Environmental
Restoration
University of California
Environmental Science and Waste Technology (E)
Environmental Restoration, MS M992
Los Alamos, New Mexico 87545
505-667-0808/FAX 505-665-4747

U.S. Department of Energy
Los Alamos Area Office, MS A316
Environmental Restoration Program
Los Alamos, New Mexico 87544
505-667-7203/FAX 505-665-4504

Date: November 15, 1999
Refer to: E/ER:99-313

Mr. John Kieling
NMED-HRMB
P.O. Box 26110
Santa Fe, NM 87502

SUBJECT: QUARTERLY TECHNICAL REPORT FOR JULY-SEPTEMBER 1999

Dear Mr. Kieling

Enclosed are two copies of the Environmental Restoration Project's Quarterly Technical Report, July-September 1999. The Quarterly Technical Report presents information from each focus area on the quarter's activities, including regulatory meetings, sampling, cleanups, and report writing. Also enclosed is a certification statement signed by the designee owner and operator for the Los Alamos National Laboratory.

If you have questions regarding this report, please contact Dave McInroy at (505) 667–0819 or Joe Mose at (505) 667–5808.

Sincerely,

Julie A. Canepa, Program Manager
LANL/ER

Sincerely,

Theodore J. Taylor, Program Manager
DOE/LAAO

JC/TT/MB/dm

Enclosures: (1) Quarterly Technical Report, July-September 1999
(2) Certification

Cy (w/ encs.):
M. Boettner, E/ER, MS M992 (2 copies)
J. Brown, S-7, MS F674
M. Buksa, E/ET, MS M992
D. Daymon, EES-13, MS M992
A. Dorries, EES-13, MS M992
T. George, E/ER, MS M992
J. Mose, LAAO, MS A316
W. Neff, E/ET, MS M992
D. Neleigh, EPA, R.6, 6PD–N
J. Plum, LAAO, MS A316
A. Pratt, EES-13, MS M992
G. Rael, AL-ERD, MS A906
T. Taylor, LAAO, MS A316
T. Trujillo, AL-ERD, MS A906
M. Leavitt, NMED–GWQB
J. Parker, NMED–HRMB
G. Saums, NMED–SWQB
S. Yanicak, NMED–AIP, MS J993
RPF, (ER Catalog ER19990155), MS M707

Cy (w/o encs.):
T. Baca, E/DO, MS J591
R. Hutton, SAIC, MS J521
M. Kirsch, E/ER, MS M992
B. Martin, E/ER, MS M992
D. McInroy, E/ER, MS M992
J. Vozella, LAAO, MS A316
J. Bearzi, NMED–HRMB
E/ER File, MS M992
Tracker Room 604, MS M992

CERTIFICATION

I certify under penalty of law that these documents and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violation.

Document Title: Quarterly Technical Report, July-September 1999

Name: _____ Date: 11/15/99
Julie A. Canepa, Program Manager
Environmental Restoration Project
Los Alamos National Laboratory

or

Tom Baca, Program Director
Environmental Science & Waste Technology
Los Alamos National Laboratory

Name: _____ Date: 11-15-99
Theodore J. Taylor, Program Manager
Environmental Restoration Program
DOE–Los Alamos Area Office

or

Joseph Vozella,
Acting Assistant Area Manager of
Environmental Projects
Environment, Safety, and Health Branch
DOE–Los Alamos Area Office

LA-UR-99-5773
ER19990155

Los Alamos National Laboratory

Environmental Restoration

A Department of Energy Environmental Cleanup Program

QUARTERLY TECHNICAL REPORT

July–September 1999

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CONTENTS

LIST OF ACRONYMS AND ABBREVIATIONS

BMP	best management practice
CAB	Citizens' Advisory Board
CMS	corrective measures study
D&D	decontamination and decommissioning
DOE	US Department of Energy
DOE-LAAO	US Department of Energy-Los Alamos Area Office
DX	Dynamic Experimentation (Division)
E	Environmental Science and Waste Technology (Division)
EPA	US Environmental Protection Agency
ER	environmental restoration
ESA	Engineering Sciences and Technology (Division)
ESH	Environment, Safety, and Health (Division)
ESH-1	Health Physics Operations Group
ESH-5	Industrial Hygiene and Safety Group
ESH-18	Water Quality and Hydrology Group
ESH-19	Hazardous and Solid Waste Group
ESH-20	Environmental Assessments and Resource Evaluations Group
FWO	Facility and Waste Operations (Divisions)
FY	fiscal year
HE	high explosives
HRMB	hazardous and Radioactive Materials Bureau
HSWA	Hazardous and Solid Waste Amendments
IS	Industrial Sites (Team)
ISV	in situ vitrification
LANL	Los Alamos National Laboratory
MDA	material disposal area
NFA	no further action
NMED	New Mexico Environment Department
NTISV	nontraditional in situ vitrification
PCB	polychlorinated biphenyl
PRS	potential release site
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RSI	request for supplemental information
SAP	sampling and analysis plan
SSHASP	Site-Specific Health and Safety Plan
SWPPP	Storm Water Pollution Prevention Plan
SWAT	Surface Water Assessment Team
TA	technical area
TCLP	toxicity characteristic leaching procedure
VCA	voluntary corrective action
VCM	voluntary corrective measure

QUARTERLY TECHNICAL REPORT

JULY–SEPTEMBER 1999

LOS ALAMOS NATIONAL LABORATORY

ENVIRONMENTAL RESTORATION PROJECT

ALBUQUERQUE OPERATIONS OFFICE

CONTRACTOR: University of California

PROJECT MANAGER: Julie Canepa

NUMBER OF POTENTIAL RELEASE SITES: Approximately 2,000

POTENTIAL WASTE: Radionuclides, High Explosives, Metals, Organics

1.0 INTRODUCTION

This quarterly report describes the technical status of activities in the Los Alamos National Laboratory (the Laboratory) Environmental Restoration (ER) Project. The activities are divided according to the current focus area structure and then, when applicable, by the technical area (TA) where the specific activity is located. The Hazardous and Solid Waste Amendments (HSWA) portion of the Laboratory's Hazardous Waste Facility Permit (Module VIII, Section P, Task V, C) requires the submission of a technical progress report on a quarterly basis. This report, submitted to fulfill the permit's requirement, summarizes much of the fieldwork and report-writing efforts performed this quarter in the ER Project.

2.0 FOCUS AREAS

2.1 Canyons — Focus Area Leader: Allyn Pratt

2.1.1 Work Plans

The Sandia Canyon/Cañada del Buey Work Plan was completed and submitted to the US Department of Energy (DOE) and the New Mexico Environment Department (NMED) this quarter.

2.1.2 Ongoing Reach Investigations

2.1.2.1 DP Canyon (part of Los Alamos Canyon system)

Focus area personnel completed the DP Canyon reach report ("Evaluation of Sediment and Alluvial Groundwater in DP Canyon") and submitted it to the DOE and NMED this quarter. The report presents the results of sediment and alluvial groundwater investigations conducted during the previous two years. Data from the investigation were used to determine the nature and extent of contamination, revise a conceptual model for contaminant distribution and transport, and assess the potential for human-health and ecological risk under present-day land use.

2.1.2.2 Mortandad Canyon

Analytical data were received for 57 Phase I sediment samples collected in May 1999 in reaches M-3, M-4, TS-1, and TS-2, and focused data validation was performed for these data packages. These data will be used to guide Phase I sampling in downstream reaches (e.g., M-5, TS-3) and to guide Phase II sampling in these four reaches and in upstream reaches (M-1, M-2, E-1).

2.1.2.3 Cañada del Buey (White Rock Land Transfer Parcel)

Analytical data were received for 10 Phase I full-suite sediment samples collected in May 1999 in reach CDB-4 as part of the surface characterization of the White Rock land transfer parcel, and focused data validation was performed for these data packages. These data will be used to narrow the analyte suites for Phase II sampling, which is scheduled for November 1999.

2.1.2.4 Upper Sandia Canyon

Personnel conducted the fourth (and final) quarter of surface water base-flow sampling at six stations in accordance with the Upper Sandia Canyon sampling and analysis plan (Environmental Restoration Project 1998, 62340) in support of the Remedial Actions Focus Area. Final validation of the data is pending.

2.1.2.5 Cañon de Valle

Canyons Focus Area personnel provided geomorphologic mapping and characterization support for sediment sampling activities in Cañon de Valle. This work is in support of the corrective measures study (CMS) plan for the Potential Release Site (PRS) 16-021(c) 260 outfall. Preliminary geomorphologic maps were prepared for reaches CDV-1, upstream of the 260 outfall, and CDV-2, downstream of the 260 outfall. Based on this mapping and associated physical characterization, 137 samples were collected for x-ray fluorescence screening for barium and 34 samples for high-explosive (HE) screening. These screening data, used to select 30 samples for off-site analyses for metals and HE, were collected in September 1999.

2.1.2.6 Groundwater Activities

Measurement of water level in alluvial wells continued in Los Alamos Canyon and Pueblo Canyon. The drilling rig was moved from R-25 to Mortandad Canyon, and Phase II of the installation of R-15 began. As of June 30, 1999, total depth of R-15 was 540 ft in dry Cerros del Rio basalt. As drilling proceeded, a perched zone of saturation was encountered in the basalt at a depth of 646 ft. Using the recovery of water level after bailing for water-quality samples as a slug test, a hydraulic conductivity consistent with silt was obtained for the perching horizon. Data from a transducer placed in the regional zone of saturation prior to well completion suggest a static water-level depth of 964 ft. The well was completed with a single screen in the regional zone of saturation on September 19, 1999; total depth was at 1107 ft in the Puye Formation. Selected core samples from R-9, R-12, and R-25 were submitted for analysis of hydraulic properties.

2.2 Material Disposal Areas — Focus Area Leader: Deba Daymon

2.2.1 General Information for Material Disposal Areas Focus Area

The Material Disposal Area (MDA) core document was submitted to DOE for review and comment on August 16, 1999.

2.2.2 Technical Area Activities

2.2.2.1 TA-21

PRS 21-027(d)-99, NTISV Cold Demonstration. In July, a borehole was drilled through the approximate center of the vitrified product, and a 2-inch diameter core sample was collected from top to bottom of the product. A report on the evaluation of the glass core for homogeneity and quality was received in September.

In July, preparation of the voluntary corrective measure (VCM) report was initiated for the field activities associated with the diesel contamination identified during construction of the simulated absorption bed for the nontraditional in situ vitrification (NTISV) cold demonstration. Analytical results were received in September and are being evaluated. A request for supplemental information (RSI) for the VCM plan was received in late July and will be addressed in the VCM report as agreed by NMED.

NTISV, Hot Demonstration at MDA V. A draft copy of the Interim Measure Plan for the Hot Demonstration at MDA V was submitted to DOE in late July for review. Preparation for the NTISV hot demonstration was initiated in mid-September.

PRS 21-005. Analytical results received from the field investigation of the former nitric acid pit, PRS 21-005, in late July indicated that there had not been a release from the pit. The draft Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) report was completed and submitted to the DOE on September 1, 1999.

PRSs 21-015 (MDA B) and 21-017(a,b,c) (MDA U). Review of the analytical data for these PRSs was completed in early July. Preparation of a sampling and analysis plan (SAP) addendum and data summary for each of these PRSs began in early July. The documents will not be completed until after the strategy for MDAs has been finalized in the TA-54 RFI report and the MDA core document.

PRSs 21-024(f) and C-21-015. The voluntary corrective action (VCA) plan for PRSs 21-024(f) (a septic tank) and C-21-015 (a sump) was submitted to NMED in mid-July. Pre-characterization samples were collected from the steel septic tank and the sump in late July. One sample was collected from the wastewater within the septic tank, and a second sample was collected from the bottom of the septic tank. Samples were submitted for analyses at a fixed-laboratory.

Analytical results from the wastewater sample indicate that the water in the septic tank should be managed as a liquid radioactive waste due to low concentrations of thorium-230 and uranium-234. No organic compounds were detected in the wastewater. Results from the total metals, chemical oxygen demand, total suspended solids, total nitrogen, and pH analyses indicate that the wastewater currently meets all waste acceptance criteria for the TA-50 Liquid Radioactive Waste Treatment Facility.

Results from the soil and sludge samples indicate that at least a portion of the metal tank and concrete septic tank waste stream may require management as a mixed low-level waste. Total concentrations of chromium and mercury in the sludge exceed the corresponding RCRA regulatory levels for toxicity characteristic after application of the 20X rule. One sample was collected and submitted for toxicity characteristic leaching procedure (TCLP) analysis in late September. Radionuclides that were above area soil background levels were plutonium-239/240, uranium-234, radium-224, and radium-226. Low concentrations of volatile and semivolatile organic compounds were detected in both the soil and sludge. A maximum concentration of 20 parts per billion PCBs was detected in the soil within the concrete sump. It is not known how the sludge will be managed. This will be determined after the TCLP results are received.

Based on re-prioritization of FY 2000 work, this VCA has been postponed; therefore, in late September, the site was restored to previous conditions.

PRS 21-029, DP Tank Farm. An RSI was received for the RFI Work Plan, Volume II, DP Tank Farm, in mid-August. A meeting with NMED to discuss the RSI is scheduled for early next quarter.

2.2.2.2 TA-49

PRS 49-001(b,c,d,g), MDA AB, Areas 2, 2A, and 2B. Drafts of the stabilization plan for implementing interim measures and best management practices (BMPs), the BMP completion report, and the interim measures completion report were submitted to NMED on August 30, 1999.

Moisture monitoring at MDA AB was completed for this quarter; the results are included at the end of this report as an attachment.

2.2.2.3 TA-54

The draft RFI report for TA-54 was submitted to DOE for review and comment on September 1, 1999.

The quarterly pore gas monitoring at MDAs G and L was completed as required by Module VIII of the Laboratory's Hazardous Waste Facility Permit.

2.3 Remedial Actions — Focus Area Leader: Warren Neff

2.3.1 High Explosives Production Sites Team

The High Explosives Production Sites Team spent most of the last quarter in fieldwork and report-writing activities.

2.3.1.1 TA-16

Hydrogeology. The field team continued to monitor water levels in the Cañon de Valle alluvial wells and in the intermediate-depth wells. Transient saturation was observed in Martin Spring borehole in July. In September, quarterly samples were collected from Cañon de Valle springs and surface water. Stable isotope samples were collected for precipitation events and during quarterly sampling. In addition, every-other-day water samples (bromide tracer) were collected from the TA-16 springs; no bromide tracer breakthrough was observed. All fourth-quarter results are pending. A geophysics study completed in Cañon de Valle showed both a broad zone of saturation in the center of the canyon and a smaller saturated zone on the south side of the canyon. Geomorphologic mapping in Cañon de Valle was continued. Over 100 screening samples and thirty laboratory samples were collected and analyzed.

PRS 16-021(c) (the 260 outfall). The RFI report and CMS plan for PRS 16-021(c) were approved by NMED during September 1999. Additionally, an addendum to the CMS plan was completed and submitted to NMED on September 30, 1999. This plan was developed to specify requirements for deep drilling at TA-16 in support of determining the nature and extent of contamination of deep groundwater.

An on-site study of zero-valent treatment of HE-contaminated soils was initiated. Planning continued for the source removal interim measure. A meeting with NMED on this interim measure was held in August, and a draft of the interim measure plan was completed.

V-Site. The V-Site VCM report was completed and submitted to NMED on July 30, 1999.

TA-16 Burning Ground VCA. The plan for the VCA at the Burning Ground was completed; this plan is an Appendix to the MDA P Phase II SAP. Both this and the closure plan for the TA-16-387 burn pad were submitted to NMED.

Surface Water. BMPs were inspected and maintained.

2.3.2 Firing Sites Team

2.3.2.1 TA-33

Work continued on the TA-33 segmented gate system VCA. Modifications were made to the site-specific health and safety plan (SSHASP) to allow completion of the TA-33 VCA fieldwork and the geodetic survey at PRS 33-010(c). The waste characterization strategy form for BMP work was revised. The following fieldwork and report-writing activities were completed this quarter:

- The geodetic survey to delineate boundaries at PRS 33-010(c) was conducted.
- The PRS C-33-001 BMP consisting of removing polychlorinated biphenyl (PCB) contaminated sediment from the asphalt area was completed. The 30-day PCB waste storage area was initiated on September 14, 1999.
- The BMP at PRS 33-008(c) consisting of removing debris from the drainage area was completed. Swipes were taken from the debris collected in the 33-008(c) drainage; tritium was detected on some pieces of debris. A satellite storage area was established prior to waste generation to accommodate the mixed waste.
- The addendum to the TA-33 VCA plan was completed. Final approval was obtained on September 27, 1999, and the field team remobilized to TA-33. Oversized material at PRSs 33-007(b) and 33-010(c) was screened. Restoration activities are under way.
- A draft VCA report for this TA-33 SGS project was prepared for peer review; however, based on the analytical results received, it was decided not to submit this report to the Administrative Authority or to request no further action (NFA) for the three PRSs involved. Additional data collection will be required before the extent of contamination at these sites can be determined.

2.3.3 Industrial Sites Team

Industrial Sites (IS) Team personnel attended and participated in a Surface Water Assessment Team (SWAT) meeting and provided updated analytical data packages for PRSs 42-003, 48-003, 48-007(c), and 53-014.

2.3.3.1 TA-3

Upper Sandia Canyon. The IS Team completed collection of fourth-quarter water samples. Validation was completed for a third round of water data. Discussions continued with NMED about the analytical results.

PRS 03-010(a). NMED Hazardous and Radioactive Materials Bureau (HRMB) was contacted to notify them of a road construction project that may impact this disposal site, as well as to discuss outstanding

NMED-HRMB concerns resulting from the review of the RFI report for the site. Coordination activities between ER Project personnel and the construction project coordinator occurred to determine potential impacts on the PRS; these activities included several meetings and a site visit.

PRS 03-056(c). Preparations continue for the VCA at PRS 03-056(c), a transformer storage area located on a steep slope leading to a Sandia Canyon tributary. The VCA will remove PCB-contaminated soil that remains in the area, following an earlier cleanup. Most of the documents required to begin the field activities were completed during this quarter, including the VCA plan, the site-specific health and safety plan, the stormwater pollution prevention plan, the ecological scoping checklist, and the facility tenant agreement. DOE is currently reviewing the VCA plan. Funding for this project is expected to be allocated in fiscal year (FY) 2000.

Best Management Practices. IS Team personnel completed BMP activities at PRS 03-010 (diversion of water from the roadway to an existing drainage channel by installing an asphalt curb) and PRS 03-014(c2) (stormwater runoff/run-on).

2.3.3.2 TA-35

The draft TA-35 integrated SAP was completed and underwent peer review, which determined that the document needs to be reworked to be consistent with the current concepts described in the newly developed Integrated Technical Strategy document (LANL 1999, 63524) and to add elements found in a traditional SAP. The revisions will include specific sampling locations and analytical suites instead of a sampling approach through which sampling locations and analytical suites would have been determined. The team will make revisions for one PRS and/or cluster and have those revisions reviewed before revising the document for all PRSs and/or clusters included in the TA-35 SAP.

2.3.3.3 TA-53

A meeting was held with a representative of NMED-HRMB to discuss and clarify questions regarding the response to the RSI for the work plan and SAP for TA-53. Questions about the collocation model and sampling strategy for the southern impoundment were discussed. The representative has concerns with the eight proposed berm samples around the southern lagoon, and those concerns will be included in a notice of deficiency for the TA-53 work plan. The notice will also include a requirement for sampling the sludge in the tanks at PRSs 53-006(a,b,c,d,e).

Regulating authorities from NMED and the US Environmental Protection Agency (EPA) visited TA-53 field operations September 9, 1999, and were pleased with the BMP activities, which involved the removal of degraded geotextile material at the northern surface impoundment. Discussions were held with the regulators concerning the facility's potable water discharges to the southern surface impoundment.

Field activities at TA-53 have been focused on execution of the 1998 RFI work plan and SAP for consolidated PRS 53-002(a)-99 [PRSs 53-002(a, b), the northern and southern surface impoundments]. The sample collection task in and around the northern surface impoundments and portions of the decommissioned outfall path was completed. The motorized auger tool, which was expected to perform the job of augering to sample depths outlined in the SAP, did not have adequate horsepower; therefore, the SSHASP was upgraded to include drill rigs. This modification increased the budget and duration of the project. The progress of field activities for the quarter is outlined below.

PRS 53-002(a)-99 (Northern and Southern Impoundments). Borehole locations surrounding the northern impoundments were staked and marked for utilities as required by the excavation permit. The

SSHASP was upgraded to include a larger drill rig so samples could be extracted from depths up to 30 ft. Branches and a tree had to be removed in order to access borings on the west side of the impoundments; approval was received from the Laboratory's Ecology Group (ESH-20). During August, 39 samples were collected from 12 locations around both the northern and southern surface impoundments. Sample results are pending.

Northern Impoundment [PRS 53-002(a)]. Analytical results from the 59 samples collected within the northwest surface impoundment in May are still pending; data validation has not yet been completed.

In July, five boreholes were completed within the northeast surface impoundment to a depth of 15 ft, through compacted tuff (to get to unconsolidated tuff). In all, 85 samples were collected from 17 locations at various depths within the northeast surface impoundment. This completes the sampling campaign for the two northern surface impoundment interiors. Validated sample results are pending.

Borehole locations between the northern impoundments were staked and marked for utilities. A total of 39 samples from various depths were collected from 12 locations. Sample results are pending. While drilling at the influent discharge lines between the impoundments, field personnel hit the nearby inactive radioactive liquid waste line. This inactive line contained no liquid. A sample was collected at the depth where the line was hit; results are pending. The facility, the Health Physics Operations Group (ESH-1), and the Industrial Hygiene and Safety Group (ESH-5) were notified.

The area east of the decommissioned outfall from PRS 53-002(a), which was referred to as areas A and B in the TA-53 work plan/SAP, and which is a Los Alamos Canyon tributary, was also sampled in July. Three samples were collected from three locations in area A. Seventeen samples were collected from 10 locations in area B. Sample results are pending.

The decomposed geotextile material remaining in the two northern impoundments was removed in July, as sampling in the impoundments progressed. The used geotextile was transported to TA-54 for disposal as low-level radioactive waste.

Southern Impoundment [PRS 53-002(b)]. In July, the northern and western perimeters of the southern surface impoundment were dry, but the center of the impoundment was still wet and muddy. Jute matting was placed over the northern and western areas of the southern surface impoundment where sludge was dry. Because of additional rain, and potable water added by the TA-53 facility, the southern surface impoundment remains wet to date. Sampling at the berm locations around the southern impoundment began in September with one sample collected at the 1 to 2-ft depth, at which point the drill rig failed. Work was stopped due to budget constraints.

PRSs 53-006(a,b,c,d,e). IS Team personnel continue to work with the facility management at TA-53 to collect samples while the radioactive liquid waste system was upgraded. During the facility upgrade of the radioactive liquid waste tanks (and some pipelines), the IS Team collected 10 samples from 5 potholes below the upgraded pipe tie-ins. Sample results are pending.

2.3.4 Town Sites Team

2.3.4.1 TA-0

The ER Project received correspondence from NMED this quarter regarding PRSs 00-016 and 00-017. A letter of Approval and Concerns addressed the VCA report for PRS 00-016, the small arms firing range; the concerns will be addressed with the NMED-HRMB, and the PRS will be proposed for removal from

the HSWA module. A letter regarding Administrative Completeness and Fee Assessment for the RFI report for PRS 00-017, the hospital waste lines, was also received.

A VCA plan for the DOE Los Alamos Area Office (DOE-LAAO) land transfer tract, covering PRSs 00-003, 00-012, and 00-030(i), has been written and peer reviewed. Responses to comments are currently being incorporated into the plan.

PRS 00-019. The Town Sites Team completed the removal of the pump house and remaining underground lines at the central wastewater treatment plant (PRS 00-019). During the removal of the piping, the team discovered the remains of other treatment plant structures; therefore, work was suspended pending the development of a cost estimate for the expansion in project scope.

PRS 00-030(g). Work began on the RFI report for the old Catholic church septic tank [PRS 00-030(g)]. During the data evaluation and assessment, it was discovered that data were missing and would have to be re-collected. That effort has been completed, and the report preparation will resume once data are received.

A revision to the RSI response for the outfall drainage SAP for PRS 00-030(g) has been prepared and is undergoing internal review.

2.3.4.2 TA-1

The review of all TA-1 PRSs has been suspended after completing the reassessment of historical data. The data gaps, and their potential impacts, have been preliminarily identified. The original conceptual models have been adjusted to reflect the changes in site conditions; a status summary is being prepared.

2.3.4.3 TA-73

The RFI report for PRS Aggregate 73-2 was started. Data analysis and assessment has been completed. Two additional areas of elevated soil contamination have been remediated and confirmation samples have been collected. Once the analytical results are received, the report will be completed.

The authorized limits effort to dispose of waste to be generated at PRS 73-002 (airport incinerator ash) is ongoing. DOE-Albuquerque Operations Office approved the request, and all necessary documentation has been provided to the Colorado Department of Public Health for its consideration for concurrence to allow disposal at a landfill in Adams County, Colorado. Additional concerns are being addressed with the Colorado regulators.

2.3.5 MDA P Closure

Excavation and segregation of soil and debris from the MDA P West Lobe continued. Approximately 6800 yd^3 of soil and debris were excavated this quarter. Total material excavated during FY99 was 18,866 yd^3.

Disposal of nonhazardous soil and debris continued this quarter and disposal of soil containing hazardous waste began. Scrap metal and concrete have been recycled, and a small volume of asbestos and asbestos-containing material was disposed. The total disposal this quarter, in all categories, was 2920 yd^3.

2.4 Analysis and Assessment — Focus Area Leader: Alison Dorries

2.4.1 General Information for Analysis and Assessment Focus Area

The Integrated Technical Strategy document, an interim document describing the ER Project's strategic plan, was revised and submitted to DOE on August 30, 1999.

2.4.2 Team Activities

2.4.2.1 Data Analysis and Assessment Team

The team leader continued participation as a core member of the Integrated Information Management System Team, directing work to cleanup ER Project legacy electronic data using DOE-LAAO land transfer parcel data set as a pilot. Documentation of the data set preparation and screening processes that were followed for the land transfer report was prepared. The task to design new Oracle database tables as a repository for ER Project technical data was initiated. The team leader and team members also participated in focus group meetings for the reengineering of Field Support Facility processes.

The team leader participated in Watershed Integration Team meetings to develop decision criteria for water quality indicators, and attended the first LANL Watershed Management Program Stakeholder Meeting as a representative of the ER Project.

Team members participated in the August revision of the Integrated Technical Strategy document.

Data Quality and Adequacy Task. Team members continued incorporating peer review comments into six routine validation standard operating procedures and revising figures in order to finalize these documents. The final draft of the technical guidance document regarding EPA Method 5035 sampling for volatile organic compounds was prepared.

Modeling Support Task. A preliminary draft of a white paper addressing contaminant profile calculations at aggregate and watershed scales was prepared. The technical paper "Integrated Data Sets for Modeling" was submitted to DOE at the end of July.

2.4.2.2 Risk Analysis and Review Team

Peer Review and Consistency Team. Twenty-one peer reviews were conducted this quarter.

Ecological Risk Team. Team members completed two technical support deliverables this quarter: the Ecorisk database and "General Assessment Endpoints for Ecological Risk Assessment at Los Alamos National Laboratory."

Human Health Risk Team. In the fourth quarter, the Human Health Risk Team delivered a technical support document "Standard Human Health Risk Assessment Scenarios," to DOE. This document summarizes standard human-health-risk exposure scenarios, including standard input parameters and methodology for determining cleanup levels.

2.4.2.3 Strategic Decision Analysis Team

The Strategic Decision Analysis Team accomplished several key programmatic objectives in the final quarter of FY99 in support of the watershed approach to risk-based decision-making. Team members participated in writing the Integrated Technical Strategy document, which outlines how the ER Project

plans to use numerical modeling to support risk-based decisions at various scales defined by the environmental system potentially affected by one or more sources of contamination.

The team completed three successful modeling applications that focused on the watershed approach to remediation: surface-water modeling of North Ancho Canyon (using the SPLASH code), erosion modeling of Lower Pajarito Canyon (using the KinEros code), and groundwater modeling of the Los Alamos/Pueblo watershed (using the FEHM code).

In addition, the Strategic Decision Analysis Team made progress in enhancing the standard groundwater modeling framework for MDAs (with emphasis on MDA G) by incorporating vapor-phase diffusion to account for volatile organic compound behavior in the vadose zone (using the FEHM code). The standard MDA process-level (i.e., pathway-specific) models were abstracted into a single system model of MDAs, again focusing on MDA G in support of the RFI for that site. The system model (using the RIP code) was used to support calculations of future risk due to potential release and transport of contaminants from MDA G. A decision-analytic approach was then used to apply the same model to MDAs H and L, in support of the RFI for these two sites. This approach is documented in the MDA core document, which was submitted to the DOE in August for comments.

2.5 Regulatory Compliance— Focus Area Leader: Tori George

2.5.1 Team Activities

2.5.1.1 Communication and Outreach Team

The Communications and Outreach Team completed several activities this quarter in conjunction with the Northern New Mexico Citizens' Advisory Board (CAB). Members of the team participated in the CAB monthly meetings and presented to the CAB a draft copy of the Citizens' Tool Kit to the ER Project, which provides an overview of the Project and its regulations. The team also provided a set of watershed maps. A presentation on Acid Canyon contamination and a tour of TA-50, TA-35, and Mortandad Canyon were also coordinated.

In addition to the tour for the CAB, the team organized the following tours:

- a tour of MDA B at TA-21, TA-21-011(k), and MDA P for the Laboratory's Integrated Safety Management Team;
- a tour of RFI sites at TA-16 for staff from NMED-HRMB; and
- a tour of various ER sites for staff from EPA Region 6.

Members of the team provided information to Los Alamos County residents living near the Sombrillo Nursing Facility (located in the eastern part of Los Alamos) regarding the cleanup at the nearby decommissioned wastewater treatment plant. Staff members from the ER Project met with the Sombrillo Nursing Facility Board of Directors on August 25, 1999, to provide a status report on the cleanup activity.

Other outreach activities this quarter included the following:

- Presented information on the Native American Risk Scenario to tribal leaders at San Ildefonso Pueblo.
- Assisted in planning a location for the opening ceremonies for the Wildlife Refuge scheduled for October 30, 1999.

- Assisted with planning the Laboratory's 10th Community Environmental Meeting, held July 14, 1999, at Fuller Lodge; the subject of the meeting was "Cancer Trends in Los Alamos County 1973–1997."
- Coordinated an ER Project poster session for the Laboratory's Student Sustainability Workshop.
- Coordinated an ER Project poster session for the University of California President's Council ES&H Review Panel; the posters included information on the watershed approach and MDA P.

The Communications and Outreach Team completed the web-based development, design, and publishing of the ER Project's Potential Release Site Database

Land Transfer Activities. The final ER land transfer report was delivered to DOE Headquarters, DOE-Albuquerque Operations Office, and DOE-LAAO this quarter. The team provided land transfer updates to the CAB ER Subcommittee in July and at the CAB monthly meetings in August and September. Team members participated in a tour of land transfer parcels presented by Los Alamos County and San Ildefonso Pueblo representatives.

2.5.1.2 Deliverables Tracking and Consistency Team

Team members continued data entry into the PRS database and continued tracking regulatory deliverables. Various reports were generated in support of the Baseline effort and permit renewal. Final database design was completed and the PRS database web application was deployed on the ER internal home page. Team members were involved in three peer reviews for records management and contracts.

Future Deliverables. Members of the team continued the ongoing effort to determine all regulatory obligations and to work with NMED to categorize and proceed on those obligations. As a result, two Class I requests for permit modification were submitted to address work that could not be completed in FY99, as stated on the Work Schedule. Team members prepared and displayed a chart for ER personnel indicating all fourth quarter FY99 deliverables and their associated status. Work continued on the Future Deliverables Database currently under development.

Closeout for PRSs. Documentation for 150 closeout files was completed and checked for accuracy. Team members continued the ongoing effort to establish master PRS files for the ER Project in support of future closeout efforts.

2.5.1.3 ER Policy and Guidance Team

Personnel from DOE-LAAO completed the second review of the Permit Renewal Package. Comments were resolved and incorporated into the final document, and the package was distributed on September 17, 1999, to the DOE-LAAO and NMED-HRMB. Staff from the ER Project and HRMB tentatively agreed to meet frequently to discuss and resolve issues directly relevant to renewal of the Laboratory's Hazardous Waste Facility Permit.

Work continued on the response to, and follow-up on, Compliance Order 98-01, which addresses the DP Tank Farm at TA-21. On August 9, 1999, the Laboratory received an RSI on the TA-21-029 RFI Work Plan, Vol. II, which was submitted to HRMB in response to the compliance order. ER Project personnel began compiling the response and requested an extension to the thirty-day turn-around time.

Members of the team continued working with facility managers, the office of Deputy Director for Laboratory Operations, and Environment, Safety, and Health (ESH) Division, focusing on Laboratory

integration to enhance environmental protection and compliance. On July 7, 1999, a meeting was held with the Secretary of the NMED; the Laboratory's Deputy Director for Operations; and Division Directors for ESH, Facility and Waste Operations (FWO), and Environmental Science and Waste Technology (E) Divisions to discuss environmental work at the Laboratory and potential roadblocks to that work. Team members continued working with the Deputy Director of Operations' Environmental Working Group and as members of the Policy Subteam to develop environmental milestones for the Laboratory's Integrated Safety Management Program and to discuss participation in the NMED's self-assessment program regarding regulatory compliance.

In addition to institutional issues, the team worked to integrate significant facility-specific issues such as the planned sediment retention ponds at TA-54. The team worked with personnel from the Decontamination and Decommissioning (D&D) Project, the Water Quality and Hydrology Group (ESH-18), and the Hazardous and Solid Waste Group (ESH-19) on issues related to the ponds to ensure there will be no unacceptable impacts to TA-54 operations or to other planned E/ER activities at TA-54 or within the watersheds. Lastly, the team continued working with other focus areas to support completion of the Integrated Technical Strategy (ER Project 1999, 63524), which, in part, implements the baseline.

Team members provided regulatory assistance for the following ER Project activities:

- Development of a position for a "contained-out" determination for certain wastes generated from the closure of MDA P (a contained-out determination indicates that certain potentially contaminated media do not contain a hazardous waste). Such a determination by HRMB would provide greater flexibility and economy in treatment and disposal options without compromising environmental protection. Contained-out determinations may also be applicable for the planned interim measure and CMS at the TA-16-260 outfall.

- In an effort to identify a path forward for TA-16-260 media contaminated with HE, identification of a process for determining whether the wastes were reactive as defined by Title 20, Chapter 4, Part 1, Subpart II of the New Mexico Administrative Code and the RCRA. This determination is necessary to help ensure safety in handling, treating, or shipping these wastes and to maintain compliance.

- Investigation of temporary authorization for waste management at TA-16-260.

- Development of closure plans for the flash pad at TA-16-387 and the oil burn tray at TA-16-394.

- Identification of an acceptable and compliant path forward for corrective action at the TA-53 surface impoundments. A portion of the radioactive liquid waste collection system at TA-53 is planned for reuse as part of the new radioactive liquid waste treatment facility under construction.

- Dynamic Experimentation (DX) Division regulatory analysis of their planned activities and impacts on waste management/corrective action issues for the Nevada Test Site.

- Development of the in situ vitrification (ISV) interim measure plan and analysis of the ISV cold-demonstration report.

- Review of various ER Project documents and the NMED document entitled "Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Assessment."

In support of ER Project training activities, a team member arranged for EPA internet briefings on the topics of Field Analysis of PCBs and Monitored Natural Attenuation.

2.5.1.4 Regulatory Integration and Operations Team

Team members provided assistance with regulatory compliance issues for activities within the ER Project this quarter. Personnel provided regulatory reviews of documents prepared by the ER Project and participated in peer reviews. Deployed personnel from ESH-19 participated in the reviews as subject matter experts regarding hazardous and solid waste issues, and personnel working in the clean water compliance area provided guidance regarding water issues. Documents receiving reviews included RFI reports, an interim measure plan, the Integrated Technical Strategy document, voluntary corrective action plans and reports, an internal standard operating procedure, a closure plan, sampling and analysis plans, reach reports, a well completion report, and a response to a request for supplemental information. Monthly meetings with NMED continued as well as meetings regarding special topics such as permit modification and VCAs.

Team personnel continued information gathering, meetings, and site visits with NMED to address NFAs proposed in previous requests for permit modification but require additional documentation and/or sampling. Each site requires additional research and in many instances a site visit to clarify outstanding issues. To date, 25 recommendations for NFA have been approved for removal from the HSWA module, 10 require additional information and a subsequent cursory review by NMED, and 42 have been withdrawn.

Members of the team also researched and visited sites to be recommended for NFA for the first time. As a result of these efforts, three RFI reports for first-time NFAs were prepared and transmitted to DOE.

Clean Water Compliance. Team members met with the Watershed Management Core Team to continue efforts to revise sections of the Draft Watershed Management Plan (LANL 1999, 62920) that address sampling procedures, chemicals of potential concern, and information management. Discussions were initiated to consider what actions will be taken when watershed analytical indices are exceeded; these discussions will have implications to the completion of ER watershed reports. A Watershed Management Program meeting was held in mid-September to update stakeholders on the status of the program and to listen to their concerns.

The Surface Water Assessment Team meetings were held this quarter to continue discussions of surface water related issues, including the status of the TA-35 SAP, the watershed/aggregation approach, and NMED Surface Water Quality Bureau's Clean Water Action Plan. Recommendations for BMPs were made based on Surface Water Site Assessments for TAs-8, -9, -48, and -53.

Other clean water compliance activities included the following.

- Completed the remaining field visits to complete surface-water site assessments and Ecorisk assessments for work-off sites.
- Attended an all-day inspection with the Enforcement Branch of the EPA on July 12th to inspect facility BMPs and to review the associated Storm Water Pollution Prevention Plans (SWPPPs). The inspection included a tour of TA-54 MDA G and the construction-related D&D of the TA-3 service station.
- Continued meetings with the Los Alamos County Solid Waste Management Unit Working Group to discuss common issues associated with Townsite projects. Updates were provided for progress at the Central Wastewater Treatment Facility (PRS 00-019), Tar Site (PRS C-00-041), Airport (PRS 03-002), and Bayo Canyon.

- Reviewed and commented on the TA-21 Site Drainage Plan SWPPP. The D&D Project has developed a SWPPP to address drainage concerns at TA-21, which will be modified as individual sites are addressed.

- Completed annual compliance evaluations at three areas with site-specific SWPPPs: MDA AB at TA-49, MDA P at TA-16, and the TA-16 CMS (16-260 outfall). All sites passed the inspection and had no findings of noncompliance.

- Completed the FY99 Annual BMP Inspection Report, which summarizes all BMP installations, inspection, and maintenance activities for FY99.

- Participated in a readiness review for TA-33 BMP implementation.

- Provided final comments and edits on Standard Operating Procedure 2.01, "Surface Water Site Assessments," which is now available on the ER internal Web site.

Waste Management Activities. Team members reviewed and provided comments on waste characterization strategy forms and waste profile forms. Regulatory support continued for the MDA P project.

Natural Resource Damage Assessment Activities. A representative of the Regulatory Integration and Operations Team continued to work on National Resource Damage Assessment issues. The team member participated in Interagency Wildfire Management Team meetings and represented the ER Project on the focus team for development of the Laboratory Implementation Requirement (LIR 404-30-02.0), and the Laboratory Implementation Guidelines addressing the National Environmental Policy Act and biological and cultural resources.

Support to Focus Areas. Personnel from the Regulatory Integration and Operations Team are deployed to the operational focus areas to provide support regarding regulatory issues. In addition to providing general regulatory compliance assistance this quarter, such as reviewing documents, attending operational focus area meetings, and participating in peer reviews for operational focus area documents, the deployed members of the team assisted with the following tasks in the operational focus areas.

Canyons Activities. The deployed regulatory generalist assigned to the Canyons Focus Area provided support by submitting field notification for sampling activities in upper Sandia Canyon. The team member also submitted three waste profile forms and coordinated the disposal of two roll-off bins of R-25 drill cuttings at the Los Alamos County landfill.

MDA Activities. The deployed regulatory generalist assigned to the MDA Focus Area participated in numerous meetings regarding the success of the NTISV cold demonstration and the pending NTISV hot demonstration at MDA V, which is scheduled for November 1999. Other activities included assisting with preparation of several documents, such as the draft interim measures plan for the NTISV hot demonstration; the RSI for the DP Tank Farm Work Plan, Volume II; the TA-49 Data Summary Report, which was submitted to DOE; and the TA-54 RFI report.

In support of field activities, the team member completed waste management and stormwater inspections at TA-49 and supervised the BMP maintenance activities to repair storm damage to the cap on MDA AB. The team member also prepared and submitted to NMED numerous 10-day sampling notifications and a notification letter regarding the cessation of work at PRS 21-024(f) (an inactive septic system) because of the decreased priority of the site.

Remedial Actions Activities. The deployed regulatory generalist assigned to the Remedial Actions Focus Area participated in meetings, including discussions regarding the strategy for the interim measure at the TA-16-260 outfall and the requirements and interpretation of the Toxic Substances Control Act Mega Rule. Site visits/tours this quarter included observing BMP activities at TA-33, accompanying the DOE Oversight Bureau to TA-21 and MDA P, accompanying DOE-LAAO to TA-53 impoundments, and discussing impacts of West Connector Road at PRS 03-010(a).

Peer reviews as well as internal reviews were conducted for VCA, CMS, and interim measures plans; a VCA report; a CMS progress report; a data summary report; and fact sheets. The deployed member also provided input for the VCA/VCM report format.

Additional activities/tasks associated with the TA-16-394 Closure Plan were conducted; these activities included information/history research, a site tour with personnel from the Engineering Sciences and Applications Division (ESA), and preparation of several sections of the Closure Plan.

3.0 REFERENCES

Environmental Restoration Project, March 27, 1998. "Sampling and Analysis Plan for Upper Sandia Canyon," Los Alamos National Laboratory Report LA-UR-98-4893, Los Alamos, New Mexico. (Environmental Restoration Project 1998, 62340)

LANL (Los Alamos National Laboratory), August 1999. "Integrated Technical Strategy," Los Alamos National Laboratory Report LA-UR-99-3506, Los Alamos, New Mexico. (LANL 1999, 63524)

LANL (Los Alamos National Laboratory, February 9, 1999. "Draft Watershed Management Plan," Los Alamos National Laboratory report, Los Alamos, New Mexico. (LANL 1999, 62920)

Attachment

TA-49 Soil Water Content Measurements

Attachment

WORK RELEASE 99-0011, TASK 8

TA-49 SOIL WATER CONTENT MEASUREMENTS

On September 8 and 9, 1999, neutron logs were performed at ten different boreholes over the two-day period at TA-49, Material Disposal Area (MDA) AB. A CPN 503DR Hydroprobe Moisture Depth Probe was used to perform these measurements per the draft Departmental Operating Procedure (DOP)-54G-23, R.0 (Newell, 1999), currently being finalized for subsurface investigations at Technical Area (TA)-54. See Table 1 for a list of the ten boreholes and a brief description of each. Figure 1 illustrates the borehole locations.

The first step of the measurement process was to obtain a standard count in an area >30 ft away from radioactive or hydrogen sources. Performing a standard count involves placing the probe on the metal plate located on the lid of the carrying case and requesting the standard count from the instrument. The standard count was measured and recorded each day in the field notebook.

The basic setup for a measurement involves positioning the surface assembly on the exposed casing above a borehole and deploying the instrument and cabling from the surface assembly into the borehole. After the instrument is at the desired depth, the start button in pressed and the instrument counts for 16 seconds. The instrument measures 32 counts in the 16-second interval and then displays the average count. The measurement locations and corresponding average counts were recorded in the field notebook. Measurements were taken at one-foot intervals.

Table 1. Borehole Descriptions

Borehole Number	Casing Type	Borehole Diameter (in)	Borehole Depth (ft)
49-2907	Double steel casing to 25 ft, single steel after 25 ft.	6	155
49-2906	Double steel casing to 25 ft, single steel after 25 ft	6	155
TH-3	4" Sch. 40 PVC at surface only	5	112
TH-4	4" Sch. 40 PVC at surface only	5	92
TH-5	4" Sch. 40 PVC at surface only	5	107
2BY	2" Sch. 40 PVC	2	33
2AY	2" Sch. 40 PVC	2	28
2AO	2" Sch. 40 PVC	2	62
TH-2	4" Sch. 40 PVC at surface only	5	106
TH-1	4" Sch. 40 PVC at surface only	5	114

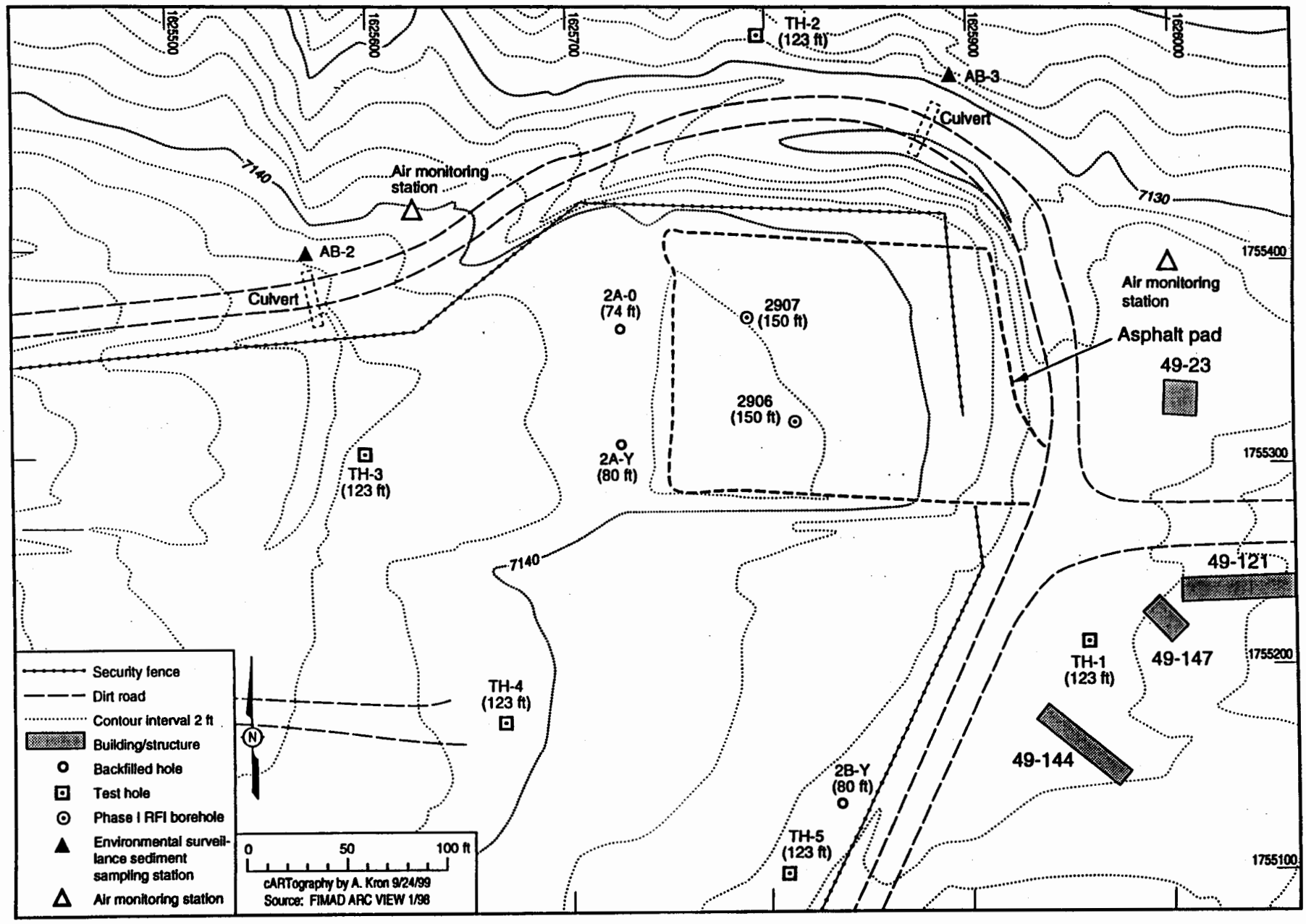


Figure 1. Monitoring hole locations at MDA AB.

The recorded depths and counts were entered into a spreadsheet and then were converted to volumetric water contents. It is important to note what calibration equation was used to convert raw counts to a volumetric water content. In previous reports produced by the EES-15, the same linear calibration equation was used to convert counts to a volumetric-water content for all boreholes. Their equation was based on a 1994 and more recently a 1998 calibration procedure which used barrels filled with crushed tuff of know bulk density and moisture content. The neutron probe was then used to detect counts through a 6.4 cm access tube located in the center of the barrel. The resulting counts divided by the standard count were then correlated to the known moisture contents to achieve a linear calibration equation (Nyhan, Martinez, and Langhorst, 1994, 44015.1).

Since both borehole diameter and casing type affect the relationship between detected slow neutron flux and media moisture content, it is our opinion that different equations should be used for boreholes with different diameters and different casing types. For example a borehole that is cased with PVC has an elevated hydrogen content that should be factored into the count / moisture content calibration. Therefore we have applied calibrations consistent with the Performance Assessment Monitoring Program at TA-54 that meets industry standards. In 1996, a calibration was performed at Area G for the Performance Assessment Monitoring Program that created a relationship between neutron counts and moisture content. To establish the relationship, the neutron counts of 5" and 9" uncased boreholes were correlated to the gravimetric moisture contents and bulk densities of the core samples removed from the respective boreholes (Newell, 1999). Since Boreholes TH-1, TH-2, TH-3, TH-4, and TH-5 are approximately 5" in diameter and were found to have only a short PVC surface casing (less than 5'), the 5" uncased borehole calibration equation was used for these boreholes. For Boreholes 2BY, 2AY, and 2AO, calibration functions supplied by Campbell Pacific Nuclear Corporation were used for the appropriate pipe configuration (CPN Corp., 1983). The completion details of Boreholes 2906 and 2907 are not sufficiently known to apply a calibration. Therefore we suggest that raw counts be reported and subsequent results be trended with time. The raw data for these boreholes when compared to others in the area indicate that the double casing in the upper 25' is too dense and neutrons are not penetrating beyond the borehole casings. This would account for the lack of a characteristic moisture spike from recent infiltration that was noted in all other boreholes at TA-49 and TA-54. Further discussion of calibration process and trend analysis will be included in the white paper currently being prepared. Table 2 outlines the calibration equations used for each of the boreholes.

Prior to conducting the next round of moisture monitoring, the exact well construction details for all ten boreholes will be verified to confirm that the correct calibration equations are being used. Details of well construction such as the precise depths to which the PVC casings extend, the depths to which the double steel casings extend, and the size and schedule of both the steel and PVC casings used will be verified. This information can then be applied to the raw count date to calibrate near surface measurements in 2BY, 2AY, and 2AO. Other calibration changes can be made, as necessary. Since bentonite or drill mud may exist in 49-2906 and 49-2907, we do not anticipate that an appropriate calibration can be developed.

Appendix A includes raw count data, volumetric moisture contents, and a plot of moisture content vs. depth for each of the boreholes.

Table 2. Calibration equations used to convert counts to moisture contents

Borehole Number	Calibration Equation Applied
49-2907	NA
49-2906	NA
TH-3	$0.0002 * counts^{1.3404}$
TH-4	$0.0002 * counts^{1.3404}$
TH-5	$0.0002 * counts^{1.3404}$
2BY	(count/stdcount)*29.0912-1.2361
2AY	(count/stdcount)*29.0912-1.2361
2AO	(count/stdcount)*29.0912-1.2361
TH-2	$0.0002 * counts^{1.3404}$
TH-1	$0.0002 * counts^{1.3404}$

NA = No applicable calibration

References

CPN Corporation, June 16, 1983. *501 Depthprobe Density/Moisture Gauge Operating Manual.* (CPN Corp., 1983)

Newell, Dennis, September 1999. SWO. *Subsurface Moisture Measurements Using Neutron Probes: Draft Version DOP-54G-23, R.0.* (Newell, 1999)

Nyhan, J.W., J.L. Martinez, G.J. Langhorst, October 1994. Calibration of Neutron Moisture Gauges and Their Ability to Spatially Determine Soil Water Content in Environmental Studies: LA-12831. Los Alamos, NM. (Nyhan, Martinez, and Langhorst, 1994, 44015.1)

APPENDIX A

Raw Count Data

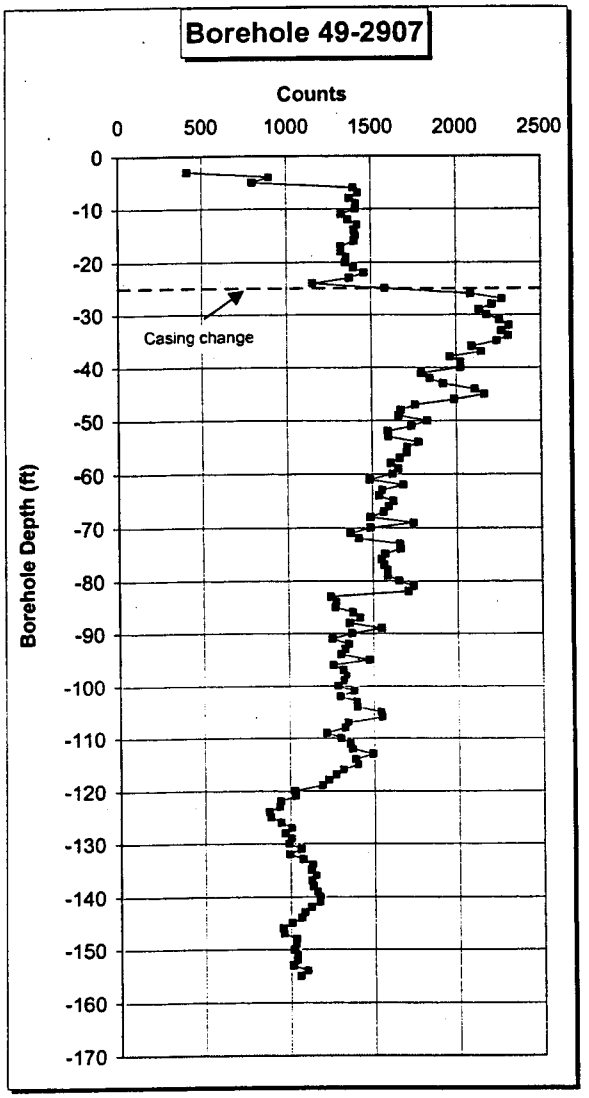
Volumetric Moisture Contents

Plots of Moisture Content vs. Depth

Borehole 49-2907

Notes: Casing up 3.0 ft, 8" outside casing and 6" inside casing to 25 ft., steel casing after 25 ft.
s = 6887, ps = 6893, chi = 0.97

Depth (ft)	Counts
3	414
4	898
5	798
6	1399
7	1427
8	1376
9	1414
10	1410
11	1327
12	1368
13	1424
14	1403
15	1411
16	1403
17	1324
18	1324
19	1355
20	1349
21	1397
22	1462
23	1374
24	1155
25	1583
26	2089
27	2274
28	2214
29	2138
30	2184
31	2259
32	2314
33	2271
34	2311
35	2243
36	2095
37	2150
38	1965
39	2030
40	2029
41	1795
42	1845
43	1924
44	2112
45	2169
46	1990
47	1757
48	1673
49	1660
50	1829
51	1735
52	1595
53	1599
54	1776
55	1709
56	1707
57	1664
58	1612
59	1656
60	1621



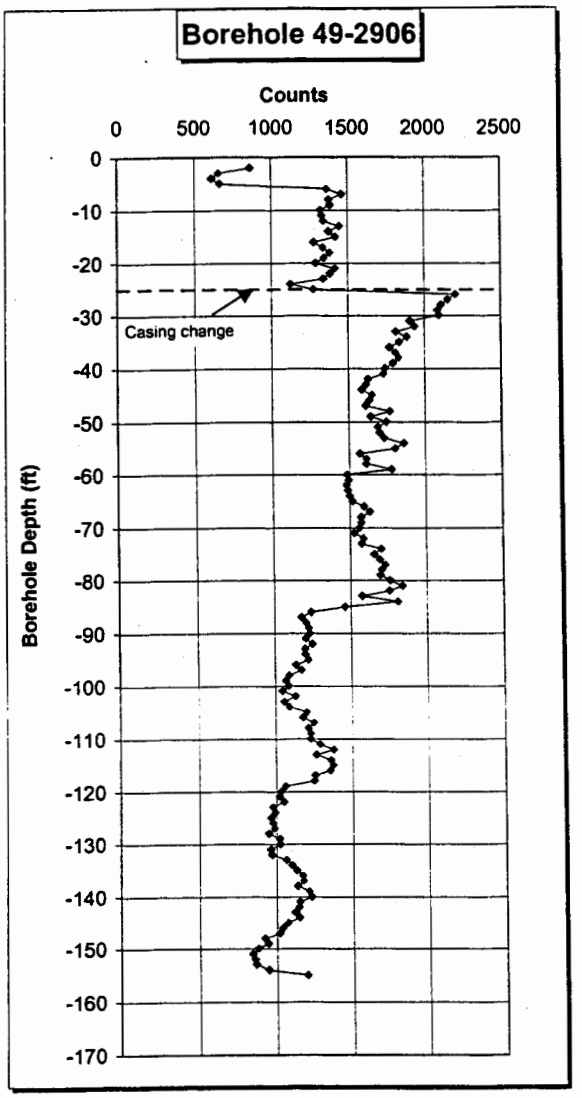
Depth (ft)	Counts
61	1487
62	1685
63	1559
64	1541
65	1627
66	1599
67	1569
68	1490
69	1744
70	1491
71	1371
72	1421
73	1663
74	1666
75	1574
76	1552
77	1568
78	1589
79	1588
80	1656
81	1741
82	1711
83	1251
84	1283
85	1278
86	1383
87	1425
88	1362
89	1550
90	1376
91	1259
92	1358
93	1334
94	1309
95	1478
96	1261
97	1323
98	1343
99	1326
100	1290
101	1387
102	1304
103	1402
104	1405
105	1545
106	1552
107	1351
108	1331
109	1219
110	1305
111	1361
112	1374
113	1495
114	1392
115	1406
116	1318
117	1274
118	1229
119	1192
120	1029

Depth (ft)	Counts
121	1032
122	947
123	940
124	877
125	887
126	948
127	1010
128	972
129	1010
130	993
131	1065
132	998
133	1077
134	1131
135	1123
136	1152
137	1126
138	1135
139	1159
140	1175
141	1174
142	1123
143	1083
144	1066
145	1009
146	956
147	962
148	1035
149	1034
150	1020
151	1040
152	1037
153	1013
154	1100
155	1057

Borehole 49-2906

Notes: Casing up 1.3 ft, 8" outside casing and 6" inside casing to 25 ft., steel casing after 25 ft.
s = 6887, ps = 6893, chi = 0.97

Depth (ft)	Counts
2	865
3	660
4	613
5	668
6	1366
7	1462
8	1380
9	1387
10	1324
11	1332
12	1345
13	1447
14	1376
15	1421
16	1280
17	1340
18	1385
19	1346
20	1290
21	1418
22	1385
23	1342
24	1123
25	1274
26	2205
27	2154
28	2111
29	2089
30	2096
31	1907
32	1938
33	1814
34	1886
35	1836
36	1770
37	1811
38	1831
39	1795
40	1740
41	1729
42	1629
43	1615
44	1586
45	1653
46	1636
47	1612
48	1770
49	1643
50	1747
51	1690
52	1700
53	1730
54	1859
55	1804
56	1570
57	1613
58	1611
59	1779
60	1485



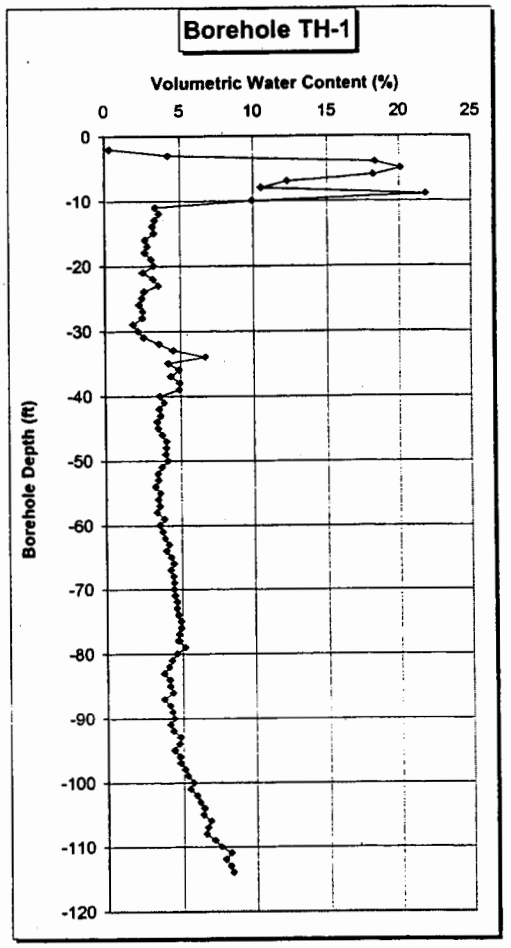
Depth (ft)	Counts
61	1496
62	1481
63	1490
64	1500
65	1518
66	1592
67	1630
68	1573
69	1575
70	1563
71	1528
72	1587
73	1575
74	1703
75	1656
76	1693
77	1729
78	1705
79	1694
80	1758
81	1840
82	1754
83	1573
84	1810
85	1460
86	1239
87	1174
88	1205
89	1224
90	1230
91	1202
92	1246
93	1197
94	1198
95	1219
96	1137
97	1172
98	1090
99	1069
100	1088
101	1045
102	1132
103	1058
104	1092
105	1205
106	1178
107	1250
108	1214
109	1231
110	1229
111	1291
112	1378
113	1263
114	1360
115	1373
116	1356
117	1256
118	1249
119	1062
120	1032

Depth (ft)	Counts
121	1020
122	1050
123	978
124	993
125	964
126	978
127	987
128	949
129	1020
130	1024
131	962
132	970
133	1064
134	1101
135	1131
136	1169
137	1175
138	1137
139	1212
140	1229
141	1150
142	1146
143	1121
144	1148
145	1073
146	1039
147	1018
148	921
149	944
150	879
151	844
152	858
153	864
154	946
155	1199

Borehole TH-1

Notes: Casing up 1.7 ft., 4" pvc casing at surface only, 5" borehole
s = 6924, ps = 6887, chi = 1.09

Depth (ft)	Counts	Moisture Content (%)
2	262	0.35
3	1690	4.24
4	5041	18.36
5	5399	20.13
6	5013	18.22
7	3738	12.30
8	3331	10.54
9	5742	21.86
10	3187	9.93
11	1417	3.35
12	1500	3.62
13	1412	3.33
14	1361	3.17
15	1389	3.26
16	1194	2.66
17	1252	2.84
18	1192	2.66
19	1334	3.09
20	1377	3.22
21	1148	2.53
22	1370	3.20
23	1483	3.56
24	1167	2.58
25	1125	2.46
26	1064	2.28
27	1142	2.51
28	1132	2.48
29	920	1.88
30	1031	2.19
31	1155	2.55
32	1488	3.58
33	1770	4.51
34	2378	6.71
35	1672	4.18
36	1884	4.91
37	1721	4.35
38	1899	4.96
39	1886	4.92
40	1494	3.60
41	1583	3.89
42	1486	3.57
43	1514	3.66
44	1437	3.41
45	1454	3.47
46	1542	3.75
47	1627	4.03
48	1622	4.02
49	1610	3.98
50	1648	4.10
51	1529	3.71
52	1447	3.45
53	1462	3.49
54	1392	3.27
55	1496	3.60
56	1453	3.47
57	1486	3.57
58	1424	3.37
59	1575	3.86
60	1478	3.55

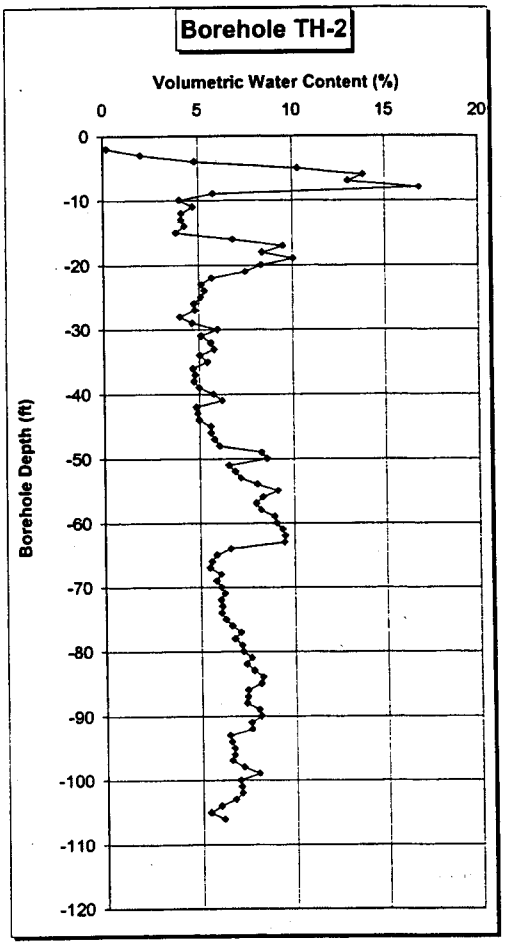


Depth (ft)	Counts	Moisture Content (%)
61	1540	3.75
62	1582	3.88
63	1667	4.17
64	1612	3.98
65	1705	4.29
66	1756	4.47
67	1694	4.26
68	1748	4.44
69	1760	4.48
70	1753	4.46
71	1771	4.52
72	1813	4.66
73	1812	4.66
74	1836	4.74
75	1890	4.93
76	1891	4.93
77	1847	4.78
78	1830	4.72
79	1966	5.20
80	1802	4.62
81	1711	4.31
82	1644	4.09
83	1540	3.75
84	1656	4.13
85	1663	4.15
86	1721	4.35
87	1539	3.74
88	1662	4.15
89	1711	4.31
90	1739	4.41
91	1663	4.15
92	1726	4.36
93	1862	4.83
94	1837	4.75
95	1740	4.41
96	1843	4.77
97	1854	4.80
98	1943	5.12
99	1999	5.31
100	2100	5.68
101	2036	5.45
102	2167	5.92
103	2221	6.12
104	2301	6.42
105	2275	6.32
106	2413	6.84
107	2365	6.66
108	2331	6.53
109	2482	7.10
110	2589	7.52
111	2768	8.22
112	2673	7.84
113	2758	8.18
114	2801	8.35

Borehole TH-2

Notes: Casing up 1.8 ft., 4" pvc casing at surface only, 5" borehole
s = 6924, ps = 6887, chi = 1.09

Depth (ft)	Counts	Moisture Content (%)
2	168	0.19
3	958	1.98
4	1857	4.81
5	3276	10.30
6	4082	13.84
7	3899	13.01
8	4729	16.85
9	2132	5.79
10	1616	4.00
11	1830	4.72
12	1645	4.09
13	1644	4.09
14	1693	4.25
15	1558	3.80
16	2408	6.82
17	3084	9.50
18	2814	8.40
19	3215	10.05
20	2797	8.34
21	2577	7.47
22	2105	5.70
23	1947	5.13
24	1999	5.31
25	1941	5.11
26	1837	4.75
27	1846	4.78
28	1609	3.97
29	1804	4.63
30	2182	5.98
31	1944	5.12
32	2088	5.63
33	2137	5.81
34	1923	5.05
35	2040	5.46
36	1819	4.68
37	1852	4.80
38	1830	4.72
39	1908	4.99
40	2120	5.75
41	2246	6.21
42	1862	4.83
43	1885	4.91
44	1902	4.97
45	2078	5.60
46	2079	5.60
47	2135	5.80
48	2205	6.06
49	2785	8.29
50	2855	8.57
51	2333	6.54
52	2420	6.87
53	2494	7.15
54	2721	8.03
55	2994	9.13
56	2796	8.33
57	2703	7.96
58	2771	8.23
59	2948	8.95
60	2971	9.04

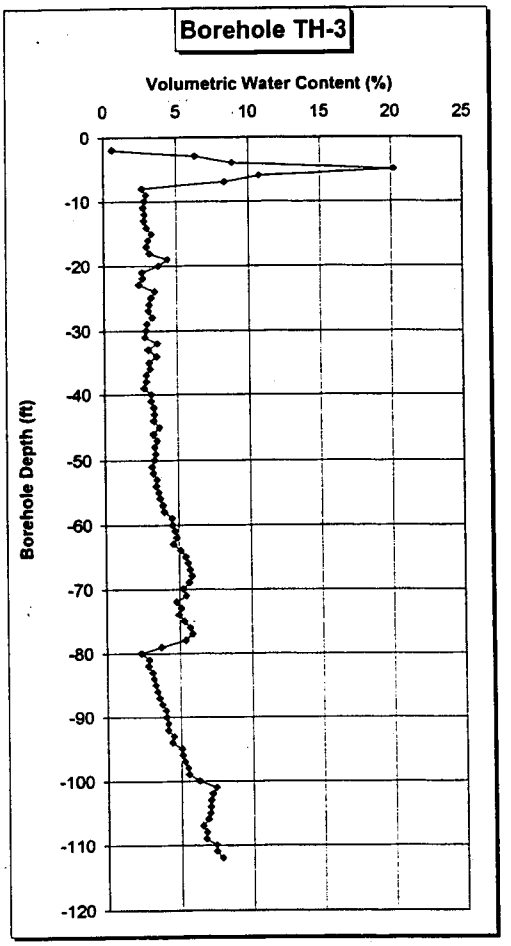


Depth (ft)	Counts	Moisture Content (%)
61	3050	9.36
62	3084	9.50
63	3075	9.47
64	2349	6.60
65	2148	5.85
66	2080	5.60
67	2048	5.49
68	2208	6.07
69	2144	5.84
70	2209	6.08
71	2261	6.27
72	2204	6.06
73	2223	6.13
74	2208	6.07
75	2273	6.31
76	2360	6.64
77	2477	7.08
78	2394	6.77
79	2493	7.14
80	2506	7.19
81	2625	7.66
82	2555	7.38
83	2655	7.77
84	2776	8.25
85	2752	8.16
86	2571	7.45
87	2564	7.42
88	2551	7.37
89	2719	8.03
90	2745	8.13
91	2611	7.60
92	2620	7.64
93	2311	6.45
94	2335	6.54
95	2373	6.69
96	2375	6.70
97	2342	6.57
98	2501	7.18
99	2714	8.01
100	2449	6.98
101	2466	7.04
102	2471	7.06
103	2379	6.71
104	2179	5.97
105	2023	5.40
106	2225	6.13

Borehole TH-3

Notes: Casing up 1.9 ft, 4" pvc casing at surface only, 5" borehole
s = 6887, ps = 6893, chi = 0.97

Depth (ft)	Counts	Moisture Content (%)
2	402	0.62
3	2272	6.31
4	2925	8.85
5	5416	20.21
6	3382	10.75
7	2795	8.33
8	1190	2.65
9	1277	2.92
10	1237	2.79
11	1214	2.72
12	1247	2.82
13	1225	2.76
14	1292	2.96
15	1391	3.27
16	1313	3.03
17	1280	2.92
18	1346	3.13
19	1725	4.36
20	1536	3.73
21	1176	2.61
22	1192	2.66
23	1109	2.41
24	1460	3.49
25	1375	3.22
26	1344	3.12
27	1313	3.03
28	1405	3.31
29	1280	2.92
30	1261	2.87
31	1230	2.77
32	1505	3.63
33	1304	3.00
34	1491	3.59
35	1325	3.06
36	1346	3.13
37	1254	2.84
38	1256	2.85
39	1206	2.70
40	1365	3.19
41	1360	3.17
42	1420	3.36
43	1436	3.41
44	1410	3.33
45	1533	3.72
46	1403	3.31
47	1483	3.56
48	1431	3.40
49	1448	3.45
50	1417	3.35
51	1370	3.20
52	1391	3.27
53	1472	3.52
54	1453	3.46
55	1507	3.64
56	1540	3.75
57	1595	3.93
58	1616	4.00
59	1779	4.55
60	1782	4.55

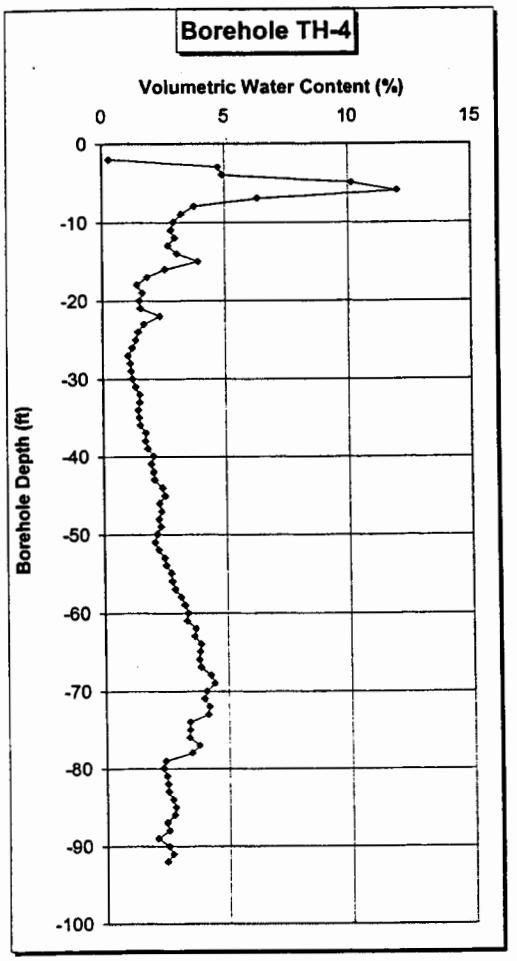


Depth (ft)	Counts	Moisture Content (%)
61	1836	4.74
62	1869	4.86
63	1798	4.61
64	1940	5.11
65	2037	5.45
66	2080	5.60
67	2118	5.74
68	2158	5.89
69	2104	5.69
70	1981	5.25
71	2040	5.46
72	1853	4.80
73	1943	5.11
74	1895	4.95
75	2000	5.32
76	2111	5.72
77	2156	5.88
78	2021	5.39
79	1531	3.72
80	1081	2.33
81	1263	2.87
82	1242	2.81
83	1341	3.11
84	1367	3.19
85	1401	3.30
86	1441	3.43
87	1486	3.57
88	1536	3.73
89	1616	4.00
90	1621	4.01
91	1661	4.15
92	1654	4.12
93	1772	4.52
94	1734	4.39
95	1931	5.07
96	1933	5.08
97	1985	5.27
98	2042	5.47
99	2059	5.53
100	2250	6.23
101	2556	7.39
102	2492	7.14
103	2461	7.02
104	2452	6.99
105	2445	6.96
106	2407	6.82
107	2312	6.46
108	2381	6.72
109	2366	6.66
110	2549	7.36
111	2556	7.39
112	2658	7.78

Borehole TH-4

Notes: Casing up 1.6 ft, 4" pvc casing at surface only, 5" borehole
s = 6887, ps = 6893, chi = 0.97

Depth (ft)	Counts	Moisture Content (%)
2	225	0.28
3	1834	4.73
4	1886	4.92
5	3242	10.16
6	3677	12.03
7	2275	6.32
8	1539	3.74
9	1370	3.20
10	1270	2.89
11	1238	2.80
12	1286	2.94
13	1196	2.67
14	1316	3.03
15	1587	3.90
16	1152	2.54
17	892	1.80
18	732	1.38
19	824	1.62
20	774	1.49
21	793	1.54
22	1079	2.33
23	844	1.67
24	752	1.43
25	715	1.34
26	655	1.19
27	581	1.01
28	620	1.11
29	634	1.14
30	652	1.18
31	699	1.30
32	770	1.48
33	770	1.48
34	743	1.41
35	758	1.45
36	776	1.49
37	864	1.73
38	852	1.69
39	889	1.79
40	968	2.01
41	933	1.91
42	968	2.01
43	977	2.04
44	1093	2.37
45	1129	2.47
46	1050	2.24
47	1080	2.33
48	1039	2.21
49	1067	2.29
50	1013	2.14
51	977	2.04
52	1029	2.18
53	1118	2.44
54	1138	2.50
55	1205	2.70
56	1214	2.72
57	1254	2.84
58	1333	3.09
59	1381	3.24
60	1419	3.36

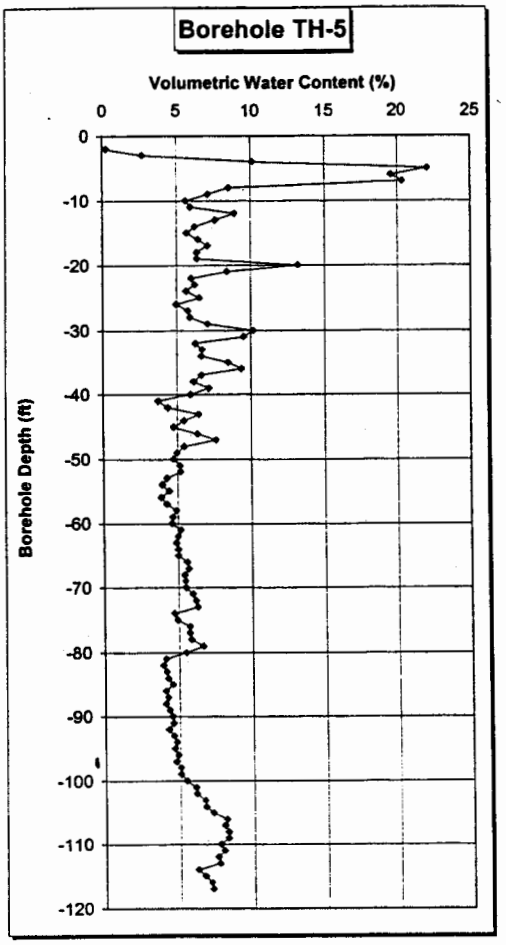


Depth (ft)	Counts	Moisture Content (%)
61	1406	3.32
62	1517	3.67
63	1502	3.62
64	1581	3.88
65	1571	3.85
66	1556	3.80
67	1575	3.86
68	1699	4.27
69	1746	4.43
70	1641	4.08
71	1616	4.00
72	1677	4.20
73	1661	4.15
74	1429	3.39
75	1426	3.38
76	1423	3.37
77	1548	3.77
78	1449	3.45
79	1100	2.39
80	1068	2.29
81	1113	2.42
82	1129	2.47
83	1135	2.49
84	1194	2.66
85	1232	2.78
86	1211	2.71
87	1108	2.41
88	1142	2.51
89	977	2.04
90	1137	2.49
91	1195	2.67
92	1112	2.42

Borehole TH-5

Notes: Casing up 1.9 ft, 5" open hole, s = 6924, ps = 6887, chi = 1.09
s = 6924, ps = 6887, chi = 1.09

Depth (ft)	Counts	Moisture Content (%)
2	197	0.24
3	1196	2.67
4	3240	10.15
5	5786	22.09
6	5294	19.61
7	5445	20.36
8	2846	8.53
9	2488	7.13
10	2080	5.60
11	2177	5.96
12	2936	8.90
13	2619	7.63
14	2252	6.23
15	2106	5.70
16	2316	6.47
17	2484	7.11
18	2291	6.38
19	2290	6.38
20	3941	13.20
21	2813	8.40
22	2188	6.00
23	2249	6.22
24	2093	5.65
25	2334	6.54
26	1901	4.97
27	2120	5.75
28	2158	5.89
29	2478	7.09
30	3245	10.17
31	3089	9.52
32	2254	6.24
33	2381	6.72
34	2366	6.66
35	2827	8.46
36	3052	9.37
37	2365	6.66
38	2223	6.13
39	2494	7.15
40	2163	5.91
41	1529	3.71
42	1726	4.36
43	2311	6.45
44	2037	5.45
45	1835	4.74
46	2288	6.37
47	2614	7.61
48	2036	5.45
49	1900	4.96
50	1829	4.72
51	1959	5.17
52	1966	5.20
53	1695	4.26
54	1598	3.94
55	1743	4.42
56	1575	3.86
57	1693	4.25
58	1881	4.90
59	1807	4.64
60	1789	4.58

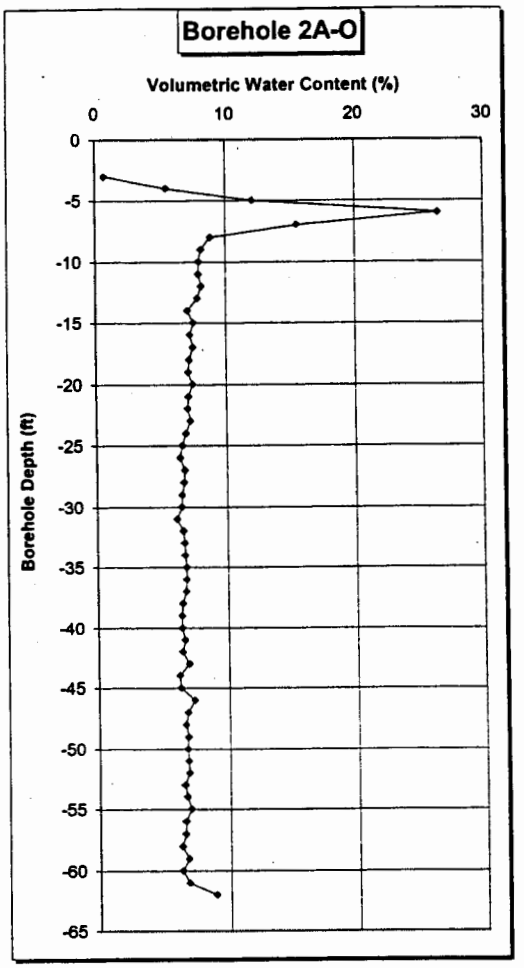


Depth (ft)	Counts	Moisture Content (%)
61	1967	5.20
62	1908	4.99
63	1873	4.87
64	1911	5.00
65	1913	5.01
66	2080	5.60
67	2110	5.71
68	2028	5.42
69	2044	5.48
70	2049	5.49
71	2178	5.96
72	2237	6.18
73	2270	6.30
74	1828	4.71
75	1882	4.90
76	2120	5.75
77	2118	5.74
78	2147	5.85
79	2366	6.66
80	2045	5.48
81	1650	4.11
82	1592	3.92
83	1656	4.13
84	1690	4.24
85	1781	4.55
86	1641	4.08
87	1687	4.23
88	1641	4.08
89	1719	4.34
90	1773	4.52
91	1790	4.58
92	1702	4.28
93	1791	4.59
94	1851	4.79
95	1810	4.65
96	1881	4.90
97	1839	4.75
98	1924	5.05
99	1924	5.05
100	2033	5.44
101	2206	6.06
102	2220	6.12
103	2371	6.68
104	2388	6.74
105	2511	7.21
106	2749	8.15
107	2711	7.99
108	2778	8.26
109	2770	8.23
110	2639	7.71
111	2703	7.96
112	2596	7.54
113	2624	7.65
114	2239	6.19
115	2363	6.65
116	2476	7.08
117	2502	7.18

Borehole 2A-O

Notes: Casing up 3.1 ft, 2" PVC
s = 6924, ps = 6887, chi = 1.09

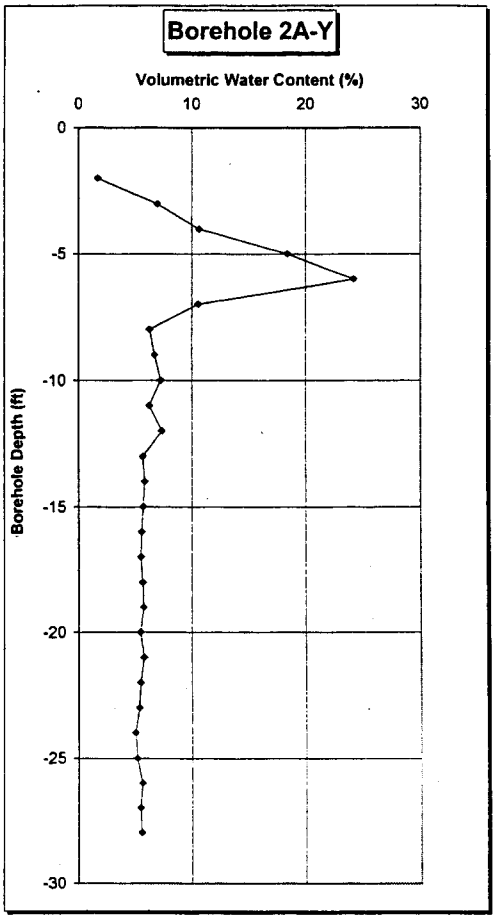
Depth (ft)	Counts	Moisture Content (%)
3	465	0.72
4	1601	5.49
5	3172	12.09
6	6605	26.52
7	3993	15.54
8	2407	8.87
9	2234	8.15
10	2196	7.99
11	2188	7.96
12	2238	8.17
13	2163	7.85
14	1986	7.11
15	2091	7.55
16	2030	7.29
17	2079	7.50
18	2010	7.21
19	1988	7.12
20	2067	7.45
21	1994	7.14
22	1974	7.06
23	2022	7.26
24	1934	6.89
25	1865	6.60
26	1825	6.43
27	1911	6.79
28	1893	6.72
29	1859	6.57
30	1845	6.52
31	1758	6.15
32	1875	6.64
33	1893	6.72
34	1901	6.75
35	1923	6.84
36	1927	6.86
37	1911	6.79
38	1847	6.52
39	1831	6.46
40	1831	6.46
41	1881	6.67
42	1835	6.47
43	1954	6.97
44	1780	6.24
45	1800	6.32
46	2046	7.36
47	1925	6.85
48	1881	6.67
49	1923	6.84
50	1905	6.77
51	1925	6.85
52	1933	6.88
53	1853	6.55
54	1893	6.72
55	1966	7.02
56	1865	6.60
57	1857	6.57
58	1794	6.30
59	1915	6.81
60	1800	6.32
61	1925	6.85
62	2412	8.90



Borehole 2A-Y

Notes: Casing up 1.6 ft, 2" PVC
s = 6924, ps = 6887, chi = 1.09

Depth (ft)	Counts	Moisture Content (%)
2	703	1.72
3	1960	7.00
4	2833	10.67
5	4674	18.40
6	6066	24.25
7	2807	10.56
8	1800	6.32
9	1905	6.77
10	2034	7.31
11	1788	6.27
12	2057	7.41
13	1657	5.72
14	1691	5.87
15	1667	5.77
16	1629	5.61
17	1619	5.57
18	1651	5.70
19	1669	5.77
20	1609	5.52
21	1679	5.82
22	1615	5.55
23	1581	5.41
24	1502	5.07
25	1540	5.23
26	1643	5.67
27	1607	5.52
28	1629	5.61



Borehole 2B-Y

Notes: Casing up 1.6 ft, 2" PVC
s = 6924, ps = 6887, chi = 1.09

Depth (ft)	Counts	Moisture Content (%)
2	750	1.92
3	3198	12.20
4	1942	6.92
5	1938	6.91
6	1663	5.75
7	1718	5.98
8	1685	5.84
9	1754	6.13
10	1744	6.09
11	1869	6.62
12	1798	6.32
13	1855	6.56
14	1752	6.12
15	1712	5.96
16	1770	6.20
17	1663	5.75
18	1609	5.52
19	1730	6.03
20	1706	5.93
21	1625	5.59
22	1645	5.67
23	1893	6.72
24	1583	5.42
25	1570	5.36
26	1589	5.44
27	1550	5.27
28	1552	5.28
29	1577	5.39
30	1597	5.47
31	1651	5.70
32	1804	6.34