue is discussed further under item 8 below.

2. Repository Engineering--

a. Attachment B contains a summary of key events recently completed or scheduled for the near future in the category of repository engineering. As can be seen, this schedule calls for start of the first exploratory shaft (ES) 24 months hence. Comment "b" below addresses what is meant by the beginning of the ES construction, i.e., drilling into the basalts.

b. DOE conclusions have affirmed the need for a second exploratory shaft. The shaft diameter is currently set at 10 feet. This entails a bore hole of about 12 to 14 feet in diameter. Considerations are being given to boring both ES bore holes at the same time to shorten the schedule for the underground exploration activities. In addition it is being considered expedient and potentially technically acceptable for site characterization to start the main shaft bore holes in the sediments and proceed to the top of the basalt prior to completion of large scale hydrologic testing. Attachment D contains the major DOE assumptions as of March 1987 controlling site characterization.

c. Two RHO reports, one concerning rock stress and the other concerning design methodology, have been delayed. I plan to obtain copies of these reports following completion and will forward them to staff for their review.

3. Geology--

a. Estella Leopold completed a review of the pollen assemblages reported for the Rattlesnake Mountain well RSH-1 in BNWL 776. This report is enclosed as Attachment C. Her review tends to confirm the interpretation of the age of the coal deposits in that well as being older than the generally accepted age of the Columbia River Basalts--about 17 million years. However, she notes that the omission of Compositae from the assemblage does not necessarily indicate an age greater than the mid Miocene age associated with the basalts. She noted that assemblages from samples in the lower part of RSH-1 are similar to assemblages in the Wenatchee Formation which is from the Oligocene Period.

b. The USGS under the cognizance of Washington State geologist, Bill Brewer, completed a side looking radar survey of the area around the Hanford Reservation as well as the Reservation itself. Mr. Brewer has indicated that enhanced images of the survey will be completed in May, 1987. They are expected to indicate fault lines and other structures potentially not observed in the morphology heretofore.

c. During the period I reviewed the the history of swarm earthquakes near the reference repository location and compared the discussion in the Draft SCP chapter with this history. Attachment E is pertinent to this history. Also of importance is the swarm at Rattlesnake Springs in November 1985. The two swarms are important to recognize because of their proximity to the RRL and the nature of the swarm described in Attachment E as the Cold Creek Swarm Events. The analysis associated with this swarm, Attachment E, indicated the mechanisms were primarily thrust with only minor right-lateral strike-slip components. Both swarms appear to be associated with the Yakima Ridge structure immediately south and southwest of the RRL.

4. Performance Assessment--

a. Strategies for, for example, the waste package performance, are not yet resolved by DOE. Definitions are still being derived for such terms as "degree of confidence" and other qualitative terms which provide no usable design basis. In light of this situation it appears that the objective of allocating performance to the various components of the repository and specifying quantitative functional design criteria with appropriate quantitative reliability and confidence statements has not progressed significantly beyond the qualitative discussions of the past.

5. Geochemistry--

a. Work is being conducted at Temple University to investigate the mobility of radioisotopic species in basalts through analog studies in Icelandic basalts. I have requested a summary report of results of this work and will forward it to staff upon receipt.

b. A comprehensive report of I-129 levels in the groundwater together with Hanford history concerning release of this isotope and it's monitoring is nearing completion and should be available within a couple months. The groundwater radiochemical data collected during this study is also being incorporated into the data base being used by BWIP for ready access by analysts. The review accomplished in preparing this report has influenced the preparation of the hydrochemistry plan for the BWIP site characterization and will provide significant background for Staff review of this plan as well as other plans related to geology and hydrology heretofore not available. Such items as monitoring at DB-15 in the Frenchman Springs unit to obtain up-to-date I-129 data and the levels of helium in the water at DB-15 and DB-7 are planned to further understand the origin of the I-129 in these wells. The existence of elevated helium would be indicative of a uranium and/or thorium source nearby.

6. Site/Environmental--

a. BWIP is preparing an Environmental Field Study Plan. This plan is scheduled to be completed in August 1987. Planning for the Draft EIS and Final EIS is consistent with the schedules presented in the Revised Mission Plan. PNL has the lead for DOE regarding environmental tasks.

b. DOE and Indian representatives met during the period to plan the work scope for environmental and socioeconomic work in the rest of FY 1987. I have requested a copy of this work scope, which is still being revised to reflect Indian/DOE agreements, and will forward it to the staff for their information upon receipt. A single copy of a proposed draft of the work plan was forwarded to staff (Linehan) via. separate correspondence.

7. Hydrology--

a. During the period I reviewed assessments regarding potential failures in nested piezometers. A report by Golder Associates, addresses this concern. It is entitled Preliminary Evaluation of the Adequacy of Piezometer Seals and is dated February 1987. It was forwarded to staff via. separate correspondence and is part of the package DOE presented to program participants for preparation for the DOE/NRC hydrology workshop in April.

I recommended that the issue regarding piezometer integrity be addressed during the hydrology workshop from the view point of the quality assurance being applied to the instrumentation design and checkout. I note that the integrity of the instrumentation will affect the determination of the baseline hydrologic potential as well as affet the determination of other hydrologic parameters during pump testing.

b. During the period DOE/HQ in conjunction with Weston and supported by RHO and DOE/RL personnel, developed the strategy for the hydrologic test program for the BWIP. This does not cover detailed test plans. I note that the workshop noted above only addressed general strategy--not the details of the testing to be pursued. However, details should be available shortly, since the most recent scheduling efforts include the beginning of the DC-24 bore hole drilling in June 1987.

If mini audits or participation in readiness reviews are to be conducted by the staff, planning should anticipate the early start of drilling in June. It is my observation that many of the controls particularly those of a managerial nature that are planned and which affect quality will not be in place by June. Comments under item 8 below address this situation at DOE and RHO.

8. Quality Assurance--

a. In my last memorandum I reported on the audit of Pacific Northwest Laboratory (PNL). A closeout meeting was conducted by

DOE with senior PNL management in March. PNL management appeared to understand and accept the DOE/MAC comments concerning PNL's control of program requirements and clear specification of responsibilities and authorities through a classical project manager for the BWIP work. Also the point that the management controls are part of the controls that are needed to obtain quality and hence an integral part of the quality assurance program was highlighted by the MAC auditor.

Although corrective actions were recognized as required by the PNL management, senior PNL management attitude in support of a sound quality assurance program was apparent. Their stated commitment should be borne out by their actions to design and apply satisfactory quality assurance functions to the area of management controls.

b. During the period I attended a weekly readiness status among DOE and RHO representatives in which DOE indicated to RHO that various administrative or management controls, some of which are intended to obtain and/or assure quality in the various technical products being produced by BWIP, were required prior to a general restart of technical activities. This appeared as a surprise to RHO representatives since the controls were not considered as part of the "quality assurance program" and hence not a necessary prerequisite for restart of technical work.

This general consideration, seemingly widely held among the local DOE contractors and DOE, appears to be the result of determinations and policy of DOE to categorize management and/or administrative system requirements and the respective procedures outside the umbrella of the quality assurance program required by Appendix B of 10CFR50 and, hence, outside the specter of NRC review and regulatory cognizance from the DOE view point. It is this determination that is confusing the contractors, RHO and PNL alike, and has resulted in the in the low priority of actions in this vital area of procedure development and implementation of quality assurance program requirements. It continues to contribute to the lack of acceptance of responsibility for necessary assurance actions by PNL, RHO and DOE quality assurance managers in this realm of project activities.

To correct this situation I consider that the hierarchy of requirements documents should clearly list the quality assurance program requirements at the top with lower tier management requirements and procedures and systems engineering requirements and procedures as subsidiary documents. Hence basic orders which DOE specifies for the BWIP, for example, DOE 5700 series orders, should be considered as part of the project's quality assurance program required by the rules of Part 60, assuming the various DOE orders do not conflict with the NRC rules. (Currently there may be conflicts between the requirements of the DOE orders and the requirements of Part 60/50 Appendix B, particularly in so far as these orders specify various quality assurance requirements

contained in NQA-1 at a level above the Appendix B requirements as supplemented by the QA Review Plan. Attachment F identifies the current hierarchy of requirements for DOE/HQ and DOE/RL, marked-up to reflect the possible correction noted herein.

Also it should be noted that the requirements stemming from the Mission Plan appear in the hierarchy presented by DOE at a higher level than the quality assurance plan. Since the Mission Plan is in part a scheduling document, which schedule results from coordinating funding restraints and technical requirements and procedures in order to achieve quality in the technical products of the project, it is incorrectly placed in the hierarchry as indicated in the mark-up of Attachment F. In particular the schedular part of the Mission Plan should not appear to the participants as a requirement, if quality of the technical products is to be preserved.

c. Currently DOE/RL is in the process of revising draft procedures for the development of schedules and funding baselines which are consistent with technical baselines for necessary work. The procedures are intended to achieve quality in the technical products. (The procedures are not considered part of the Quality Assurance Program--they fall under the heading of Project Management Plans identified in Attachment F--even though they are intended to achieve quality in the technical baseline of activities.) Planning does not include verification and audit by quality assurance personnel procedures at discrete, planned, points in the process, this being consistent with the DOE/RL concept that the activities are outside the scope of the Quality Assurance Plan. Staff Review of these procedures and the respective requirements documents is warranted in connection with any future mini-audit or quality assurance workshop. In addition the QA Review Plan revision should include an item which addresses this aspect of a quality assurance program for BWIP.

As a related observation, it is not apparent how the overall DOE/RL--DOE/HQ procedural control in this area is being developed to achieve quality and provide the required quality assurance. Procedural identification of the interfaces between the DOE/RL--DOE/HQ and their contractors with procedural specification of comprehensive control and recording of information exchanges at these interfaces is of key importance to achieve the desired control with quality and to facilitate assurance actions. The comment above concerning the placement of the "schedular requirements" contained in the Mission Plan is related to this item and suggests an area where controls with appropriate quality assurance actions are indicated.

DOE actions during and subsequent to a recent meeting (which I was restricted from attending after having been informed of it in advance) on March 25, 1987 among DOE/RL, DOE/HQ and RHO personnel would be pertinent in reviewing the effectiveness of controls in this area. The meeting addressed modifying schedules for the

hydrologic test program and apparently resulted in action to initiate the drilling operations at DC-24 and DC-25 prior to the general restart of data gathering activities, which as of the March 17, 1987 restart briefing discussed below was not planned until September or October, 1987. Attachment H is pertinent to the planning discussed in the March 17 briefing. I am only partially aware of the actions and expedited schedules resulting from the March 25 meeting. Although I have requested information concerning this meeting from DOE has not been forthcoming with such information, indicating that there is no record of the meeting.

d. On March 17, 1987 I attended a briefing concerning actions to prepare requirements and invoke procedures which control technical and administrative actions that affect quality. NRC (Kennedy) attended the briefing and has a copy of the materials distributed to the participants. The concern described above in comment 8b, regarding the scope of the quality assurance program, was identified to DOE at the briefing. In addition concerns which I have noted in the past regarding the grading of activities and categorization on the Q-List was described to DOE/HQ (Knight) who indicated he understood the issue following my discussion with him.

To date I am not aware of steps being taken to provide for the grading of actions pertinent to Q-Listed items or actions. A recent list of actions concerning the hydrology drilling program presented at the hydrology workshop--Attachment G--still includes only one grade of actions for Q-Listed items and actions. I consider various other items and actions on the list should be appropriately Q-Listed. For example, materials for the piezometers, fluid circulation monitoring, cleaning the hole, developmental logging, bore hole geologic logging, etc., identified in Attachment G as QA Level 2 and 3 items are not Q-Listed and, by definition, would not be of concern at licensing and hence outside the scope of NRC's cognizance now and then. It is apparent to me that these items and actions are of potential importance at licensing and should be on the Q-List even though reduced control and quality assurance actions may be acceptable as suggested by Attachment G.

MISCELLANEOUS ITEMS

a. DOE Inspector General personnel completed an investigation, started in the Spring of 1985, into matters associated with monitoring I-129 in the environment at Hanford in the past. I read this report which was dated April 1, 1987. I was informed the report was sent to NRC/OI by the DOE Inspector General Office (IG). I notified NRC/OI of this item and other information regarding the IG report and the current I-129 data review discussed in item 5b above. I noted to OI that I considered that the current review effort was satisfactory and would most likely bring forth the existing information pertinent to licensing a

repository at BWIP, this objective being the basis of my original interest in the subject matter. I noted the IG report indicated no problems in the previous handling of the I-129 information.

In this regard the IG report noted that general on-reservation and off-reservation I-129 information had been published in BNWL-CC-1800 83 of June 1972. This document was declassified in December 1972. In addition information concerning on-reservation groundwater I-129 was published in BNWL SA 4478 of January 1973. These documents were not cited in subsequent information generally available to the public, for example, the EIS for the waste management operations published in December 1975, and it received limited distribution (22 copies) within DOE/Contractor organizations. It was not made available to me in 1985 when I requested this type of information in a published form.

b. DOE initiated a weekly meeting among myself, 6 to 8 DOE personnel, generally lead by J. Keating, the on-site CERT (Indian) representative, a Washington State representative and a GAO representative. The intent is to review and identify issues, actions complaints etc., i.e., a scheduled forum for communicating among all the participants. It is at these meeting that I summarize the concerns I have identified in the previous week. I believe the meetings are serving a useful purpose for all attendees.

c. State and Indian cognizances of activities at the site are increasing. They are showing an ever increasing awareness of and desire for review of all types of site activities. Attachment A illustrates this evolving condition. GAO also has two nearly full time representatives assigned to overviewing BWIP activities. I consider my interface with these various representatives mutually satisfactory.

d. During the subject period I attended the ASQC quality assurance conference in Las Vegas. Issues stemming from that conference were discussed with NRC Staff who also attended the conference, including Bell and Kennedy.

e. No action has occurred to involve me in the training sessions for RHO personnel regarding the agreements of Appendix 7 and interaction with on-site representatives as previously committed to by DOE (Anttonen). DOE/HQ has tabled the issue although the need for such training at RHO is still evident and resolution of disparate interpretations of Appendix 7 wanting.

/S/

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

Distribution for April 15, 1987 memorandum:

cf:	JTBuckley	JOBunting	DLChery RES
JJLinehan	JMLibert	JMHoffman	JEKennedy
PTPrestholt	RLBallard	SWasler-NE	FXCameron
PHildenbrand	FRCook/rdg	PJustus	I&E
DBrooks	HLefevre	KCChang	NMColeman

DOE/JEKnight	DOE/RL/JAnttonen	DOE/RL/JMecca
UIN/WBurke	O.DOE/WDixon	O.DOE/MBlazek
NP/RTHalfmoon	Wash.DOE/THusseman	YIN/RJim
NP/UIN/OR/AAlkezmeeny		

Attachment A

ESTABLISHED BY THE
TREATY OF JUNE 9, 1855
CENTENNIAL JUNE 9, 1955

CONFEDERATED TRIBES AND BANDS
Yakima Indian Nation

POST OFFICE BOX 151
TOPPENISH, WASHINGTON 98948

GENERAL COUNCIL
TRIBAL COUNCIL

March 24, 1987

Mr. John Anttonen
Assistant Manager for Nuclear Waste
U.S. Department of Energy
Basalt Waste Isolation Project
Richland Operations Office
P.O. Box 550
Richland, WA 99352

Dear Mr. Anttonen:

The Yakima Indian Nation, in cooperation with the Confederated Tribes of the Umatilla Indian Reservation, the Nez Perce Tribe, and the State of Washington and the Nuclear Regulatory Commission (NRC), plan to review the records of well bores in and around the Hanford Reservation. The records are located in the RRL trailer office and are contained in several safes and bookshelves in the library area. Limited examination of one of the bore hole records was made a few weeks ago by Abdul Alkezweeny, the CTUIR and Nez Perce Tribal On-Site Representative, and Bob Cook of NRC. A team of reviewers consisting of one person from each of the affected parties and the NRC, headed by Curtis Canard, a geologist with the Council of Energy Resources Tribes, is planning to conduct the reveiw during the period of May 11 to May 15, 1987.

We are requesting your assistance in helping the reviewers carry out their assignment. They will require the aid of personnel to facilitate use of library area and the physical access to the information in the safes noted above. The reviewers may desire copies of records for retention. However, these will be identified and requested formally. Finally, the names of the reviewers and other information required for obtaining badges will be sent to the proper DOE office for processing.

Thank you in advance for your cooperation. We are looking forward to hearing from you.

Sincerely,

Russell Jim

Russell Jim, Manager
Nuclear Waste Program

cc: Bill Burke, CTUIR
Ron Halfmoon, Nez Perce
Bob Cook, NRC
Curtis Canard, CERT
Terry Husseman, Washington
Dr. Georges V. Abi-Ghanem, EWA, INC.

Attachment B

BASALT WASTE ISOLATION PROJECT

MILESTONE LOG
PROJECT SUMMARY

MARCH 5, 1987

TITLE	BASELINE	FORECAST	ACTUAL
Repository			
Rod Consolidation Study to HQ	12/86	03/87	
Retrievability Compliance Strategy Plan to HQ for review	12/86	03/87	
Issue Site Characterization Plan (SCP - Conceptual Design Report (CDR) to HQ for review and acceptance	01/87	03/87	
Final FY 1989 Project Validation Material to HQ	03/87	03/87	
Draft Repository Subsystem ACD Requirements to HQ for review	04/87	04/87	
Initiate Repository ACD	02/89	02/89	
Exploratory Shaft			
Draft ESF Design Basis Study Report received at HQ for review	01/87	04/87	
Final FY 1989 Project Validation Material to HQ	03/87	03/87	
Recommendation on ESF Design change as received at HQ for review	03/87	06/87	
Submit Draft Exploratory Shaft Facility Design Requirements for final design received at Richland and HQ for review and approval	05/87	07/87	
Draft ESF Design Requirements for Final Design Report received at HQ for approval	07/87	09/87	
Start First Shaft (ES-1) Construction	04/89	04/89	
Submit Draft Final Design Report to HQ for review and acceptance	05/88	01/89	

Attachment C

2/20/87

F.R.Cook
Senior On-Site Licensing Representative
Nuclear Regulatory Commissiion
Washington D.C. 20555

Dear Mr. Cook,

I have read with interest the pollen section in the report by Raymond and Tillson (1968) on "Evaluation of a thick Basalt sequence in S. Central Washington...", and I thak you for sending me the copy. The fossil pollen work was done by a collegue who has more experience with the Tertiary pollen of Washington state than anyone I know. He was a student of Robert Tschudy (USGS), who was a top authority in Cenozoic palynology.

I am happy to report that the work seems to be exceedingly well done, and the conclusions seem faultless as far as we understand the stratigraphic ranges of the forms present. I will give you my own interpretation of the pollen evidence:

The appearance of Larix/Pseudotsuga is of special interest, as with my experience in the USGS, we found the earliest forms at Florissant, Colo., where the basal Oligocene is perhaps best known) by pollen) in the U.S. The form ranges upward to the present, but I have never seen it in pre-Oligocene beds. It appears above 3500' in the Rattlesnake Hills well. Another telling form is Jussiaea (Onagraceae or evening primrose family). This is the same story: no pre-Oligocene occurrences are known to me.

A number of forms are not restricted to the Oligocene, but are typical in Oligocene and younger beds in the Northwest: one of these is Cedrus, which is present in the deepest sample. Most of the angiosperm pollen reported from the lower samples are also typical of Oligocene (though they do range outside of that interval). Grass pollen is in the same category.

In summary, an Oligocene age seems to be the case, based on knowledge from leaf and pollen floras of the Pacific Northwest. Newman's reasoning that the age (including the lower beds) may be late Oligocene makes sense to me. We can expect that the early Oligocene is more tropical is backed up by a variety of reports, including Coos Bay, Oregon, and other sites in Oregon and California. His reasoning that the absence of the Miocene and younger pollen of the Compositae (daisy) family indicates a pre-Miocene age,(I would add at least a pre-late Miocene age) is founded on broad evidence in the western states and Northwest. I would agree that perhaps the upper parts of the well might be as

young as Miocene, assuming that in some environments Compositae is somehow not well represented even in Miocene time.

It looks good to me. I am wondering what this means in terms of the Hanford site plans. Guess this awaits a further discussion with you or our Olympia geologists, like Bill Brewer.

Sorry for the delay in this letter and report.

Sincerely,

Estella B. Leopold

Estella B. Leopold
Botany KB-15
University of Washington
Seattle WA 98195

cc. Bill Brewer

P.S. In case someone at NRC wonders on what basis I write this letter, may I state that I spent 21 years working for USGS on Cenozoic pollen, with particular emphasis on Eocene and younger sediments of the western United States. In the Pacific Northwest I have done some work on the Miocene and Pliocene including sediments of the Vantage beds, Ellensberg Fm. and the Wenatchee Fm (Oligocene?), which in many ways the lower part of the Rattlesnake Hills well assemblage resembles. A grad student of mine did her thesis on the Weaverville flora (Oligocene?) of northern California. I am quite familiar with the fossil leaf literature of this region, since I teach a course on that topic.

Attachment D

Attachment D

Basalt Waste Isolation Project
FY 1989 Budget Submittal
Assumptions

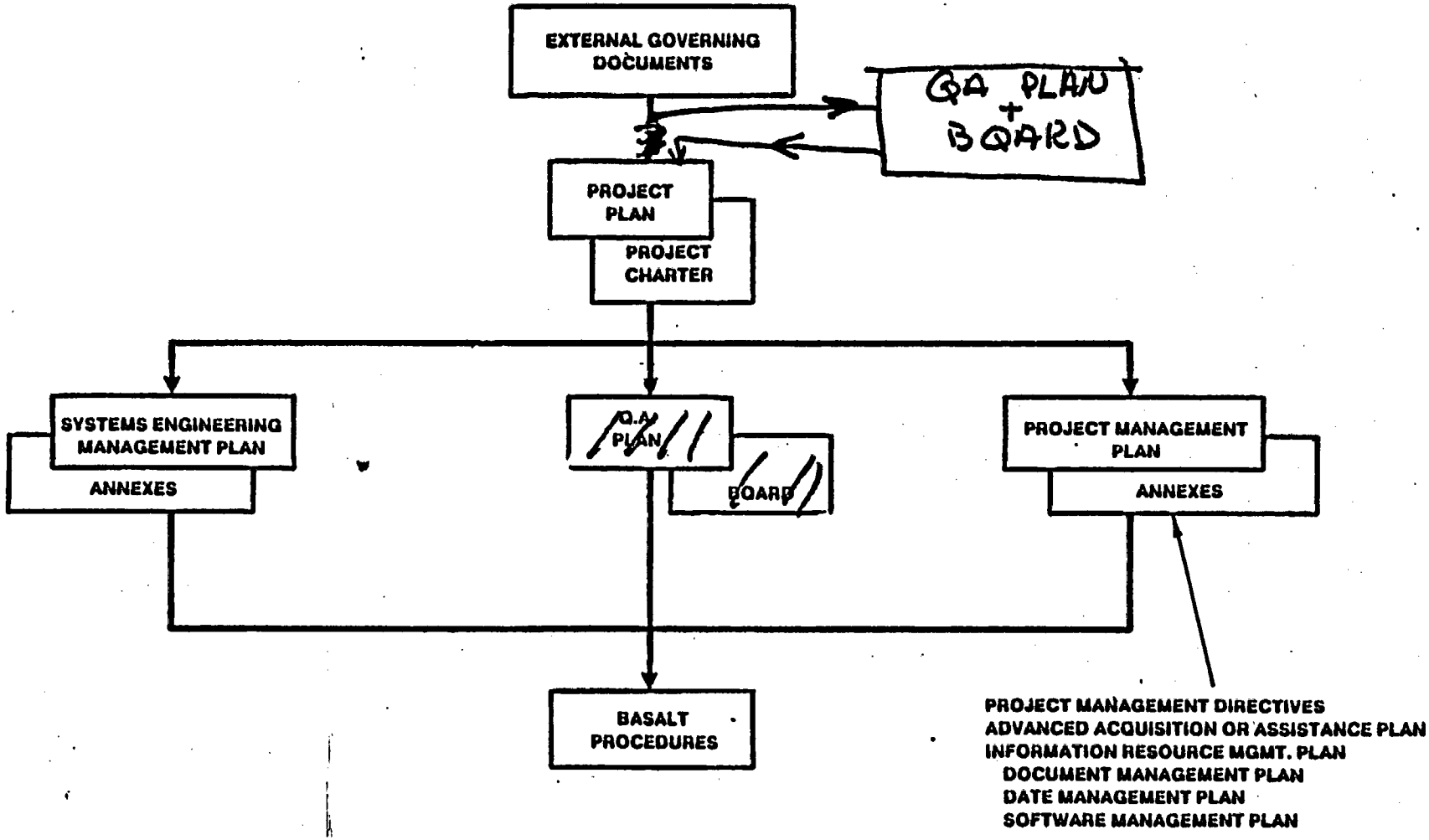
Non-Technical

- Program priorities contained in DOE-RL Guidance letter of January 22, 1987 used in planning.
- All outyears are planned using escalated dollars, per the DOE-RL escalation guidance.
- A minimum of twenty (20) days prefinancing.
- DOE-RL Budget Guidance for PETT, Robotics Grants, Support Service Contract, and Environmental/Socioeconomics used in planning.
- Defense Waste funding provided in separate section and is not included in the Project Summary.

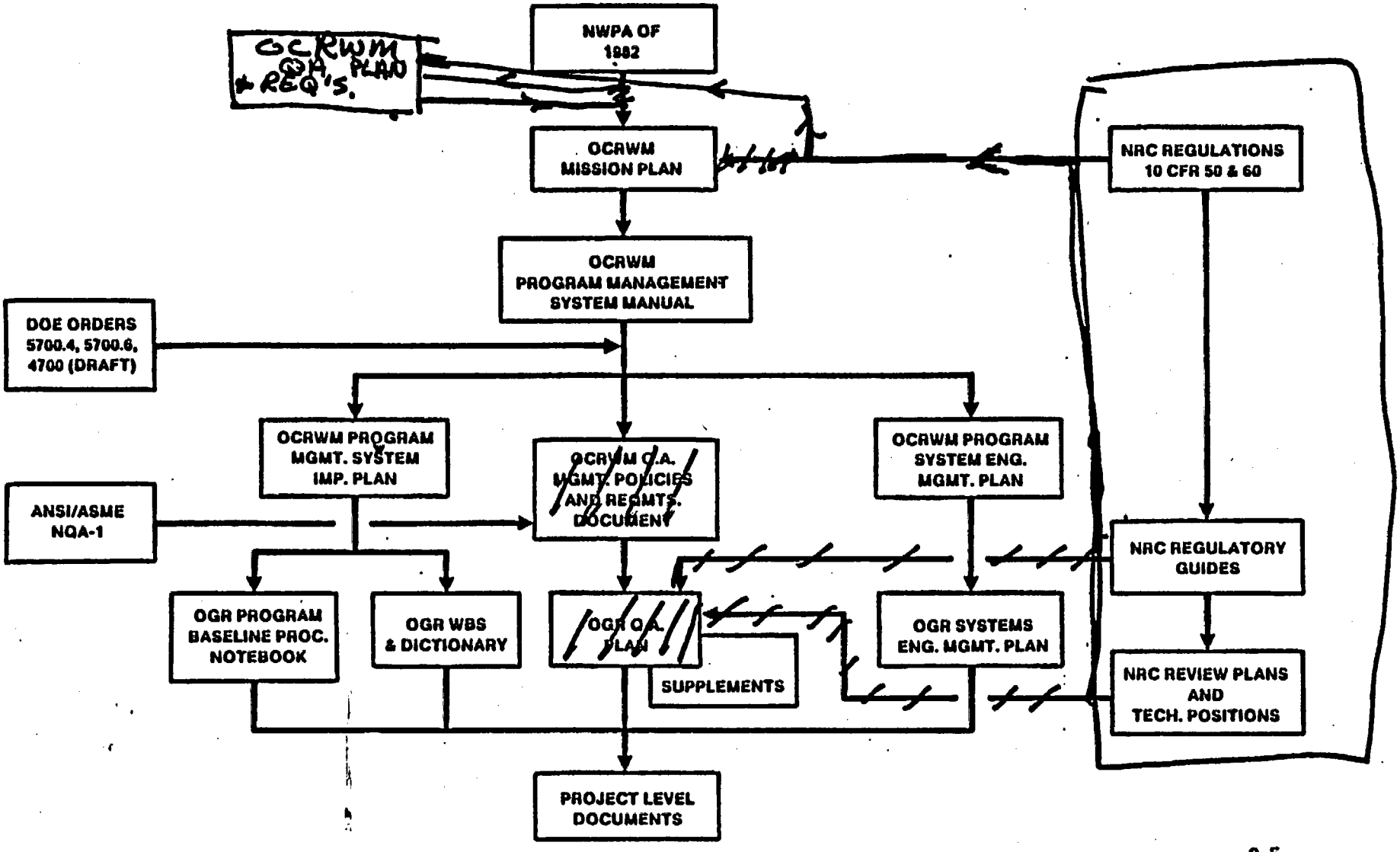
Technical

- Program based on current DOE-RL and Mission Plan requirements.
- Planning will proceed on the basis of using one drill rig. The advantages and cost impact of using a second rig will continue to be examined.
- ES-2 is a 10-foot diameter shaft rather than 6 feet.
- Hydrology Program constrains the drilling of the Exploratory Shaft into the basalt.

DOE-RL
PROJECT MANAGEMENT CONTROL SYSTEM



EXTERNAL GOVERNING DOCUMENT



Attachment G

FACILITY DESIGN
DC-24CX, DC-25CX, DC-32CX, AND DC-33CX

TABLE 1

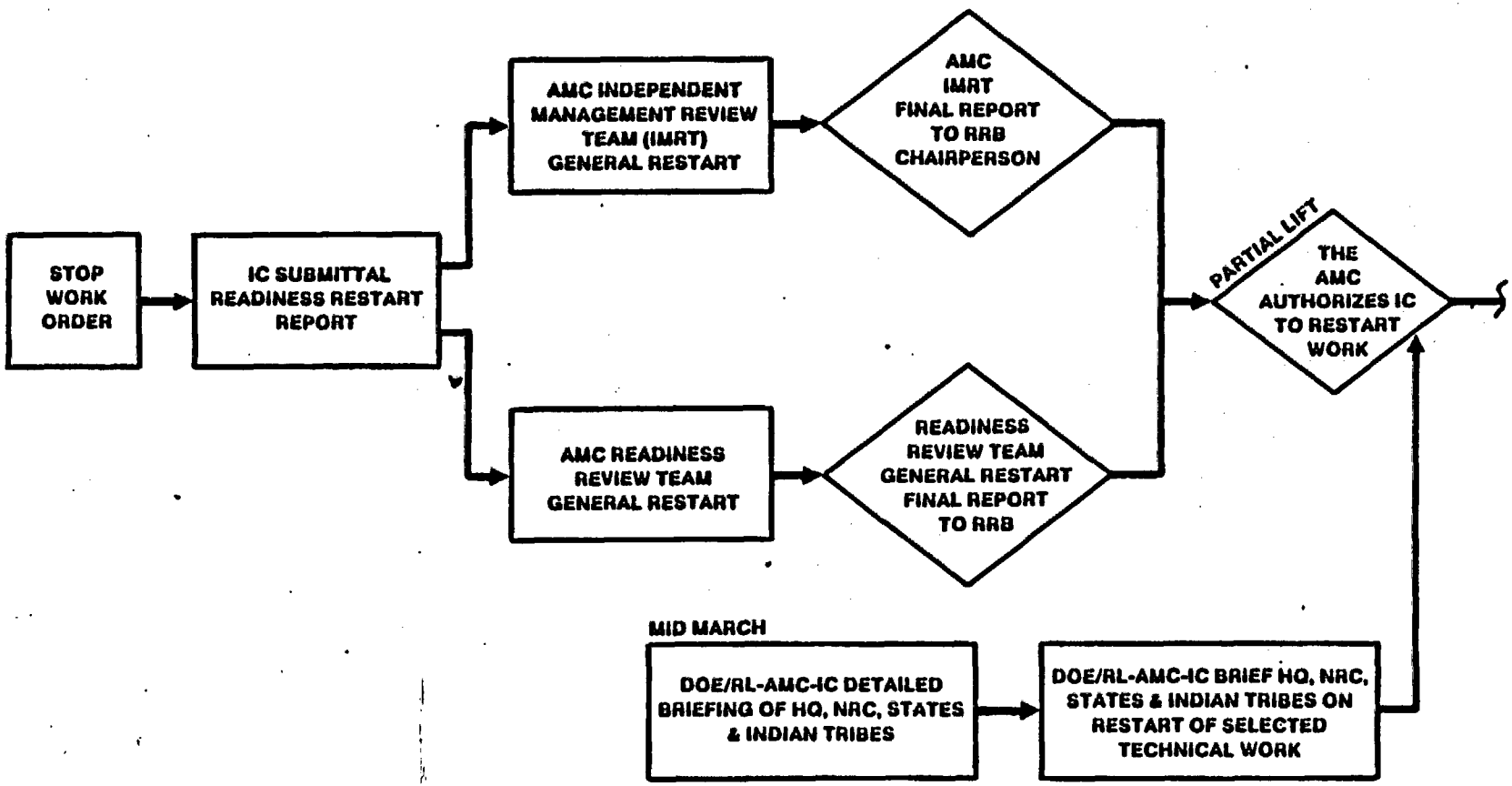
ITEMS IDENTIFIED AND
QUALITY ASSURANCE LEVEL ASSIGNMENT

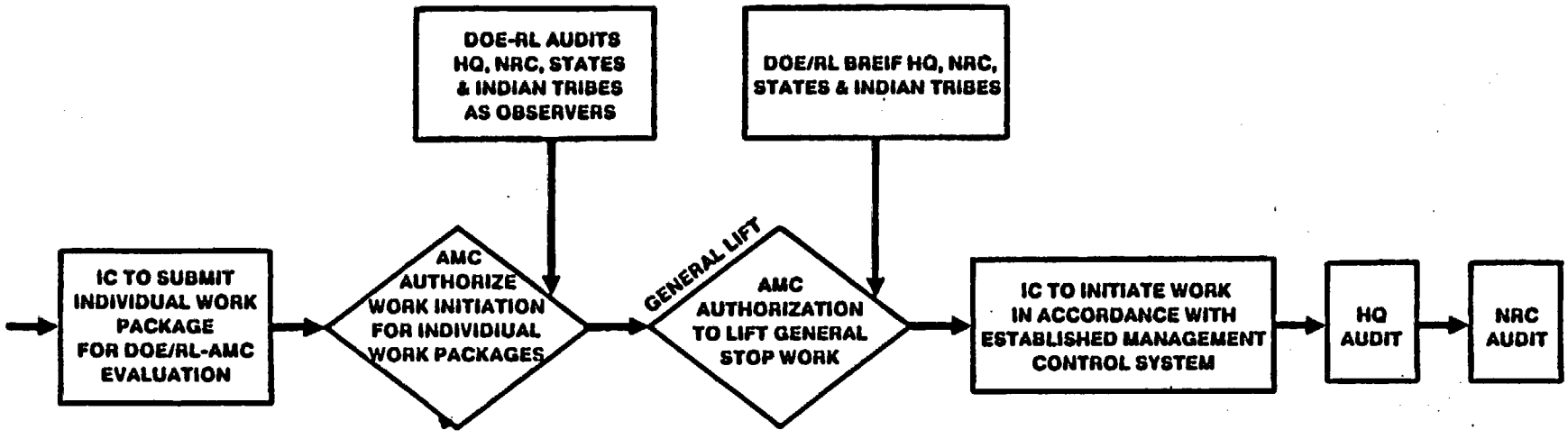
ITEM	QA LEVEL
Site Evaluation and Preparation (BHL-001)	
Site Excavation	3
Survey Borehole Coordinates	1
Drilling (BHL-002)	
Mobilization/Demobilization	2
Cable Tool Drilling	2
Set Conductor Pipe	2
Rotary Drilling	1
Spot Cementation	2
Set Casing/Cement	2
Fluid Circulation Monitoring	3
Drill Cuttings	1
Workover Rig	2
Set Pump - Clean Hole	3
Piezometer (BHL-003)	
Set Cement Plug (Top and Bottom)	1
Assemble, Measure, and Place Piezometer (Includes Welding Centralizers)	1
Tubing Test (Joint and Composite Test)	1
Filter Pack Placement	1
Develop Piezometer	1
Install and Monitor Transducer	1
Materials	3
Geologic/Geophysical Logging (BHL-004)	
Open and Cased Hole Logs	1
Developmental Logs	3
Borehole Geologic Logs	3

Attachment H.

OFFICE OF ASSISTANT MANAGER FOR COMMERCIAL NUCLEAR WASTE
BASALT WASTE ISOLATION PROJECT

FLOW CHART
STOP WORK ORDER BSWO-86-004
GENERAL RESTART PROGRAM





LEGEND:
IC - INTEGRATING CONTRACTOR
AMC - OFFICE OF ASSISTANT MANAGER FOR COMMERCIAL NUCLEAR WASTE
RRB - READINESS REVIEW BOARD