#1
6/5/96

Department of Energy

Albuquerque Operations Office
Los Alamos Area Office
Los Alamos, New Mexico 87544

Kim

JUN 3 - 1996

Ms. Teri Davis
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2044 Galisteo St., Bldg. A
P. O. Box 26110
Santa Fe, NM 87505

Dear Ms. Davis:

Confirming our discussions with you, a meeting with the New Mexico Environment Department (NMED) Hazardous and Radioactive Materials Bureau (HRMB) to present the proposed Los Alamos National Laboratory (LANL) Groundwater Protection Strategy, attachment 1 (enclosed), is set for June 6, 1996, at the HRMB conference room, 2044 Galisteo Street, Santa Fe, at 9:30 a.m. Our proposed agenda for the meeting is shown on Attachment 2 (enclosed). The Department of Energy (DOE) and LANL have invited Ms. Marcy Leavitt of the Ground Water Quality Bureau, and Mr. Jim Piatt of the Surface Water Quality Bureau to attend this meeting as both bureaus have applicable regulatory standards, and coordination during development of the Hydrogeologic Workplan is necessary. The NMED DOE Oversight Bureau has also been invited as this bureau participates on the LANL Groundwater Technical Review Committee.

The enclosed LANL Groundwater Protection Strategy establishes our goals for protecting groundwater, and surface water influenced by groundwater inflow. The strategy sets the stage for the ongoing Data Quality Objective Planning Process that is determining the needs, priorities, and phased activities to implement the NMED requested site-wide Hydrogeologic Workplan. The workplan is targeted for completion in September 1996. DOE and LANL have requested this meeting to review our proposed strategy and receive NMED comments.

Following this meeting, DOE and LANL will request a meeting during the fourth week of June to review the detailed activities proposed in the LANL site-wide Hydrogeologic Workplan to ensure compliance with Resource Conservation and Recovery Act groundwater monitoring requirements and the Hazardous and Solid Waste Amendments Permit hydrogeologic requirements.

HSWA LANL 6/17/96

12805

TC

If you have any comments or questions, please contact Ken Zamora of my staff at (505) 665-5047.

Sincerely,

Joseph C. Vozella
Assistant Area Manager
Office of Environment and Projects

LAAMEP:7KZ-009

Enclosures

cc w/enclosures:
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Attachment 1
DRAFT
LOS ALAMOS NATIONAL LABORATORY
GROUND WATER PROTECTION STRATEGY
JUNE 3, 1996

PURPOSE

This strategy provides a basis and direction for ground water protection at Los Alamos National Laboratory (Laboratory), and serves as a guide for the development of a Hydrogeologic Workplan (Workplan). The Workplan will describe ground water protection activities, with an emphasis on monitoring and characterization, that fulfill regulatory requirements (federal and state) derived from the Resource Conservation and Recovery Act (RCRA) and the Hazardous and Solid Waste Amendments (HSWA) to RCRA. The Workplan will also encompass hydrogeologic activities that satisfy institutional objectives found in the Laboratory's Ground Water Protection Management Program (GWPMP) Plan, many of which share the same need for monitoring and characterization information required by RCRA/HSWA. Thus, this strategy also provides direction for implementation of the GWPMP Plan. This strategy not only provides a common vision of ground water protection principles, but will help to guide discussions between the Laboratory, Department of Energy (DOE), New Mexico Environment Department (NMED), other regulators and stakeholders.

This strategy is the foundation for the Workplan, which will provide integrating documentation of the Laboratory's coordination of cost-effective, current and planned activities to understand and protect the hydrogeologic environment. These integrated Laboratory activities will be documented in the Workplan, with specific details regarding their contribution to ground water protection in descriptive text and referenced activities, e.g. Environmental Surveillance Program, Environmental Restoration Project activities. The Workplan will define the activities necessary to meet the goals of this strategy, primarily focusing on the hydrogeologic monitoring and characterization activities deemed necessary to comply with RCRA/HSWA regulatory requirements, including those described by current permit language, and further described by recent regulatory correspondence. Any similar or GWPMP-specific hydrogeologic activities necessary for compliance with DOE Order 5400.1 (10 CFR 834), New Mexico Water Quality Control Commission Regulations (20 NMAC 6), Natural Resource Trusteeship, and other applicable regulations will be incorporated in the Workplan for the sake of comprehensive integration, ensuring the avoidance of actual (or perceived) duplication of effort, but will not be viewed as subject to RCRA/HSWA review, approval and/or implementation.

and the occurrence of saturated flow in response to hydrologic events or discharges of liquids. There are at least three modes of ground water occurrence beneath the Pajarito Plateau (Figures 2, 3), the first two of which occur in the vadose zone: (1) ground water in alluvium in some canyons, (2) perched intermediate ground water (ground water above a less permeable layer that is

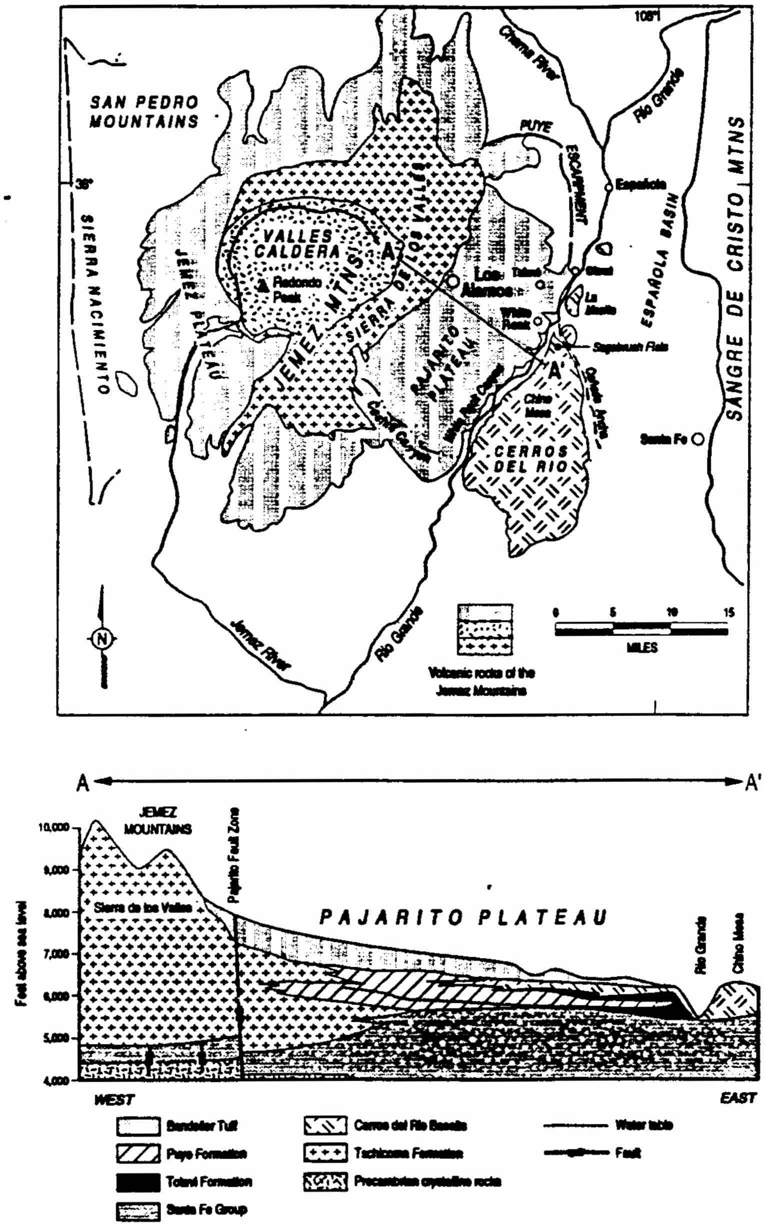


Figure 1. General geographic location, topographic features, and simplified geologic units in the vicinity of Los Alamos, NM.

separated from the underlying ground water by an unsaturated zone at intermediate depths (150-400 ft), and (3) the regional aquifer, which is separated from the upper ground water by hundreds of feet of tuff, basalts and volcanic

CONTEXT FOR STRATEGY DEVELOPMENT

Background

The Laboratory is administered for the DOE by the University of California. Since its inception in 1943, the principal mission of the Laboratory has been the design, development, and testing of weapons for the nation's nuclear arsenal. This effort is supported by research programs in nuclear physics, hydrodynamics, conventional explosives, chemistry, metallurgy, radiochemistry, and biology. In addition to the weapons program, Laboratory personnel are involved in medium energy physics; space nuclear systems; controlled thermonuclear fusion; laser research; environmental research; geothermal, solar, and fossil energy research; nuclear safeguards; computer science; biomedical research; and space physics. In 1992, the Laboratory expanded its mission to include development of new programs in three nationally significant areas for which it has special capabilities: health and biotechnology, environmental technologies, and industrial partnerships.

Research and development facilities are located in 33 active Technical Areas (TAs) across the 43 mile^2 Laboratory site, which rests on the Pajarito Plateau on the eastern flank of the Jemez Mountains (Figure 1). The Pajarito Plateau consists of a series of fingerlike mesas separated by deep canyons containing ephemeral and intermittent streams that run from west to east (Figures 2, 3). Mesa tops range in elevation from approximately 7,800 ft. on the flank of the Jemez Mountains to about 6,200 ft. at their eastern termination above the Rio Grande valley. The eastern margin of the plateau stands 300 to 900 ft. above the Rio Grande. Underlying the plateau is a thick sequence of volcanic rock i.e. pyroclastic flow and pumice fall (Bandelier Tuff) that emanated from the Jemez Mountains. Two major volcanic eruptions in the Jemez Mountains occurred about 1.6 and 1.2 million years ago, producing widespread and voluminous ash flow sheets. The latest eruption in the Jemez Mountains occurred about 60,000 years ago. These volcanic rocks are interfingered with sedimentary and volcanic rocks deposited in the Rio Grande Rift. These deposits, include the Santa Fe Group, which is made up of poorly consolidated sands, clays, and gravels, and the Puye formation, which is made up of volcanic sediments. These deposits are important because the regional aquifer occurs in them. Depth to the regional aquifer beneath Laboratory sites ranges from 600 to 1200 ft. (Figure 2).

The zone between the mesa tops and the top of the regional aquifer is a *vadose zone*, , which is defined as that portion of the geologic profile beneath the earth's surface and above the first principal water-bearing aquifer. This zone should not be thought of an unsaturated zone however, because flow in the vadose zone occurs and is dynamic, with periods of unsaturated flow, partial saturated flow

sediments in the western portion of the Laboratory, with the vadose zone becoming thinner to the east. The intermediate perched ground water occurrence is controlled by the stratigraphic variations at the base of the Bandelier Tuff and in the underlying conglomerates and basalts.

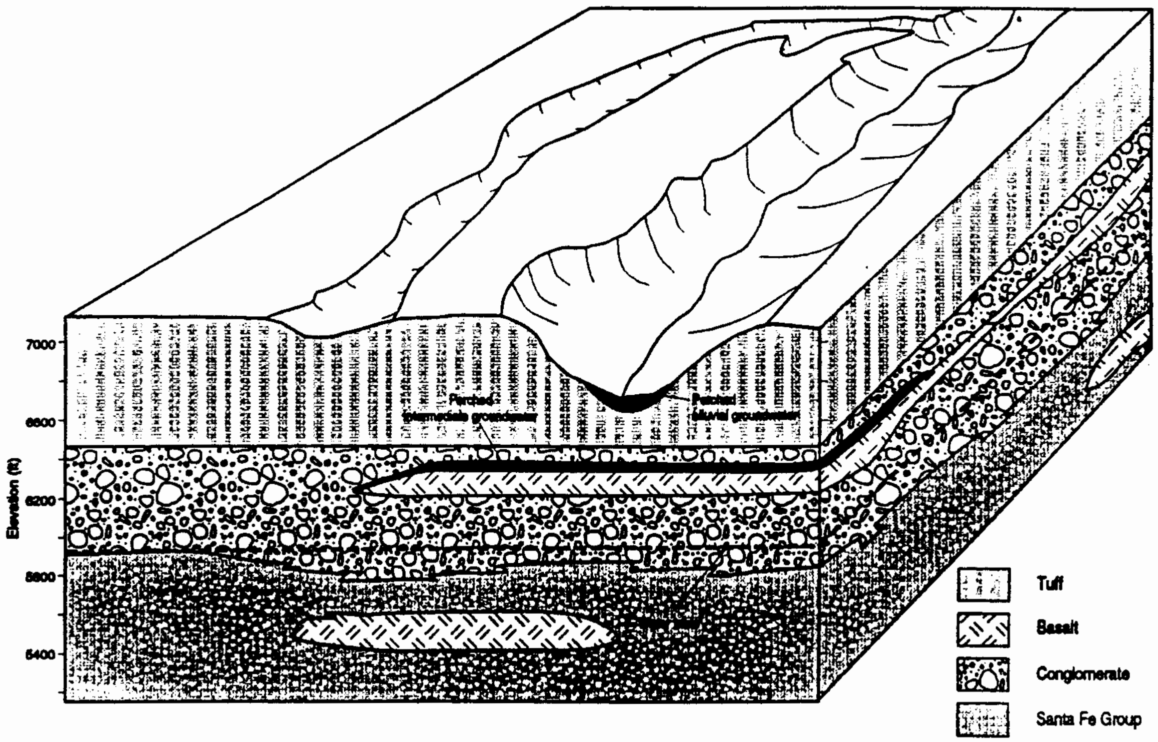


Figure 2. Generalized conceptual illustration of geologic-hydrologic relationships in the Los Alamos area

Later in this document, the specific goals of this strategy will be addressed. A comprehensive set of water quality standards, to be applied to each of these three ground water zones, is proposed. The strategy states that application of these standards will vary according to the particular ground water zone, and the beneficial uses that water in that zone can support. In certain instances, a ground water zone may even serve as a source for surface water, and specific standards relevant to surface water will be applied. Two terms, used in the strategy that follows, require definition. The term, *ground water* is defined as: interstitial water which occurs in saturated earth material and which is capable of entering a well in sufficient amounts to be utilized as a water supply. The second term, *subsurface water* is defined as ground water and water in the vadose zone that may become ground water or surface water in the reasonably foreseeable future or may be utilized by vegetation.

IF IT'S ALREADY GW THAN HOW CAN IT BECOME GW

The majority of Laboratory TAs are located on mesa tops, and the activities occurring at the TAs over the past 50 years have included manufacturing, machining, testing and disposing of high explosives; creating, machining, and testing radioactive materials; storage of chemical and transuranic waste; disposal of low level radioactive solid waste; machining, plating, and disposing of metal

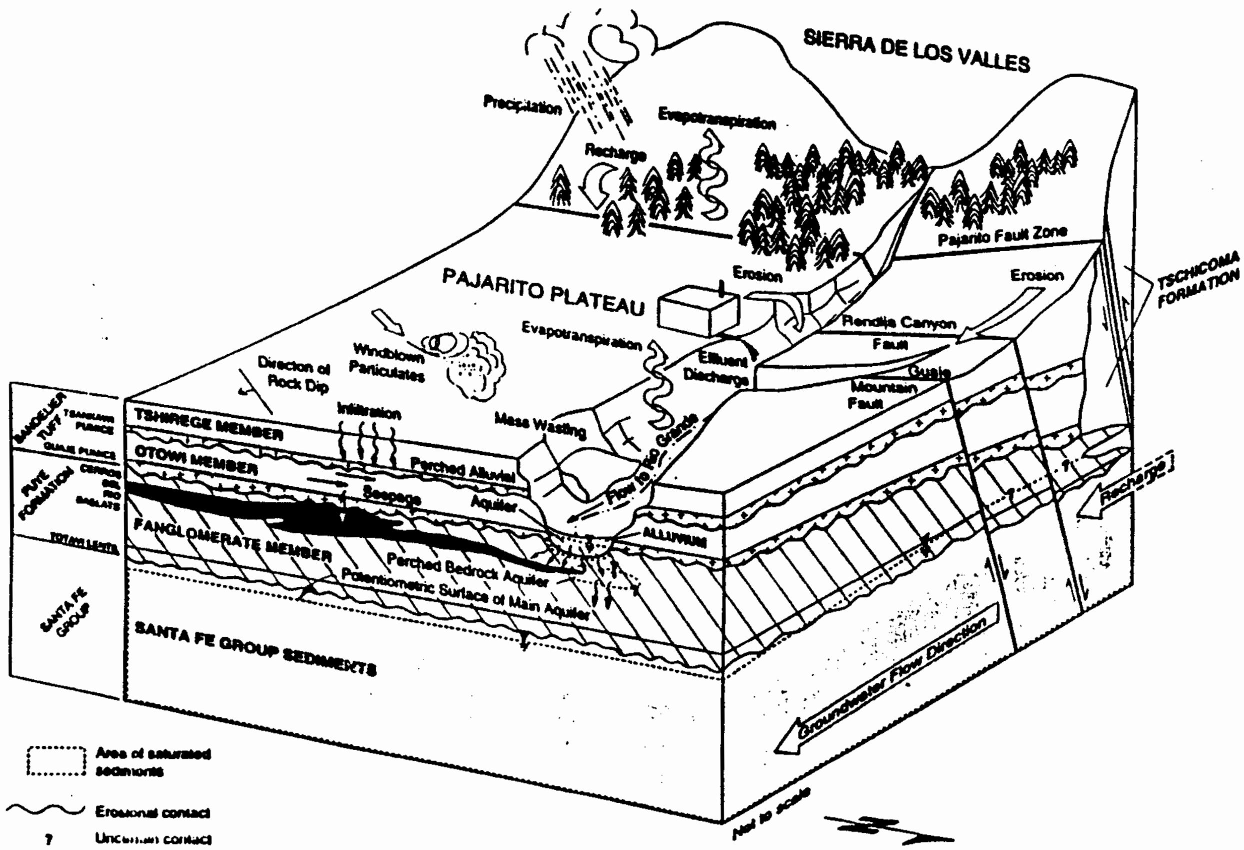


Figure 3. Conceptual geohydrologic model and general relation of major geologic units for Operable Unit 1071 on the Pajarito Plateau, Los Alamos, NM. (From Aldrich et al., 1992.)

waste-related materials; use of underground storage tanks for petroleum products; use of septic tanks for sewage; use of lagoons for storage and disposal of sewage and industrial liquid waste; disposal of solid-type waste in piles, pits, and shafts; and discharge of liquid effluents onto the mesa top. Laboratory activities in the canyon bottoms include discharge of liquid sewage and industrial effluents; use of lagoons for storage and disposal of sewage and industrial liquid waste; discharge of radioactive liquid waste; testing of explosives and assembled devices; and operation of laboratory facilities, including nuclear reactors. The sites where releases of radioactive and hazardous materials have the potential to occur is documented in RCRA Facility

The specific concerns regarding characterization of the regional aquifer beneath the Laboratory have been summarized by the New Mexico Environment Department in correspondence dated August 17, 1995 as follows:

> "Basic geology, hydrogeology, and pathways for contaminant transport have not been adequately addressed to date. At present, the following fundamental hydrogeologic issues/questions remain unresolved at LANL:
>
> • Individual zones of saturation beneath LANL have not been adequately delineated, and the 'hydraulic interconnection' between these is not understood. A facility-wide description of the hydrogeologic characteristics affecting ground-water flow beneath the facility cannot be made without adequate delineation of the perched-intermediate aquifer(s) beneath LANL.
>
> • The recharge area(s) for the main and perched-intermediate aquifers have not been identified. It is unknown at this time if any significant quantity of water is recharging the main aquifer through fracture-fault zones which occur on the Pajarito Plateau. Characterization of these site-wide fault zones as potential pathways for aqueous migration is not complete. It is unknown what effect, if any, these zones may have on the direction of ground-water flow and hydraulic gradient of the main and perched-intermediate aquifers.
>
> • The ground water flow direction(s) of the main aquifer and perched-intermediate aquifer(s), as influenced by pumping of production wells is unknown.
>
> • Aquifer characteristics cannot be determined without additional monitoring wells installed within specific intervals of the various aquifers beneath the facility. Locations of wells designed for aquifer testing cannot be addressed adequately without the delineation of individual zones of saturation beneath LANL."

In addition to characterization and contamination issues, the water quantity available for beneficial use in the regional aquifer is also a concern. Long-term projections of water availability and potability in the aquifer cannot be made at present, due to a lack of detailed data. Water level declines due to municipal pumping may exceed 2.4 feet per year at some locations. The total usable quantity (and quality) of stored water in the regional aquifer, as well as its rate of replenishment (i.e. recharge), have not been quantified. In addition, water quality in the Guaje and former Los Alamos well fields, as well as at San Ildefonso Pueblo located on the east side of the Laboratory, has unacceptably high arsenic levels. These high natural levels are suspected to be caused by

Investigation (RFI) Work Plans and other reports prepared by the Laboratory's Environmental Restoration (ER) Project.

Although present Laboratory activities are regulated by federal and state environmental requirements and permits, some of the earlier activities took place in the 1940's, 1950's and 1960's prior to comprehensive regulations, and therefore they present possible human health or environmental risks. The potential impacts from these earlier Laboratory activities are the subject of characterization, assessment, risk-modeling, and as necessary, remediation under the Laboratory's ER Project, which is regulated by the HSWA module of the RCRA permit. Within the permit, approximately half of the Potential Release Sites (PRS is an acronym for Solid Waste Management Units [SWMUs] and Areas of Concern [AOCs]) identified from previous Laboratory activities, are listed. The remaining PRSs are identified on the Laboratory's PRS list. The goal of the ER Project is to characterize and assess each PRS so as to ultimately remove it from the HSWA permit, or remove it from the Laboratory PRS list, acknowledging that the site no longer represents a threat to human health or the environment. In addition, the present Laboratory activities, although regulated and permitted, must also be assessed and monitored to determine if adequate human health and environmental protection is ensured.

<u>Concerns</u>

Laboratory activities may have resulted in contaminant releases in solid, liquid, or gaseous form. Laboratory sites on the mesa tops may have released contaminants into the underlying tuff, which forms the vadose zone above ground water. In the vadose zone below the mesas, vapor transport of contaminants has been documented. Fractures in the vadose zone may play a role in transport, where the fractures are open and the site either received large volumes of water, mobilizing contaminants, or produced gaseous by-products that were transported via vapor-transport. Soils and tuff on the mesa tops or sediments in the canyon bottoms may be sites where contaminants can be retained, and serve as secondary sources that have the potential to continue to release contaminants into the environment. Within the canyons, contaminants in the sediment can be transported downstream by surface water flow, and may impact alluvial ground water (Figure 3). In locations where an intermediate ground water zone underlies the alluvial ground water, contaminants may be transported between the two zones. From all of the above-mentioned sources and pathways, there is the potential that contaminants can be transported to the deeper regional aquifer.

ALREADY DOCUMENTED

poorer quality water being drawn into wells from deeper portions of the aquifer. Without additional data, future water management decisions regarding the development and production of potable water from the regional aquifer, will be seriously compromised.

Basic understanding of the hydrogeology of the vadose zone and the regional aquifer is somewhat incomplete at this time. Without a basic understanding of the hydrogeologic and geochemical processes operating beneath the Pajarito Plateau, the Laboratory cannot adequately implement long-term ground water protection monitoring nor plan for long-term water supply production. The Laboratory has the scientific and technical resources to address these needs, and currently operates multiple programs (e.g. Environmental Surveillance, Environmental Restoration), to address these needs. In order to unify its efforts, the Laboratory proposes this strategy to serve as the basis for development of its Hydrogeologic Workplan. This effort will be guided by the implementation of a Data Quality Objective (DQO) process in order to establish the data needs, the method(s) of fulfilling those needs, and a cost-effective, technical peer-reviewed, prioritized and phased technical approach to collecting the data.

STRATEGY

The goal of this strategy is to describe a dynamic approach to protecting the ground water resource from unacceptable impacts resulting from the Laboratory activities described above. As previously stated, the details of implementing this strategy will be documented in the Hydrogeologic Workplan, which is scheduled for completion in September 1996.

Fundamental to this strategic approach is the utilization and development of four major sources of monitoring and characterization information at the Laboratory. The first source encompasses all existing hydrogeologic and geochemical information, accumulated from past studies and the Laboratory's existing ground and surface water monitoring network. The second source is the ER Project's characterization and assessment of PRS's on a site-specific basis, including investigations of the canyons that contain ephemeral and intermittent streams that flow toward the Rio Grande, which will provide information regarding the Laboratory's vadose zone. A third source of information will be the proposed installation of regional aquifer wells that will be used to characterize and define the Laboratory's basic hydrogeologic setting by providing lithologic, geochemical, and hydrologic information (e.g. data from borehole core samples, geophysical logs, aquifer tests, water quality analyses, and information regarding depth to and flow direction of the regional aquifer. The fourth source involves the installation of regional aquifer wells downgradient from large geographic areas of the Laboratory which have historically hosted major Laboratory operations and activities, i.e. large aggregates of PRSs, which will provide long-

term water quality monitoring. Each of these four sources will provide monitoring and characterization information critical to the protection of the ground water resource. However, by using the DQO process, priorities will be established for monitoring and characterization activities, based on decision criteria, and phased activities with specific priorities, especially the prioritized installation of wells, being established among the four sources for inclusion in the Workplan.

Both the Laboratory's Environmental Surveillance Program, and the ER Project are integral components of this strategy. As previously mentioned the ER Project will investigate PRSs to assess their risks to human health and the environment. This assessment is performed through the following steps in the RCRA Facility Investigation (RFI) process: 1) collect and evaluate available data; 2) plan and conduct additional investigations; 3) assess risks to human health and the environment; 4) propose a remedy, if necessary and 5) implement the remedy, if necessary. In this process, an investigation can end at any step that a remedy, if needed, becomes obvious or when there is no need for further action. These ER Project investigations are primarily site-specific, but may cover large geographical areas (e.g. the canyons).

The ER RFI process will be followed under this strategy, and integration of the strategy and the ER Project will be enhanced by: 1) ER's collection of hydrogeologic and geochemical data and its storage in a central database; 2) ER's application of available tools and techniques to investigate ground water occurrence, hydrodynamic behavior, and assess potential risks from contaminants, with the development of new technologies, if necessary; and 3) ER's development of monitoring systems for PRSs, and areas of hydrologic importance (e.g. the canyons) where monitoring is necessary. Regarding Laboratory-wide ground water protection activities, the ER Project will support Laboratory activities where they benefit ER. The ER Project will gain hydrogeologic and geochemical characterization information from the Laboratory's installation of regional aquifer wells, which will help design alluvial, perched intermediate, and regional aquifer monitoring systems for ER sites that require monitoring of those ground waters.

This strategy is intended to protect ground water to sustain uses which the water can support, by applying regulatory standards for ground water quality appropriate to protecting the particular beneficial use. The selected standards will establish a baseline for monitoring, so as to determine whether the standards are, or are likely to be, exceeded as a result of Laboratory activities. Ground water from the regional aquifer serves many beneficial uses (e.g. potable water supply, irrigation, livestock and wildlife watering, etc.). In general, this strategy seeks to place the highest priority on the protection of the regional aquifer for its beneficial use as a source of drinking water. The regional aquifer also contributes

guidance that will result in supplementing the contaminant distribution data with hydrogeologic and geochemical characterization data necessary to complete the risk assessment. The risk assessment will evaluate surface water and ground water pathways.

If this subsurface water is ground water, it will be designated as the "upper most aquifer" pursuant to RCRA. This ground water will be considered to be capable of supplying sufficient quantities to support the beneficial uses of supplying drinking water, wildlife and livestock water , and irrigation water, and will be protected with standards applicable to those uses, as well as applicable RCRA constituent limits. Furthermore, such ground water could serve as inflow to surface waters via springs, seeps, and base flow, and therefore provide beneficial uses in surface water, evoking beneficial uses and standards to protect those uses for surface water, as designated by the WQCC. Additionally, this water may serve as a contaminant pathway to other ground water or surface water, and thus must be protected to promote human health and prevent unacceptable ecological risks.

Because this uppermost subsurface water occurs in the vadose zone, the strategic approach will rely primarily on the ER project, which is being implemented chiefly in the vadose zone, and by relying on the ER RFI process, which is iterative and based on risk to human health and the environment. Existing hydrogeolgic and geochemical data will be assembled, and data needs will be identified. Characterization activities to reduce uncertainties to acceptable levels, based on the potential use of the water, will be planned and implemented. Assessment of the risks by various pathways will be employed to determine any necessary remediation, including monitoring. This strategy will employ monitoring as close to the source as possible to provide a warning should the contaminants migrate at rates faster than expected.

Within this uppermost subsurface water zone, the canyons at the Laboratory represent a situation where there are legacy and current operational water quality issues. The legacy issues are within the scope of the ER Project. There is essentially no cost-effective way to differentiate between legacy and current operational contaminants. Thus, regarding the canyons, ER will characterize, assess, and complete corrective actions, including monitoring, as necessary, and then convey any monitoring installations to the Laboratory's Environmental Surveillance Program for continuing monitoring of operational impacts. These monitoring systems for the uppermost subsurface water will be based on risk assessment, hydrogeologic characterization, current contamination, if any, and selected corrective measures, if needed. When hydrogeologic factors (e.g. porosity, moisture content, lithology, etc.) demonstrate favorable conditions, vadose zone monitoring will be the preferred activity under this strategy. More-

flow via springs and seeps into New Mexico surface waters e.g. the Rio Grande, which also has incumbent beneficial uses and water quality standards, as designated by the New Mexico Water Quality Control Commission (WQCC). Therefore, this strategy will also apply appropriate surface water quality standards to those relevant surface waters influenced by ground water discharge, so as to determine whether the standards are, or are likely to be, exceeded as a result of Laboratory activities.

RCRA concentration limits, as provided for under 40 CFR 264.94 will be established, as they apply to ground water, and surface water influenced by ground water discharge. These concentration limits will be established based on either background levels of a constituent, or if applicable, from the constituent limit appearing in Table 1 of 40 CFR 264.94 (a) (2). If neither of these methods of establishing a constituent limit is appropriate, the Laboratory may propose an Alternative Concentration Limit (ACL) to NMED, and if established by the NMED, such a limit will be applied. In proposing ACLs, the Laboratory intends to use the maximum concentration limits (MCLs) contained in the following regulations and standards, as appropriate, for the specific water use to be protected: National Primary Drinking Water Regulations, (40 CFR 141); National Secondary Drinking Water Regulations, (40 CFR 143); New Mexico Environmental Improvement Board (NMEIB), Drinking Water Regulations, (20 NMAC 7.1); WQCC Ground Water Standards, (20 NMAC 6.2, Subpart III, 3103); WQCC Standards for Interstate and Intrastate Streams (20 NMAC 6.1, Subpart I; WQCC Abatement Standards and Requirements (20 NMAC 6.2, Subpart IV, 4103); San Ildefonso Pueblo (proposed) Water Quality Standards; and Cochiti Pueblo Water Quality Standards.

The intent of this strategy is to select the most protective standards from various applicable regulatory standards, based on ground water uses in each of the three ground water zones, and apply those standards for monitoring and risk assessment. The strategy for application of regulatory standards to the three ground water zones is further described in the following pages.

Uppermost Subsurface Water Quality ~~(Vadose Zone)~~

The strategic goal for protecting the subsurface water in the vadose zone is to prevent contamination from new sources and characterize and/or respond to contamination entering this water from existing sources. Ground water in the canyon bottoms and other subsurface water in the vadose zone, that may become ground water or serve as a source of surface water, or be utilized by vegetation occurs at the Laboratory. The primary PRSs that potentially impact this water are those located near the canyons (disposal areas and outfalls) and in the canyon bottoms. The ER Project will assess the presence and extent of releases from these PRSs. This strategy compliments the work of the ER Project by providing

over, innovative technologies will be considered in comparison to conventional monitoring methods and techniques.

Remedial activities will be based on risk posed by any pathways. Thus, constituent limits applied to hydrogeologic media on Laboratory property will meet relevant risk criteria. RCRA concentration limits will be established based on either background levels of a constituent, or if applicable, from the constituent limit appearing in Table 1 of 40 CFR 264.94 (a) (2). If neither of these methods of establishing a constituent limit is appropriate, the Laboratory may propose an Alternative Concentration Limit (ACL) to NMED, and if established by the NMED, such a limit will be applied. In proposing ACLs, the Laboratory intends to use the maximum concentration limits (MCLs) contained in the following regulations and standards, as appropriate, for the specific water use to be protected: National Primary and Secondary Drinking Water Standards; NMEIB Drinking Water Regulations; WQCC Ground Water Standards; WQCC Abatement Standards or Alternative Abatement Standards; WQCC Standards for Interstate and Intrastate Streams; proposed San Ildefonso Water Quality Standards; and Cochiti Pueblo Water Quality Standards.

Ground Water Quality: Intermediate Perched Ground Water ~~(Vadose Zone)~~

This ground water is probably limited in extent, which limits its beneficial use, particularly as a drinking water supply, due to extremely small yields. However, water in the intermediate zone may be hydraulically connected with alluvial ground water, may potentially commingle with the underlying regional aquifer, and may also contribute to surface water via springs or seeps. Therefore, this ground water should not exceed water quality standards to such a degree that, it would result in water quality standards being exceeded in any other water, especially the regional aquifer. Should this intermediate ground water represent a usable source of drinking water in its own right, standards appropriate to that use will be applied. This ground water will be protected to promote human health and prevent unacceptable ecological risks.

As with the alluvial ground water, the main thrust of this strategy depends on remediation of PRSs that present an unacceptable risk to the intermediate ground water. The strategic approach will rely primarily on the ER RFI process of collecting existing data, planning and implementing necessary characterization, assessing the risks, and completing any necessary corrective actions, including monitoring. This approach will consider those sites where a potential source or known contamination exists. Hydrologic connection to other ground water and surface water is a key consideration in this approach. The location and characterization of intermediate zones may offer opportunities for utilizing indirect methods of investigation, such as geophysical techniques. Nevertheless,

chemical characterization will require direct examination of the waters of these intermediate saturated zones.

SAME COMMENTS

RCRA concentration limits will be established based on either background levels of a constituent, or if applicable, from the constituent limit appearing in Table 1 of 40 CFR 264.94 (a) (2). If neither of these methods of establishing a constituent limit is appropriate, the Laboratory may propose an Alternative Concentration Limit (ACL) to NMED, and if established by the NMED, such a limit will be applied. In proposing ACLs, the Laboratory intends to use the maximum concentration limits (MCLs) contained in the following regulations and standards, as appropriate, for the specific water use to be protected: National Primary and Secondary Drinking Water Standards; NMEIB Drinking Water Regulations; WQCC Ground Water Standards; WQCC Abatement Standards or Alternative Abatement Standards; WQCC Standards for Interstate and Intrastate Streams; proposed San Ildefonso Water Quality Standards; and Cochiti Pueblo Water Quality Standards.

Ground Water Quality in the Regional Aquifer

The strategic goal for water in the regional aquifer is to maintain its use as a drinking water supply. Furthermore, this ground water serves as a water source for the Rio Grande, and therefore should be protected for all of the applicable beneficial uses in surface water, as designated by the WQCC. Strategically, a very high priority will be placed on protecting this ground water to promote human health and prevent unacceptable ecological risks.

TOO LATE

The focus of this strategy is on early detection and remediation of releases of contaminants before they reach the regional aquifer. This strategy also emphasizes the long-term assurance of ground water protection provided by monitoring of the regional aquifer, and shallower ground water zones. As described in the previous two sections, the ER Project is focused on detection and remediation of releases from legacy sites. To support the ER Project, as well as provide the Laboratory with a long term regional monitoring network, characterization of the regional aquifer will be performed as a priority, so as to describe the hydrogeologic setting beneath the Laboratory, and guide installation of a monitoring system, capable of monitoring the regional aquifer to detect any impacts of current and future operations at the Laboratory. Ultimately, monitoring wells in all three ground water zones will be used to confirm that the standards applicable to the uses of the regional aquifer are met, and provide assurance that a system is in place to detect deterioration in water quality over the long-term.

RCRA concentration limits will be established based on either background levels of a constituent, or if applicable, from the constituent limit appearing in Table 1

Attachment 2

AGENDA

DOE/LANL MEETING WITH NEW MEXICO ENVIRONMENT DEPARTMENT

JUNE 6, 1996

MEETING FOCUS:

A. Discuss the LANL Draft Groundwater Protection Strategy and Receive Comments from NMED

B. Convey Status Report on Data Quality Objective (DQO) Planning Process

SCHEDULE:

9:00 A.M. Discuss the Purpose of the LANL Draft Groundwater Protection Strategy

9:15 A.M. Discuss General Aspects of the Strategy

9:30 A.M. Discuss Each of the Three Groundwater Zones

10:30 A.M. Discuss Groundwater Quantity Issues

10:45 A.M. Discuss Status of DQO Planning Process

11:00 A.M. Adjourn

of 40 CFR 264.94 (a) (2). If neither of these methods of establishing a constituent limit is appropriate, the Laboratory may propose an Alternative Concentration Limit (ACL) to NMED, and if established by the NMED, such a limit will be applied. In proposing ACLs, the Laboratory intends to use the maximum concentration limits (MCLs) contained in the following regulations and standards, as appropriate, for the specific water use to be protected: National Primary and Secondary Drinking Water Standards; NMEIB Drinking Water Regulations; WQCC Ground Water Standards; WQCC Abatement Standards or Alternative Abatement Standards; WQCC Standards for Interstate and Intrastate Streams; proposed San Ildefonso Water Quality Standards; and Cochiti Pueblo Water Quality Standards.

Water Quantity in the Regional Aquifer

The Laboratory must determine that ground water of adequate quality and in adequate quantity is available for long term withdrawal from the Lower Espanola Basin. Water quantity relates to factors which affect continued availability of a good quality water supply for both Los Alamos users and for other users in the southern portion of the Espanola Basin. Some of these factors include: how increases in water supply pumping by Los Alamos, Santa Fe, Espanola, and the Pueblos will affect each of the other users; how such pumping will affect overall water quality for each of the other users; and how such pumping will affect other aspects of the hydrologic system such as water levels in the Rio Grande and the movement of chemical constituents in the regional aquifer.

The strategy for addressing water quantity issues will focus on numerical simulation (modeling) of aquifer response to ground water withdrawal. Forecasts will be prepared by applying various ground water withdrawal scenarios. Development of the ground water model(s) will necessitate the acquisition of hydrogeologic information to address uncertainties. This approach includes the construction of several deep wells in the regional aquifer to allow characterization of aquifer characteristics e.g. saturated thickness, transmissivity, specific capacity, etc., as well as ground water quality at depth. Future Laboratory activities will rely on a dependable water supply of good quality. Without the development of adequate forecasts, the quantity and quality of available ground water resources cannot be determined.

Module VIII of RCRA Operating Permit

Section P, Task III: Facility Investigation, A. Environmental Setting, 1. Hydrogeology

a. A description of the regional and facility specific geologic and hydrogeologic characteristics affecting groundwater flow beneath the facility;

b. An analysis of any topographic features that might influence the groundwater flow system.

c. An analysis of fractures within the tuff, addressing tectonic trend fractures versus cooling fractures;

d. Based on field data, tests, (gamma and neutron logging of existing and new wells, piezometer and boring) and cores, a representative and accurate classification and description of the hydrogeologic units which may be part of the migration pathways at the facility (i.e., the aquifers and any intervening saturated and unsaturated units);

e. Based on field studies and cores, structural geology and hydrogeologic cross sections showing the extent (depth, thickness, lateral extent) of hydrogeologic units which may be part of the migration pathways identifying:
i) Unconsolidated sand and gravel deposits,

ii) Zones of fracturing or channeling in consolidated or unconsolidated deposits, and

iii) Zones of high permeability or low permeability that might direct and restrict the flow of contaminants;

f. Based on data obtained from groundwater monitoring wells and piezometer installed upgradient and downgradient of the potential contaminant source, a representative description of water level or fluid pressure monitoring;

g. A description of manmade influences that may effect the hydrogeology of the site; and

h. Analysis of available geophysical information and remote sensing information such as infrared photography and Landsat imagery.

C. Issues

The lack of knowledge surrounding these fundamental hydrogeologic issues does not allow for compliance with the regulatory requirements of a site-wide hydrogeologic characterization as outlined within Section P, Task III of the HSWA Module (see Appendix A). At present, the following fundamental hydrogeologic issues/questions remain unresolved at LANL:

- Individual zones of saturation beneath LANL have not been adequately delineated. LANL has inaccurate and incomplete knowledge concerning the geometries and boundary conditions of the zones of saturation beneath the facility. As a result, the "hydraulic interconnection" between these multiple zones of saturation is not fully understood. A facility-wide description of the hydrogeologic characteristics affecting ground-water flow beneath the facility cannot be made without adequate delineation of the ~~perched~~ intermediate perched aquifer(s) beneath LANL. [Task III (A) (1)(a)(d)(e)(f)]

- ~~The r~~Recharge area(s) for the main and perched-intermediate aquifers have not been identified. It is unknown at this time if any significant quantity of water is recharging the main aquifer through the fracture-fault zones which occur on the Pajarito Plateau. Characterization of these site-wide fault zones as potential pathways for aqueous migration is not complete. It is unknown what effect, if any, these zones may have on the direction of ground-water flow and hydraulic gradient of the main and intermediate perched~~-intermediate~~ aquifers. [Task III (A) (1)(a)(b)(c)(e ii,iii)(h)]

- ~~The g~~Ground-water flow direction(s) of the main aquifer and perched-intermediate aquifer(s), as influenced by pumping of production wells, are unknown. [Task III (A) (1)(a)(b)(f)(g)]

- Aquifer characteristics cannot be determined without the installation of additional monitoring wells ~~installed~~ within specific intervals of the various aquifers beneath the facility. Locations of wells designed for aquifer testing cannot be addressed adequately without resolving the first bullet ~~being answered~~. [Task III (A) (1)(a)(d)(eiii)(f)]

III. GEOLOGIC SETTING

This information was taken directly from Section 2.6.1 Geology.

"The Laboratory is situated on the Pajarito Plateau on the east flank of the Jemez Mountains and on the west side of the Rio Grande valley (Figure 2-4). The Jemez Mountains are part of the Jemez volcanic field, which consists of some 432 mi3 of volcanic rocks erupted from numerous vents, including a giant, multistage caldera (Gardner et al., 1986, 0310). The Jemez

- Vadose Zone - the zone below ground surface and above the top of ground water. Water within the vadose zone should be distinguished from ground water by atmospheric pressure; water within the vadose zone is below atmospheric pressure. Saturated conditions may occur within the vadose zone (e.g. rain-saturated topsoil, saturated clay layers, etc.); however, the water is less than atmospheric pressure. Water in the vadose zone is unable to move into wells or other places which are at atmospheric pressure.

- Ground Water - that portion of water beneath the ground surface that can be collected with wells, galleries, etc, or that flows naturally to the earth's surface. Ground water is at or above atmospheric pressure.

- Aquifer - ground water bearing formations which can sufficiently transmit and yield water in usable quantities.

#2
6/6/96

DRAFT GROUND WATER PROTECTION STRATEGY
HANDOUT FOR MEETING
JUNE 6, 1996

PURPOSE: PROVIDE A BASIS AND DIRECTION FOR GROUND WATER PROTECTION AT LOS ALAMOS NATIONAL LABORATORY

- SERVE AS A GUIDE FOR DEVELOPMENT OF HYDROGEOLOGIC WORK-PLAN, WHICH IS A RCRA DOCUMENT

- INTEGRATE ALL LABORATORY ACTIVITIES TO PROTECT GROUND WATER AROUND A COMMON STRATEGY

- DIRECT IMPLEMENTATION OF GROUND WATER PROTECTION MANAGEMENT PROGRAM PLAN

- DEFINITIONS OF GROUND WATER; SUBSURFACE WATER; AND VADOSE ZONE

GENERAL STRATEGY: DYNAMIC APPR0ACH TO PROTECTION

- FOUR MAJOR SOURCES OF MONITORING AND CHARACTERIZATION INFORMATION AT THE LABORATORY
    - EXISTING HYDROGEOLOGIC AND GEOCHEMICAL INFORMATION
    - ER PROJECT'S CHARACTERIZATION AND ASSESSMENT OF PRS's
    - PROPOSED REGIONAL AQUIFER CHARACTERIZATION WELLS
    - PROPOSED REGIONAL AQUIFER MONITORING WELLS

- RELIANCE ON THE ENVIRONMENTAL RESTORATION PROJECT AND THE RCRA RFI PROCESS

- GROUND WATER PROTECTION TO SUSTAIN USES OF WATER

- RCRA CONCENTRATION LIMITS-40 CFR 264.94 AND ACLs

- STANDARDS TO PROTECT THE USES OF GROUND WATER

- DATA QUALITY OBJECTIVE (DQO) PROCESS IN SETTING DATA NEEDS AND PRIORITIES

- DQO THOUGHT PROCESS, DEFINITIONS AND PRIORITIES

- GROUND WATER ZONES AND THE "BIG PICTURE FOR PROTECTION"

UPPERMOST SUBSURFACE WATER QUALITY (VADOSE ZONE):

- GOAL IS TO PREVENT CONTAMINATION FROM NEW SOURCES AND CHARACTERIZE AND/OR RESPOND TO CONTAMINATION FROM EXISTING SOURCES
- THE THREE STATES OF SUBSURFACE WATER AND THE DEFINITION OF "UPPERMOST AQUIFER"
- RELIANCE ON THE ENVIRONMENTAL RESTORATION PROJECT IN PROTECTING THE VADOSE ZONE
- RCRA CONCENTRATION LIMITS-40 CFR 264.94 AND ACLs
- STANDARDS TO PROTECT THE USES OF GROUND/SURFACE WATER

GROUND WATER QUALITY: INTERMEDIATE PERCHED GROUND WATER (VADOSE ZONE)

- EXTENT OF THE INTERMEDIATE PERCHED GROUND WATER AND ITS POTENTIAL FOR SERVING AS A PATHWAY TO OTHER WATER
- RCRA CONCENTRATION LIMITS-40 CFR 264.94 AND ACLs
- STANDARDS TO PROTECT THE USES OF GROUND WATER

GROUND WATER QUALITY IN THE REGIONAL AQUIFER:

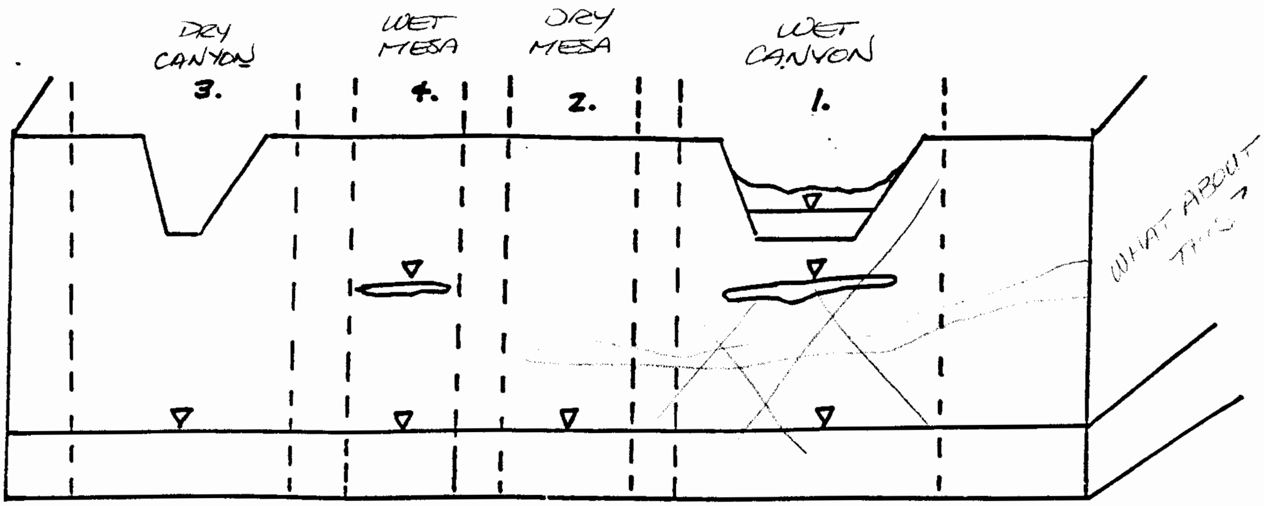
- PROTECTING THE REGIONAL AQUIFER FOR DRINKING WATER
- RCRA CONCENTRATION LIMITS-40 CFR 264.94 AND ACLs
- STANDARDS TO PROTECT THE USES OF GROUND WATER

WATER QUANTITY IN THE REGIONAL AQUIFER:

- ADEQUATE QUANTITY AND QUALITY OF GROUND WATER FOR THE LABORATORY AND LOS ALAMOS COUNTY
- NUMERICAL SIMULATION OF AQUIFER RESPONSE TO PUMPING

DATA QUALITY OBJECTIVE PROCESS: "THE DQO PROCESS FOCUSES THE OBJECTIVES OF THE STUDY AND ENSURES THAT PROPOSED DATA COLLECTION ACTIVITIES ARE DEVELOPED FROM DECISION CRITERIA AND STRATEGIES."

- THE FOUR (4) HYDROLOGIC SCENARIOS FOR APPLICATION -OF THE DQO PROCESS
  - SEE ILLUSTRATION OF SCENARIOS (BELOW)



- DECISIONS; QUESTIONS; DATA NEEDS; DECISION RULES; DATA COLLECTION DESIGN

- EXAMPLE OF SCENARIO 1. WET CANYON

- QUESTIONS: I. ARE THE ALLUVIAL SEDIMENTS AND UPPERMOST SUBSURFACE WATER FROM VARIOUS PRESENT AND LEGACY SOURCES AT CONTAMINANT CONCENTRATIONS GREATER THAN SOME REGULATORY LIMIT OR RISK LEVEL? II. IS THE INTERMEDIATE PERCHED GROUND WATER UNDERLYING THE ALLUVIAL SEDIMENTS AND UPPERMOST SUBSURFACE WATER AT CONTAMINANT CONCENTRATIONS GREATER THAN SOME REGULATORY LIMIT OR RISK LEVEL? III. IS THE REGIONAL AQUIFER, AS AFFECTED BY A CANYON SYSTEM, IMPACTED BY CONTAMINANT CONCENTRATIONS GREATER THAN SOME REGULATORY STANDARD OR RISK LEVEL? IV. WHAT ARE THE PATHWAYS FOR EXPOSURE TO CONTAMINANTS FROM ALLUVIAL SEDIMENTS AND THE UPPERMOST SUBSURFACE WATER?

- EXAMPLE OF SCENARIO 2. DRY MESA TOP

- QUESTIONS: I. ARE THE SOILS/TUFF OR UPPERMOST SUB-SURFACE WATER FROM VARIOUS PRESENT AND LEGACY SOURCES AT CONTAMINANT CONCENTRATIONS GREATER THAN SOME REGULATORY STANDARD OR RISK LEVEL? II. IS THE REGIONAL AQUIFER, AS POTENTIALLY AFFECTED BY A PRESENT OR LEGACY SOURCE, IMPACTED BY CONTAMINANT CONCENTRATIONS GREATER THAN SOME REGULATORY STANDARD OR RISK LEVEL? III. WHAT ARE THE PATHWAYS FOR EXPOSURE TO CONTAMINANTS FROM SOILS/TUFF AND WATER IN THE UPPERMOST SUBSURFACE WATER?

- USES FOR THE DQO PROCESS: HYDROGEOLOGIC WORKPLAN AND CONCEPTUAL DESIGN REPORT FOR THE MONITORING WELL INSTALLATION PROJECT

- STATUS OF DQO PROCESS AND SCHEDULE

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Marcy Leavitt	NMED/GWQB	827-2919/827-2[illegible]
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Steven Pierce	NMED/SWQB	827-2800/827-016[illegible]
Steve Yanicak	NMED/DOE OB	672-0448/672-0466
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