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August 15, 1990

**Meeting Minutes Transmittal/Approval
Unit Managers Meeting: Past Practices - General Topics
450 Hills Street, Room 47
July 17 & 18, 1990**

From/ Appvl. Robert K. Stewart Date: 8/15/90
 Robert K. Stewart, R.I. Coordinator, DOE-RL (A6-95)

Appvl.: Douglas R. Sherwood Date: 15 Aug 90
 Douglas R. Sherwood, Representative, EPA (B5-01)

Appvl.: Larry Goldstein Date: 8/15/90
 Larry Goldstein, CERCLA Unit Supervisor, Washington Dept. of Ecology

The purpose of this meeting was to discuss general topics which are common to all operable units.

Meeting Minutes are attached. Minutes are comprised of the following:

- Attachment #1 - Meeting Summary/Summary of Commitments and Agreements
- Attachment #2 - Agenda for the meeting
- Attachment #3 - Attendance List
- Attachment #4 - Action Items Status List
- Attachment #5 - Notes on the Hanford Land Use Issues Presentation
- Attachment #6 - Notes on the Performance Assessment Update and the Hot and Cold Physical Laboratory Update Presentations
- Attachment #7 - Notes on the Borehole Geophysics for the Hanford Site Presentation

Prepared by: Doug Fassett Date: 8/15/90
SWEC GSSC

Concurrence by: Joe V. Hall Date: 8/15/90
WHC ER Programs

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Distribution:

Dave Einan, EPA (B5-01)
Doug Sherwood, EPA (B5-01)
Dan Duncan, EPA, Region 10, RCRA

Chuck Cline, WDOE (two copies)

R.O. Patt, Oregon Water Resources Dept.

Ward Staubitz, USGS

Donna Lacombe, PRC

Doug Fassett, SWEC (A4-35)

C.E. Clark, DOE-RL (A6-95)
D.L. Clark, DOE-RL (A5-55)
Julie Erickson, DOE-RL (A6-95)
R.D. Freeberg, DOE-RL (A6-95)
R.E. Gerton, DOE-RL (A6-80)
Jim Goodenough, DOE-RL (A6-95)
R.D. Izatt, DOE-RL (A6-95)
Mary Harmon, DOE-HQ (EM-442)
Paul Pak, DOE-RL (A6-95)
Jim Rasmussen, DOE-RL (A6-95)
Bob Stewart, DOE-RL (A6-95)
Mike Thompson, DOE-RL (A6-95)
S.H. Wisness, DOE-RL (A6-95)

Melvin Adams, WHC (H4-55)
Frank Calipristi, WHC (B2-35)
Steve Clark, WHC (H4-55)
Larry Hulstrom WHC (H4-55)
Wayne Johnson, WHC (H4-55)
Alan Krug, WHC (H4-55)
Merl Lauterbach, WHC (H4-55)
Fred Roeck, WHC (H4-55)
KaeRae Parnell, WHC (H4-18)
Jim Patterson, WHC (B2-15)
Steve Weiss, WHC (H4-55)
Tom Wintczak, WHC (B2-15)
R.D. Wojtasek, WHC (B2-15)

Don Kane, EMO (K1-74)
Terri Stewart, PNL (K2-12)
Michael A. Neely, PNL (K6-96)

ADMINISTRATIVE RECORDS: 1100-EM-1, 300-FF-1, 300-FF-5, 200-BP-1, 100-HR-1,
100-HR-3, 100-BC-1, 100-BC-5, 100-NR-1, 100-NR-3; Care of Susan Wray, WHC

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Attachment #1
Meeting Summary and Summary of Commitments and Agreements
General Topics Unit Managers Meeting
450 Hills St., Room 47
July 17 & 18, 1990

Meeting Summary/Summary of Commitments and Agreements

1. Bob Stewart (DOE-RL) opened the meeting. The next Unit Managers Meeting was scheduled for August 15 and 16, 1990.
2. Doug Fassett (SWEC) circulated the General Topics from the June 12, 1990, meeting minutes for approval and signature. There were no comments; the minutes were approved and signed.
3. The Becker borehole drilling report was completed and it is now in internal review.
4. Brian Sprouse (WHC) was not available to present the Administrative Record overview.
5. Tom Wintczak (WHC) reported that all RI/FS and RFI/CMS activities will be transitioned to Environmental Management Operations (EMO) from WHC due to a potential conflict of interest. The maintenance and operations contractor cannot also perform RI/FS activities. A transition plan is expected to be completed by October 1, 1990. EMO RI/FS and RFI/CMS activities will be directly funded by DOE and EMO will report to DOE-RL. However, WHC will continue to provide environmental restoration guidance.

Don Kane (EMO) stated that the transition will not impact the TPA. Since WHC is in the role of the remediation contractor, EMO would like to have continued WHC involvement. Mike Nealy will set up the transition for this particular need.

Bob Stewart suggested that EMO transition be put on the meeting agenda for the next couple of months. There was general agreement to do this.

Tom Wintczak stated that a transition matrix is being developed to inform everyone of changing roles. Office of Sample Management (OSM) will continue to coordinate sample management. RI coordination will be the first change due to the EMO transition. The changes in management and RI Coordinators are expected to be the major changes. Changes in management and RI Coordinators are expected to be the major changes. Don Kane said that continuity is a primary concern, therefore contractor changes will be gradual. New operable units are expected to be assigned to the Corps of Engineers (Corps) rather than EMO. The Corps will also report to DOE-RL.

Mike Thompson will provide a briefing at the next Unit Managers Meeting on transition issues.

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WHC has been inundated with changes due to required responses to the Tiger Team. Therefore, some delays in completing projects are likely.

Bob Stewart described recent EPA training on CERCLA projects that he attended. Interest was expressed by many people to bring the training to DOE-RL. *Bob states that he was working with site program and training groups to hopefully bring the EPA training to Hanford.*

Tom Wintczak said that WHC has directed EMO to terminate the 100-FR-1 Work Plan due to a lack of funding this fiscal year. The TPA deadline could still be met if funding is provided by October 1. Current TPA milestones could be missed due to the insufficient funding provided by the current budget. Bob Stewart stated that the budget is being discussed at upper DOE levels; the problem is being addressed.

6. Mel Adams (WHC) presented Hanford Land Use Issues. The presentation consisted of information and issues only. The issue becomes more critical at the FS stage and the groundwater corrective action stage. Alternatives to groundwater and land use were presented. This issue needs to be considered now since it requires lengthy debate. Is a faster alternative than an EIS needed to put the land use issue before the public? The consideration of this issue in an EIS may take too long.

Larry Goldstein (Ecology) stated that there is an opportunity for Ecology to reclassify the aquifers under Hanford based on new information. The aquifer classification must be considered in conjunction with future land use. Bob Stewart stated that the Hanford permit is being drafted. Ecology Goal is to have it issued by October 31st. The land use issue could be conveniently introduced to the public at that time. However, Larry Goldstein stated that Ecology does not want the permit delayed because of such a complicated issue. It may be more appropriate to initially address land use in certain operable units. Don Kane (EMO) suggested that a positive approach would be to obtain community involvement on the comprehensive plan and future land use issue. James Goodenough (DOE-RL) said that regarding the D&D site-wide remediation EIS, the assumption is that the 100 areas will remain under DOE control. The ROD for this EIS is expected to be signed by October 1st. Julie Erickson stated that the issue of land use will be considered on a DOE site-by-site basis, not nationwide. Larry Goldstein stated that the future use of the 100 areas needs to be clarified and presented to the public. Tom Wintczak added that the public must be aware that the law must at least be considered but future land use issues may require exceptions to the law. But, Ward Staubitz (USGS) said that the data must support the land use decisions. The degree of confidence must be identified to determine the amount of data required. Julie Erickson (DOE-RL) added the fact that the remedial action EIS has been proposed to DOE-HQ in an ADM. Further action depends on the DOE-HQ response. Mel Adams reported that a 10-minute presentation would be prepared for the quarterly public TPA meeting. The formation of a Steering Committee involving public interest groups may be encouraged to help resolve future land use issues. Notes on this presentation are included in Attachment #5.

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Action #GT.59: Raise the issue with DOE managers, for the need of a single agreed-to strategy for the resolution of future land use.
Action: Bob Stewart

7. Jerry Cammann (WHC) presented the Performance Assessment Update. PNL has the charter to do the onsite modeling. Ward Staubitz (USGS) said that the workplan for 200-BP-1 calls for unsaturated flow tests while saturated flow tests are being conducted. This issue deserves further consideration. The WHC position on recharge rates was questioned. Jerry Cammann pointed out that there is not a consensus; however, there is a milestone to resolve the issue by 1993. WHC will ensure that EPA and Ecology comments on infiltration and matrix potentials are included in the BC-1 and KR-1 workplans. Ward Staubitz stated that the work plans should concentrate on obtaining the appropriate data needed to develop the flow models. The van Genuchten model appears not to work well with low saturation conductivities. RDDT&E program is set up to support general concerns, not particular operable units. However, the data obtained should be applicable to specific operable units.

Goals of the Hanford Site Performance Assessment Program: predict groundwater recharge on various outcrops; and predict contaminant fate and transport in the subsurface. Modeling is the means by which these predictions will be made. Modeling software currently being evaluated are PORFLO-3 and PROMC-3.

Glendon Gee of PNL stated that evapotranspiration data is being continuously collected; however, there is still little data on soil-profile/water-retention in the 100 areas. Also, information on conductivity is lacking. There is extensive data on grain-size distribution. Notes on this presentation are included in Attachment #6.

Action #GT.60: Plan a technical session with participation by WHC and PNL to address proper techniques of characterization of soil hydraulic properties and the application of unsaturated flow and solute transport models for the RI/FS Workplans. Include Ward Staubitz and Chuck Cline and others as needed. Action: Jerry Cammann

8. The presentation on borehole geophysics was given on July 18th due to an action item for the 200 BP-1 operable unit. Due to the general nature of the presentation, a summary is included in the general topics meeting minutes.

The focus of borehole geophysics is on Passive Gamma-Ray Logging for gamma emitting radionuclides. Costs of the various techniques could be provided if necessary.

Slower logging will produce better precision. Signal saturation could influence precision in highly radioactive strata. Lab quality data is obtained; however, the technique will supplement, not replace, lab samples. The investigation extends 4-6" into the formation. A tool is not available to monitor perched zones at these conditions (cased, unsaturated conditions).

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The program is funded by many different programs that may benefit from the investigations. Schedules are beginning to slip due to difficulties in calibrating the tools. Previous logs from the site (gamma density and neutron-neutron) have no usefulness due to a lack of resolution. Notes on this presentation are included in Attachment #7.

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Attachment #2

General Topics Unit Managers Meeting Agenda
July 17 & 18, 1990
450 Hills Street, Room 47

9:00 - 9:30

Approval of April's Unit Managers Meeting Minutes - Doug Fassett

Administrative Record Review - Brian Sprouse

9:30 - 10:30

EMO RI/FS Transition - Tom Wintczak/Don Kane

10:30 - 11:00

Land Use and Point of Compliance - Mel Adams

11:00 - 12:00

Performance Assessment Update - Jerry Camman

12:00 - 1:00

Lunch

1:00 - 2:00

Hot and Cold Physical Laboratory Update - Jerry Camman
- Soils Hydraulic Properties

Action Item Status - Doug Fassett

Operable Units

2:00 - 3:00

1100-EM-1 - Steve Clark

3:00 - 3:30

300-FF-1 - Larry Hulstrom

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3:30 - 4:00

300-FF-1 - Larry Hulstrom

July 18, 1990

450 Hills Street/Rm. 47

8:00 - 9:00

200-BP-1 - Rich Carlson

9:00 - 10:00

100-NR-1 & 100-NR-3 - Bob Julian
- 100 N. Groundwater Flow and Contaminant Transport Model

10:00 - 10:30

100-BC-1 & 100-BC-5 - Steve Weiss

10:30 - 12:00

Borehole Geophysics

12:00 - 1:00

LUNCH

1:00 - 3:00

100-DR-1, 100-HR-1, & 100-HR-3 - Steve Weiss, Fred Roeck, Alan Krug

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Attachment #3
Attendance List
General Topics Unit Managers Meeting
July 17 & 18, 1990

Name	Org.	O.U.	Phone
Clark, Diane	DOE-RL		(509) 376-7557
Erickson, Julie	DOE-RL	200 Areas	(509) 376-3603
Goodenough, James D.	DOE-RL	100-DR, HR, KR	(509) 376-7087
Hildebrand, R. Douglas	DOE-RL		(509) 376-7287
Pak, Paul	DOE-RL	100-NR	(509) 376-4798
Taylor, Keith V.	DOE-RL		(509) 376-5500
Thompson, K. Michael	DOE-RL	Groundwater	(509) 376-6421
Cline, Chuck	Ecology	CERCLA Unit	(206) 438-7556
Cross, Steve	Ecology	CERCLA Unit	(206) 459-6675
Goldstein, Larry	Ecology	CERCLA Unit	(206) 438-7018
Kane, Don	EMO		(509) 376-0259
Neely, Mike	EMO		(509) 376-5056
Einan, Dave	EPA	300-FF, 1100-EN, 100-KR	(509) 376-3883
Morell, Douglas	Golder	200DP-1, 1100-FM	(206) 883-0777
Wright, Bill	Golder	100 ED-1	(206) 883-0777
Gephart, Roy	PNL		(509) 376-2781
Last, G. V.	PNL	300 FF-1	(509) 376-8527
Gee, Glendon	PNL		(509) 376-8424
LaCombe, Donna	PRC	EPA Cont.	(206) 624-2692
Roy, Mell	SAIC		(509) 943-3133
Timm, Chris	SAIC	Supt. to 1100 A.	(509) 943-3133
Burger, John A.	SWEC	GSSC to DOE-RL	(509) 376-2636
Fassett, Doug	SWEC	GSSC to DOE-RL	(509) 376-9969
Drost, Brian	USGS	EPA Support	(206) 593-6510
Staubitz, Ward	USGS	EPA Support	(206) 593-6870
Cammann, Jerry	WHC		(509) 376-8506
Day, Roberta	WHC		(509) 376-2249
Hulstrom, Larry	WHC	300-FF-1, -5	(509) 376-4034
Jones, David	WHC	QA	(509) 376-8557
Julian, Bob	WHC	100 NR-1, -3	(509) 376-2539
Krug, Alan	WHC	100-HR-1	(509) 376-5634
Lauterbach, M. F.	WHC		(509) 376-5257
Patterson, Jim	WHC		(509) 376-0902
Relyea, J. F.	WHC	Phys. Prop. Lab	(509) 376-8300
Stalker, Kelly	WHC		(509) 376-2058
Vance, LaDell	WHC	QA	(509) 376-2469
Weiss, Steve	WHC	100-DR-1, BC-1, BC-5	(509) 376-1683
Wintczak, Tom	WHC		(509) 376-0902

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Attachment #4
 Action Items Status List
 General Topics Meeting
 July 17, 1990

Item No.	Action /Source of Action	Status
ST1.6	EPA and Ecology requested that they be supplied with the report documenting the results of the Becker drilling and containment system test. W.H. Price (WHC) will supply a copy of the report for EPA and Ecology's on-site review. After clearance, copies of the report will be provided.	Open Test has started. The initial test borings were completed, and the method found appropriate for trial at the U-17 site. Problems with the deeper hole have resulted in timing delays for completion of the test. The final report will be provided to EPA/Ecology when the test is completed. (6/12/90) The report has been completed and internal review is ongoing. It will be available in about one month. (7/17/90) <i>It is anticipated that the report will be cleared and issued by the end of September 1990. Regulators will be provided a copy at that time. (8/15/90)</i>
GT.18	WHC will develop a small team for the purpose of developing a Hanford-specific guidance document. The committee is to include members from EPA/Ecology, SWEC/IT, and PNL/EMO as well as WHC. Action: Tom Wintczak (1/24/90, GT-UMM)	Open Deferred pending closure of streamlining issue. (6/12/90) The Lessons Learned document will be integrated into this document. (7/17/90) <i>Deferred pending closure of the streamlining issue. (8/15/90)</i>
GT.30	Within two weeks of delivery of the narrative (per GT.29) to EPA and Ecology, Ecology will provide suggestions for the integration of RCRA TSD activities into that strategy. Action: T. Michelena/ L. Goldstein, Ecology (3/20/90, GT-UMM)	Open May 8, 1990 meeting, 9:00 AM at 450 Hill St., Room 35 - this meeting helped but further discussion on this issue is necessary. (6/12/90) Mike Thompson has revised the strategy to incorporate EPA-HQ and DOE-HQ input. Ecology and EPA will be asked to review the revised strategy and incorporate TSD considerations. (7/17/90)

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- GT.31 DOE/WHC is to develop an implementation plan for the strategy associated with the logic diagram on source/groundwater operable unit integration and streamlining. This plan is to include schedule and budget impacts associated with implementation. Action: K.M. Thompson, April UMM (3/20/90, GT-UMM)
- Open
Completion of development of the strategy is needed before an implementation plan is developed. The implementation strategy should be developed incorporating appropriate NEPA planning. (6/12/90) Preparation of the implementation plan has been deferred pending completion and acceptance by Tri-Party Agreement participants. The revised strategy will not address NEPA issues in detail due to time constraints. (7/17/90)
- GT.38 If possible, at the May Unit Managers Meeting a presentation on the approved, preferred alternative method for disposal of the reactors will be given. Action: Jim Goodenough (4/18/90, GT-UMM)
- Open
The final disposal decision (proposed action) has not yet been made. A presentation will be made to the Unit Managers at the earliest meeting following formalization of the proposed action.
- GT.43 A follow up meeting will be scheduled with EPA, Ecology, DOE and WHC to discuss the apparent conflicts between NEPA and RCRA/CERCLA activities. Action: Julie Erickson/Paul Dunigan (4/18/90, GT-UMM)
- Open
- GT.44 The site land use and point of compliance will be discussed at the June General Topics Unit Managers Meeting. Action: Mel Adams (4/18/90, GT-UMM)
- Closed
- GT.46 RDDT&E activity updates will be presented to the Unit Managers on a quarterly basis. Where specific activities are being conducted within an Operable Unit those RDDT&E functions will be discussed at that Unit Managers Meeting. The ISV work at 116-B-6A will be discussed at the next 100-BC-1/-5 meeting. Action: Jim Patterson (5/16/90, GT-UMM)
- Closed
To be put on Aug. UMM agenda.

- 90118850567
- GT.48 WHC to ascertain if a report or an update on the Becker drilling program is appropriate for the July or August UMM. Action: Don Moak/Jim Patterson (5/16/90, GT-UMM)
- GT.49 The plan for the Background Strategy is to be delivered to DOE for review by June 1990. This plan is to include a brief discussion of estimated costs and associated schedules for determining background in both media. Action: Jim Hoover, WHC (5/16/90, GT-UMM)
- GT.50 WHC will develop a plan for determining background using both TSD and Past Practices Operable Units. Initial efforts will be focused on the near-term (interim measure) while assuring consistency for longer term (site-wide) determination. Action: J. Hoover and RI Coordinators (TSD and PP units)
- GT.51 A committee will be formed over the next several weeks to develop and propose an alternative procedure for RI/FS (RFI/CMS) characterization generated waste. The committee is to have representatives from DOE, WHC Field Services, WHC Regulatory Analysis, WHC Projects, WHC EET, WHC/DOE Legal and KEH. Action: Bob Stewart (5/16/90, GT-UMM)
- Open
A presentation will be given when the report is out. (7/17/90) *An update will be provided to the Unit Managers after the report has been issued. Possibly October 1990. (8/15/90)*
- Open
Report expected first of August. (7/17/90) *The Strategy Planning Document will be issued by the end of the Fiscal Year. Cost and Schedules will be discussed during the August Unit Manager's Meeting. (8/15/90)*
- Open
Subject will be discussed during the August Unit Manager Meeting. Status action item at that time. (8/15/90)
- Open
Committee formed and draft procedure in preparation. Bob Stewart will provide copies of the draft for EPA/Ecology review. It was agreed at the June 12 meeting that draft procedures would be prepared considering RI/FS (RFI/CMS) characterization waste as non-RCRA generated waste, and the procedure would be written to handle waste in a manner to protect human health and the environment. (6/12/90) A draft procedure is almost complete. It will be presented to regulators in about two weeks. (7/17/90) *Work on draft procedure has been delayed due to higher priority activities. The new target date for getting the draft to EPA/Ecology is by the end of August. (8/15/90)*

- 90118850568
- GT.53 Obtain available materials on Point of Compliance and Land Use for EPA and Ecology review since this topic was cancelled in the June 12 Unit Managers Meeting. Action: Jim Patterson. Closed
- GT.54 Provide the acceptance Criteria, Requirements Analysis and other HEIS criteria to EPA and Ecology. Action: Bob Henckel Open
The package has been compiled; it will be mailed by DOE-RL. Frank Calipristi is currently performing the final review. (7/17/90) Package was sent out on 7/26/90 to Tim Nord and Doug Shearwood (8/15/90).
- GT.55 Provide information on the conversion of all Hanford data to the GIS coordinate system. The information should be sent to Chuck Cline, Ward Staubitz, and Doug Sherwood. Action: Larry Brown and Bob Henckel. Open
The best method of presenting the data on the GIS system is being discussed. Ward Staubitz and Chuck Cline will followup with WHC. (7/17/90) No Change (8/15/90)
- GT.56 Provide copies of DOE Order 5400.5, and the 300-FF-1 surveillance report of radiation surveys to EPA/Ecology. Action Bob Stewart. Closed
The material was retransmitted to EPA (Dave Einar) as requested on June 14, 1990. (7/17/90)
- GT.57 Determine what parts of ENCORE are funded and will be completed. Action: Jim Patterson Open
It has been put on the priority list for funding for next year but the amount is uncertain. (7/17/90) 900K has been initially allocated for the total ENCORE Program. Scope of work is still being negotiated. This includes IRM, systems, plans and many other items. (8/15/90)
- GT.58 DOE will expedite completion of the integration document, Lessons Learned, so that it will be available for all involved parties. Action: Bob Stewart. Open. This Item was previously labeled HR1.18. (6/12/90) Comments have been received and they will be compiled. (7/17/90) Action has been delayed because of other required activities. (8/15/90)

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GT.59 Raise the issue for the need of a single agreed-to strategy for the resolution of future land use. Action: Bob Stewart (7/17/90, GT.UMM)

Closed
The issue was discussed with Roger Freeburg and Ron Izatt of DOE-RL, Paul Day of EPA, and Toby Mitchelena of Ecology. Currently, responsibility for resolving the issue resides at several levels. The present strategy is to address the issue via a E.R. Programatic EIS. Julie Erickson is responsible. (8/15/90)

GT.60 Plan a technical session with participation by WHC and PNL to address proper techniques of characterization of soil hydraulic properties and application of unsaturated flow and solute transport models for the RI/FS Workplans. Include Ward Staubitz and Chuck Cline and others as needed. Action: Jerry Cammann (7/17/90, GT.UMM)

Open

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REV. 2, 6/22/90

HANFORD LAND USE ISSUES

WESTINGHOUSE HANFORD COMPANY

JUNE 1990

Attachment #5

PROBLEM IDENTIFICATION AND OPPORTUNITY

- o FUTURE LAND/GROUNDWATER USE ALTERNATIVES HAVE NOT BEEN CONSIDERED FOR HANFORD IN A SYSTEMATIC WAY

- o WITHOUT AN OVERALL LAND/GROUNDWATER USE POLICY
 - CURRENT REGULATORY FRAMEWORK WILL LEAD TO INCH BY INCH CHARACTERIZATION AND REMEDIATION BY DEFAULT
 - MOST EXTREME, COSTLY AND HIGHEST HEALTH RISK APPROACH (FOR WORKERS) MAY RESULT BY DEFAULT
 - MACRO SCALE ENGINEERING APPROACHES WILL NOT BE CONSIDERED (THESE APPROACHES HAVE POTENTIAL TO GREATLY REDUCE CLEANUP COSTS)

- o TIME IS RIPE TO PRESENT POLICY/STRATEGY ALTERNATIVES

LAND USE ISSUE AT HANFORD - INTRODUCTION

- o A FULL SPECTRUM OF FUTURE LAND/GROUNDWATER USE ALTERNATIVES FOR HANFORD HAVE NOT BEEN ARTICULATED AND PRESENTED TO PUBLIC
 - HDW-EIS CONSIDERED HIGH LEVEL/TRU WASTE; WAS GENERALLY NOT CAST IN TERMS OF LAND/GROUNDWATER USE ALTERNATIVES ALTHOUGH 200 AREA DEDICATED CONTROL ZONE WAS DESCRIBED
 - CURRENT REGULATORY FRAMEWORK MAY, BY DEFAULT, LEAD TO AN EXTREME LAND USE ALTERNATIVE WITH ONLY PIECEMEAL PUBLIC CONSIDERATION (WORK PLAN BY WORK PLAN)
 - HANFORD CLEANUP IS A MAJOR COMMITMENT OF PUBLIC RESOURCES; PUBLIC INPUT IS NEEDED ON OVERALL FUTURE LAND/GROUNDWATER USE ALTERNATIVES
- o FUTURE LAND/GROUNDWATER USE POLICY IS THE KEY ISSUE FOR GROUNDWATER AND SOURCE OPERABLE UNIT REMEDIATION
 - INVESTIGATIONS CAN PROCEED GENERALLY DUE TO DEARTH OF DATA; HOWEVER
- o ISSUE WILL BECOME ACUTE IN FEASIBILITY STUDY PARTICULARLY LATER PHASES BECAUSE OF NEED TO DEFINE POINTS OF COMPLIANCE AND CLEANUP LEVELS
- o ISSUE HAS BECOME "CENTER STAGE" IN RECENT UNIT MANAGERS MEETINGS

LAND USE ISSUE AT HANFORD - SPECTRUM OF ALTERNATIVES (5)

ALTERNATIVE #1 (PRISTINE)

1) COMPLETELY RESTORE HANFORD TO BACKGROUND CONDITIONS

- LAND/GROUNDWATER MADE RELEASABLE TO PUBLIC USE AFTER CLEANUP PERIOD FOR HABITATION, FARMING, INDUSTRY, ETC.

PROBLEMS:

- HIGHEST COST OPTION; PUBLIC MAY NOT FINANCIALLY SUPPORT GIVEN OTHER NATIONAL PRIORITIES
- REPOSITORY FOR RECOVERED WASTE NOT IDENTIFIED AND MAY NOT MATERIALIZE
 - NOT IN MY STATE!!
 - NO TRANSPORT THROUGH MY STATE!!

LAND USE ISSUE AT HANFORD - SPECTRUM OF ALTERNATIVES (5)

(CONTINUED)

- HEALTH RISK TO WORKERS GREATER THAN RISK PREVENTED TO FUTURE PUBLIC?
- DISCOURAGES CONSIDERATION OF LARGE SCALE ENGINEERED SOLUTIONS
- POINT-OF-COMPLIANCE WILL BE AS CLOSE AS POSSIBLE IN THE SOURCE; INCH BY INCH CHARACTERIZATION AND REMEDIATION
- MAY NOT BE TECHNICALLY FEASIBLE ESPECIALLY IN GROUNDWATER

LAND USE ISSUE AT HANFORD - SPECTRUM OF ALTERNATIVES
(CONTINUED)

ALTERNATIVE #2

- 2) RESTORE LAND/GROUNDWATER ON PARTS OF HANFORD; REMOVE RECOVERED WASTE FOR PERMANENT STORAGE (OR DISPOSAL) TO OTHER PART(S) OF HANFORD
- E.G., RESTORE 100 AREAS, 300 AREAS FOR PUBLIC USE; REMOVE WASTE TO 200 AREAS FOR PERMANENT STORAGE (OR DISPOSAL) IN PERMITTED FACILITIES

LAND USE ISSUE AT HANFORD - SPECTRUM OF ALTERNATIVES
(CONTINUED)

ALTERNATIVE #3

3) RESTORE SHALLOW LAND AS IN OPTION #2 BUT NOT GROUNDWATER

- PROVIDE ALTERNATE SOURCE OF WATER FOR FUTURE PUBLIC USE ON RESTORED LAND
- GROUNDWATER CONTROL ZONES UNTIL ATTENUATION ALLOWS USE

NOTE: MAKES NO SENSE TO RESTORE GROUNDWATER BUT TO TAKE ACTION ON LAND ABOVE IT; THEREFORE, ALTERNATIVE TO RESTORE GROUNDWATER BUT NOT LAND ABOVE IT IS NOT PRESENTED

LAND USE ISSUE AT HANFORD - SPECTRUM OF ALTERNATIVES
CONTINUED

ALTERNATIVE #4

- 4) ISOLATE AND STABILIZE IN-PLACE WASTE AT HANFORD WITH SOME TARGETED RECOVERY OF "HIGH-RISK" WASTE
- COMPLIANCE AT RIVER
 - ACTIVE AND/OR PASSIVE CONTROL OF GROUNDWATER UNTIL ATTENUATION ALLOWS USE

COMMON BENEFITS TO ALTERNATIVES #2, 3, AND 4

- o LARGE NON-CONTAMINATED AREAS OF HANFORD COULD BE MADE AVAILABLE FOR CONTROLLED PUBLIC USE
 - LAND USE POTENTIALS INCLUDE NATIONAL WILDLIFE AREAS, GRAZING PERMIT ZONES, NATIONAL ATOMIC MUSEUM, LIMITED AGRICULTURE, USE OF SACRED SITES BY NATIVE GROUPS, INDUSTRIAL USE
 - REQUIRES ACTIVE LAND MANAGEMENT IN PERPETUITY

LAND USE ISSUE AT HANFORD - SPECTRUM OF ALTERNATIVES
CONTINUED

ALTERNATIVE #5

- 5) ESTABLISH HANFORD AS NATIONAL SACRIFICE ZONE WITH ACTIVE AND PASSIVE LAND/WATER USE CONTROL INTO FUTURE
- LOWEST COST ALTERNATIVE
 - PUBLIC ACCEPTABILITY DOUBTFUL

NOTE: THIS ISSUE PRESENTED FOR COMPLETENESS, FEW KNOWN ADVOCATES.

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LAND USE ISSUE AT HANFORD

CONCLUSION

- o FUTURE LAND/GROUNDWATER USE OPTIONS AT HANFORD NEED TO BE DEFINED AND PRESENTED FOR PUBLIC CONSIDERATION
 - NEPA DOCUMENT WITH ABOVE GENERAL ALTERNATIVES WOULD BE SUITABLE MECHANISM (HRA-EIS NOW BEING SCOPED IS OPPORTUNITY)
 - OTHER MECHANISMS COULD BE USED INCLUDING MISSION STATEMENT
- o GROUNDWATER CLASSIFICATION SHOULD REFLECT LAND USE DECISIONS
- o FOLLOWING ISSUES SUCH AS POINTS OF COMPLIANCE WILL DERIVE FROM THE LAND USES SELECTED
 - THE GREATER THE CLEANUP EFFORT AND THE DEGREE OF CLEANUP, THE LARGER THE FUTURE SPECTRUM OF USES POSSIBLE FOR THE LAND
 - CLEANUP COST WILL BE HIGHLY SENSITIVE TO FUTURE USE ENVISIONED FOR THE LAND

POINT OF COMPLIANCE ISSUE AT HANFORD

o POINT OF COMPLIANCE SPECTRUM

- AT GROUNDWATER LEVEL BELOW EACH INDIVIDUAL SITE INCLUDING COMPLETE CLEANUP OF SOIL UP TO SURFACE; CONSISTENT WITH ALTERNATIVE #1 (CONSTRAINED BY WELL LOCATIONS)
- 100 METERS FROM THE EDGE OF WASTE AFTER INSTITUTIONAL CONTROL PERIOD; SITE BOUNDARY DURING INSTITUTIONAL CONTROL PERIOD (5820.2A GUIDANCE)
- EDGE OF EACH OPERABLE UNIT
- EDGE OF EACH NPL AGGREGATE AREA
- 5KM WELL FROM SITE(S) (HDW-EIS)
- WITHIN 2 MILE RADIUS OF FACILITY BOUNDARY; FACILITY DEFINED AS EACH AGGREGATE AREA (EPA GUIDELINES FOR CLASSIFICATION REVIEW AREAS)
- AT HANFORD SITE BOUNDARY (OR RIVER) AFTER INSTITUTIONAL CONTROL PERIOD

POINT OF COMPLIANCE ISSUE AT HANFORD

CONTINUED

- o SOLUTION OF POINT OF COMPLIANCE ISSUE IMMEDIATE AND CRUCIAL TO PROGRESS TOWARDS EFFECTIVE REMEDIATION
 - FIRST FEASIBILITY STUDIES UNDERWAY (CERCLA)
 - FIRST NODS FOR RCRA SITE CLOSURES

- o POINT OF COMPLIANCE ISSUE DERIVES DIRECTLY FROM LAND/GROUNDWATER USE DECISION

- o LACK OF RESOLUTION IMPACTS RI SCHEDULES, CANNOT GET TO ROD WITHOUT

TIME OF COMPLIANCE ISSUES

- o CLEANUP PERIOD ISSUE IS SETTLED AND DEFINED BY TRI-PARTY AGREEMENT (2018)

- o ACTIVE INSTITUTIONAL CONTROL PERIOD ASSUMED TO BE NOT MORE THAN 100 YEARS (DOE ORDER 5820.2 PERTAINING TO LLW DISPOSAL)
 - ISSUE NOT ADDRESSED IN RCRA/CERCLA?

- o TIME OF COMPLIANCE FOLLOWS DIRECTLY FROM FUTURE LAND/GROUNDWATER USE POLICY
 - IF POLICY IS COMPLETE RESTORATION OF HANFORD FOR PUBLIC USE (ALTERNATIVE #1), TIME OF COMPLIANCE MUST BE END OF CLEANUP PERIOD;

TIME OF COMPLIANCE ISSUES**CONTINUED**

- o INSTITUTIONAL CONTROL PERIOD**
 - FOR ALTERNATIVE #1 (COMPLETE CLEANUP), INSTITUTIONAL CONTROL PERIOD IS 2018**
 - FOR OTHER ALTERNATIVES, DEFINITION OF INSTITUTIONAL CONTROLS AND INSTITUTIONAL CONTROL PERIOD BECOMES IMPORTANT**
- o FOR AREAS TO BE UNCONDITIONALLY RELEASED TO PUBLIC, GROUNDWATER SHOULD BE DRINKING WATER QUALITY AFTER INSTITUTIONAL CONTROL PERIOD**
- o FOR RELEASED AREAS, CONDITIONS SHOULD ALLOW FLORA/FAUNA TO FLOURISH**
- o FOR AREAS NOT INTENDED TO BE RELEASED TO THE PUBLIC, COMBINATION OF ACTIVE AND PASSIVE CONTROLS WILL BE NEEDED IN PERPETUITY WITH RELIANCE ON PASSIVE CONTROLS AFTER INSTITUTIONAL CONTROL PERIOD**

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LEVELS OF COMPLIANCE ISSUES

- o MAXIMUM RADIOACTIVE CONTAMINANT LEVELS (MCL) BASED ON 4 MREM/YEAR TO ANY ORGAN (40 CFR 141)

- o LAND USE POLICY SELECTED SHOULD DRIVE WHEN/WHERE GROUNDWATER WILL BE USABLE FOR UNRESTRICTED PUBLIC USE

- o CERCLA REQUIRES CONSIDERATION OF ARARS INCLUDING RCRA
 - SOME ROOM FOR NEGOTIATION EXISTS IN PROCESS

 - FOR AREAS OF UNRESTRICTED PUBLIC USE, BACKGROUND OR DRINKING WATER STANDARDS

 - FOR RESTRICTED USE AREAS; CONTAINMENT, ATTENUATION AND CONTROLLED RELEASE SUCH THAT OUTSIDE UNCONTROLLED AREAS COMPLY WITH STANDARDS

- o SOIL CLEANUP STANDARDS NOT AVAILABLE (NO MCL'S)
 - SHOULD BE BACKGROUND ONLY FOR THOSE AREAS TO BE RELEASED TO PUBLIC

ECONOMIC ISSUES RELATED TO GROUNDWATER STRATEGY

- o FUTURE LAND USE POLICY (INCLUDING GROUNDWATER CLASSIFICATION) MUST CONSIDER COST/BENEFIT SINCE REMEDIATION IS A MAJOR PUBLIC ACTION
- o NEPA DOCUMENTATION NEEDS TO ADEQUATELY CONSIDERED COST/BENEFIT OF FUTURE LAND AND GROUNDWATER USE ALTERNATIVES
- o COST/BENEFIT OF IMPLEMENTATION OF ALTERNATE LAND/WATER USE POLICIES AT HANFORD SHOULD CONSIDER AT A MINIMUM:
 - COST OF PROVIDING ALTERNATIVE WATER SOURCES FOR LANDS TO BE RETURNED TO PUBLIC USE IN FUTURE (AS AN ALTERNATIVE TO AQUIFER REMEDIATION)
 - COST PER UNIT RISK AVOIDED AT OTHER NPL SITES COMPARED TO HANFORD
 - COST/BENEFIT OF RESTORATION OF HANFORD AQUIFERS PARTICULARLY FOR PUMP AND TREAT ALTERNATIVES
 - COST/BENEFIT OF LAND REMEDIATION AT HANFORD FOR UNRESTRICTED USE

MACROENGINEERING/INSTITUTIONAL ISSUES
RELATED TO HANFORD GROUNDWATER REMEDIATION
(RESULTS OF OFFSITE CONSULTANT PANEL - MAY 1989)

INSTITUTIONAL ISSUES:

- o DECISION MAKING CURRENTLY FOCUSED ON CERCLA/RCRA REGULATORY COMPLIANCE; FRUSTRATES CONSIDERATION OF LARGE SCALE APPROACHES THAT COULD BE COST/BENEFICIAL TO PUBLIC

- o DOLLAR COST OF A "CLEAN-UP" BASED APPROACH MAY NOT BE WARRANTED BY BENEFITS PROVIDED; HEALTH RISK OF ONSITE WORKERS MAY EXCEED OFFSITE RISK PREVENTED (ACCIDENTS/ALARA)

- o PUBLIC WILL BECOME IMPATIENT FOR ACTION AS COST INCREASES WITH LITTLE VISIBLE PROGRESS; LARGE-SCALE, ACTION ORIENTED APPROACHES WILL BE REQUIRED AS PUBLIC SUPPORT FOR CURRENT (PIECEMEAL) APPROACH DISSIPATES
 - OUR PERCEPTION IS THAT CURRENT APPROACH BY STATE WILL LEAD TO INCH BY INCH CHARACTERIZATION AND REMEDIATION REGARDLESS OF THE COST OR RISK

 - WHILE REGULATORY COMPLIANT, THIS APPROACH FRUSTRATES INTENT OF NEPA TO PRESENT PUBLIC WITH BROAD ALTERNATIVES FOR FUTURE USE OF HANFORD

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**MACROENGINEERING/INSTITUTIONAL ISSUES
RELATED TO HANFORD GROUNDWATER REMEDIATION
(RESULTS OF OFFSITE CONSULTANT PANEL - MAY 1989)**

CONTINUED

**LARGE SCALE ENGINEERING APPROACHES HAVE BEEN "BRAINSTORMED" AND SEVERAL
COULD BE CONSIDER FURTHER:**

- o LARGE SCALE GROUNDWATER ISOLATION**
 - HYDRAULIC ISOLATION**
 - UTILIZATION OF NATURAL FEATURES**
 - PHYSICAL ISOLATION**

- o LARGE SCALE SURFACE EXCAVATION AND DISPOSAL TECHNIQUES**

**RECOMMENDED APPROACH TO DEVELOPING HANFORD
GROUNDWATER PROTECTION/REMEDATION STRATEGY**

- o DEFINE AND ARTICULATE ALTERNATE HANFORD LAND/GROUNDWATER USE POLICIES**
 - WHC WILL DEVELOP FOR REVIEW BY DOE AND REGULATORS**

- o PRESENT ALTERNATIVES TO PUBLIC FOR COMMENT BY EIS OR OTHER MECHANISM**
 - ECONOMIC CONSIDERATIONS SHOULD BE CONSIDERED IN ALTERNATIVES**
 - LARGE SCALE ENGINEERING APPROACHES SHOULD BE CONSIDERED IN ALTERNATIVES**

- o SELECTED POLICY SHOULD BE EMBODIED IN FUTURE REVISION TO TRI-PARTY AGREEMENT**
 - FEASIBILITY STUDIES FOR EACH OPERABLE UNIT WOULD COMPREHEND SELECTED POLICY**
 - RCRA CLOSURE PLANS WOULD COMPREHEND SELECTED POLICY**

**RECOMMENDED APPROACH TO DEVELOPING HANFORD
GROUNDWATER PROTECTION/REMEDATION STRATEGY**

CONTINUED

o THIS APPROACH TO BE PHASED IN:

- CONTINUE ON RCRA CLOSURES AND RI/FS PROCESS PER TRI-PARTY AGREEMENT

o ACTIONS COMPLETED:

- BRIEFING PREPARED ON ISSUES
- WHITE PAPER PREPARED ON LAND USE AND LARGE SCALE ENGINEERING APPROACHES (IN WHC REVIEW)
- EIS ALTERNATIVES INCLUDING SEVERAL RELATED TO LAND USE BEING PREPARED (BY JULY 15)

o NEXT ACTIONS:

- WHC DEFINES ALTERNATIVES
- ALTERNATIVES FACTORED INTO EIS EVEN THOUGH A MORE RAPID MECHANISM FOR PLACING ALTERNATIVES AND ISSUES BEFORE PUBLIC MAY ALSO BE PURSUED

EXAMPLE LAND USE CASE ALTERNATIVE

- o CONSIDER FOLLOWING AS EXAMPLE CASE (PRESENTED AS AN EXAMPLE OF HOW EACH CASE OUGHT TO BE DEFINED)
- HANFORD FUTURE LAND/GROUNDWATER USE POLICY
 - RESTORE 1100 AGGREGATE AREA TO UNRESTRICTED PUBLIC USE INCLUDING GROUNDWATER
 - ISOLATE AND STABILIZE 200 AREA AGGREGATE UNIT IN-PLACE; CONTROL ACCESS IN PERPETUITY INCLUDING USE OF ACTIVE AND PASSIVE INSTITUTIONAL CONTROLS; INVESTIGATE LARGE SCALE TECHNIQUES TO HYDRAULICALLY ISOLATE PLATEAU; (200 AREA IS "NATURALLY" ISOLATED)
 - RESTORE 100 AND 300 AREAS CONSISTENT WITH COST/BENEFIT CONSIDERATIONS OUTLINED PREVIOUSLY; CONSIDER LARGE SCALE EXCAVATION OF 100/300 AREA WASTE AND REMOVAL OF 200 AREA PLATEAU FOR DISPOSAL OF RECOVERED WASTE

EXAMPLE LAND USE CASE

(CONTINUED)

- MAXIMIZE SOCIAL UTILITY OF NONCONTAMINATION HANFORD AREAS INCLUDING ACTIVE LAND USE MANAGEMENT INVOLVING GRAZING, USE OF SACRED AREAS BY TRIBES, AGRICULTURE, WILDLIFE REFUGES, NATIONAL ATOMIC MUSEUM (RETENTION UNDER NATIONAL HISTORIC PRESERVATION ACT), INDUSTRIAL USE
- POINTS OF COMPLIANCE
 - TOP OF GROUNDWATER TABLE (UNCONFINED) IN 1100 AREA; COMPLETE SOIL HORIZON
 - 100/300 AREAS TO BE DEFINED AFTER CONSIDERATION OF COST/BENEFITS
 - EDGE OF 200 AREA AGGREGATE AREA
- TIME OF COMPLIANCE
 - EQUALS CLEANUP TIME FOR 1100 AREAS
 - 100/300 AREAS TO BE DEFINED AFTER CONSIDERATION OF COST/BENEFIT

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EXAMPLE LAND USE CASE
CONTINUED

- 100 YEARS AT EDGE OF 200 AREA AGGREGATE AREA (2150)
- LEVELS OF COMPLIANCE
 - BACKGROUND OR DRINKING WATER IN 1100 AREAS
 - 100/300 AREA: BACKGROUND OR DRINKING WATER BENEATH RESTORED LAND AREAS, ISOLATE GROUNDWATER BENEATH AREAS NOT RESTORED SUCH THAT ATTENUATION/ISOLATION RESULTS IN DRINKING WATER QUALITY BENEATH SURROUNDING RELEASABLE AREAS
 - GROUNDWATER USE BENEATH 200 AGGREGATE AREA RESTRICTED IN PERPETUITY; DEFINE ADEQUATE COMBINATION OF ACTIVE/PASSIVE CONTROLS
- WILL REQUIRE RECONCILIATION WITH REACTOR DISPOSAL EIS IN 100 AREAS



OUTLINE

- **Hanford Site Performance Assessment (HSPA)
Program update**

- **Physical property laboratory status**
 - **nonradioactive**

 - **radioactive**



HSPA PROGRAM OBJECTIVES

**Develop the tools, methodologies,
and data base required to defensibly
predict:**

- groundwater flow and contaminant transport
- radiation dose and exposure levels to hazardous chemical substances



HSPA PROGRAM APPROACH

- **Data and assumptions**
- **Conceptual models**
- **Scenarios**
- **Computer Software**
- **Numerical Simulations**
- **Analyze results**



HSPA PROGRAM SUPPORT ROLES

- **Treatment, storage, and disposal facility design and siting**
- **Support cost-benefit studies**
- **Support identification of site characterization data needs**
- **Evaluate remediation alternatives**
- **Document regulatory compliance**



HSPA PROGRAM - FY1990 ACTIVITIES

- **Data base maintenance**
- **Recharge measurements**
- **Contaminant behavior**
- **Recharge simulations**
- **Flow and transport simulations**
- **Uncertainty analysis**
- **Applications**



HSPA PROGRAM - FY1990 ACTIVITIES

Data base maintenance

- **Storage and update of recharge data**
- **Archive software for simulating recharge**
- **Archive software for simulating flow and transport**
- **Archive software for pre- and post-statistical processors**



HSPA PROGRAM - FY1990 ACTIVITIES (cont.)

Recharge measurements

- **Near-surface water balance**
 - BWTF, grass site, 200 East deep lysimeter
 - document recharge; validate UNSAT-H
 - vegetation playing important role

- **Isotopic evaluation of recharge**
 - Touchet Bed silts/Pasco gravels
 - tritium, chlorine, oxygen/deuterium ratios, nitrate, technetium, iodine
 - test plan drafted; undergoing review



HSPA PROGRAM - FY1990 ACTIVITIES (cont.)

Contaminant behavior

- **Laboratory test methods**
 - batch sorption
 - diffusion half-cell
 - flow-through column

- **Test matrices**
 - Touchet Bed silts/Pasco gravels
 - saturated/unsaturated
 - altered/unaltered environments
 - U, Sr, Cs, Tc, I, Cr, NO-3

- **Empirically derive retardation and diffusion coefficients for reactive species**

"Making Sure Through Total Quality"



HSPA PROGRAM - FY1990 ACTIVITIES (cont.)

Recharge simulations

- Install UNSAT-H (Version 2.0) on CRAY

- Simulate data sets from BWTF and grass site

- Evaluate need for new UNSAT-H capabilities
 - hysteresis
 - temperature vs. soil hydraulic properties
 - surface water retention
 - snowmelt
 - frozen soil



HSPA PROGRAM - FY1990 ACTIVITIES (cont.)

Flow and transport simulations

- **Debug/test PORFLO-3, version 2.0**
 - multi-fluid/multi-phase
 - chain decay
 - fluid density function
 - periodic boundary condition
 - method of processing 1, 2, 3-D problems
 - additional solvers

- **Issue documentation for version 2.0**

- **Version 2.0 run against laboratory data set for organics in soils; data analysis underway**
 - transmission fluid
 - mineral oil
 - Soltrol-221



HSPA PROGRAM - FY1990 ACTIVITIES (cont.)

Flow and transport simulations (cont.)

- PORFLO-3 (version 1.0) simulations of Jornada Site data set
- Develop proposal for Jornada-like facility at Hanford
- Debug/test PORMC-3, version 1.0
- Issue PORMC-3 documentation
- Pre- and post-processors for PORMC-3
- Pre-/post-processor documentation



HSPA PROGRAM - FY1990 ACTIVITIES (cont.)

Applications

- Procure engineering work station
- Provide CRAY computer time
- Feedback to software developers and data collectors
- Internal/independent benchmark and verification testing
- 100-N Area LWDF simulation

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Westinghouse
Hanford Company

Environmental Technology

UNIT MANAGER'S MEETING

July 17, 1990

J. W. Cammann

Westinghouse Hanford Company
Richland, WA

Attachment #6

"Making Sure Through Total Quality"



HSPA PROGRAM - EXAMPLE APPLICATION

- **Problem**
 - 100-N Area Liquid Waste Disposal Facilities

- **Approach**
 - formulate conceptual model with available data
 - measure in situ permeabilities
 - obtain moisture retention curves in laboratory
 - refine conceptual model
 - calibrate numerical simulation using observation well data
 - predict future contaminant transport without artificial recharge
 - conduct sensitivity analyses to evaluate corrective actions



PHYSICAL PROPERTY LABORATORY STATUS

Physical properties (nonradioactive)

- Currently established in 2101M; moving to 3728 bldg.
- Support to 1100-EM-1, LLBG's, RCRA groundwater wells, 100N Area
- Hydraulic conductivities, particle size, moisture retention curves
- Standard soil tests
 - sieve/hydrometer
 - specific gravity
 - hydraulic conductivity
 - atterburg limits
 - unconfined comp. strength
 - triaxial comp. strength
 - consolidation
 - moisture-density rel.
 - moisture retention

"Making Sure Through Total Quality"



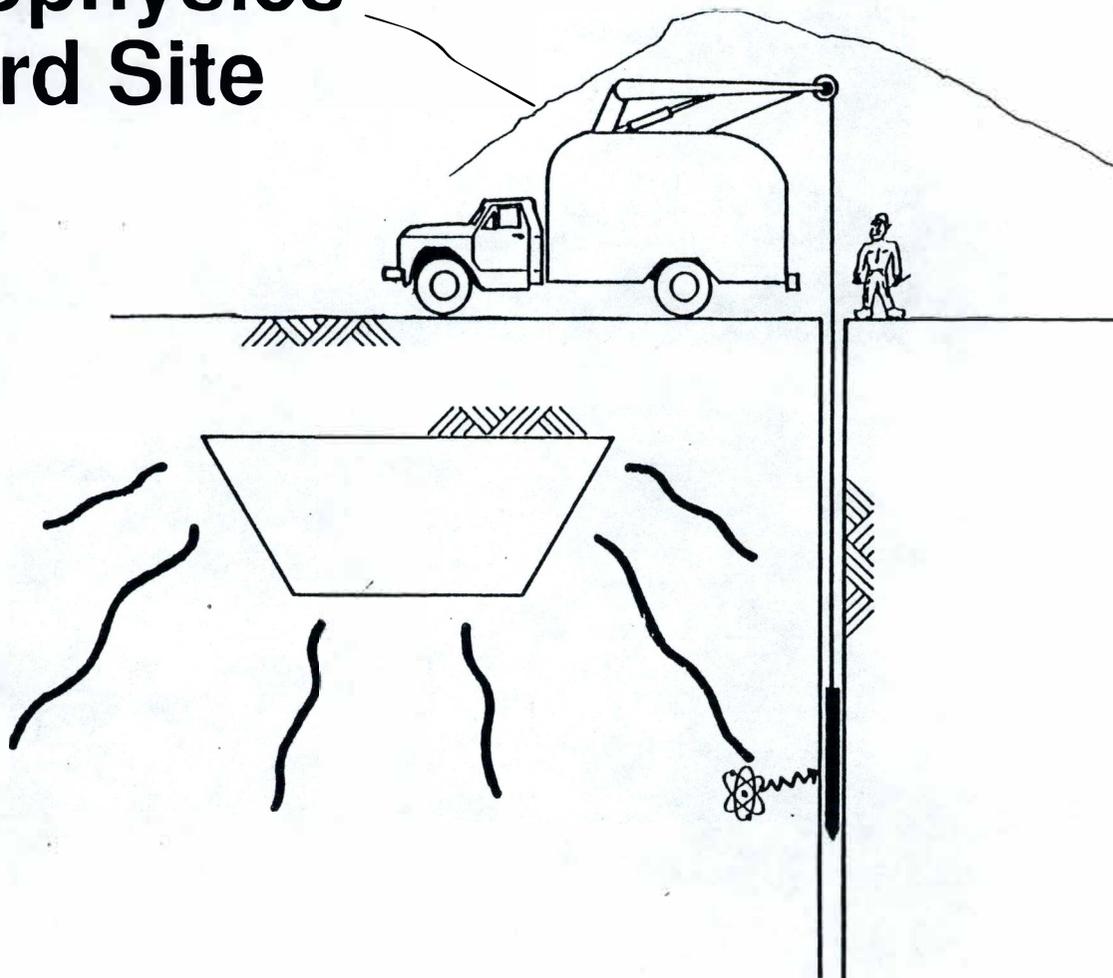
PHYSICAL PROPERTY LABORATORY STATUS

Physical properties (radioactive)

- 377 bldg. transferred from PNL to WHC
- Radiological survey of facility completed;
decontamination completed where necessary;
HEPA filter changeout by end of August
- "Hot" physical property test procedure development
underway
- Planning a November startup in support of
200-BP-1 operable unit RI
 - column leach testing
 - retardation factors

Borehole Geophysics for the Hanford Site

- What is Borehole Geophysics?
- Hanford Boreholes
- Purpose for logging at Hanford
- Selected Techniques
- Program Status
- 200-BP-1 Logging
- Future Tools



JOHANNES KEPLER'S UPHILL BATTLE



Borehole Geophysics Program

- **Primary objectives**
 - **In-situ geologic and hydrologic characterization**
 - **Radionuclide assay**

Basic Borehole Geophysical Logging Methods

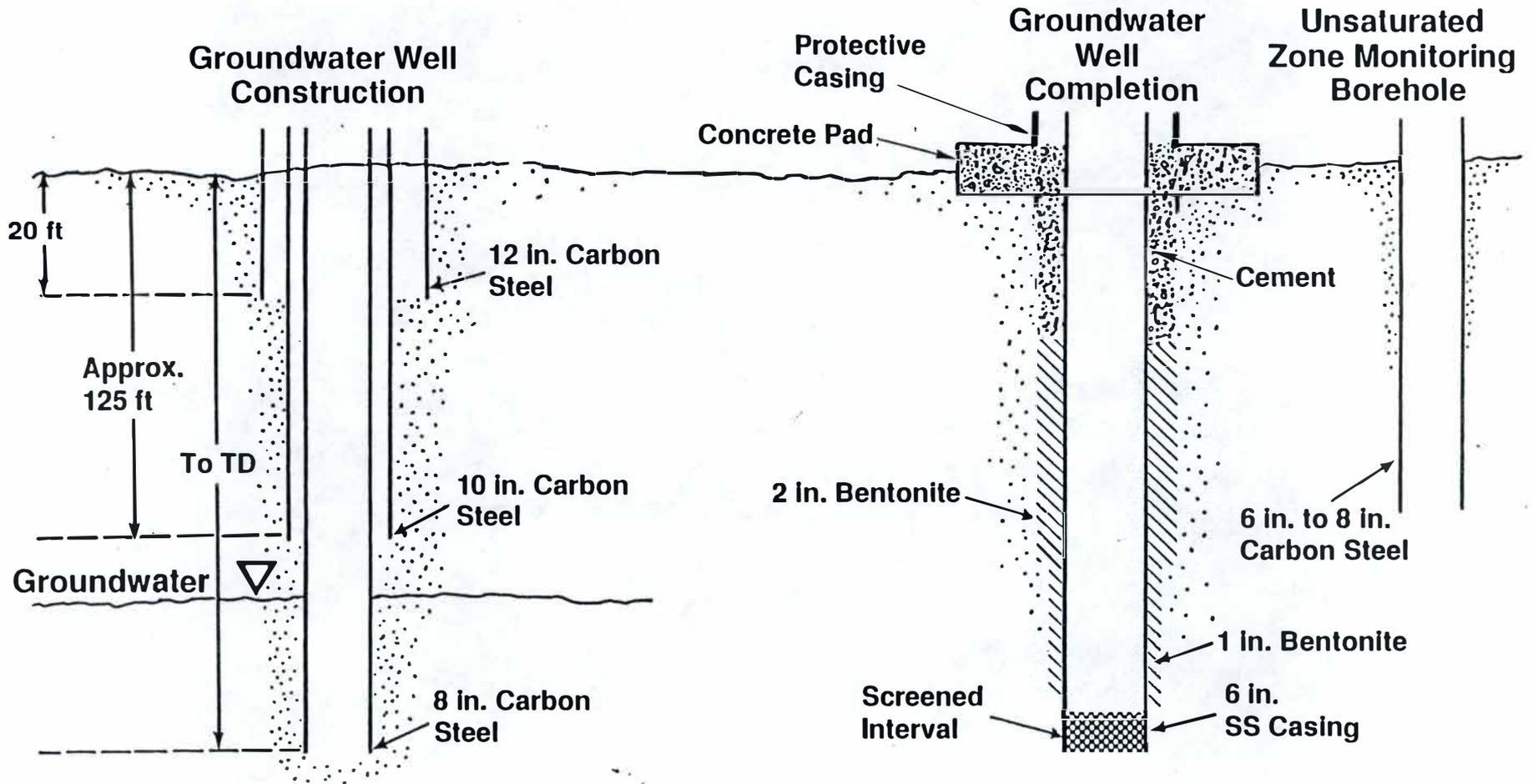
- Nuclear
- Electrical
- Acoustic
- Temperature
- Magnetic
- Borehole gravity
- Mud logging

Borehole Environment

<u>Hanford Boreholes</u>	<u>Oil Wells</u>	<u>Mineral Exploration</u>
Typically cased	Usually uncased	Uncased
Saturated and unsaturated	Saturated	Variable
Large diameter (6 in. – 10 in.)	Large diameter (8 in. – 14 in.)	Slim holes (3 in. Typical)
Cable tool drilled	Rotary/cone bit	Rotary cored

Note: Oil well logging tools are for oil wells; slim hole mineral tools are for slim hole logging.

Hanford Borehole Construction (Ideal)



Geophysical Logging Techniques Selected for Hanford

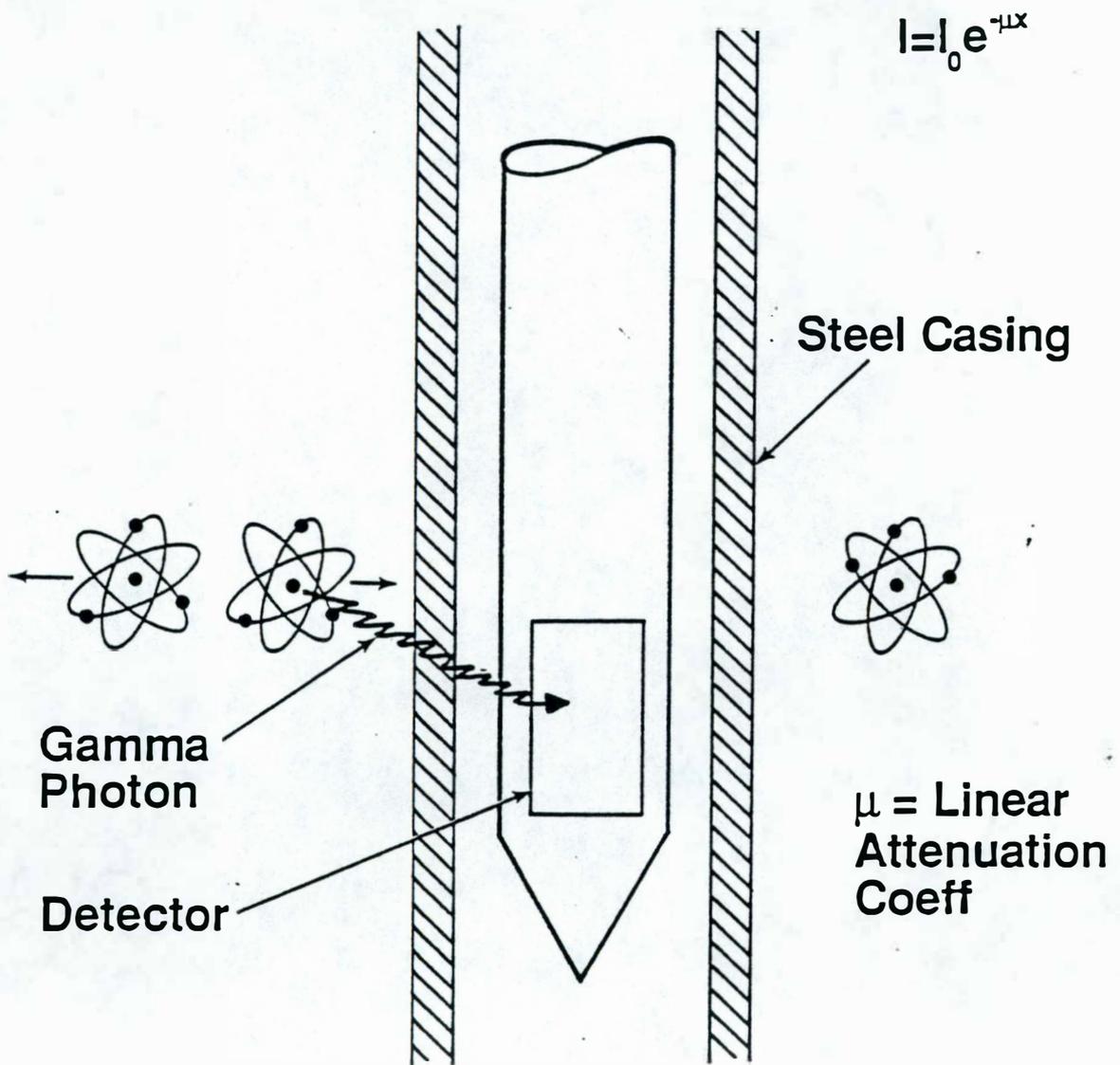
Immediate

- **Nuclear logging**
 - **Passive gamma-ray**
 1. **Gross gamma-ray**
 2. **Nal spectral gamma-ray**
 3. **HpGe spectral gamma-ray**
 - **Gamma-gamma density**
 - **Neutron-neutron hydrogen index**

Future

- **Neutron activation**
- **Electrical induction logging**

Passive Gamma-Ray Physics



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Gross Gamma-Ray Log

- A count simply indicates detection of a gamma photon
- Provides a relative gamma activity profile
- Does *not* identify radionuclides (contains no gamma-ray energy information)
- Biased to low energy

WESTINGHOUSE HANFORD COMPANY

WELL NUMBER 299-W19-29 AREA 200-W
 DATE 11-6-89
 LOG RUN # 3 LOG TYPE GAMMA RAY
 SURVEY COORDINATES 37, 249 N 72, 940 E
 ELEVATION DATUM Top of SS casing ELEVATION 701.87
 LOG MEASURED FROM Cement Pad
 LOCATION DESCRIPTION East of 224-11 Bldg
 GROUND SURFACE ELEVATION 698.55 Top of Brass Cap
 SURFACE TEMPERATURE 12.2°C WEATHER Cloudy, Cool

BOREHOLE INFORMATION

DRILLER DAVE GARCIA H&H
 DRILL RIG TYPE CABLE TOOL BIT TYPE/DIAMETER 12", 10", 8"
 BOREHOLE DIAMETER(S)/DEPTH 4" FIBERGLASS CASIN TO 254.7'
 DEPTH DRILLER NA DEPTH LOGGER 254.7'
 LIQUID LEVEL 235.87' LIQUID APPEARANCE CLEAR
 TEMPERATURE 18.5°C

CASING RECORD

TYPE <u>4" FIBERGLASS</u>	INTERVAL <u>254.7 - SURFACE</u>
TYPE <u>6.5" SS Outer casing</u>	INTERVAL
TYPE	INTERVAL
TYPE	INTERVAL

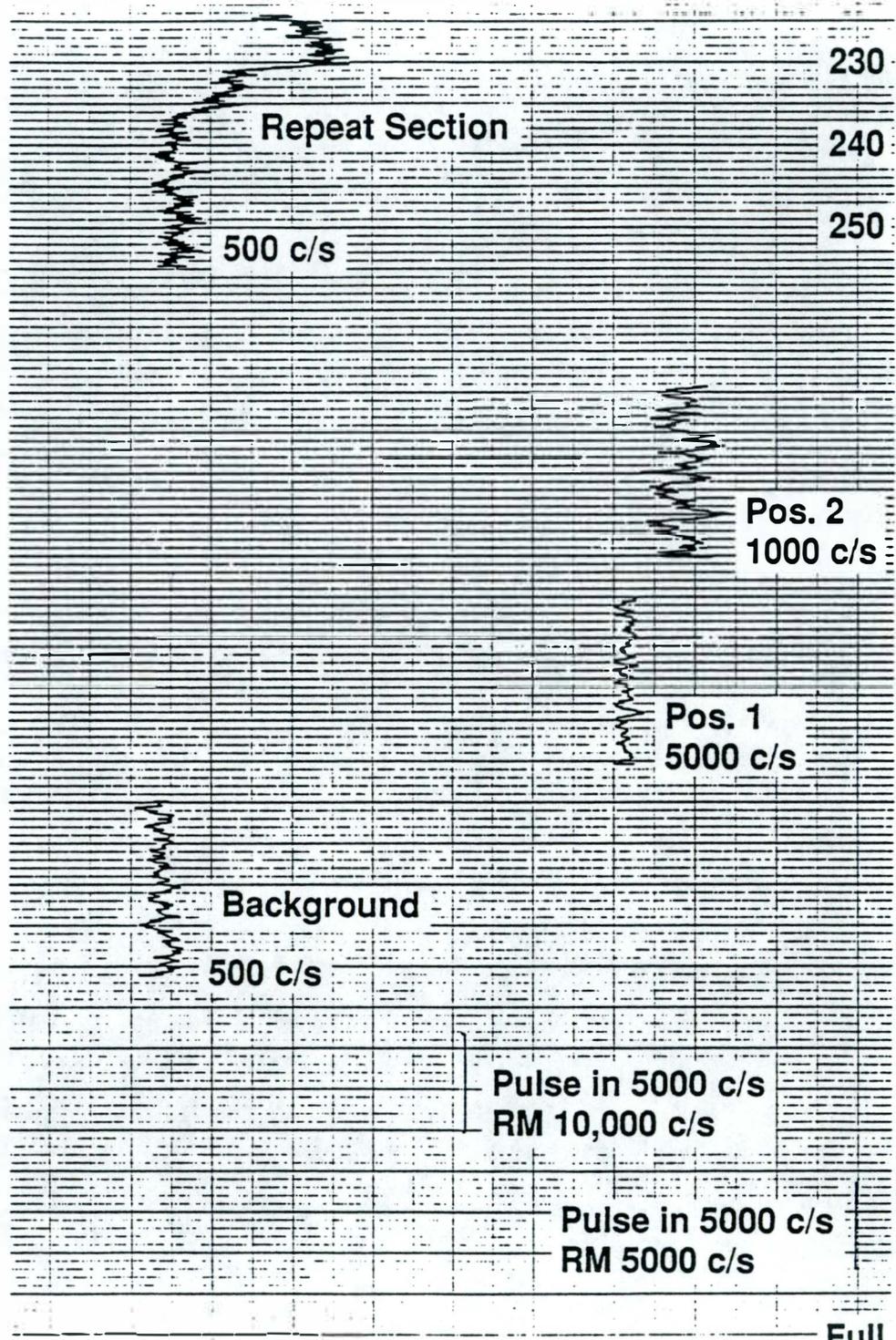
WELL SCREEN INTERVAL:

COMMENTS: Telescoping casings removed; 12" - 12.5'; 10" - 172.7'; 8" - 256'
Top of outer casing sticks - 40" above surface of Cement Pad.

Upper part of Cable Tool removed & averaged by RPT.
No radioactive contamination env. for 11-6-89

LOGGING COMPANY <u>POL</u>	
OPERATORS <u>D. J. McElroy</u>	
EQUIPMENT BRAND <u>M.L.S.</u>	EQUIPMENT TYPE <u>ANALOG</u>
TOOL TYPE <u>GAMMA RAY</u>	BASE CALIBRATION DATE <u>12-88</u>
SERIAL NO. <u>CG 27A97</u>	CALIBRATION REFERENCE <u>WMC-EP-0246</u>
CALIBRATION / PROBE FACTOR <u>8.53 X 10⁻² cpi/ppm/cts</u>	
DEAD TIME <u>7.44 sec</u> WARM UP TIME <u>7.20 MIN.</u>	
LOGGING INFORMATION	
LOG INTERVAL FROM <u>254.7'</u> TO <u>2.5'</u>	
REGRUN(S) <u>254.7' - 244'</u>	
PRE SURVEY CALIBRATION POSITION 1 <u>397 cpi/ppm/cts</u> POSITION 2 <u>6 cpi/ppm/cts</u> BACKGROUND <u>70 cts</u>	
LOGGING SPEED <u>5' / MIN.</u>	
START TIME <u>1000</u> COMPLETION TIME <u>1100</u>	
CHART SPEED(S), FT./IN. <u>10 ft./in.</u>	
CHART RECORDER HORIZONTAL SCALE, CPS/IN. <u>50 cts/in.</u>	
RERUN SCALES, CPS/IN. <u>50 cts/in.</u>	
TIME CONSTANT(S) <u>1 sec.</u>	
POST SURVEY CALIBRATION POSITION 1 <u>397 cpi/ppm/cts</u> POSITION 2 <u>59 cpi/ppm/cts</u> BACKGROUND <u>70 cts</u>	
PERCENT CHANGE: POSITION 1 <u>0%</u> POSITION 2 <u>3.5%</u>	
COMMENTS:	
WITNESSED AND VERIFIED BY <u>J. J. Smith</u> Wellbore suitable for lithologic correlations - <u>MLG</u> <u>11-6-89</u>	

90118850620



230

Repeat Section

240

500 c/s

250

Pos. 2
1000 c/s

Pos. 1
5000 c/s

Background

500 c/s

Pulse in 5000 c/s
RM 10,000 c/s

Pulse in 5000 c/s
RM 5000 c/s

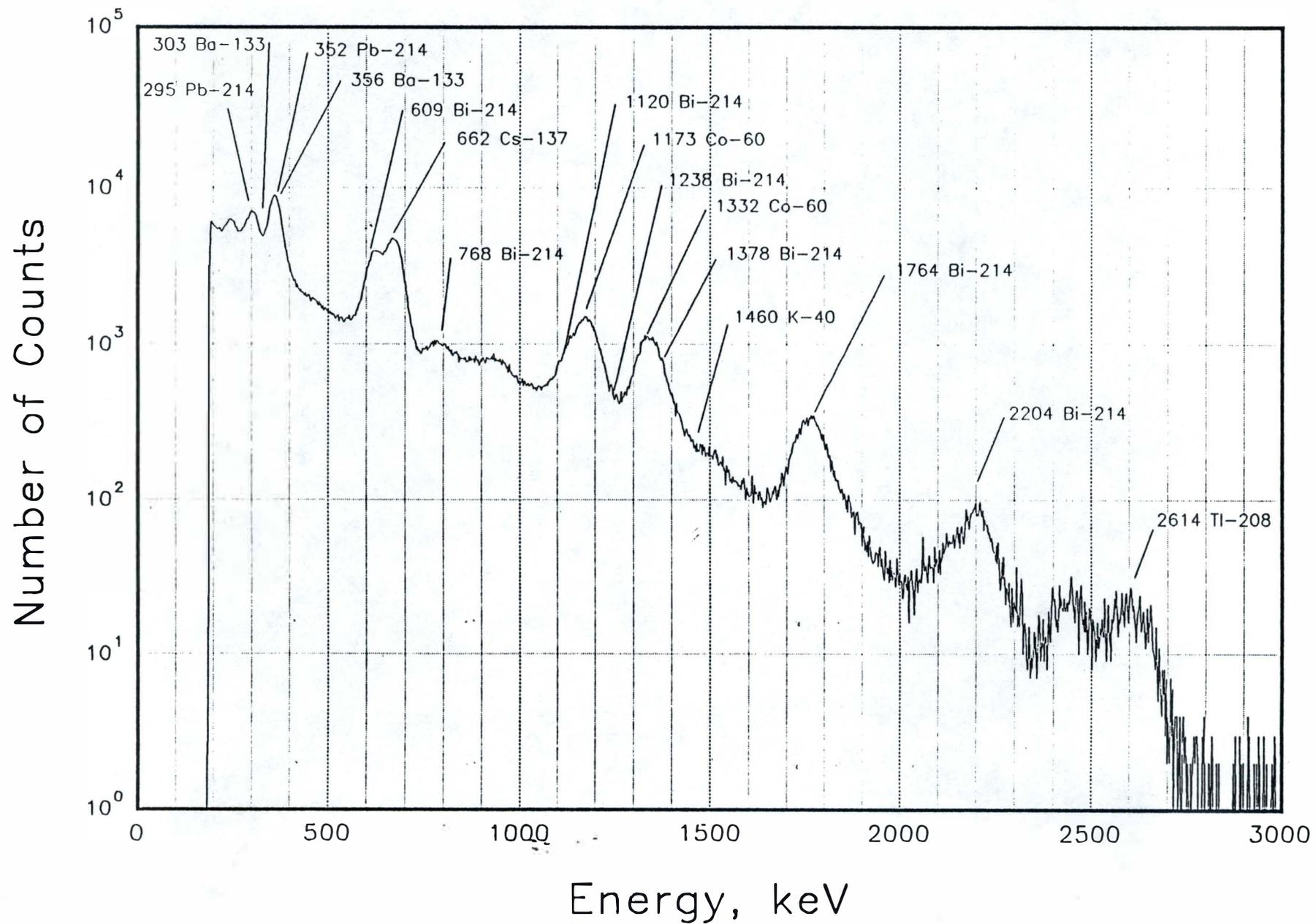
Full
Scale

Nal Spectral Gamma-Ray Log

- **Resolves gamma photon energy**
- **Provides activity/concentration profile of specific radioelements**
- **Energy resolution may not be adequate to uniquely identify radionuclide**

Reference Spectrum

8/29/89

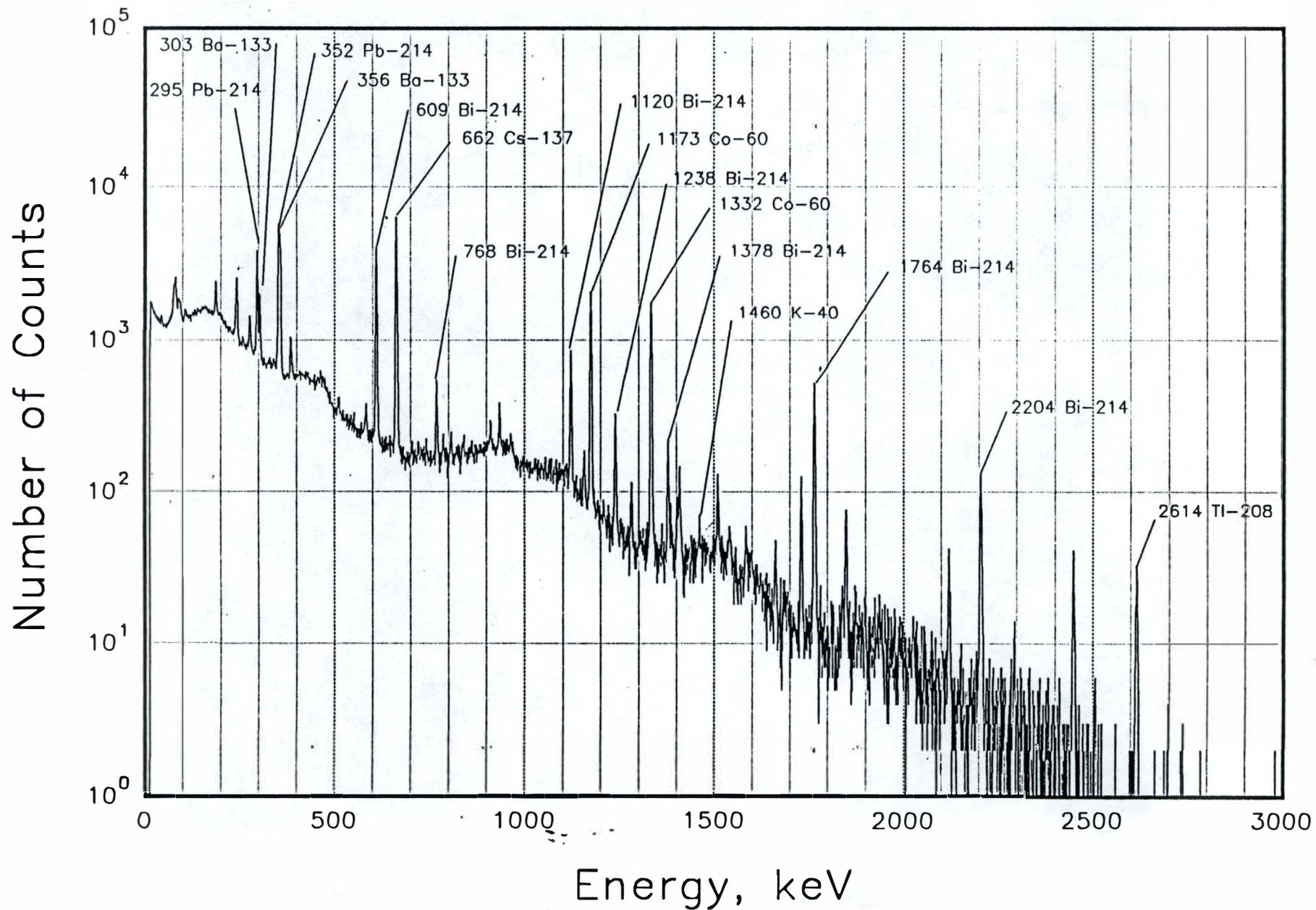


HpGe Spectral Gamma-Ray Log

- **Resolves gamma photon energy**
- **Provides very high energy resolution for unmistakable radionuclide identification**
- **Provides concentration profiles of specific radioelements**

Reference Spectrum

8/29/89

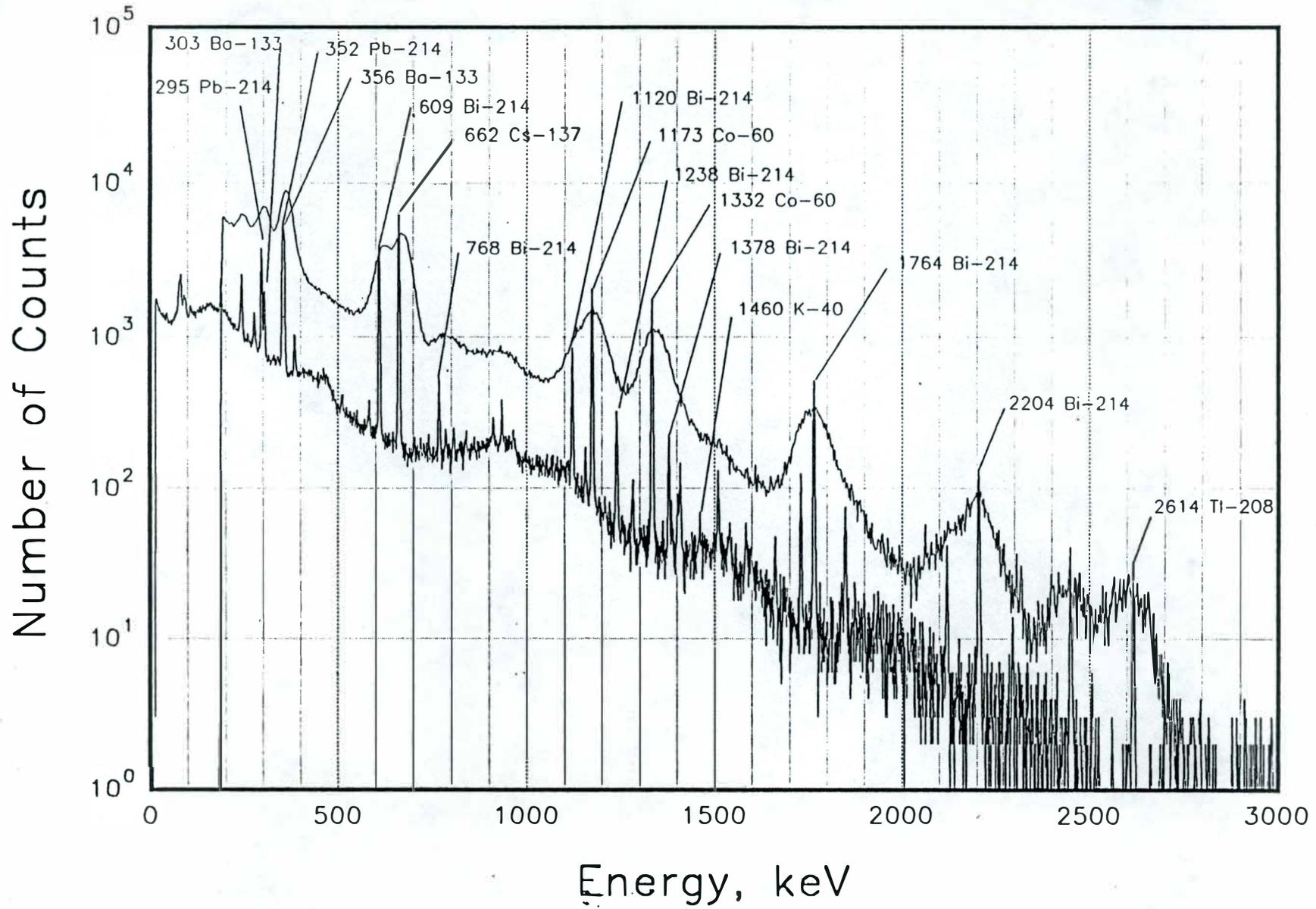


Differences in Gamma-Ray Detectors

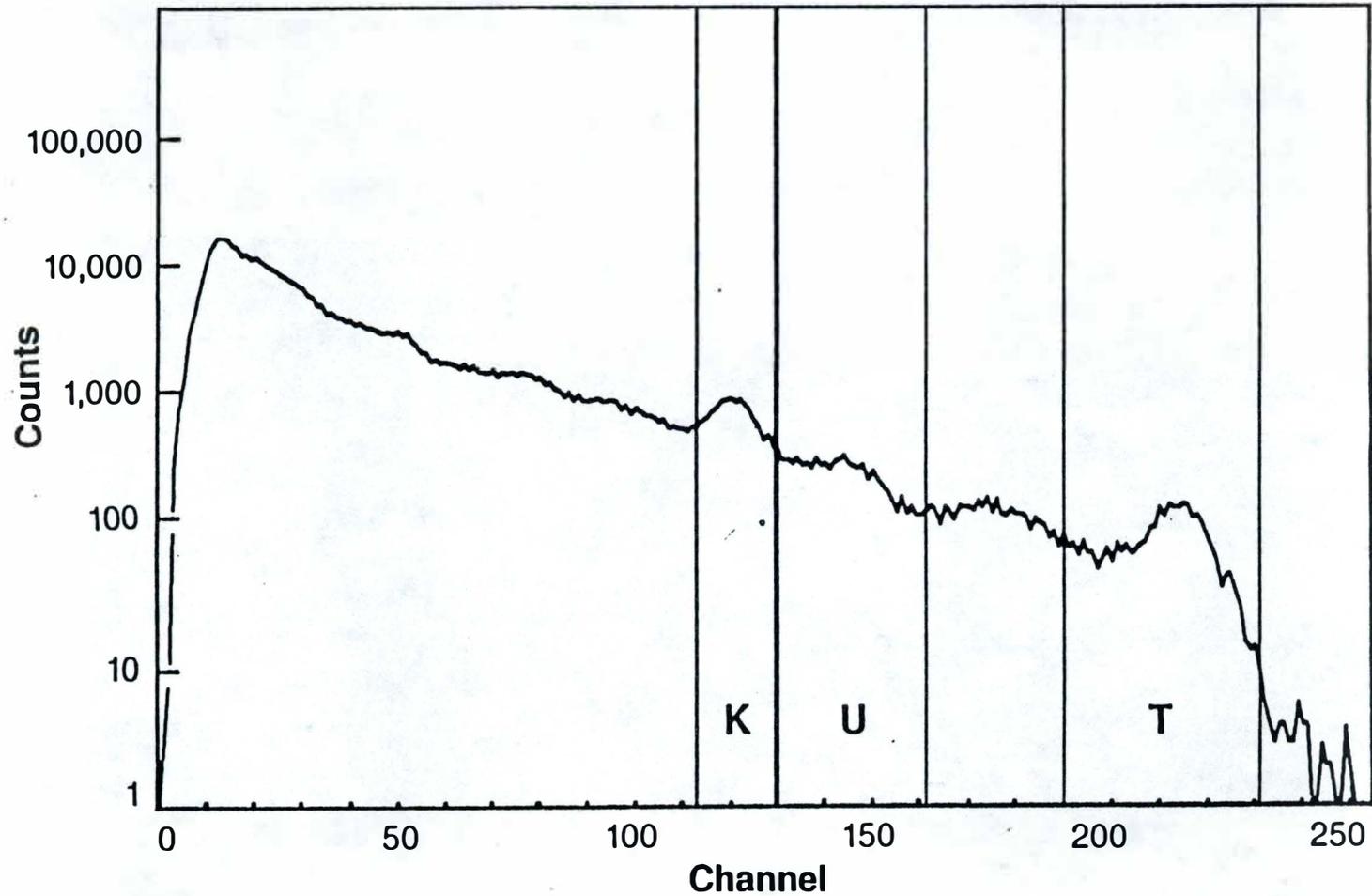
	<u>Gross</u>	<u>Nal Spectral</u>	<u>HpGe Spectral</u>
Energy Resolution	None	Good	Very high
Radioelement ID	Not possible	Possible	Usually unequivocal
Ease of use	Very easy	Moderate	More complex
Calibration	Simple	Difficult	Difficult
Signal-to-noise ratio	Very poor	Moderate	Excellent

Reference Spectrum

8/29/89



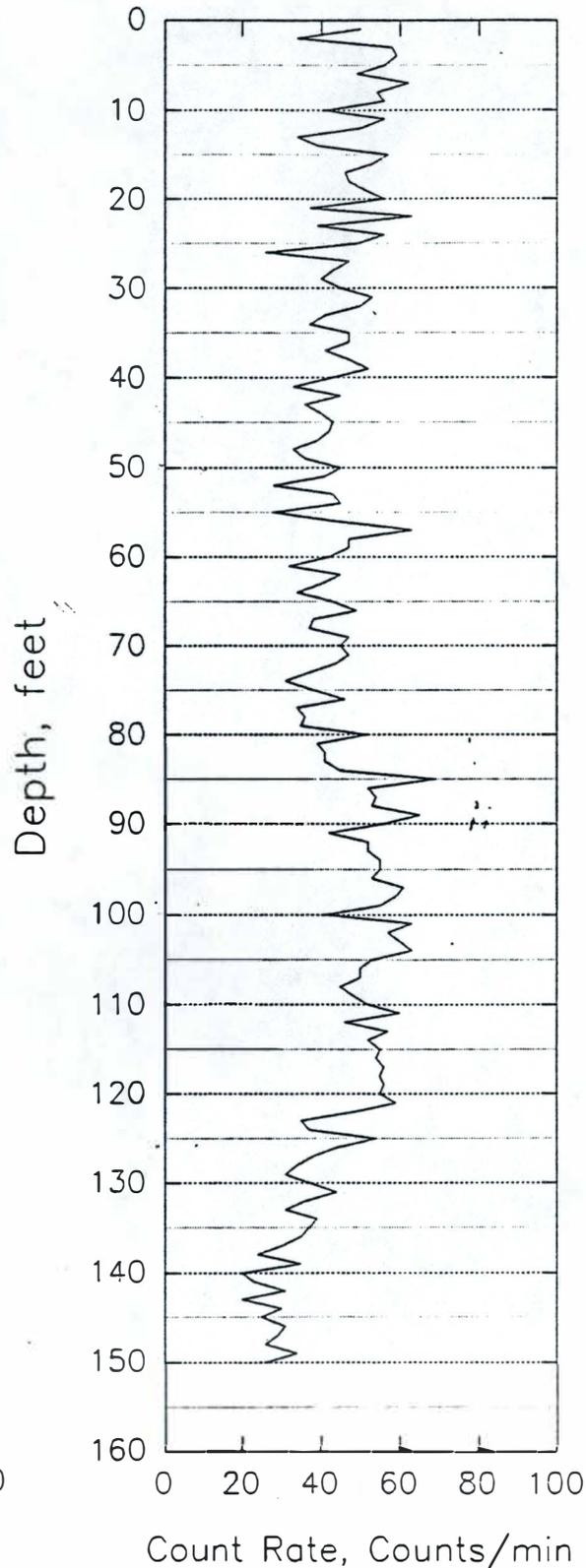
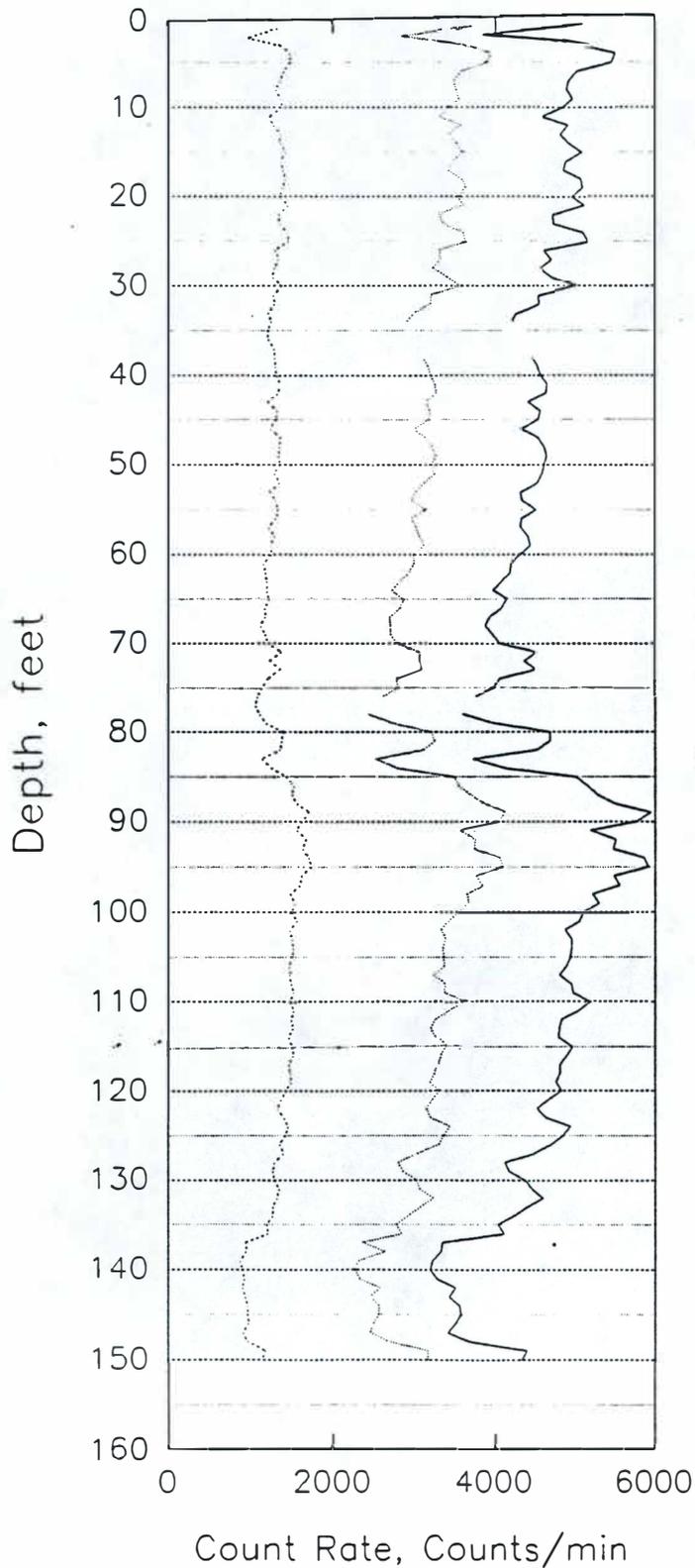
KUT Spectrum Available at the Well Site



299-W26-11 Spectral Gamma-ray Log Results

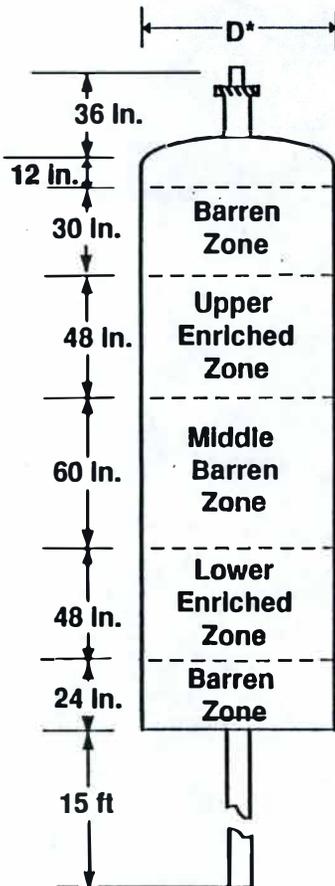
— Total Counts
— 75 to 398 KeV
..... 399 to 1453 KeV

— K-40 Count Rate



90118850628

Calibration of Passive Gamma-Ray Tools: Base Calibration



*D	
Model	Diameter (in.)
SBL/SBH	48
SBT/SBK	48
SBU/SBM	48
SBA/SBB	60

- Semi-infinite, homogeneous zones
- Known radioelement concentrations
- Stable radioelement activity (secular equilibrium)
- Multiple radionuclides (energies)
- Multiple concentrations

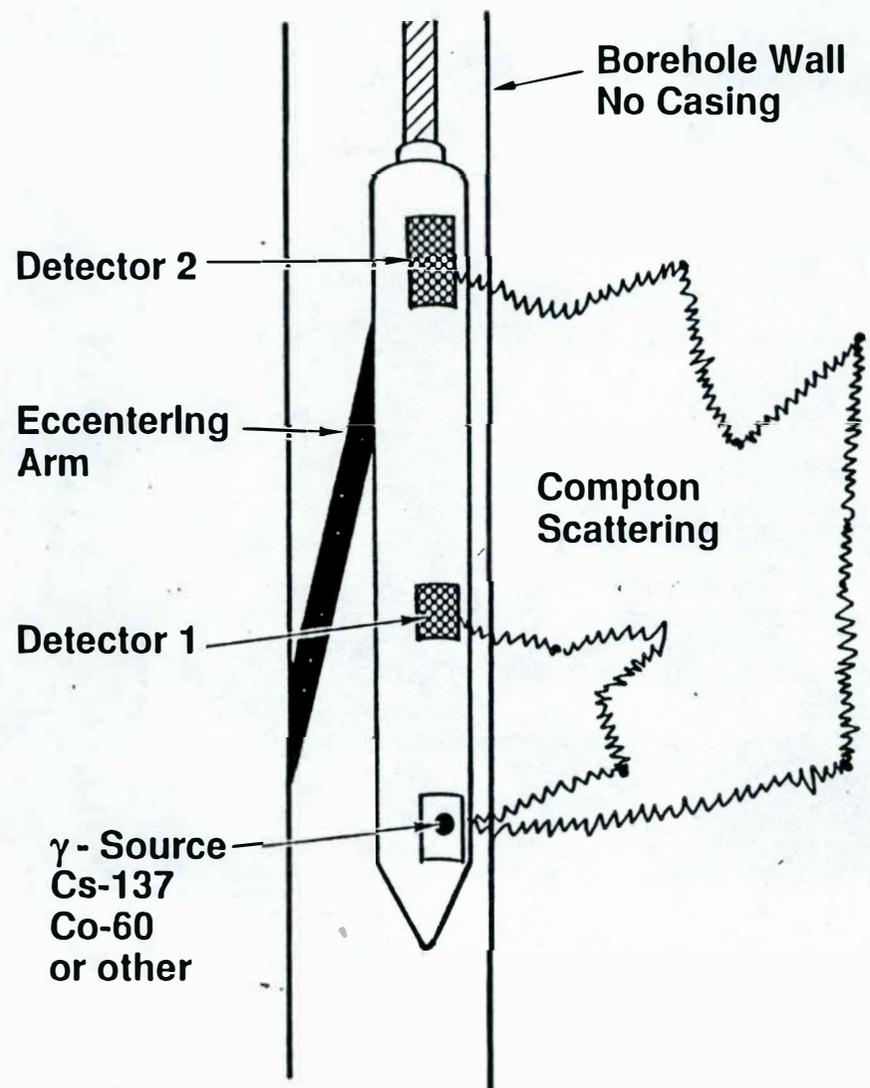
Calibration of Passive Gamma-Ray Tools

Other calibrations

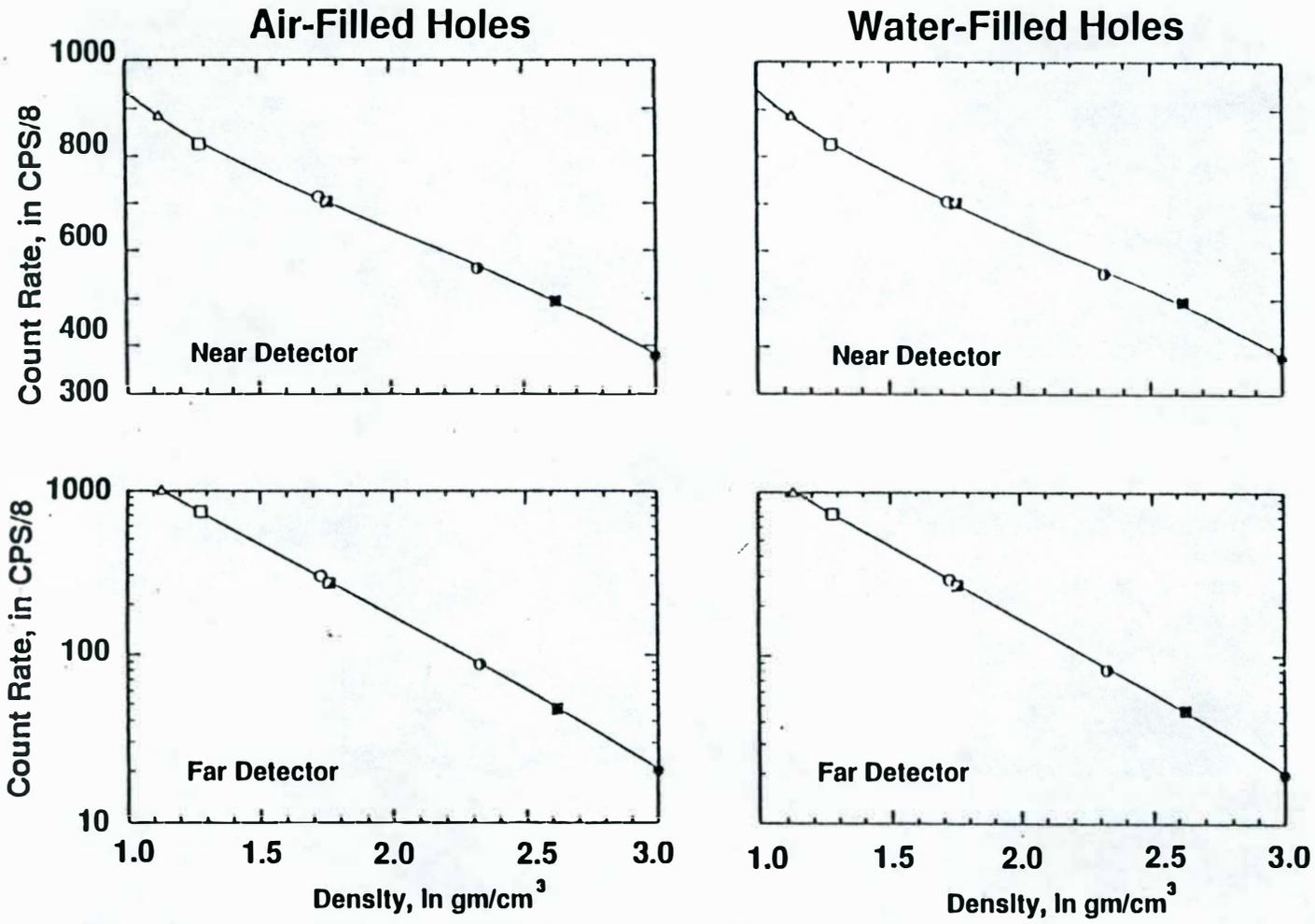
- Shop calibrations
- Pre- and post-logging field verifications

Data interpretation pitfalls

Gamma – Gamma Density Tool Physics



γ - γ Density Tool Response



- △ Saline water
- Plexiglass calibration block
- ▣ Magnesium calibration block
- Aluminum calibration block
- Low-density concrete test pit
- Medium-density concrete test pit
- ◐ High-density concrete test pit

γ - γ Density Tool Environment

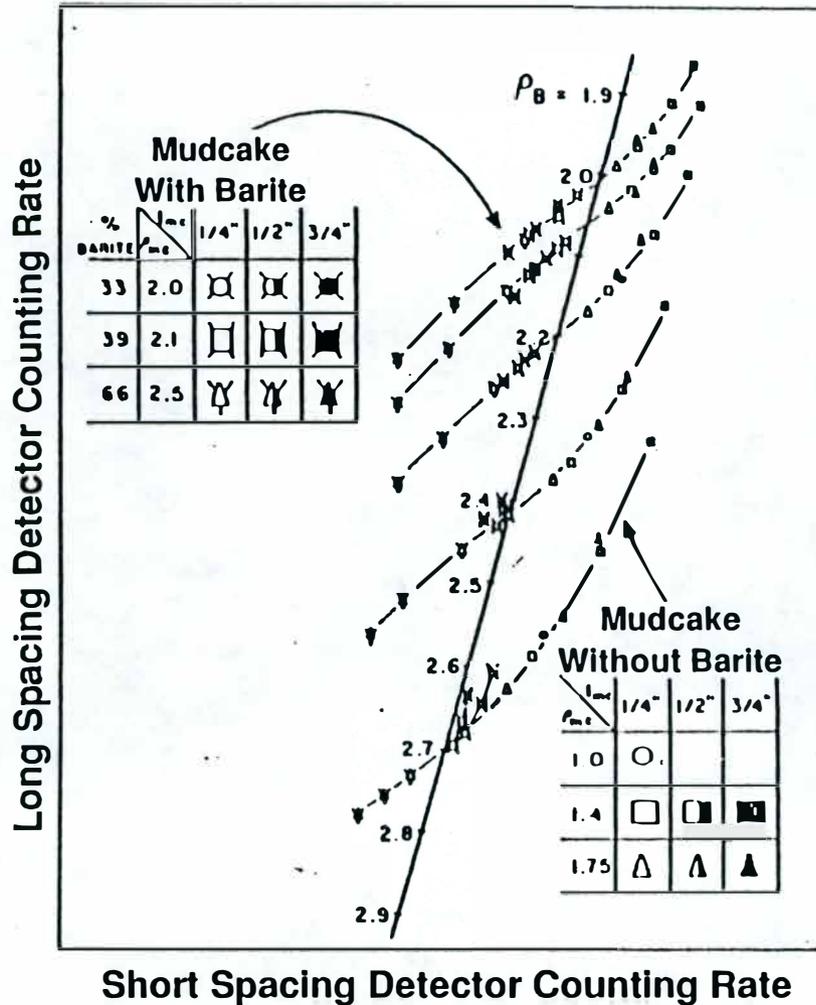
- Ideal Borehole
 - Smooth borehole wall
 - No mud cake
 - Water filled
 - No casing

- Oil well/mineral logging borehole
 - Rugose borehole wall
 - Mud cake
 - Water filled/air filled
 - No casing

- Hanford boreholes
 - Rugose borehole wall
 - No mud cake
 - Water filled/air filled
 - *Casing !!!*
 - * * * Gap behind casing * * *

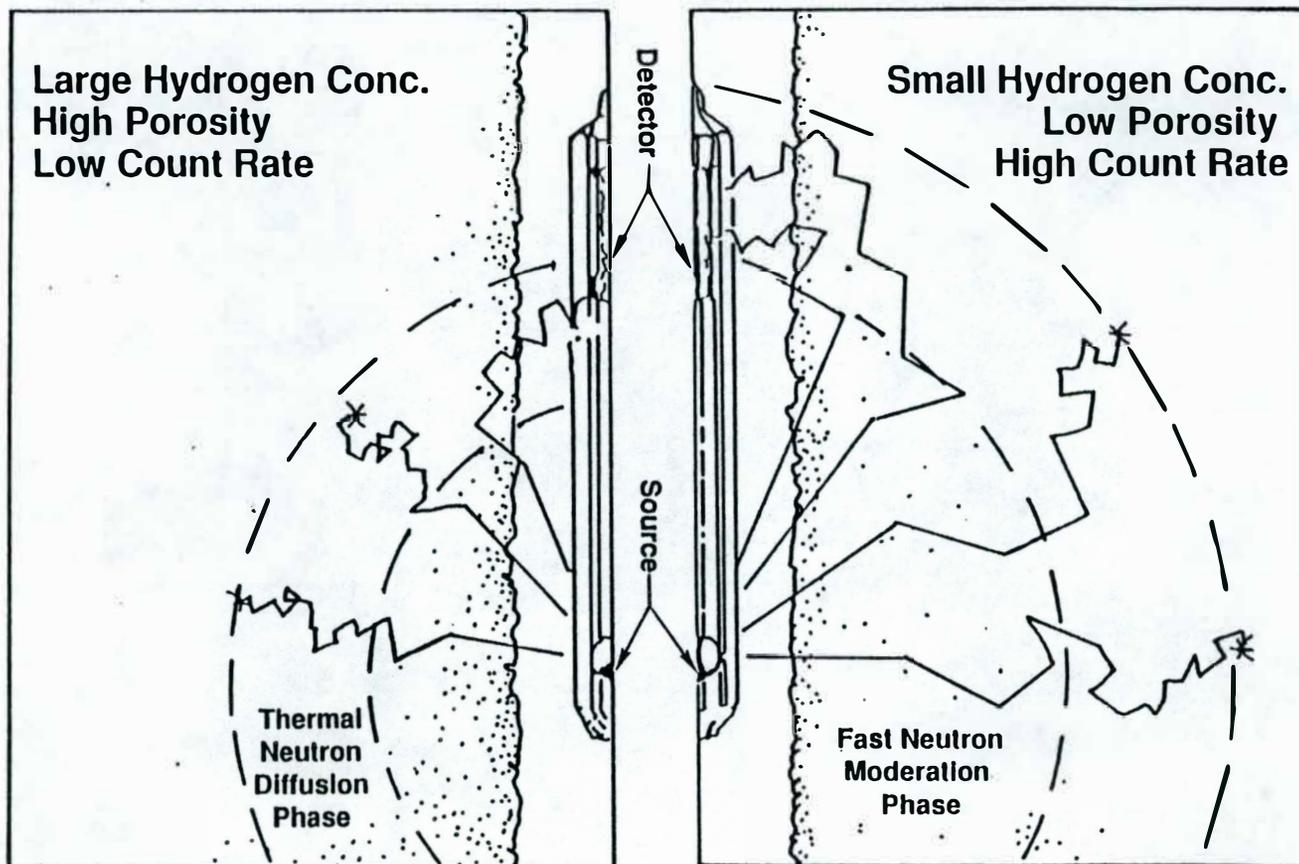
Compensated Density – Commercial Style

Schlumberger Likes Curved Ribs



Neutron Diffusion

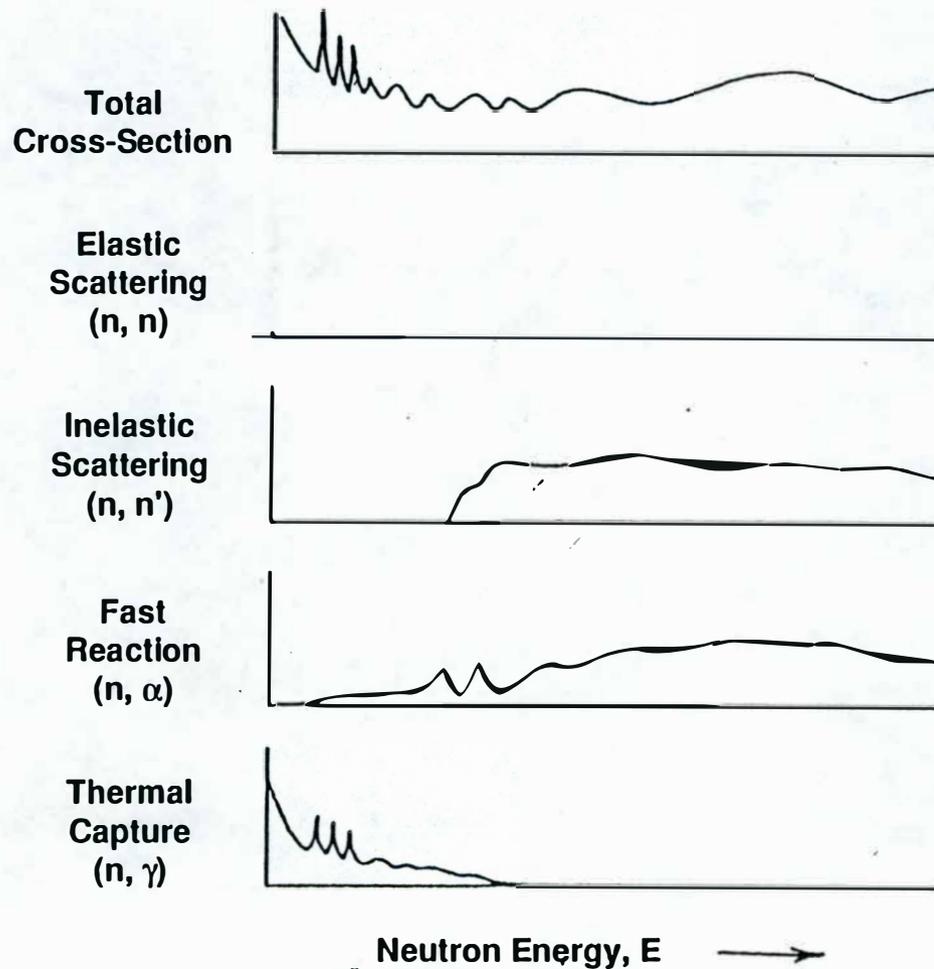
Effects of Formation Water Content



Neutron-Neutron Hydrogen Index Tool

Neutron Cross-Sections vs. Energy

(Example)



Neutron-Neutron Hydrogen Index Tool

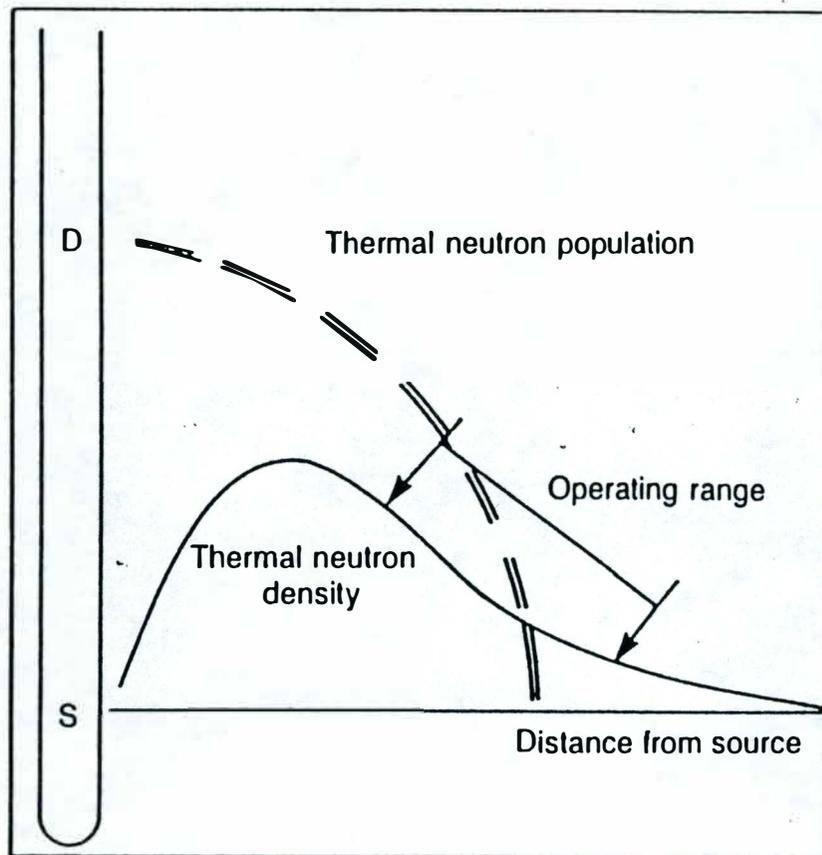


FIG. 5-58

Thermal neutron population radially away from the source

Neutron-Neutron Hydrogen Index Tool

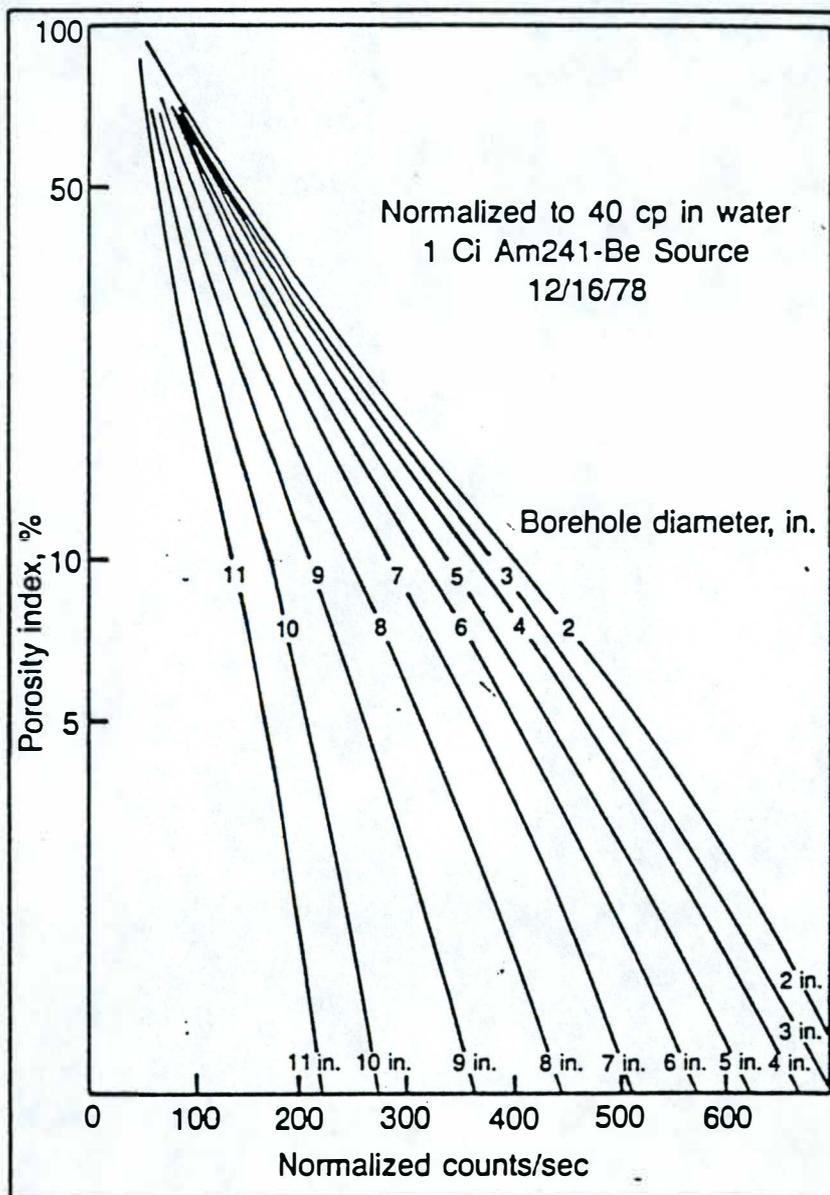


FIG. 5-56

Neutron porosity index in limestone as a function of normalized counts/second

(courtesy Century Geophysical Corp.)

Neutron-Neutron Hydrogen Index Tool

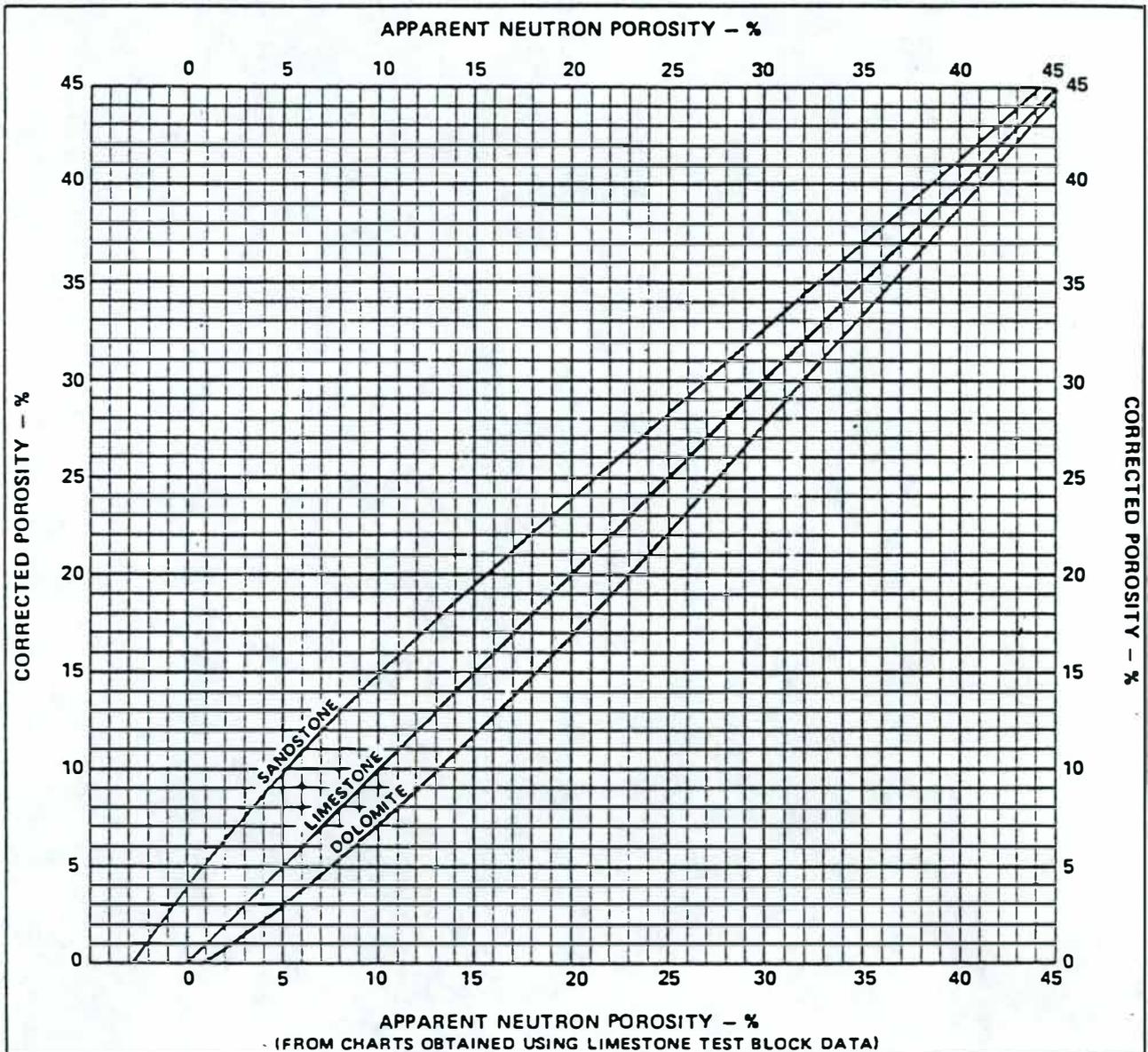


FIG. 5-55

Estimated neutron correction for formation chemistry effects (neutron-neutron logging, water-filled holes)
(courtesy Gearhart Industries Inc.)

Neutron-Neutron Hydrogen Index Tool

Thermal or epithermal count rate



*Calibrations, corrections,
calculations*

Hydrogen index, I_H



*Calibrations, corrections,
calculations*

Water content/porosity
(unsaturated)/(saturated)

***** Pitfalls *****

Neutron-Neutron Hydrogen Index Tool

Borehole environment effects

- Borehole size
- Mud
- Casing
- Formation poisons (B, Cl)
- Dry/saturated

Solutions

- Dual detector sonde
- Use epithermal detectors
- Special calibrations
- Details to tool design
- Special data analysis/interpretation (corrections)
- Correlation with density log

Purpose of Logging at Hanford

- **Geology characterization**
- **Hydrology characterization**
- **Radionuclide assay**

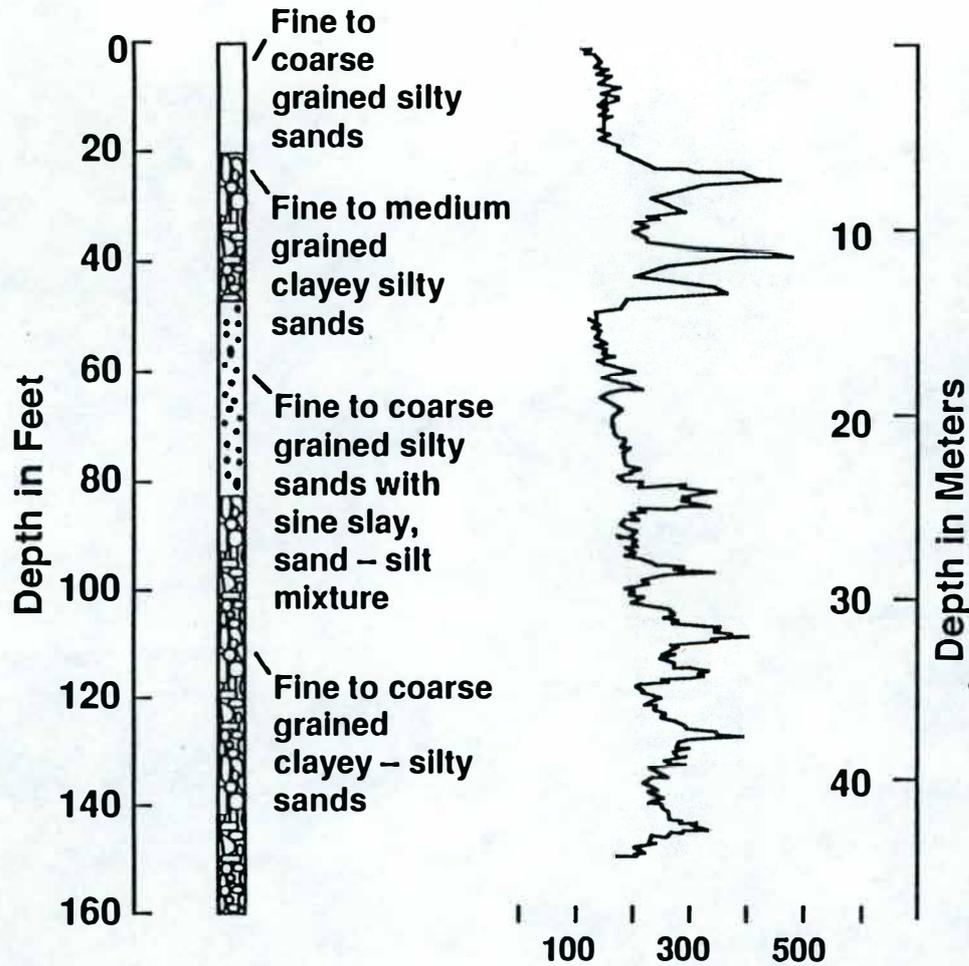
Geology Characterization

*Tools: γ - γ density, n - n hydrogen index, passive γ
(spectral is best)*

- In-situ physical properties
 - Density, porosity, water content, %K-40
 - Significance: Identify clay, caliche, sand, grain packing, etc.
- High spacial resolution data
 - Significance: Identify thin lithology
- Cross borehole correlation
 - Significance: Objective data for correlation

Monitor Well No. 21

Gamma Ray Log



Comparison of Driller's Log with Gamma Ray Log - Gas Hills Wyoming

Hydrology Characterization

Tools: γ - γ density, n-n hydrogen index

- Identify/quantify % H₂O in unsaturated zone
- Quantify porosity in saturated zone

*** * * Pitfalls * * ***

True Porosity Determination

SCHLUMBERGER LOG INTERPRETATION / APPLICATIONS

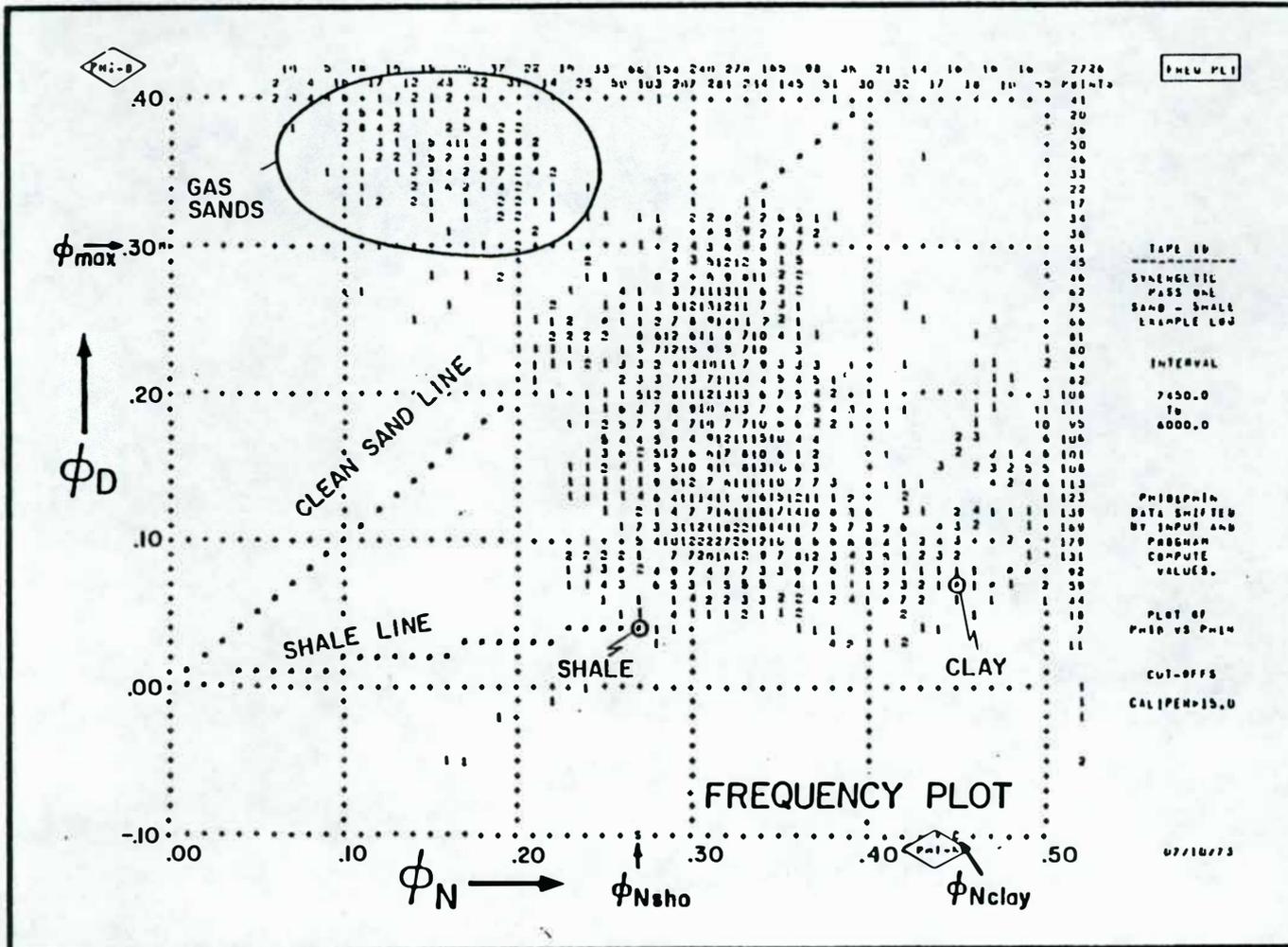


Fig. 7-6 — Frequency crossplot of ϕ_D vs ϕ_N . Figs. 7-6 through 7-10 illustrate crossplots used for selection of parameter values for SARABAND.

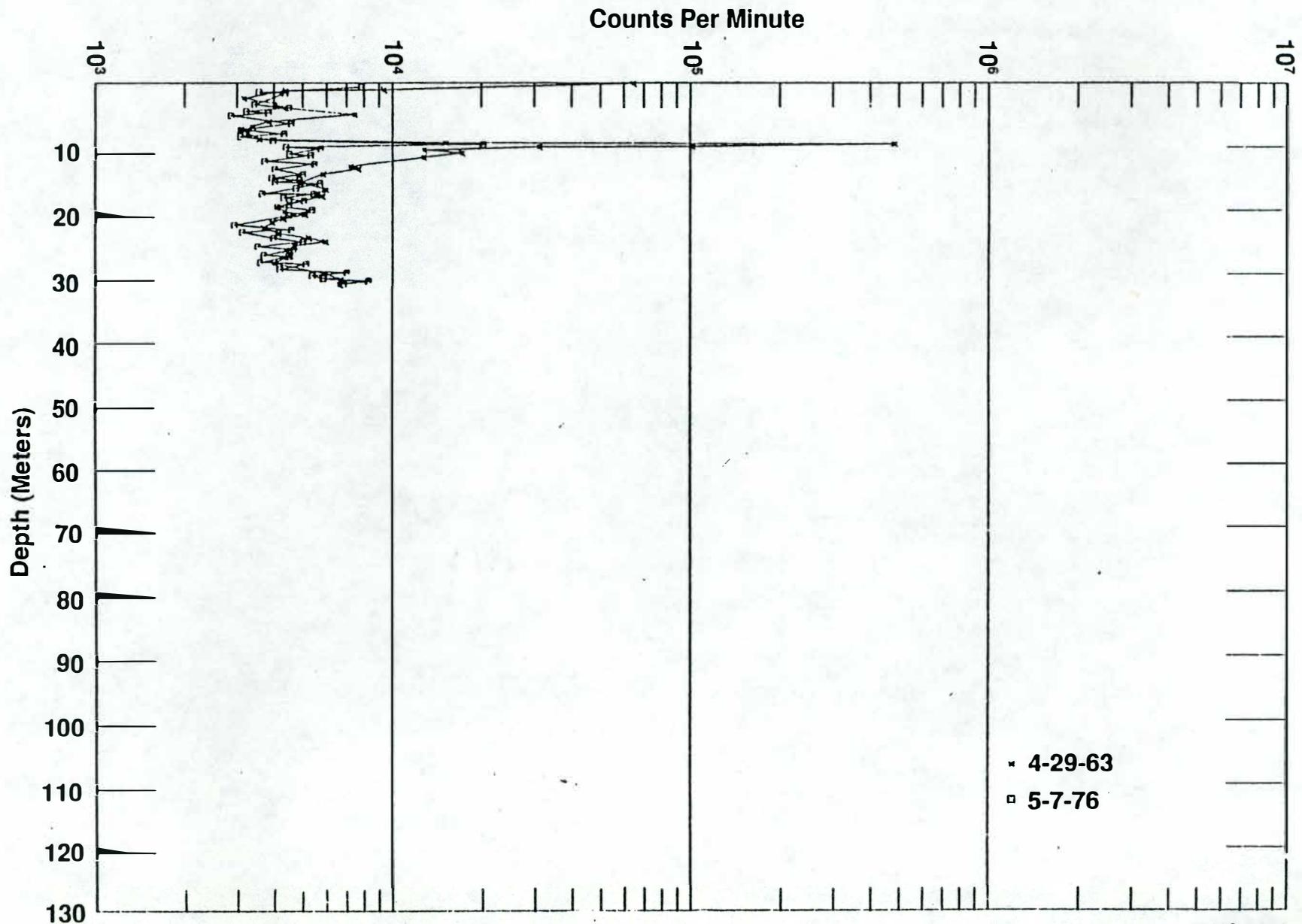
$$\phi_D = \frac{(2.65 - \rho_b)}{(2.65 - 1.00)}$$

Radionuclide Assay

***Tools: HpGe spectral gamma-ray (high resolution)
NaI spectral gamma-ray (high efficiency)***

- **Gamma emitting radionuclides only**
- **High spacial resolution is required**
- **Known and documented precision and accuracy**

Radionuclide Assay Requires High Spatial Resolution



Radionuclide Monitoring*

- **Inconsonant conditions**
- **Active facilities radionuclide disposition**
- **Performance assessment data from all sites**

* **Requires *unsealed* borehole in the unsaturated zone**

Status of Hanford Borehole Geophysics Program

- **Gross gamma-ray systems**
- **Spectral gamma-ray systems**
- **γ - γ density**
- **n-n hydrogen index**

Gross Gamma-Ray Systems

- **PNL gross gamma-ray log**
 - **Calibrated for lithology ID**
 - **Operating procedure**
 - **Produces analog strip chart log**
 - **Used for lithology ID**
 - **Not adequate for radionuclide assay**

- **Tank farms gross gamma-ray systems for leak detection**
 - **Not calibrated**
 - **Poor operating procedures**
 - **Poor instrumentation**
 - **Poor interpretation**
 - **Not adequate for geologic characterization or radionuclide assay**

Spectral γ -Ray System

- Radionuclide logging system
 - HpGe and NaI detectors
 - To be used to "baseline" active and inactive cribs
 - To be used at RCRA/CERCLA operable units
 - Operational at end of summer
 - Full data analysis/interpretation ~ one year

Gamma-Gamma Density and n-n Hydrogen Index Tools

- **Computer modeling work underway***
 - **Completion early FY91**
- **Tool design and purchase in FY91**
- **Calibration work will be required**
- **\$200K identified, additional \$100K needed**
- **Money needed for construction of calibration facility**

*** Status of modeling work available**

200-BP-1 Work

- **Gross gamma-ray logging of all GW wells**
- **Radionuclide assay (RLS) of unsaturated zone boreholes planned (late FY90)**
- **γ -density and n-n hydrogen index logging not ready**

Future Tools

Neutron activation for:

- Additional radionuclide concentrations (Pu, Sr, etc.)
- Elemental analysis (H, Si, Ca, Cl, Al, Fe, etc.)
- Hazardous chemicals (Cl)
- Neutron die-away or lifetime log (thermal and/or epithermal)
- Neutron – capture gamma-ray

Gamma density tools for casing seal assessment

- Ideal for addressing state of Oregon concerns

Induction logging for electrical properties

- Requires PVC casing
- Provides excellent lithology and moisture tool

Borehole Geophysics at Hanford

Conclusions

- Objectives
 - Geology/hydrology characterization
 - Radionuclide assay

- Data needs
 - High spacial resolution
 - Properly designed tools
 - Calibrations/interpretations
 - Remember pitfalls

Borehole Geophysics at Hanford

Conclusions

- **Basic tools**
 - **Passive spectral gamma**
 - **Neutron-neutron hydrogen index**
 - **Gamma-gamma density**
 - **Neutron activation**
 - **Electrical induction**
- **Results**
 - **Useful data**
 - **Defensible data**
 - **Proper integration (characterization, performance assessment)**
 - ***Nationally recognized program***