Permit

STATE OF NEW MEXICO
BEFORE THE SECRETARY OF ENVIRONMENT

IN THE MATTERS OF THE APPLICATION OF
THE UNITED STATES DEPARTMENT OF ENERGY
AND LOS ALAMOS NATIONAL SECURITY LLC
FOR A HAZARDOUS WASTE FACILITY PERMIT
FOR LOS ALAMOS NATIONAL LABORATORY
AND THE NOTICE OF INTENT TO DENY A PERMIT
FOR OPEN BURN UNITS TA-16-388 AND TA-16-399 FOR
LOS ALAMOS NATIONAL LABORATORY

HWB 09-37 (P)
HWB 10-04 (P)

ENTERED

CITIZEN ACTION NEW MEXICO
STATEMENT OF INTENT TO PRESENT TECHNICAL TESTIMONY

My name is David B. McCoy and I am the Executive Director of Citizen Action New Mexico (CA). Pursuant to 20.1.4.300 NMAC, on behalf of Citizen Action, I intend to provide a technical written statement as well as oral testimony concerning the above-captioned New Mexico Environment Department (NMED) permitting matters for Los Alamos National Laboratory (LANL).

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EDUCATION AND WORK BACKGROUND

I attended Western State University College of Law where I received a Bachelor of Laws and Juris Doctor degrees. I am admitted to the California State Bar (#170737).

I have been employed as Executive Director for Citizen Action since July, 2006

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and will be testifying in the capacity as Director. During that time I have participated in Resource Conservation and Recovery Act (RCRA) legal proceedings for the Sandia National Laboratories ("Sandia") Mixed Waste Landfill, Chemical Waste Landfill Closure Plan and Post Closure Plan, the Sandia RCRA Draft Part B Permit, and the Kirtland Air Force Base RCRA Draft Part B OB/OD Permit. The RCRA proceedings for the Chemical Waste Landfill ("CWL"), which is a RCRA "regulated unit," resulted in plans to install a network of groundwater monitoring wells at CWL that were compliant with 40 CFR 264.91-100. The network of groundwater monitoring wells at CWL were required to be three down gradient monitoring placed at the Point of Compliance under 40 CFR 264.95 and one upgradient background well.

I have reviewed and provided both written and oral comments about proposals and reports of the Department of Energy (DOE), Sandia, LANL, and the New Mexico Environment Department. I have reviewed many groundwater reports for Sandia, LANL and Kirtland Air Force Base with Registered Geologist Robert Gilkeson from the perspective of whether legal compliance and adequate enforcement of RCRA requirements exist at those facilities and their hazardous waste areas. I have reviewed public participation requirements of RCRA. Citizen Action has presented allegations to the Defense Nuclear Facility Safety Board regarding the operation of a Sandia nuclear reactor and hot cell facility in a building that cannot be made safe from the design basis earthquake.

Citizen Action has worked diligently within the regulatory process to address issues – to ensure enhanced public participation in the processes. Citizen Action has co-

ordinated efforts and information sharing with other environmental organizations within New Mexico, such as Southwest Research Information Center, Concerned Citizens for Nuclear Safety, Citizens for Alternatives to Radioactive Dumping and others. This has included obtaining RCRA documents through the Freedom of Information FOIA by successful lawsuit and/or the administrative appeals process.

I was co-counsel *pro hac vice* with Attorney Nancy Simmons in the lawsuit *New Mexico Environment Department v. Citizen Action* (D0101-CV20070-2626) that resulted in the release of some 3,700 pages of approximately 221 public records that the NMED held secret for ten years that were written by TechLaw, Inc. and AQS and that are relevant to the instant proceedings for the LANL RCRA Draft Part B Permit.

From 1998 to 2005, I provided pro bono consultation, research and writings for the Environmental Defense Institute (EDI) and Keep Yellowstone Nuclear Free (KYNF) for RCRA permitting matters related to Idaho National Laboratory's ("INL") INTEC nuclear incinerators, the New Waste Calcining Facility ("Calciner") and the Waste Experimental Reduction Facility ("WERF"), High Level Liquid Waste Evaporators("HLLWE"), Process Equipment Waste Evaporator ("PEWE"), INTEC Liquid Waste Management System, Liquid Effluent Treatment and Disposal ("LET&D"), and safety issues for the Advanced Test Reactor ("ATR").

With EDI and KYNF, I jointly drafted Notices of Intent to Sue for failure to have RCRA permits for the Calciner and WERF incinerators that resulted in closure and cleanup.

I was lead for drafting and filing a petition with the US Environmental Protection

Office of Inspector General (OIG) regarding failure of the Department of Energy to comply with hazardous waste permitting laws at INL. Upon review of the allegations, the EPA OIG agreed with numerous permitting deficiencies and made recommendations for changes. http://www.epa.gov/oig/reports/2004/20040205-2004-00006.pdf

I was formerly an intervener before the Nuclear Regulatory Commission in the matters of the Trojan Nuclear Reactor Spent Fuel Pool expansion and Control Building hearings, 50-344.

I am a current member of the Board of Directors for the Environmental Defense Institute in Idaho.

Citizen Action has members both downwind and downstream of LANL in Santa Fe and Albuquerque. Santa Fe is receiving drinking water from municipal wells that indicate contamination from radionuclides and the potential for additional contamination from LANL. Albuquerque is receiving drinking water supplies from the Rio Grande that can receive contamination from LANL.

SUMMARY OF CITIZEN ACTION POSITION ON THE LANL DRAFT PERMIT

Citizen Action is opposed generally to Draft Permit Sections 9, 10 and 11. The basis for the opposition is that all "regulated units" at LANL have not been appropriately identified. The regulated units, MDA G, H and L are inappropriately defined as "permitted units." The regulated units G, H and L are required to comply with ground water monitoring requirements under 40 CFR 264.91-100. The regulated units G, H and

L lost interim status in 1985 and are long overdue for meeting the requirements to submit closure plans and post-closure plans. The closure and post –closure permits are not provided for in the Draft Permit and the Draft Permit is currently legally defective for those omissions. The Consent Order does not meet the requirement for closure and post closure.

The Draft Permit incorrectly assumes that the 2005 Compliance Order on Consent (Consent Order) is an "enforceable document" so that the regulated units at LANL can apply alternate groundwater monitoring requirements. The Consent Order was not publicly noticed to be an enforceable document and public participation was not provided for that purpose. Alternatives that would be as protective of public health and the environment as the 40 CFR 264.91-100 requirements were not formulated, presented to the public for comment and then approved by the Secretary for the NMED. The public was assured by the NMED that the Consent Order would not be used for Closure and Post-Closure, but that those plans would be part of the RCRA Part B Permit. NMED kept the public from being fully informed about technical issues at LANL by keeping public records secret and not disclosing their existence. The documents are relevant to identified issues that may remain unresolved to the present.

No groundwater monitoring plan for the regulated units at LANL exists that meets the Consent Order requirements, EPA requirements, RCRA requirements or industry standards. At a minimum, groundwater monitoring for the regulated units would require the one upgradient and three Point of Compliance downgradient monitoring wells (40 CFR 264.95). Compliance monitoring requirements must be

included.

Numerous publications call into question the ability of the groundwater monitoring wells at LANL to provide reliable and representative water samples. The claimed "rehabilitation" of groundwater monitoring wells contaminated with drilling muds and bentonite clay is unproven by LANL. Alternative requirements would not be protective of the public health and environment. The Draft Permit should apply and NMED should enforce the requirements for monitoring of regulated units as provided for in 40 CFR 264.91-100. Because the permit does not define a requirement for a point of compliance for each regulated/permitted unit, contamination is allowed to migrate for miles before reaching a Los Alamos County drinking water well or the site boundary.

My full testimony is attached to this affidavit.

I estimate my testimony will require no more than 1 hour.

EXHIBITS

EXHIBIT 1
63 Federal Register 56710 (October 22, 1998)

EXHIBIT 2
LANL Characterization Well R-22 Geochemistry Report (LA-13986-MS, Issued: September 2002)

EXHIBIT 3
New Mexico Environment Department v. Citizen Action (D0101-CV20070-2626)

EXHIBIT 4
Plans and Practices for Groundwater Protection at the Los Alamos National Laboratory: Final Report, (2007)

EXHIBIT 5
Ford, R., S.D. Acree, and R.R. Ross. 2006. Memorandum to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (05RC06-001) - Review of LANL *Well Screen Analysis Report* - Ada, Oklahoma: United States Environmental Protection Agency, National Risk Management Research Laboratory, Ground Water and Ecosystems Restoration Division. Final Report, February 16, 2006

EXHIBIT 6
S.D. Acree, and Richard Wilkin, Ph.D. Memorandum to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (09RC06-001) - Review of LANL *Well Screen Analysis Report (WSAR), Rev.2* (LA-UR-07-2852) Groundwater Background Investigaton Report (GBIR) Rev. 3.(LA-UR-07-2853) United States Environmental Protection Agency, National Risk Management Research Laboratory, Ground Water and Ecosystems Restoration Division. March 30, 2009.

EXHIBIT 7
December 4, 2009 NMED Department of Energy Oversight Bureau and Hazardous Waste Bureau document, *Proposals for Independent Environmental Monitoring at Los Alamos National Laboratory, New Mexico,* December 4, 2009

EXHIBIT 8
July 12, 2001 from Lindsay A. Lovejoy, Jr., Assistant Attorney General to the New Mexico Environment Department Hazardous Waste Bureau Chief James Bearzi

EXHIBIT 9
New Mexico Assistant Attorney General Lindsay Lovejoy Letter July 30, 2002

EXHIBIT 10
Ford, R., S.D. Acree, and R.R. Ross. 2005. Memorandum to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (01RC06-001) Impacts of Well Construction Practices. Ada, Oklahoma: United States Environmental Protection Agency, National Risk Management Research Laboratory, Ground Water and Ecosystems Restoration Division. Draft Version, September 30, 2005.

EXHIBIT 11
Ford, R., S.D. Acree, and R.R. Ross. 2006. Memorandum to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (05RC06-001) Impacts of Hydrogeologic Characterization Well Construction Practices. Ada, Oklahoma: United States Environmental Protection Agency, National Risk Management Research Laboratory, Ground Water and Ecosystems Restoration Division. Final Report,February 10, 2006.

TESTIMONY OF DAVID B. McCOY

The Los Alamos National Laboratory (LANL) Resource Conservation and Recovery Plan (RCRA) Part B Draft Permit is required to provide protection of the public and environment through the application of discrete enforcement standards contained in RCRA and other documents. Some 21,000,000 cubic feet of hazardous, mixed hazardous and radioactive waste from nuclear weapons production have been buried at LANL legacy waste dumps across LANL mesas. The pathway for the contamination is through the vadose zone to the regional aquifer. A second set of the waste inventory is the large uncharacterized volume of liquid wastes released from outfalls discharging into canyon settings causing surface contamination and remobilized by wind and water providing contamination to the stream bottoms for transport to the Rio Grande. A third source of contamination is in shallow soils randomly remobilized by surface run-off and wind erosion. Seepage ponds sometimes called evaporation ponds were used as outfalls and overflowed directly into the canyons. The dangerous contamination at LANL buried in unlined pits and trenches and on the soil surface is provided a pathway down canyons by groundwater and surface water runoff to enter municipal drinking water wells for the cities of Los Alamos and Santa Fe. LANL contamination flows into the Rio Grande River that provides drinking water to downstream New Mexico municipalities and residents. (LANL Site Wide Environmental Impact Statement, p.).

The Draft Permit, by purporting that the Compliance Order on Consent ("Consent Order") is an "enforceable document," sets up a method to thwart the requirements of 40 CFR 264.91-100 for groundwater monitoring at the regulated units at LANL. MDA G, MDA H and MDA L are "regulated units" under 40 CFR §264.90(a)(2) because the three facilities received RCRA hazardous waste after July 26, 1982. These regulated units do not meet the exceptions contained in§264.90(b) for the application of alternatie groundwater monitoring requirements.[1] As will be discussed below, the Consent Order did not meet the public participation and the technical requirements of 40 CFR 270.1(c) to become an "enforceable document." The Draft Permit would allow the existing inchoate groundwater monitoring for the regulated units to remain in place by the incorrect

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[1] **Under RCRA, "regulated units" must comply with the requirements of 40 CFR 264.91 through 264.100 for groundwater monitoring.** 40 CFR § 264.90(a)(2) provides:

> "All solid waste management units must comply with the requirements in §264.101. **A surface impoundment, waste pile, and land treatment unit or landfill that receives hazardous waste after July 26, 1982 (hereinafter referred to as a "regulated unit") must comply with the requirements of §§ 264.91 through 264.100 in lieu of § 264.101 for purposes of detecting, characterizing and responding to releases to the uppermost aquifer.** The financial responsibility requirements of § 264.101 apply to regulated units."

assertion that the Consent Order is an enforceable document. The Draft Permit at 11.3.1 leads the reviewer to the mistaken belief that the Draft Permit will require groundwater monitoring for all regulated units as defined in 40 CFR 264.90(a)(2), which provide the requirements of 40 CFR 264.91-100 for regulated units.

However, the Draft Permit, at sections 9.3 (Closure Requirements for Regulated Units), 10.1.1 (Post Closure Care Plan), and 11.1 (Corrective Action), vitiates the groundwater monitoring requirements for regulated units by incorrectly presenting that the Consent Order is an "enforceable document" for the purposes described in 40 CFR 270.1(c).[2] The Draft Permit incorrectly assumes that alternative groundwater monitoring requirements, different from 40 CFR 264.99-100, may be imposed on the regulated units. The strict groundwater monitoring standard set forth at 11.3.1 sharply conflicts with Section 9.3, 10.1.1 and 11.1 of the Draft Permit. Rather than imposing 40 CFR 264.91-100 requirements, Section 9.3, 10.1.1 and 11.1 would apply "alternative" closure standards for groundwater monitoring taken from the Consent Order. Section 9.3 states:

> "The Consent Order is an enforceable document that sets forth alternative closure requirements in accordance with 40 CFR § 264.110(c)."

Section 11.1 states:

> "The Consent Order is an enforceable document pursuant to 40 CFR §§ 264.90(f), 264.110(c), and as defined in 40 CFR § 270.1(c)(7)."

The Consent Order does not refer to either 40 CFR §§ 264.90(f), 264.110(c)[3] for the application of alternative groundwater monitoring requirements.

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[2] 40 CFR 270.1 (c) requires in pertinent part that:
"Owners and operators of hazardous waste management units must have permits during the active life (including the closure period) of the unit. Owners and operators of surface impoundments, landfills, land treatment units, and waste pile units that received waste after July 26, 1982, or that certified closure (according to §265.115 of this chapter) after January 26, 1983, must have post-closure permits, unless they demonstrate closure by removal or decontamination as provided under §270.1(c)(5) and (6), or obtain an enforceable document in lieu of a post-closure permit, as provided under paragraph (c)(7) of this section." (Emphasis supplied).

[3] 40 CFR § 264.110(c) provides for alternative groundwater monitoring requirements by the use of enforceable documents under 40 CFR 270.1(c):
"(c) The Regional Administrator may replace all or part of the requirements of this subpart (and the unit-specific standards referenced in § 264.111(c) applying to a regulated unit), with alternative requirements set out in a permit or in an enforceable document (as defined in 40 CFR 270.1(c)(7)), where the Regional Administrator determines that:
(1) The regulated unit is situated among solid waste management units (or areas of concern), a release has occurred, and both the regulated unit and one or more solid waste management unit(s) (or areas of concern) are likely to have contributed to the release; and
(2) It is not necessary to apply the closure requirements of this subpart (and those referenced herein) because the alternative requirements will protect human health and

The Fact Sheet demonstrates that NMED intends to allow lesser alternative for groundwater monitoring than those required by 40 CFR 264.91-100 (AR 31819, p.103):

> "If waste is left in place at any closed HWMU, residual contamination is present at concentrations greater than established cleanup levels, or groundwater contamination is present in the vicinity of any closed HWMU, the Permittees must conduct post-closure care, which must include groundwater monitoring in accordance with 40 CFR §§ 264.91 through 264.100. **The Department may replace all or some of the requirements of 40 CFR §§ 264.91 through 264.100 with alternative requirements, as set forth in a permit or other enforceable document, in accordance with 40 CFR § 264.90(f). Currently, the Consent Order is the enforceable document under which groundwater investigation and monitoring is conducted.** If any or all of MDAs G, H, or L are closed with waste left in place or residual contamination in environmental media present at concentrations greater than established cleanup levels, groundwater monitoring is required as part of post-closure care." (Emphasis supplied).

MDAs G, H and L received hazardous waste for disposal after July 26, 1982 and are "regulated units" that must comply with §§264.91 through 264.100.

40 CFR § 264.90 provides for the applicability of groundwater monitoring requirements:

> "Applicability.
> (a)(1) Except as provided in paragraph (b) of this section, the regulations in this subpart apply to owners or operators of facilities that treat, store or dispose of hazardous waste. The owner or operator must satisfy the requirements identified in paragraph (a)(2) of this section for all wastes (or constituents thereof) contained in solid waste management units at the facility, regardless of the time at which waste was placed in such units."

LANL does not qualify to meet the exceptions of 264.90(b):

> "(b) The owner or operator's regulated unit or units are not subject to regulation for releases into the uppermost aquifer under this subpart if:
> (1) The owner or operator is exempted under §264.1; or
> (2) He operates a unit which the Regional Administrator finds:
> (i) Is an engineered structure,
> (ii) Does not receive or contain liquid waste or waste containing free liquids,
> (iii) Is designed and operated to exclude liquid, precipitation, and other run-on and run-off,
> (iv) Has both inner and outer layers of containment enclosing the waste,

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the environment and will satisfy the closure performance standard of § 264.111 (a) and (b)."

(v) Has a leak detection system built into each containment layer,
(vi) The owner or operator will provide continuing operation and maintenance of these leak detection systems during the active life of the unit and the closure and post-closure care periods, and
(vii) To a reasonable degree of certainty, will not allow hazardous constituents to migrate beyond the outer containment layer prior to the end of the post-closure care period."

LANL does not comply with the above exceptions of 264.90(b). The unlined pits, trenches, shafts and surface impoundments at MDAs G, H and L are not engineered structures. The MDA G, H and L RCRA "regulated unit" disposal facilities do not have leak detection systems. The unlined surface impoundments, pits and shafts at MDA L received liquid waste. The unlined shafts at MDA L contain a large inventory (> 10,000 gallons?) of solvents in corroding 55-gallon drums. The unlined pits and shafts at MDA G received liquid waste. The MDA G, H and L RCRA "regulated unit" disposal facilities were not designed and operated to exclude liquid, precipitation and other run-on and run-off. The MDA G, H and L RCRA "regulated unit" disposal facilities do not have inner and outer layers of containment enclosing the waste. DOE and LANS did not provide continuing operation and maintenance of leak detections systems during the active life of the MDA G, H and L RCRA "regulated unit" disposal facilities. DOE and LANS will not provide continuing operation and maintenance of leak detections systems during the closure and post-closure care periods of the MDA G, H and L RCRA "regulated unit" disposal facilities. To a reasonable degree of certainty, DOE and LANS will allow hazardous constituents to migrate beyond the outer containment layer prior to the end of the post-closure care period.

Consistency between the LANL Draft Permit and other documents must be maintained. A conflict with the Draft Permit section 9.3 giving alternative closure requirements is created with the prior existing Technical Area 54 Well Evaluation and Network Recommendations (July 31, 2007 AR 16395) approved by NMED (8/31/07 AR 30474). The groundwater monitoring MDAs for G, H and L as regulated units must be accomplished under 40 CFR 264.90-99 at the sites of MDAs G, H and L. NMED recognized the monitoring requirements of 264.90-99 in the NMED approved Technical Area 54 Well Evaluation and Network Recommendations, Revision 1 Work Plan of October 2007 that states (AR 30479, p.5):

> "The following requirements from 40 CFR 264.90-.99, Subpart F apply to permitted units or regulated units that received waste after July 26, 1982. The regulations apply throughout the active life of the units and the closure and post-closure period if the units are not "clean-closed" under RCRA."

AR 16395 (http://www.lanl.gov/environment/h2o/docs/TA-54-Well-Eval.pdf) provides for Point of compliance monitoring as follows:

"The point of compliance applied for the permitted units at TA-54 is the vertical surface located at the hydraulically downgradient limit of the waste management area that extends down into the uppermost aquifer underlying the regulated units. At TA-54, this is interpreted as being at the regional aquifer immediately beneath each aggregate of regulated units at MDAs H, L, and G. An integrated groundwater-monitoring system must consist of a sufficient number of near-field wells and downgradient monitoring wells installed at appropriate locations and depths to obtain representative groundwater samples from the uppermost aquifer. These samples must represent both the quality of background water not affected by the regulated unit and the quality of groundwater passing beneath the regulated unit to allow for detection of contamination in the uppermost aquifer."

The requirements of the approved work plan take precedence over the permit that cannot incorporate MDAs G, H and L into the permit as permitted units. Section 1.9.18 Approval of Submittals indicates that "such documents, as approved, shall control over any contrary or conflicting requirements of this Permit."

The history of the March 1, 2005, as revised in 2008, Compliance Order on Consent (Consent Order) demonstrates that it is not an "enforceable document" for reasons that:

1. Public Participation requirements of notice and opportunity for comment of the Consent Order as an enforceable document were not met, and; NMED secrecy prevented meaningful opportunity for public participation.
2. The Consent Order itself provides no notice that it is an enforceable document within the meaning of 40 CFR 270.1(c) for use in lieu of a post-closure permit and required ground water monitoring requirements of 40 CFR part 264; and,
3. The groundwater monitoring standards and program used at LANL are not as protective as 40 CFR 264.91-100.
4. NMED specifically represented to the public thus creating an estoppel by matter of record that: "The closure plans for MDA's G, H and L will be incorporated in the draft permit. The public will have the opportunity for a hearing when the draft permit is released for public review." (*New Mexico Environment Department's Response to Public Comments on the Proposed Compliance Order on Consent for Los Alamos National Laboratories* (February 18, 2005) Response to Comment 13, AR 16251, p.5).

The Compliance Order on Consent (Consent Order) issued March 1, 2005 and Revised June 18, 2008 did not meet public participation requirements because the public notice did not inform the public that the draft Order was to be an Enforceable Document within the meaning of 40 CFR 270.1(c)(7). (*See,* 63 Fed. Reg. 56710, 56714, (October 22, 1998) (True and Correct Copy attached hereto as EXHIBIT 1). The Draft Order of May 2, 2002 (AR 16010) eventually culminated in a Compliance Order on Consent (Consent Order) issued March 1, 2005 (AR 16255) and Revised June 18, 2008

(AR 32111). The Consent Order was for the stated purpose of investigation and corrective action at LANL. On May 2, 2002 a New Mexico Environment Department (NMED) News Release stated (AR 16034) "the New Mexico Environment Department issued a draft order to LANL requiring a comprehensive investigation and cleanup of contaminated sites at LANL."[4] On the same day a Fact Sheet issued announcing a public comment period to begin on May 2, and ending on July 1, 2002 (AR 16031).[5] On June 24, 2002 NMED issued a Dear Concerned Citizen letter, Subject: Issuance of an Order to Los Alamos National Laboratory extended the comment period to July 31, 2002. The May 2, 2002 news release, the Fact Sheet and the Concerned Citizen letter did not state anywhere that the draft Order to be issued to LANL would be an "enforceable document" in lieu of a closure or post-closure permit for regulated units at LANL (40 CFR 270.1(c)(7).

NMED has met no legal requirements to use the Consent Order as an enforceable document. The LANL Draft Permit attempts to circumvent the regulatory requirements for TA-54 regulated units to have a closure plan, a post closure care permit and associated ground water monitoring requirements by bringing in the use of the Consent Order as an "enforceable document" with the intention to use 40 CFR 264.90(f) for "Alternative Requirements" instead of 40 CFR 264.91-100. This plan to use alternative requirements by NMED and LANL would: 1). allow LANL to continue furnishing unreliable monitoring data from the existing non-compliant network of monitoring wells that hides knowledge of contamination, and the acceptance of that incorrect data by NMED; and, 2). allow whatever installation of monitoring wells NMED deems fit at LANL without meeting the groundwater monitoring requirements contained in 40 CFR 264.91-.100. This is all contrary to the duties of LANL to furnish true and correct information and for the NMED to verify.

The Draft Permit continues to fail to provide for closure and post-closure of all the RCRA regulated units at LANL and does not apply the correct state and federal regulations for protection of the public and the environment. The RCRA Draft Permit permit does not comply with federal requirements of RCRA (42 U.S.C. §§ 6901-6992k, §6924(o) and (p)) for groundwater monitoring to protect the public and the environment from releases that may occur from where hazardous wastes and mixed radioactive were disposed. Special groundwater monitoring requirements exist for the "regulated units" at LANL that have not been adhered to. (40 CFR 264.90-100). 40 CFR 264.97 (a)(3) provides requirements for the early detection of contamination of groundwater to the uppermost aquifer.

The termination of interim status, requirement for closure and post closure permit at regulated units G, H and L, and concern for public participation is described in a letter

[4] State Environment Department Schedules Public Informational Meetings Concerning Draft Order for Investigation and Cleanup of Contamination at Los Alamos National Laboratory May 2, 2002.
[5] Fact Sheet, Order Issuance Los Alamos National Laboratory May 2, 2002.

dated July 12, 2001 from Lindsay A. Lovejoy, Jr., Assistant Attorney General to the New Mexico Environment Department Hazardous Waste Bureau Chief James Bearzi, as follows True and Corect Copy attached as EXHIBIT 8 (AR 11676)):

> "Our concerns about the need for public participation particularly relate to the Hazardous and Solid Waste Amendments ("HSWA") [RCRA] remediation process. We understand that the corrective action order will, inter alia, address HSWA remediation at Material Disposal Areas ("MDA") G, H. and L. We have pointed out to NMED that these MDAs were long ago required to stop receiving waste, have an appropriate closure plan, and close, but this has not happened. MDAs G and L were required to close under 40 CFR §§ 265.112(d)(3)[6] and 265.113(b) after NMED accepted LANL's withdrawal of its request for a permit for these area in April 1985, terminating interim status under 40 CFR § 270.73(a). MDAs G, H, and L were also required to close based on loss of interim status in November 1985, under 42 U.S.C. § 3005(e)(2) and 40 CFR § 270.73(c). However, to date they have been neither closed nor permitted (p.1).

On July 30, 2002, the New Mexico Assistant Attorney General Lindsay Lovejoy informed HWB Chief James Bearzi again of "the need to take and respond to public comment during remediation." (True and correct copy attached as EXHIBIT 9 (AR 16083).

During the period when the draft Order was under consideration until the time of its adoption in 2005 and thereafter, the NMED did not disclose public records from TechLaw, Inc. to the public that had bearing on permitting and clean up issues at TA-54 and other regulated units at LANL. The May 2002 draft Order side-stepped any issues of the long overdue closure plan and post-closure requirements that were applicable to the TA-54 regulated units when they lost interim status in 1985. The public was not informed of the requirement for a closure plan and a post-closure permit that existed for regulated units G, H and L at TA-54 after the loss of interim status in 1985, including the groundwater monitoring requirements of 40 CFR 264.91-100 identified in TechLaw, Inc. documents. Examples are cited infra.

The groundwater monitoring at LANL is not protective of the public health and environment because: 1). individual monitoring wells have not and do not provide reliable and representative groundwater samples, and 2). the monitoring wells fail to

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[6] 40 CFR 265.112 (d)(3)
The owner or operator must submit his closure plan to the Regional Administrator no later than 15 days after:
(i) Termination of interim status except when a permit is issued simultaneously with termination of interim status; or
(ii) Issuance of a judicial decree or final order under section 3008 of RCRA to cease receiving hazardous wastes or close.

collectively form a reliable network as required by 40 CFR 264.91.-100 for detection monitoring and compliance monitoring. Numerous studies confirm that the wells were not constructed in accordance with the requirements of RCRA and do not yield reliable and representative water samples.

The *TA-54 Evaluation and Network Recommendations* (LA-UR-07-5042 EP2007-0443) (July 2007) requires (AR 16395, p. 6, para 2):

> "2. Establish a groundwater-monitoring network that meets the requirements for "detection monitoring" and subsequent "compliance monitoring" at permitted units at TA-54.
>
> "The following requirements from 40 CFR 264, Subpart F apply to permitted units or regulated units that received waste after July 26, 1982. The regulations apply throughout the active life of the units and the closure and post-closure period if the units are not "clean-closed" under RCRA. The groundwater-monitoring network and facility process must be able to detect, evaluate, and respond to releases of hazardous waste or hazardous waste constituents into the uppermost aquifer. Detection monitoring is required to establish that a release has occurred. It is assumed that because of the significant depth to groundwater beneath TA-54, vadose-zone monitoring will be a key component of the overall monitoring program in support of both CMEs and the RCRA Part B permit.
>
> "The point of compliance applied for the permitted units at TA-54 is the vertical surface located at the hydraulically downgradient limit of the waste management area that extends down into the uppermost aquifer underlying the regulated units. At TA-54, this is interpreted as being at the regional aquifer immediately beneath each aggregate of regulated units at MDAs H, L, and G. An integrated groundwater-monitoring system must consist of a sufficient number of near-field wells and downgradient monitoring wells installed at appropriate locations and depths to obtain representative groundwater samples from the uppermost aquifer. These samples must represent both the quality of background water not affected by the regulated unit and the quality of groundwater passing beneath the regulated unit to allow for detection of contamination in the uppermost aquifer."

The July 2007 *Technical Area 54 Well Evaluation and Network Recommendations,* describes the detection and compliance monitoring requirements that are necessary with regard to the point of compliance monitoring under 40 CFR 264.95. A revised October 2007 Revision 1 that was approved by NMED removed the point of compliance language to substitute "near-field wells" which does not reflect RCRA requirements that down gradient monitoring wells be at the point of compliance under 264.95. Although the language of the *Technical Area 54 Well Evaluation and Network Recommendations* requires compliance monitoring, the requirement has not been enforced by NMED. Compliance

monitoring for regulated units at TA-54 was *not* initiated after finding the RCRA hazardous constituents (Volatile Organic Compounds (VOCs) and Semi-VOCs) at regional well R-22:

From page 28 in *LANL Characterization Well R-22 Geochemistry Report* (LA-13986-MS, Issued: September 2002):

> "Several VOCs and SVOCs (validated results) were detected at well R-22 including acetone (2.5 to 32 µg/L) [µg/L = micrograms per liter or parts per billion (ppb)]; benzoic acid (3 to 12.5 µg/L); toluene (0.2 to 0.76 µg/L); methylene chloride (0.62 and 2.2 µg/L); chloroform (0.94 µg/L); pentachlorophenol (6.2 µg/L); phenol (19 and 32 µg/L); 4-methylphenol (44 to 210 µg/L); and 2-butanone (6.9 to 8.9 µg/L) (Appendix A). Several substituted benzene compounds also werenidentified at the well, including isopropylbenzene (0.16 to 0.54 µg/L); 1,4-dichlorobenzene (0.16 to 0.23 µg/L); and 1,3,5-trinitrobenzene (0.12 µg/L). Methylene chloride is a laboratory solvent used during SVOC, pesticide, herbicide, and polychlorinated biphenyls (PCB) analyses using gas chromatography mass spectrometry (GCMS). Bis(2ethylhexyl)phthalate, a constituent of plastic, was detected at concentrations of 1.0 and 3.9 µg/L in the regional aquifer during the first and fourth sampling events."

From page 35 in *Response to Concerns About Selected Regional Aquifer Wells at Los Alamos National Laboratory* (LA-UR-046777, Issued September 1, 2004) states (AR 13899, p. 35):

> "Thirty-one volatile and semivolatile organic compounds have also been detected in water from well R-22. Only two of these, pentachlorophenol (1 detection, 6.3 ppb, MCL = 1 ppb) and benzo(a)pyrene (2 detections, 0.24 ppb, MCL = 0.2 ppb), were present at concentrations above the MCL (Longmire, 2002c). Monitoring for organic compounds at R-22 will continue."

From page 23 in *LANL Characterization Well R-22 Geochemistry Report* (LA-13986-MS, Issued: September 2002) (EXHIBIT 2).

> "An activity of 109 pCi/L tritium was measured near the regional water table (883 ft) during drilling of well R-22 (Ball et al. 2002, 71471). Since 2000, activities of tritium measured in screen #1 (907.0 ft) averaged 2.38 pCi/L (Table 5.1-1), which suggests that some recent recharge to the regional aquifer has occurred."

The failure of NMED to enforce compliance monitoring after detection of RCRA volatile and semi-volatile compounds measured repeatedly in the water in R-22 cannot be considered to be protective and does not comply with the requirements of 264.91-100 or 40 CFR 264.90(f)(2).

The failure to conduct compliance monitoring can readily be seen from the limited number of monitoring wells presented in Figure 2.3-13 "Regional monitoring wells, water supply wells, and groundwater gradient" in LANL Report MDA G CME Report- Rev 1 (LA-UR-09-5509 September 2009 AR 32022 See EXHIBIT 12). The monitoring wells are not at the point of compliance for the TA-54 regulated units and are very limited in number.

The requirement of § 264.110(c) that regulated units G, H and L be situated among SWMUs causing releases has not been met for use of alternatives to 264.91-100. There is no clear statement in the Draft Permit explaining what the specific SWMUs are that supposedly are among the regulated units G, H and L. If LANL did not want areas G, H and L to become regulated units, LANL could have closed the units prior to July 26, 1982 but failed to do so. Regulated units G, H and L continued receiving waste after that date.

The Draft Permit statement at section 11.1 overlooks an important proviso within 264.110 (c) that alternative requirements must be set forward as defined in 40 CFR 270.1(c)(7). However, there is no reference to 40 CFR 264.110(c) in the Consent Order. There is no reference in the Consent Order to any groundwater monitoring standards contained in 40 CFR 264.90-100, nor is there any mention that "alternatives" to those regulations will be made or that the alternatives will satisfy the closure requirements of 264. 111(a) and be as protective for the public health and environment.

NMED secrecy denied public participation for implementation of the requirements for Closure and Post-closure for the TA-54 regulated units that lost interim status in 1985. NMED secrecy defeated the requirements of RCRA and Due Process for informed, meaningful public participation in the adoption of the Consent Order.

The Hazardous Waste Bureau (HWB) has a 10-year history of placing into a secret section of the HWB Library technical documents that may have contradicted NMED permitting positions and/or that could provide different legal and technical information from other sources.

One of the most fundamental elements for state programs is the broad information gathering powers and duties of the State. Not only are States required to have the right to gather information from regulated entities, but States owe a duty to the public to actually obtain relevant information and to make that information available to the public. RCRA section 6926(f) is quite clear:

> "No state program may be authorized by the Administrator under this section unless:
> "(1) such program provides for the public availability of information obtained by the State regarding facilities and sites for the treatment, storage, and disposal of hazardous waste; and
> "(2) such information is available to the public in substantially the same manner and to the same degree as would be the case if the Administrator was carrying out the provisions of this subchapter in such state."

As a result of a lawsuit that NMED lost against *Citizen Action, New Mexico Environment Department v. Citizen Action* (D0101-CV20070-2626) (True and correct copy attached as EXHIBIT 3), NMED released some 13,000 pages of TechLaw, Inc. and AQS documents concealed for up to a decade and that cost the taxpayers millions of dollars. The technical documents are relevant to widespread toxic contamination and/or permitting actions throughout New Mexico at Los Alamos National Laboratories, Sandia Labs, Triassic Park, Safety-Kleen Systems, military bases at Kirtland AFB, Fort Wingate, Holloman AFB, Ft. Bliss, White Sands Test Facility and oil company refineries Western Refining SW (Gallup), Bloomfield Refinery (Farmington), Navajo Refining Co. (Artesia). Over 3000 documents relevant to Los Alamos Laboratories were obtained by Citizen Action and had to be inserted into the administrative record.

NMED failed to comply with RCRA administrative record keeping requirements and for furnishing actual reports, records or information to the public. NMED failed to keep non-public information, as determined by NMED, summarized in a disclosable way so as to make it available to the public or officers, employees or representatives of the United States. (42 U.S.C. 6927 and OSWER Dir. 9833.3A-1).

Deliberate NMED secrecy aided and abetted establishing the Compliance Order on Consent (May 2005) that resulted in a process that side-stepped permitting requirements, cut the public out of all substantive deliberation, and provided complete discretion for the NMED and hence for LANL. The draft Order process began in 2002 and the 2002 TechLaw, Inc. documents would have been highly useful and relevant to the public for their review of legal requirements and to speak out for imposition of closure and post-closure standards at LANL compared to the Consent Order. By denying timely access to TechLaw, Inc. documents, NMED effectively excluded the public from review of the required administrative process for closure and post-closure of TA-54. The public was denied access to technical materials that left unanswered questions that could have been used for mounting a challenge to NMED's failure to impose closure and post-closure permit requirements. TechLaw, Inc. reports, paid for by the taxpayer, preliminarily reviewed by Citizen Action, are pertinent to the formal standards and regulations applying to TA-54 for closure and post-closure permit requirements and contaminant fate and transport modeling.

January 9, 2002 TechLaw Inc. report Finite Element Heat and Transfer (FEHM) (AR 32400) is specific to TA-54 Material Disposal Area (MDA) G. The report discusses numerous other documents related to groundwater flow and radionuclide transport in the vadose zone beneath Area G. The report is critical of the technical deficiency for a LANL computer code used to model contaminant flow and transport through the complex geology associated with LANL. The code was apparently used by LANL but not subjected to a rigorous, independent review by the NMED. **LANL admits that the**

FEHM does not work for thin geologic layers that are an important control on travel of contaminants and that are common for the Pajarito Plateau (p.2):

> "...LANL has noted that FEHM cannot always effectively handle units that are thin (e.g., Guaje Pumice bed) relative to the other units being analyzed. In cases where these thin units exhibit properties that differ from the immediately overlying and underlying units, valuable information on flow and/or transport can be lost."

Unanswered questions still exist from this report held in secret for 8 years as to NMED not taking actions for peer review of the FEHM and whether governmental regulatory agencies accept the FEHM model:

> "Because the code was developed by LANL and has not been subjected to a rigorous, independent review by the NMED, these documents should be formally requested of LANL for consideration in determining if the results of FEHM model simulations are suitable for regulatory applications. LANL should provide these and any other peer-reviewed articles on the development and/or verification of the FEHM code. LANL should identify instances where FEHM generated results have been accepted by governing regulatory agencies and documentation, including the names of contacts at the approving agencies, should be submitted." (Emphasis supplied).

TechLaw, Inc. points to the inappropriateness of assumptions by LANL about low dose calculations and how uncertainty is addressed by LANL at MDA G and the importance to acquire data to reduce uncertainty regarding the physical properties controlling transport of contaminants at waste disposal sites below the canyons and below the mesas, ie., the 65 acre waste dump at regulated unit MDA G (p.3):

> "Upon review of Vadose Zone Flow and Transport Model of Los Alamos Canyon, it appears that at least some of the simulations will be repeated once additional data are gathered and used to better characterize flow and transport beneath the site. Conversely, Simulations of Groundwater Flow and Radionuclide Transport in the Vadose and Saturated Zones beneath Area G stands in contrast to this position. The report text implies that refinements that address many of the uncertainties in the present model formulations are unwarranted due to the relatively low doses calculated in the saturated zone."

The dose in the fractured zone cannot be calculated because of the many uncertainties. What are the uncertainties and what has been done to reduce those uncertainties?

More recently, and echoing TechLaw, the National Academy of Sciences *Plans and Practices for Groundwater Protection at the Los Alamos National Laboratory: Final Report*, (2007) (True and correct copy attached as EXHIBIT 4) reported failed monitoring wells and uncertainty in modeling because the data does not exist beneath the mesas where the large inventory of wastes are buried:

> p.42 "An update to the regional aquifer model is provided by Keating et al.

who state that "predicted flux through older basalts in the aquifer can vary by a factor of three . . . the true uncertainty of our predictions, including the impact of possible conceptual errors, is likely to be larger and is difficult to quantify" (Keating et al., 2005, p.653).

p. 43- "Overlooking conceptual, non-modeled, uncertainties can lead to results that give an overly optimistic perception of the current state of knowledge about present and future groundwater contamination."

TechLaw (January 9, 2002) raises a question as to whether experiments to gain knowledge of the travel through the basalt has been conducted. Whether NMED encouraged LANL to conduct the experiments remains unanswered (p.4).

"Section 8.0 describes one-dimensional modeling using FEHM performed in support of upcoming infiltration monitoring experiments. The section does an excellent job of describing how the modeling results were used in designing the experiments. Data collection activities are proposed that will vastly improve the conceptual model for the basalt units. LANL should be encouraged to conduct these experiments and refine the FEHM model formulations affected by the results."

TechLaw, Inc. finds too many uncertainties to be able to confirm whether the FEHM model offers a valid representation of MDA G and that the model cannot overcome the uncertainties in the data to calculate how much groundwater contamination can be caused by the wastes buried at MDA G (p.5).

"However, without a complete review of all information sources, it is difficult to determine if the model formulations used in the analyses adequately reflect hydrologic conditions at MDA G and, thus, offer a valid representation of the site. Site characteristics must be reflected in the model formulations so that information useful in making regulatory decisions concerning the site can be made. After reviewing the document, the effect of all surrogate data sources and assumptions is unknown and, as stated above, some of the results must be viewed as indications of likelihood (e.g., doses below the performance objectives) or trends rather than as benchmarks or 'final', quantified results."

The March 12, 2002 TechLaw, Inc. Task 8 A Deliverable Administrative Completeness Review of the LANL TA-55 PART B Permit Application (AR 32409).The TechLaw Review cover letter reveals what may be the continuing pattern and practice of NMED to allow LANL to avoid closure outside the permit by using corrective action. "In general, the application was lacking in detail and was found to be severely deficient:"

"The application also lacks detail regarding corrective actions. The application states that final assessment and remediation will be integrated and coordinated under corrective actions of the LANL Environmental Restoration Project (application Section 4.4), which would take the closure process outside of the

permit. NMED may want to further investigate LANL's choice to close these areas as RCRA corrective action areas rather than addressing them in the application. In seeking RCRA permitted status for these units, LANL should address their closure within the application rather than as corrective action under the LANL Environmental Restoration Project. If NMED agrees with the status of administratively incomplete, specification of corrective actions may need to be addressed in a compliance schedule."

The April 8, 2002 TechLaw, Inc. Summary of TechLaw Reviews and Comments on Technical Documents Related to TA-54 (AR #32418) This TechLaw report summarized numerous reviews of technical literature by TechLaw and points out numerous deficiencies in information, unsupported assumptions and the need to redesign the monitoring network at LANL:

(p.2)"The reviews identified numerous incidents where information was presented but not supported in the way needed for regulatory submittals. Many points brought out in the documents were left unsupported, possibly because they seemed obvious to the author(s). For example, many detected chemicals were eliminated without adequate justification from the conceptual site model described in Section 6 of the TA-54 RFI report. In formulating the conceptual and numerical models for transport in the subsurface below MDA L, LANL described their approach but did not always justify the actions taken, thus, giving the impression that the approach relied upon unjustified assumptions. (Emphasis supplied).

(p.2) "TechLaw recommends that NMED continue to push LANL to develop a complete understanding of the fate and transport of hazardous constituents in the subsurface of TA-54 and to incorporate that understanding in conceptual models and numerical simulations, as appropriate.
"As stated in the summary, TechLaw supports the redesign of monitoring program at TA-54 MDA L. However, provisions for some short-term modeling (i.e., quarterly) should be retained as LANL' s documents do not convey an ability to positively identify causes of elevated readings in a timely fashion."

(p.4) "TechLaw noted that statements made in the Davenport document implied that the fractures act as transport pathways within the Bandelier Tuff Clearly, these fractures could serve as conduits for releases from the various waste management units at TA-54, including Material Disposal Areas (MDAs) G, H, and L."

(p.5) "It was not clear from the document text whether vapor retardation was addressed in FEHM, RIP, or other fate and transport modeling or not. Vapor retardation was addressed in subsequent documents (see Reference 31) and it was not included in the formulation of the conceptual model and the numerical model for MDA L. **[Note: See TechLaw, Inc. FEHM comments above].**

(p.15) "TechLaw felt that the Revised Conceptual Model for TA-54 was not complete in that it did not identify primary and secondary transport pathways, off-site transport, exposure routes and receptors, or demographics and land use (current and future). In addition, much of the information and assumptions contained within the Model were not adequately substantiated.

"TechLaw found that LANL had eliminated several chemicals detected at MDAs G, H, and L from their respective conceptual site models without adequate justification. These include: mercury, silver, and selenium detected in surface soils and any organic that was not detected in at least 4 of 8 air samples at MDA G; Lead and tritium detected in sediments, Acetone detected at MDA H during surface flux sampling, and Copper detected in the subsurface at MDA H; and Cadmium, selenium, and silver with reporting limits that exceeded the laboratory background levels, Plutonium-238 detected in sediments, and Cadmium, mercury, uranium. Chromium and barium detected in boreholes 54-1010 and 54-1011 at MDA L.

"Also, LANL assumed, without adequate support, that detections of bis-2-ethylhexyl phthalate at MDAs H and L and di-n-butyl phthalate and pentachlorophenol at MDA L are laboratory artifacts. TechLaw also stated that LANL should address several additional transport mechanisms before the Model is viewed as encompassing all possible contaminant transport pathways. These include:

- Treatment of the subsurface solute transport pathway at MDA L;
- Further consideration of advection in the transport of VOCs and tritium in the subsurface;
- Consideration of wet and dry deposition processes for particles and vapors entering the atmosphere from T A-54; and
- Consideration of exposure of ecological receptors, and possibly humans, through the food chain.

"Further, TechLaw felt that a clear understanding of the influence of fracture flow on contaminant transport was not demonstrated.

"In Section 6.1.3.3, TechLaw recommended that a figure illustrating the location of all the boreholes where samples were taken at MDA L be provided.

"In Section 6.1.3.3, the text states that some analytes were detected above background levels at discrete sampling depths. These compounds are not identified and the locations of the detections are not illustrated in a figure. A reference to the location of the sampling results or to figures illustrating the results should be provided for these analytes.

(p.16) "Further, Section 6.1.3.3 states that tritium is the only radionuclide in the subsurface at MDA L. While the text implies that sampling results for radionuclides other than tritium were analyzed to determine if a pattern indicative of a release was present the analysis is not described. The text should be modified to present the locations of the detections and describe the analyses performed that led to the stated conclusion.

"The second paragraph on page 6-33 states that an analysis was performed to evaluate the potential for VOC flux. The text should be revised to describe the analysis in detail or provide a reference to the location of such a description.

"Reference citations should be provided in the text for previous work performed at TA-54 that supports the conclusions stated in Section 6.1.3.4. For example, a reference should be provided to the document that indicates that the tuff may be '... homogeneous media subject to atmospheric pressure variations ...'

"In Section 6.2.1.1, the first full paragraph on page 6-36 provides estimates of the percentage of pit, impoundment, and disposal shaft volume actually occupied by waste. The text reads as if LANL is not confident in any of the estimates. For example, an estimate of 10% is offered for the pit based on '... limited data ...' LANL should reference all information sources used to develop these estimates.

"For disposal units where uncertainty exists, TechLaw recommended that a range of possible volumes occupied be reported.

"The first paragraph at the top of page 6-37 includes unsupported statements concerning present day surface fluxes at TA-54, releases appear to have reached, or surpassed, steady-state release conditions, pore gas concentrations are steadily decreasing, and that the tritium inventory will be halved about every 12 years. TechLaw recommended that these statements, and others contained in this paragraph, be accompanied by references to LANL documents that support the claims.

"While laboratory investigators have estimated the time it would take for cliff retreat to expose the wastes in the subsurface, there is no discussion of how cliff retreat influences the fate and transport of vapor contamination beneath the MDAs. Such a discussion should be provided.

"With respect to leaching, references to LANL documents that identify the probable source of the liquid that led to metals migration and that characterize the level of residual pore water at MDA L should be provided.

"Section 6.2.13 hypothesized that alternating periods of high and low barometric pressure and changes in atmospheric temperature may influence subsurface VOC migration and, thus, flux at the surface. Because advective transport had been discounted in previous analyses, any analysis that has been performed to investigate the source of the seasonal variation in the surface flux of tritium should be referenced in the text and made available for review."

(p.18) "The Mendoza and Frind paper referenced in Reference 12 described a sensitivity analysis performed on a model derived to determine the importance of advection in the transport of organic vapors. <u>However, the physical scenario considered in Mendoza and Frind differed from the physical conditions at TA-54. LANL applied the results of the Mendoza and Frind analysis to TA-54 without documenting the applicability of the study to conditions at TA-54.</u> Further, it is not clear that consideration was given to chemical property values such as vapor pressure, Henry's Law constant, and molecular weight as suggested by Mendoza and Frind. TechLaw recommended that LANL relate the conditions and findings from the Mendoza and Frind paper to TA-54 as originally suggested in the reviewer comments on Reference 12." (Emphasis supplied).

On July 8, 2002, NMED received a *Task 14 Deliverable, Draft Post-Closure Plan for LANL TA-54 MDAs G, H and L* for container units submitted by TechLaw, Inc. (AR 32428). The document was withheld from the public in a secret area of the NMED Hazard Waste Bureau (HWB) until obtained by Citizen Action in January 2010. TechLaw, Inc. stated the requirements for a post-closure plan for MDAs G, H and L (p.G-1):

"This post-closure plan is submitted to comply with the New Mexico Administrative Code, Title 20, Chapter 4, Part 900 [(20.4.1.900 NMAC) and incorporating 40 CFR §270.14(b)(13)], and describes the activities necessary to comply with post-closure care requirements specified in 20.4.1 NMAC §270.14(b)(13); 20.4.1 NMAC, Subpart V, Part 264, Subpart G; and 20.4.1 NMAC §§264.258 and 264.310 [6-14-00] for the land disposal units at Technical Area 54 (TA54) at the Los Alamos National Laboratory (LANL) Facility."

TechLaw stated the requirements for groundwater monitoring at TA-54 (p. G-1):

"As regulated units, MDAs G, Hand L are subject to groundwater monitoring requirements under 20.4.1.500 NMAC (incorporating 40 CFR §§264.91 through 100)."

TechLaw stated the requirements for groundwater monitoring in the Regional Aquifer Groundwater at TA-54 (p. G-7, 8):

"3.1.2 Regional Aquifer Groundwater

"Monitoring of the regional aquifer will be conducted as part of post-closure care. The groundwater monitoring strategy to be implemented at the Facility will be based upon needs as described in the Order.

"Consistent with the site characterization and following a determination of the need for monitoring, the detection-type monitoring prescribed in 20.4.1 NMAC §264.98 will be initiated.

"Detection is defined in 20.4.1 NMAC §264.91(a)(1) as statistically significant evidence of contamination, as described in 20.4.1 NMAC §264.98(f). A monitoring system and compliance period consistent with 20.4.1 NMAC §§264.96 and 264.97 will be utilized. In accordance with 20.4.1 NMAC §264.98(f), LANL will determine whether there is statistically significant evidence of contamination for any chemical parameter or hazardous constituent. An appropriate frequency for sample collection and statistical analysis will be proposed to the NMED that will be capable of determining statistically significant evidence of contamination, as required by 20.4.1 NMAC §264.98(d}. Data will be collected that are appropriate for the statistical methodology applied, sufficient in sample size, and utilizing sampling procedures and frequencies of sample collection established by the Groundwater Protection Program to ensure that potential contaminant release(s) from the regulated units can be detected, in accordance with 20.4.1 NMAC §264.97"

[**Note:** DOE and LANS have not installed the necessary networks of monitoring wells at the RCRA "regulated units" MDAs G, H and L to meet the 40 CFR § 264.97 General ground-water monitoring requirements.]

TechLaw stated the Reporting requirements for the detection monitoring program at TA-54 (p. G-10,11):

"3.3 Reporting

"Post-closure care will also include reporting consistent with 20.4.1 NMAC, Subpart V, Part 264, Subpart F and 20.4.1 NMAC §264.31 0, as appropriate.

"Consistent with 20.4.1 NMAC §264.98, LANL will notify the Secretary of the NMED if, under the detection monitoring program, it is determined [in accordance with 20.4.1 NMAC §264.98(f)] that there is statistically significant evidence of contamination for chemical parameters or hazardous constituents at any of the monitoring wells. This notification will be provided in writing within seven days of the determination. The notification will indicate what chemical parameters or hazardous constituents have shown statistically significant evidence of contamination.

"If a more comprehensive monitoring program is established based upon the results of the Order, and consistent with 20.4.1 NMAC §264.99, LANL will analyze samples from monitoring wells for all 20.4.1 NMAC, Subpart V, Part 264, Appendix IX constituents at least annually, in accordance with 20.4.1 NMAC 264.99(g). This analysis will be used to determine whether additional hazardous constituents are present in the uppermost aquifer and, if so, at what concentration, pursuant to the procedures in 20.4.1 NMAC §264.98(f). ..."

These above requirements were based on references that included (p. G-12):

> **EPA, 1998, "Standards Applicable to Owners and Operators of Closed and Closing Hazardous Waste Management Facilities: Post-Closure Permit Requirement and Closure Process; Final Rule," 63 Federal Register 56710-56735.** (Emphasis supplied).
>
> LANL, 2001, "Los Alamos National Laboratory General Part A Permit Application," Revision 0.0/0.111.0/2.0, Los Alamos National Laboratory, Los Alamos, New Mexico.
>
> LANL, 1985, "Closure and Post-Closure Plans for TA 54-Area G Landfill at Los Alamos National Laboratory," September 1985, Los Alamos National Laboratory, Los Alamos, New Mexico.

September 30, 2002 TechLaw, Inc. provided ***Attachment F, Draft Closure Plan for Technical Area 54, Areas G, L, H and West.*** (AR 32437). The TechLaw, Inc. document set forth closure and post-closure for regulated units and the groundwater monitoring requirements of 40 CFR 264.91-100 as applicable to TA-54 and described Container Storage Units Closure and Land disposal units.

> "F.1.2.2 Land Disposal Units Hazardous waste, including mixed waste, and source, special nuclear, and by-product materials, as defined in the AEA, have been disposed of at TA-54 MDA's G, H, and L since the 1950's. According to Permittees, hazardous waste was disposed of at MDA's G, H, and L until 1990. <u>Consequently, MDA's G, H, and L are subject to closure and post-closure requirements under 20.4.1.500 NMAC (incorporating 40 CFR Part 264, Subpart G), and are regulated units as defined at 20.4.1.500 NMAC (incorporating 40 CFR §264.90(a)(2)) subject to the groundwater monitoring requirements under 20.4.1.500 NMAC (incorporating 40 CFR §§91 through 100).</u> Source, special nuclear, and by-product material as defined in the AEA are currently disposed of at MDA G."

Public participation requirements were not met for the Consent Order to be an enforceable document. Public participation requirements must ensure a meaningful opportunity for public involvement. At a minimum, that would require that the public first be informed that the Consent Order was to be used *as an enforceable document in lieu of a post closure permit.* (*See.* 40 CFR 265.121(b) and 63 Fed. Reg. 56710, 56714). The Consent was not presented as anything other than a document for corrective action.

The Consent Order does not meet the requirements of 270.1(c)(7) to become an "enforceable document" as contemplated by that section. The Consent Order states that it is an enforceable document in only two sections, III.U and III.W.6. Neither those two sections nor anywhere else in the Consent Order indicates that the Consent Order would be an enforceable document <u>within the meaning of or for the purposes of 40 CFR</u>

270.1(c)(7), i.e., as a document that can be used *in lieu of providing a post-closure permit*. The Consent Order (III.A) Purposes are for corrective action and not the use of the Consent Order in lieu of a post closure permit.

The Consent Order did not put the public on notice of an enforceable document within the meaning of 40 CFR 270.1 (c) in: 1). NMED Schedules for Public Meeting, 2). the NMED Fact Sheet, or 3). in the Consent Order itself. The development of the Consent Order began in 2002 when NMED issued a finding of "imminent and substantial endangerment," and culminated in 2005, when the parties signed the final compliance order. The May 2, 2002 *State Environment Department Schedules Public Informational Meetings Concerning Draft Order for Investigation and Cleanup of Contamination at Los Alamos National Laboratory* (*See,* http://www.nmenv.state.nm.us/OOTS/Public%20Notices/LANL%20Order%20PubMtgsPDF.pdf and http://www.nmenv.state.nm.us/OOTS/Public%20Notices/LANL%20Order%20Final.PDF the Fact Sheet (AR 16031) for the draft order do not provide the public with any notice whatsoever that the draft order would become an enforceable document within the meaning of 40 CFR 270.1(c) to be used in lieu of a post closure permit as per 270.1(c)(7). Nor were the requirements for obtaining such an enforceable document set forth in the Fact Sheet. http://www.nmenv.state.nm.us/hwb/lanl/LANL_Order_Fact_Sheet.pdf

Because using the Consent Order as an enforceable document is not referenced anywhere in the notices above, a reasonable person cannot be said to have had notice that the Consent Order was to be used in lieu of obtaining post closure care permits at LANL. (40 CFR 270.1 (c)(7)). The public was excluded from participation in the negotiations that took place between May 2, 2002 that began as a draft Order for investigation and clean up and subsequently emerged in the 2005 issuance of a Compliance Order on Consent between DOE, LANL and the NMED. Public participation requirements for enforceable documents are codified at 265.121(b). (Exhibit 1, 63 Fed. Reg. 56710, 56714).

The public meeting for the Consent Order, as issued in 2002, was for the Consent Order to become the vehicle for corrective action only. The Consent Order at III.W.6 states that the Consent Order is to be the only enforcement instrument for corrective action. Moreover, the Secretary of the NMED did not make the determinations required under 40 CFR 270.1(c)(7) as to what the "alternative methods" to 40 CFR Subpart F would be to groundwater monitoring requirements. Nor does the Consent Order refer to alternatives. Nor did the Secretary make the determination that the alternative methods would be equally protective of public health and the environment as required by 40 CFR 264.111. Nor does the Consent Order make any reference to 40 CFR 264.111. The Consent Order makes no reference to the Corrective action program that is set forth at 40 CFR 264.100 which requires corrective action to ensure that regulated units are in compliance with the ground-water protection standard under §264.92.

Other than the current recitals contained in the Draft Permit and the Fact Sheet, there is no agreement between the Department and LANL that the Consent Order was an

enforceable document for purposes of 40 CFR § 270.1(c)(7). The Consent Order itself does not contain the statement of any such intended purpose or agreement under 40 CFR § 270.1(c).

NMED denied that the Consent Order would be used in lieu of closure and post-closure requirements and is estopped by the record to now claim otherwise. NMED issued a *Response to Public Comments on the Proposed Compliance Order on Consent for Los Alamos National Laboratory* (February 18, 2005). The Response to Comment 13 states (AR 16251):

> "**Response:** The Consent Order does not address closure or post-closure requirements for operating units at LANL, nor does the Order address the continued disposal of wastes at Area G. Section III.W.1 of the Consent Order specifically provides that the closure and post-closure care requirements for operating units at LANL, under section 20.4.1.500 NMAC, will be addressed in the hazardous waste facility permit and not in the Consent Order. ... The closure plans for MDA's G, H and L will be incorporated in the draft permit. The public will have the opportunity for a hearing when the draft permit is released for public review. The Department is working on the permit, but it is not certain when the draft permit will be issued."

The LANL Draft Permit at section 9.1 now seeks to accomplish a definitional sleight of hand to equate "permitted units" with "regulated units." Consent Order section III.W.1 provides an exception for the use of the Consent Order for (2) the closure and post-closure care requirements of 20.4.1.500 NMAC (incorporating 40 C.F.R. Part 264, Subpart G), as they apply to "<u>operating units</u>" at the Facility. However, for reasons described below and also the historical reasons stated above, <u>MDAs G, H and L are not RCRA permitted units.</u> The Consent Order Consent Order (AR 16255 and 32111) at III.W.A asserts that it fulfills the requirements for:

> "3) groundwater monitoring, groundwater characterization and groundwater corrective action requirements for <u>regulated units under Subpart F</u> and for miscellaneous units under Subpart X of 40 C.F.R. Part 264 and 20.4.1.500 NMAC (incorporating 40 C.F.R. Part 264)." (Emphasis supplied).

This language of III.W.A provides no indication that alternative requirements, as distinguished from the 40 CFR 264.91-100 requirements of Subpart F, will be used for the regulated units.

Are the regulated units G, H and L "permitted units" within the meaning of RCRA? No. As discussed below, Citizen Action disagrees that the LANL Draft Permit definition for permitted unit is correct for purposes of the Resource Conservation and Recovery Act (RCRA). The regulated units G, H and L have not met the RCRA criteria for being permitted units. Regulated units G, H and L lost interim status and were required by RCRA to undergo closure and obtain post-closure permits. The Draft Permit is required to but does not provide the appropriate closure and post-closure requirements for groundwater monitoring for regulated units G, H and L.

The LANL Draft Permit Section 1.2 asserts:

"This Permit also establishes standards for closure and post-closure care of permitted units at LANL pursuant to the HWA and HWMR."

Under the Post-closure Section 9 of the Draft Permit, the regulated units G, H and L are listed as one of three types of "permitted units:"

"9.1 INTRODUCTION

This Permit Part addresses the three categories of permitted units at the Facility. They are identified as follows:

(1) regulated units (*i.e.,* material disposal areas G, H, L);" ...

The Draft Permit regulatory shell game is to allow regulated units G, H and L to avoid the groundwater monitoring requirements of 264.91-100. The Fact Sheet beginning at p.21 [page 102, new Fact Sheet] incorrectly attempts to equate the term "operating unit" to the term used in the Draft Permit of "permitted unit." Consent Order section III.W.1 provides an exception for the use of the Consent Order for (2) the closure and post-closure care requirements of 20.4.1.500 NMAC (incorporating 40 C.F.R. Part 264, Subpart G), as they apply to "operating units" at the Facility. The Draft Permit now would equate operating units with permitted units with regulated units. This is incorrect and the definitions for Operating Unit, Permitted Unit and Regulated Unit differ substantially from each other but are being blurred together by NMED.

The March 1, 2005 LANL Consent Order defines Operating Unit as follows:

"Operable Unit" or "OU" means any individual SWMU or AOC or a group of SWMUs or AOCs based on geographic location (i.e., technical area or test area) or grouped by similar construction, transport pathways, exposure routes, receptors, potential risk, and potential locations for Contaminants to accumulate."

The LANL Draft Permit provides a definition for permitted unit that is not compatible with RCRA and that is also incompatible with the LANL Consent Order definition. Under the Draft Permit Definitions (p.18):

"Permitted Unit means a hazardous waste management unit: 1) that is not an interim status unit; and 2) that is authorized by this Permit and listed in Attachment J (*Hazardous Waste Management Units*), Table J-1 (*Active Portion of the Facility*), or Table J-2 (*Permitted Units Undergoing Post-Closure Care*)."

Under the LANL 2005 Consent Order definitions, "Permit" means the RCRA Permit issued to the Respondents for the Facility to operate a hazardous waste treatment and storage facility, EPA ID No. NM0890010515, as it may be modified or amended.

RCRA provides a regulatory framework for obtaining a RCRA Permit. The regulated units G, H and L did not meet the RCRA criteria to become permitted units. Under RCRA, a permit application consists of two parts, part A (see 40 CFR §270.13) and part B (*see,* 40 CFR §270.14 and applicable sections in §§270.15 through 270.29). In order to be on the RCRA Part B application, a unit must be on the RCRA Part A.

The requirements of 40 CFR 270.1 (b) for MDAs G, H and L to be permitted units have not been met. MDAs G, H and L dropped off of the Part A application for the LANL permit in 1985. The LANL Draft Permit definition would allow LANL to bootstrap units such as MDAs G, H and L onto the permit by merely listing them in Table J although the units are absent from the RCRA Part A application. All three regulated units have operated illegally for more than a decade without the required closure plan that was required 15 days after closing and the post closure permits.

Interim status terminated on November 8, 1985 for land disposal units, unless the owner/operator submitted a Part B permit application and certified compliance with groundwater monitoring before November 8, 1984. Interim status terminated for regulated units Area G, H and L because the Part B application submitted on May 1, 1985 had no request for disposal at regulated units Area G, H and L.

The 7/6/2009 Fact Sheet (AR 31819) states (p.27):

> In addition, under 40 CFR § 270.73(c), interim status for land disposal facilities which were granted interim status before November 8, 1984 terminated on November 8, 1985, unless the owner/operator submitted a Part B permit application and certified compliance with ground water monitoring before that date. **This provision would also call for termination of interim status at Areas G, H and L. The Permitees recognized that interim status at Area L terminated under 40 CFR 270.73(c) on November 8, 1985 (DOE letter, Nov. 25, 1985). Areas G, H and L, as interim status facilities, were each required to have a closure and postclosure care plan for the entire "facility."** (40 CFR §§ 265.110-120)(45 Fed. Reg. 33242-43)(May 19, 1980). **No later than 15 days after termination of interim status**, the owner or operator was required to submit a closure plan to the Department (HWMR § 206.C.2.(c)(3)(a)). Regulations provided a process for Department approval and, thereafter, execution of the closure plan. (HWMR 206.C.2.(d)(2)). EPA stated that the "current regulations [in 1985] specify that the owner or operator and a professional engineer must certify that the facility (including all partial closures) has been closed in accordance with the closure plan." (50 Fed. Reg. at 11074). Thus, certification must establish that 'the entire facility has been closed in accordance with the approved closure plan. (51 Fed. Reg. at 16430).'" (Emphasis provided).

The Fact Sheet recognizes that "No later than 15 days after termination of interim status, the owner or operator must submit a closure plan to the Department." LANL failed to timely submit a closure plan for the units. LANL also failed to submit applications for the post closure care permits for the units. EPA and/or NMED failed to enforce the closure and post closure permit requirements that would have provided public notice and opportunity for a public hearing.

Because the regulated units G, H and L did not obtain permits and are closing with hazardous waste in place, the availability of imposing what may be lesser alternative groundwater monitoring requirements under 40 CFR 264.90 (f) for regulated units co-located with other SWMUs are not available for use by the State RCRA authority (NMED). NMED incorrectly takes the position that "site specific requirements may be used in lieu of full Subpart F requirements" for regulated units G, H and L.

Citizen Action disagrees with NMED's incorrect position that the EPA is allowing "site specific" use of alternative groundwater monitoring requirements as set forth in the Fact Sheet (p. 103) as follows:

> "Under the Consent Order, the Permittees are in the process of investigating groundwater contamination in the vicinity of MDAs G, H, and L and evaluating the existing wells that comprise part of a groundwater monitoring network around TA-54. The Permittees are required to establish a groundwater monitoring network for all regulated units as defined in 40 CFR § 264.90(a)(2). Alternative groundwater monitoring requirements contained in an enforceable document may be used in stated circumstances pursuant to 40 CFR § 264.90(f). Title 40 CFR § 270.1(c)(7) defines "enforceable document" and states, further, that an enforceable document for post-closure care must impose the requirements of 40 CFR § 265.121. Section 265.121, in turn, states that the full terms of 40 CFR §§ 264.91-100 must be met; therefore, it might be read to state that alternative requirements are effectively unavailable. However, EPA has explained that "site-specific requirements" may be used in lieu of full Subpart F requirements. (63 Fed. Reg. 56710, 56714)(Oct. 22, 1998)."

That lesser groundwater monitoring requirements are not available is realized from the distinction between an *unpermitted regulated unit* leaving wastes in place and a *permitted unit.*

The NMED Fact Sheet (AR 31819) analysis ignores the actual stated intent and applicable standard of 63 Fed. Reg. 56710, 56715 for groundwater monitoring applicable to regulated units at facilities closing with waste in place (Exhibit 1):

> 63 FR 56715 III.B. – *"Post closure care under alternatives to permits."* ...Facilities that close with waste in place, without obtaining a permit, and then use non-permit mechanisms in lieu of a permit to address post-closure responsibilities, will have to meet three important requirements that apply to facilities that receive permits: (1) the more extensive groundwater monitoring required under Part 264, as they apply to regulated units; (2) certain requirements for information about the facility found in Part 270 that enable the overseeing agency to implement the Part 264 monitoring requirements; and (3) facility-wide corrective action for SWMUs as required under § 264.101. These requirements are set out in new §265.121, which applies to interim status" (Emphasis supplied)).

63 Fed. Reg. 56716 explains further: "As to groundwater monitoring, this rule will substitute the stricter Part 264 requirements for the original part 265 requirements.

The closure and post-closure permit applications and the imposition of groundwater monitoring requirements at regulated units G, H and L are more than a decade overdue. EPA and NMED allowed regulated units G, H and L to illegally continue to accept waste after the loss of interim status. Area G is still receiving hazardous waste without a RCRA permit. Regulated units G, H and L lost interim status in 1985 and now require closure and obtaining post-closure permits. (See, 40 CFR 270.73-Termination of Interim Status). All operating facilities are required to have RCRA permits. The Consent Order states (p.77)(AR 16255 & 32111):

> "MDA G at TA-54 Area G was used as the Facility's primary radioactive disposal facility from 1957 until 1997. Solid and liquid wastes were disposed at MDAs G, H, and L. Area L is currently a hazardous and mixed waste container storage area. Currently, Area G is used for the disposal of low-level radioactive waste in pits, and for the storage of mixed and transuranic waste. The Respondents report that hazardous and mixed wastes were disposed of in pits, trenches, and shafts at MDA G until 1990. MDA H is an inactive hazardous and radioactive waste disposal area that received classified or sensitive wastes and debris contaminated with radioactive, hazardous, and explosive constituents between 1960 and 1989. MDA L at TA-54 Area L was used between 1959 and 1986 for disposal of mostly liquid hazardous and radioactive wastes into pits, trenches, and shafts. Environmental investigations at TA-54 show that contaminant releases have occurred at MDAs G, H, and L. None of the radioactive materials and waste management activities at TA-54 are subject to this Consent Order."

The current permit cannot include or regulate the regulated units G, H and L as "permitted units" so as to apply alternative groundwater monitoring requirements under the Consent Order as an enforceable document. The Consent Order does not qualify as an enforceable document for reasons stated above. There were no timely applications for closure and post closure permits for regulated units G, H and L. No clean closure was provided for regulated units G, H and L. No groundwater monitoring was put into place that accorded with post-closure care requirements of 264.91-100. The inclusion of G, H and L in the current permit is improper because the three units lost interim status, were required to close and did not again become listed on a Part A application at any time and cannot now be part of a Part B application.

As will be discussed in more detail below, whatever the "alternative requirements" may be that are used by NMED and LANL, they do not protect groundwater. Unfortunately, the inchoate groundwater monitoring at LANL has provided less protection than the requirements provided for by 40 CFR 264.91.-100 for collecting reliable water sampling data.

Many scientific reports over nearly a decade have described the overall failure of the DOE/LANL to comply with groundwater monitoring requirements to protect the

precious groundwater resources from contamination by LANL chemical and nuclear wastes. The Environmental Protection Agency (EPA), the DOE Inspector General, the National Academy of Sciences (NAS) and Registered Geologist Robert Gilkeson have written detailed reports that describe the major problems in the DOE/LANL groundwater protection practices and lack of compliance with regulations.

Although written standards for groundwater monitoring have been in place on paper for more than a decade, first described by the EPA permit Module VIII (1990) as the "prescriptive" requirements of 264.91-100, enforcement has not been accomplished of those legal groundwater monitoring requirements to obtain representative and reliable water samples at LANL's regulated units.

A May 30, 1995 NMED letter to LANL identified TA-54 G, H and L and several other regulated units as being subject to groundwater monitoring requirements when NMED denied a DOE request for groundwater monitoring waivers. NMED ordered DOE and LANL to prepare a Hydrogeologic Workplan. The pertinent excerpt from the letter is pasted below:

> "Los Alamos National Laboratory (LANL) has provided inadequate and incomplete information pertaining to the unsaturated and saturated conditions across the Pajarito Plateau in support of ground-water monitoring waivers for the various RCRA-regulated units (TA-54 Area G & L, TA-16 Surface Impoundment & Area P Landfill, TA-35-125 & 85 Surface Impoundments, and TA-53 Surface Impoundments). Basic geology, hydrogeology, and pathways for contaminant transport have not been adequately addressed to date."

The Hydrogeologic Workplan (May 22, 1998) recognized the requirement for groundwater monitoring to be 40 CFR 264.91 – 100 (AR 13191) (p.1-13):

> "**1.5.5 Other Requirements**
>
> "The structured groundwater monitoring requirements applied to regulated units under RCRA are prescriptive [Footnote omitted]. The New Mexico Annotated Code, Title 20, Chapter 4, Part 1 (20 NMAC 4.1) Subpart VI, Sections 264.91 - 100 establish three progressive monitoring programs that, unless a demonstration can be made that no potential for migration of liquid from the regulated unit to the uppermost aquifer exists, may be necessary to implement for detecting and addressing releases to groundwater. To adequately establish a monitoring network under any of these programs, it is necessary to characterize the subsurface (including groundwater) in a comprehensive manner."

Section IV.A.1 of the Consent Order stated: "The requirements of this Consent Order replace the requirements of the Hydrogeologic Workplan." The former Hydrogeologic Workplan was required to be implemented by the 1995 NMED letter of denial to

LANL's request for waivers of groundwater monitoring.[7] However, the NMED did not require LANL to accomplish the former prescriptive RCRA requirements of 40 CFR 264.91-100 of the Hydrogeologic Workplan.[8]

In fact, basic geology, hydrogeology, and pathways for contaminant transport were *not* adequately addressed by the LANL *Hydrogeologic Workplan* for the RCRA regulated units and *still* have not been adequately addressed to the present time. A serious deficiency is that the only RCRA regulated units that are identified in the LANL Consent Order and the draft Part B RCRA Permit are the three regulated units MDAs G, H and L, However, the NMED documents and LANL RCRA reports reviewed by Citizen Action establish that the minimum number of RCRA "regulated units" at LANL is ten (10) units (TA-54 Area G, H and L, TA-16 Surface Impoundment and Material Disposal Area P, TA-21 MDA T, TA-35, TA-125 and TA-85 Surface Impoundments, and TA-53 Surface Impoundments, Liquid Coolant Water from TA-21 Steam Plant and the associated seepage pit and disposal well).

For the sake of argument, even if the standard of 40 CFR 264.90(f) were found to be applicable to allow alternative groundwater monitoring for the regulated units at

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[7] It is procedurally questionable whether the Consent Order could have replaced the Hydrogeologic Workplan without a modification of the 1990 EPA permit. (See, 40 CFR 270.42 Appendix I). No public notice was given for the Consent Order to modify the 1990 EPA permit.

[8] The Hydrological Workplan cited the EPA 1990 HSWA Module VI11 Requirements for well construction.

> "Special permit conditions included in the HSWA Module VI11 requirements (EPA 1990) apply to the construction of monitoring wells. In particular, the following permit language is relevant to the construction of the wells proposed in this Workplan.
>
> "The monitoring wells installed under this and following sections of this permit shall be constructed using flush-joint, internal upset, threaded (or an equivalent method of joining without rivets, screws and glues) casing manufactured from inert materials. The boreholes for casings and screens shall be a minimum of six (6) inches greater in diameter than the well casing or screen outer diameter. Filter pack and screen slot openings shall be sized based on formation grain size and characteristics. Well screen lengths shall be no more that (10) ten feet in length. The filter pack shall extend no more than (2) two feet above the top of the screen and shall not cross any clay layers which may act as aquitards. If a bentonite seal is used, the bentonite shall be allowed to hydrate a minimum of (12) twelve hours before emplacement of grout. Grout shall be emplaced using a tremie pipe to ensure a consistent seal at depths greater than 5 feet, and grout shall be allowed to set a minimum of twelve hours before initiating development."
>
> "Development procedures shall include purging of the well until contaminants introduced during drilling can be assured of being removed. Development shall also include surging with a surge plug, and either bailing or pumping until the nephelometric turbidity units (N.T.U.) can be consistently measured at five (5) or less, if possible. Well head construction shall include a well pad keyed into the well annulus and a system to secure the well from traffic and unauthorized access."

LANL, the history of the groundwater monitoring at the regulated units demonstrates overall failure of the monitoring wells at TA-54 to furnish the reliable and representative water data under 40 CFR 264.91-100 so as to be protective of human health and the environment. The current groundwater monitoring at LANL does not adequately provide upgradient background water quality data for LANL. Downgradient monitoring wells are not located at the point of compliance as described by 264.95. The Draft Permit must impose the full requirements for groundwater monitoring including detection and compliance monitoring at LANL to prevent further abuse.

The record of groundwater monitoring performance at LANL demonstrates that the Consent Order requirements have been routinely violated and fail to be protective of public health and the environment. The record shows the LANL has not installed a reliable groundwater monitoring network. The record shows the knowing lack of enforcement of groundwater monitoring requirements and the acceptance and approval of unreliable monitoring well data by the NMED.

The Compliance Order on Consent (AR 32111) provides for groundwater investigation to include EPA and industry accepted methods and procedures as follows:

> "IV.A.3 Groundwater Investigation
> The Respondents shall conduct investigations of groundwater in accordance with Department approved work plans to **fully characterize the nature, vertical and lateral extent, fate, and transport of groundwater contamination originating from the Facility to determine the need for, and scope of, corrective action.** The investigation shall include an evaluation of the physical, biological and chemical factors influencing the transport of contaminants in groundwater. The Respondents shall implement the groundwater investigation requirements in accordance with the schedule set forth in Section XII of this Consent Order. **All data shall be collected according to EPA and industry accepted methods and procedures, and in accordance with Section IX of this Consent Order."**

The Consent Order includes provision for groundwater monitoring, characterization and corrective action at "regulated units."

> **"III.A PURPOSES AND SCOPE OF CONSENT ORDER**
> The purposes of this Consent Order are: 1) to fully determine the nature and extent of releases of Contaminants at or from the Facility; 2) to identify and evaluate, where needed, alternatives for corrective measures, including interim measures, to clean up Contaminants in the environment, and to prevent or mitigate the migration of Contaminants at or from the Facility; and 3) to implement such corrective measures. Except as provided in Section III.W.1, this Consent Order fulfills the requirements for: 1) **corrective action** for releases of hazardous waste or hazardous waste constituents under sections 3004(u) and (v) and 3008(h) of RCRA, 42 U.S.C. §§ 6924(u) and (v) and 6928(h), sections 74-4-4(A)(5)(h) and (i), 74-4-4.2(B), and 74-4-10(E) of the HWA, and their implementing regulations at 40 C.F.R. Part 264, subpart F (incorporated by 20.4.1.500 NMAC); 2) corrective action for releases of groundwater contaminants listed

at 20.6.2.3103 NMAC, toxic pollutants listed at 20.6.2.7.VV NMAC, Explosive Compounds, nitrate, and perchlorate pursuant to section 74-9-36(D) of the SWA; 3) **groundwater monitoring, groundwater characterization and groundwater corrective action requirements for regulated units under Subpart F** and for miscellaneous units under Subpart X of 40 C.F.R. Part 264 and 20.4.1.500 NMAC (incorporating 40 C.F.R. Part 264); and 4) additional groundwater information required in Part B permit applications under 40 C.F.R. § 270.14(c) and (d)(3) and 40 C.F.R. § 270.23(b) (incorporated by 20.4.1.900 NMAC)."

NMED has not applied the groundwater monitoring requirements of 40 CFR 264 Subpart F to the regulated units at LANL. Subpart F includes 40 CFR 264.90-101. Since the Consent Order does not cite the specific groundwater monitoring requirements of 40 CFR 264.91-100 of Subpart F, NMED has chosen to ignore the rigorous application and enforcement of the 264.91-100 portion of Subpart F to LANL regulated units.

In or about 2005, scientific concerns about the reliability and representativeness of the groundwater quality data obtained from characterization wells drilled beneath the Pajarito Plateau. This was because the LANL scientists used mud-rotary drilling methods which allowed organic drilling fluids and foams and/or bentonite clay muds to invade all of the screened intervals. These organic additives and muds have known properties to mask present and future radionuclides and toxic and hazardous contaminants. The problems with the LANL characterization wells were brought to the attention of the DOE Office of Inspector General (IG). In September 30, 2005, the DOE IG wrote a report entitled *Characterization Wells at Los Alamos National Laboratory* (AR 13953) that described the failure of DOE/LANL to meet the requirements of the Resource Conservation and Recovery Act (RCRA) and DOE Order 450.1 to install monitoring wells that produce reliable and representative water samples for the detection of LANL contaminants.

Numerous reports have rejected the reliability and representativeness of groundwater water quality data from LANL monitoring wells including rejecting the ability of the monitoring wells to be "rehabilitated." See the following:

> DOE/IG. 2005. United States Department of Energy Office of Inspector General Inspection Report 0703 – *Characterization Wells at Los Alamos National Laboratory*, DOE/IG-0703, September 2005. (AR 13953)
>
> Ford, R., S.D. Acree, and R.R. Ross. 2005. Memorandum to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (01RC06-001) Impacts of Well Construction Practices. Ada, Oklahoma: United States Environmental Protection Agency, National Risk Management Research Laboratory, Ground Water and Ecosystems Restoration Division. Draft Version, September 30, 2005. (AR 14175) (True and correct copy attached as EXHIBIT 10).

Ford, R., S.D. Acree, and R.R. Ross. 2006. Memorandum to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (05RC06-001) Impacts of Hydrogeologic Characterization Well Construction Practices. Ada, Oklahoma: United States Environmental Protection Agency, National Risk Management Research Laboratory, Ground Water and Ecosystems Restoration Division. Final Report, February 10, 2006. (True and correct copy attached as EXHIBIT 11).

Ford, R., S.D. Acree, and R.R. Ross. 2006. Memorandum to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (05RC06-001) - Review of LANL *Well Screen Analysis Report* - Ada, Oklahoma: United States Environmental Protection Agency, National Risk Management Research Laboratory, Ground Water and Ecosystems Restoration Division. Final Report, February 16, 2006. (True and correct copy attached as EXHIBIT 5).

S.D. Acree, and Richard Wilkin, Ph.D. Memorandum to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (09RC06-001) - Review of LANL *Well Screen Analysis Report (WSAR), Rev.2* (LA-UR-07-2852) Groundwater Background Investigaton Report (GBIR) Rev. 3.(LA-UR-07-2853) United States Environmental Protection Agency, National Risk Management Research Laboratory, Ground Water and Ecosystems Restoration Division. March 30, 2009. (True and correct copy attached as EXHIBIT 6).

An August 17, 1995 NMED letter (AR 12648) expressed concerns for groundwater contamination and protection at the Laboratory in the Hydrogeologic Workplan (AR 13191) (p. 1-10 through 1-11):

> "The letter further stated that NMED was evaluating work to be conducted to assure compliance with both the hydrogeologic requirements of the HSWA Module of the Laboratory's RCRA operating permit (EPA, 1990) and the requirements for groundwater monitoring of RCRA regulated units (A letter from NMED providing this evaluation was received in August, 1996). The August 17, 1995 letter stated the following determination:
>
> > 'a RCRA site-wide hydrogeologic Workplan should be developed and submitted to NMED and EPA for review and approval. A site-wide hydrogeologic Workplan developed under the driver of RCRA will provide a mechanism to assure a compliance schedule with specific tasks to meet the permit objectives. The Workplan should address both the HSWA hydrogeologic permit requirements and RCRA regulatory ground-water monitoring requirements.'

"This determination by NMED is the primary driver for preparation of this Workplan."

The Consent Order section IV.A.3 requires:

"All data **shall be collected** according to EPA and industry accepted methods and procedures, and in accordance with Section IX of this Consent Order." (Emphasis supplied).

The Consent Order section X.B. Drilling Methods requires (p. 174):

"X.B DRILLING METHODS

Groundwater monitoring wells and piezometers must be designed and constructed in a manner which will yield high quality samples, ensure that the well will last the duration of the project, and ensure that the well will not serve as a conduit for contaminants to migrate between different stratigraphic units or aquifers. The design and construction of groundwater monitoring wells shall comply with the guidelines established in various EPA RCRA guidance, including, but not limited to:

• U.S. EPA, *RCRA Groundwater Monitoring: Draft Technical Guidance*, EPA/530-R-93-001, November, 1992;

• U.S. EPA, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, OSWER-9950.1, September, 1986; and

• Aller, L., Bennett, T.W., Hackett, G., Petty, R.J., Lehr, J.H., Sedoris, H., Nielsen, D.M., and Denne, J.E., *Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells*, EPA 600/4-89/034, 1989.

The U.S. EPA, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, OSWER-9950.1, September, 1986 for design and construction of monitoring wells is <u>required by the Consent Order to be implemented at LANL</u>. Nevertheless,
Bentonite clay drilling muds and organic drilling fluids were routinely and improperly used up to the present in LANL groundwater monitoring wells. The EPA Groundwater Monitoring Technical Enforcement Guidance identifies the adverse effect for an assessment of aquifer characteristics by the use of Bentonite muds that provide an environment for bacterial growth, which, in turn, reduces the reliability of sampling results.

The DOE/IG, 2005 United States Department of Energy Office of Inspector General Inspection Report 0703 – *Characterization Wells at Los Alamos National Laboratory,* DOE/IG-0703, September 2005 (AR 15953) cited the RCRA Ground-Water Monitoring Draft Technical Guidance. The DOE/IG concluded that monitoring well design and construction at LANL did not meet the applicable requirements of 40 CFR 264.97:

- "LANL's use of mud rotary drilling methods during well construction was allowable under applicable RCRA guidance, as well as the Compliance Order on Consent. However, LANL did not adhere to specific constraints established in the RCRA guidance when using muds and other drilling

fluids, and, as a result, LANL could not assure that certain residual drilling fluids were removed; and

- " Muds and other drilling fluids that remained in certain wells after construction created a chemical environment that could mask the presence of radionuclide contamination and compromise the reliability of groundwater contamination data."

The DOE/IG stated further:

> "Documentation indicates that LANL used muds and other drilling fluids during the drilling of 24 of the 32 characterization wells. For example, 28,250 pounds of bentonite clay were used during the drilling of well R-14, and 51,100 pounds of finely ground sodium bentonite (Quick Gel) were used during the drilling of well R-16."

The prohibition for cross-contamination of different zones during drilling and to the groundwater was violated by several monitoring wells.

A September 2004 LANL *Response to Concerns About Wells at LANL* (LA-UR-04-6777) (See true and correct copy attached as figure __ to this testimony) Longmire found and reported in 2002 that regional monitoring well R-22 well screens 1, 3, 4, and 5 "have not equilibrated and are affected by residual drilling fluids." A summary of what Longmire found along with radionuclides Technetium, uranium and Tritium included (p.35):

> "Thirty-one volatile and semivolatile organic compounds have been detected in water from well R-22. Only two of these, pentachlorophenol (1 detection, 6.2 ppb, MCL = 1 ppb) and benzo(a)pyrene (2 detections, 0.24 ppb, MCL = 0.2 ppb), were present at concentrations above the MCL.
>
> ...
>
> "At this time there are measureable concentrations of tritium, volatile organic compounds, and semivolatile organic compounds which warrant continued monitoring."

<u>These findings constitute "statistically significant evidence of contamination" at R-22 (40 CFR 264.98) for detection monitoring at LANL. The imposition of compliance monitoring is required under 40 CFR 264.99.</u> Compliance monitoring has not been initiated although the contamination by RCRA contaminants was described eight years ago.

The Sept. 30, 2005 EPA Kerr Lab report in described the importance to seal the borehole section that was drilled with organic drilling additives before drilling into the regional aquifer. The EPA Kerr Lab stated ((AR 14175, p.10):

> "5.At locations determined to be critical to the detection monitoring program, consider replacement of wells that were drilled using bentonite or organic additives with wells installed without additives in the screened zones. As noted above, data available from installation of the hydrogeologic characterization wells at these locations will allow specific intervals to be targeted for screening.

Drilling additives may be used in intervals above the target screened zone. However, a casing should be pressure grouted in place and the hole cleaned prior to drilling into the screened zone and subsequent well installation

The Consent Order states (AR 32111, p. 174):

"Precautions shall be taken to prevent the migration of contaminants between geologic, hydrologic, or other identifiable zones during drilling and well installation activities. Contaminant zones shall be isolated from other zones encountered in the borings."

p. 194 "Contamination and cross-contamination of groundwater and aquifer materials during drilling shall be avoided."

(p.195). "The drilling method shall allow for the collection of representative groundwater samples. Drilling fluids (which includes air) shall be used only when minimal impact to the surrounding formation and groundwater can be ensured."

Further, the NMED HWB has not enforced the requirement in the LANL Consent Order for the LANL monitoring wells to comply with RCRA technical guidance. Consent Order Section X.B., states (p.189):

"The design and construction of groundwater monitoring wells shall comply [emphasis added] with the guidelines established in various EPA RCRA guidance, including, but not limited to:

• U.S. EPA, RCRA Groundwater Monitoring: Draft Technical Guidance, EPA/530-R-93-001, November, 1992 [also known as the EPA RCRA Manual].

The drilling activities at e.g., regional groundwater monitoring well R-40 did not comply with the guidance in the EPA RCRA Manual for the installation of casing to prevent cross-contamination between the perched zone and the regional aquifer. The pertinent excerpt from the RCRA Manual is states (p. 4-11):

"Drill the boreholes using techniques that minimize the danger of cross-contamination between water-bearing zones. Such techniques typically involve drilling an initial borehole partially into the possible confining layer, installing (grouting in) an exterior casing, emplacing grout in the cased portion of the borehole, and drilling a smaller diameter hole through the cased off/grouted portion of the borehole (i.e., telescoping casing) through the confining layer."

The use of mud rotary drilling methods results in slower Ksat values that can underestimate the contaminant transport time for the wastes to reach the regional aquifer.

A special situation presents itself from the use of bentonite clay in screen 2 in monitoring well R-26 providing for the very low Ksat value of 0.002 ft/day that was

measured. The Consent Order (IV.A.3 Groundwater Investigation) requires knowledge for the transport of contaminants in groundwater. Screen 2 does not produce water samples because the screened interval is so tightly plugged by the bentonite clay introduced by the mud-rotary drilling method and also by a mistake in well construction that surrounded the well screen with the bentonite clay grout. The presence of the bentonite clay in screen 2 was described in the LANL Evaluation of the Suitability of Wells Near Technical Area 16 for Monitoring Contaminant Releases from Consolidated Unit 16-021(c)-99, Revision 1 (LA-UR-07-6433, September 2007) (TA-16 Well Evaluation Report). (AR 30191) The pertinent excerpts from the report are pasted below:

> "R-26: Bentonite is present at Screen 2. The source of this bentonite is not known, but it was probably introduced during well completion. The presence of bentonite may result from a seal integrity problem or from the presence of residual drilling mud (p. 22)."
>
> **"4.2.3.8 R-26**
> R-26 has one screen (Screen 2) in the regional aquifer. During sampling at Screen 2 in 2005, it was discovered that the lower port was plugged with bentonite. In November 2005, the transducer was relocated to another port in the same screened interval. Still, collected pressure data are suspect because bentonite was present in the screen (p. 30)."

A NMED November 24, 2009 Notice of Disapproval (NOD) (AR 32236) was issued for the new multiple-screen monitoring well R-40. The NOD described the 60-day period that water contaminated with organic drilling products in a perched zone of saturation was allowed to flow down the open multiple-screen well and into the regional aquifer. The NMED approved the drilling work plan that allowed the cross-flow between the perched zone and the regional aquifer. NMED approved the work plan despite the fact that the plan allowed drilling through two perched zones of saturation with organic drilling products. Monitoring wells were installed in the two perched zones although the zones were drilled through with organic drilling foam.

The LANL 2008 Interim Facility-Wide Monitoring Plan (AR 31663)acknowledges the presence of organic drilling additives in two of the new regional aquifer monitoring wells that were drilled into the regional aquifer only with air and water. The pertinent excerpts from Appendix F are pasted below:

p. F-60 R-36 (Regional) Minor presence of residual organic drilling products is steadily clearing up.

p. F-62. R-42 (Regional) Minor presence of residual organic drilling products is steadily clearing up.

The Consent Order's (AR 16255) requirement to purge well screens before sampling is routinely violated by the LANL Westbay monitoring wells that have multiple well screens and cannot be purged prior to sampling. Thus, the data from Westbay monitoring wells is not reliable and representative of the formation water.

The Consent Order describes the requirement for **Well Purging** at (IX.B.2.i.i):

> "All zones in each monitoring well shall be purged by removing groundwater prior to sampling and in order to ensure that formation water is being sampled. Purge volumes shall be determined by monitoring, at a minimum, groundwater pH, specific conductance, dissolved oxygen concentrations, turbidity, redox potential, and temperature during purging of volumes and at measurement intervals approved by the Department in writing. The groundwater quality parameters shall be measured using a flow-through cell and instruments approved by the Department in writing." (Emphasis supplied).

The December 4, 2009 NMED Department of Energy Oversight Bureau and Hazardous Waste Bureau document, *Proposals for Independent Environmental Monitoring at Los Alamos National Laboratory, New Mexico,* December 4, 2009 (True and correct copy attached as EXHIBIT 7) illustrates that the data provided by LANL from no-purge Westbay monitoring wells has been accepted by the NMED for over a decade:

> "Beginning in 1998 and as part of the LANL groundwater characterization program, 15 regional wells and one intermediate aquifer well were installed and equipped with Westbay multiport-sampling systems. Samples from these wells are collected without prior purging. Subsequent water-quality data collected from these wells suggested that many of the wells were not providing representative samples, and that some type of assessment and corrective action were warranted. It was concluded that residual drilling fluids present within the sampling area (screen, filter pack, and formation) were the cause of the poor sample quality..."
>
> "... Field data and hydrochemical data indicate that the groundwater being pumped was not representative of the formation and was impacted by drilling fluids."

It is a violation of RCRA for NMED to have knowingly accepted the incorrect data from the Westbay monitoring wells. (42 U.S.C. 6928).

The National Academy of Sciences *Plans and Practices for Groundwater Protection at the Los Alamos National Laboratory: Final Report,* (2007) (Exhibit 4) reported failed monitoring wells and uncertainty in modeling because the data does not exist beneath the mesas where the large inventory of wastes are buried:

> (p.42) An update to the regional aquifer model is provided by Keating et al. who state that "predicted flux through older basalts in the aquifer can vary by a factor of three . . . the true uncertainty of our predictions, including the impact of possible conceptual errors, is likely to be larger and is difficult to quantify" (Keating et al., 2005, p. 653).
>
> (p.46) "Although LANL is using a numerically sophisticated multiphase model for vadose and regional groundwater modeling, it is not yet possible to predict

with confidence when, where, or if a contaminant might appear in the regional aquifer."
(p. 46) ... "the detailed knowledge needed to predict subsurface flow paths does not exist. Lack of understanding of these phenomena, coupled with rapid flow in the alluvium and apparent rapid flow facilitated by perched waters, was central to the surprise over detection of chromium near the water supply wells. An improved knowledge of these inter-watershed processes is needed to design an effective, early warning monitoring program."
(p. 49) "Many if not all of the wells drilled into the regional aquifer under the Hydrogeologic Workplan appear to be compromised in their ability to produce water samples that are representative of ambient groundwater for the purpose of monitoring."
(p. 51) "Previous problems in installing well screens at LANL have been reported to include excessively long screens, screens installed at the wrong depths to intercept contaminants, too many screens per well, and screen materials that corrode in groundwater (Gilkeson, 2006b). The use of overly long screens can cause dilution of sampled contaminants. Multiple screens, on occasion as many as nine screens in some LANL wells, can cause dilution or possibly cross-contamination of samples if there is leakage between screens."
(p. 53) "There is general agreement that the use of bentonite clay and organic additives has compromised the ability of at least some R-wells to yield water samples that are truly representative of the ambient, undisturbed groundwater conditions (LANL, 2005d; Ford et al., 2006; Ford and Acree, 2006; NMED, 2006). Robert Gilkeson, a registered geologist and former advisor to LANL, stated that bentonite clay and/or organic drilling additives had invaded the screened intervals in all of the LANL characterization wells (Gilkeson, 2006a,b). He illustrated a conceptual model of how these materials can set up a "reactive capture barrier" that would tend to remove contaminants from sampled groundwater; see Figure 5.2 (also see Chapter 3, Figure 3.2)."
(p. 53) "Because the construction of these wells was expensive, some $1 million to $2 million for each well (Broxton, 2006), LANL began work in 2006 to try to recover some of the compromised screened intervals (LANL, 2005d, 2006e,f).
This rehabilitation effort is itself controversial (Gilkeson, 2006a,b; LANL, 2004d). The New Mexico Environment Department's (NMED's) notice of disapproval of the Well Screen Analysis Report (letter dated September 18, 2006)
indicated continued disagreement on a number of important issues regarding the rehabilitation work."
(p. 54) "Geologist Robert Gilkeson described concepts of how drilling fluids could form a zone that removes contaminants from sampled groundwater."
(p. 59) "**SIDEBAR 5.3 Citizens' Concern for Radionuclides Reported in Drinking Water**

"Near the end of this study, the non-governmental organization Concerned Citizens for Nuclear Safety (CCNS) and Robert H. Gilkeson, a registered
geologist, brought to the committee's attention data in LANL's Draft Site-Wide Environmental Impact Statement (SWEIS; DOE, 2006) that indicated

contamination of drinking water supply wells by neptunium and other radionuclides, including plutonium, americium, strontium, and cesium. CCNS and Gilkeson pointed out that data tables in the draft SWEIS showed, for example, that neptunium (Np-237) was detected in 4 of 13 samples from Los Alamos County supply wells and in 2 of 3 samples from the Buckman well field that supplies over 40 percent of the drinking water for residents of the city of Santa Fe. Mean concentrations of Np-237 were 10.6 and 10.3 pCi/L, respectively. These reported concentrations approach the EPA limit of 15 pCi/L for alpha-particle emitting nuclides in drinking water.

"In its memorandum to the committee, CCNS and Gilkeson stated: "We are surprised at the high levels of neptunium. This contamination may be because of the poor precision of the gamma spectroscopy analytical method. The LANL scientists claim the neptunium contamination doesn't exist and the detects are 'false positives.' Nevertheless, the contamination is presented as *valid detections* in the data tables in the draft LANL SWEIS" (Gilkeson and Arends, 2007, p. 5).

"In responding to CCNS, LANL did in fact attribute the reported data to 'false positives,' stating: "Detections of LANL-derived contaminants, such as plutonium, americium, and strontium, have occurred sporadically in water supply wells. . . . Because the overall frequency of detection is low, we believe that these sporadic detections are false positives or caused by problems at the analytical laboratory. This conclusion is supported by numerous reanalyses of these samples and by lack of consistent detections in paired samples" (Phelps, 2007, p. 2).

"This exchange between CCNS and LANL is a good example of why the committee is concerned about LANL's representations of groundwater sampling data. Whether or not the data were statistically significant, and the committee takes no position on this, the data were reported by LANL in its draft SWEIS and, reasonably, taken as real concerns by public stakeholders."

According to the March 30, 2009 Memorandum of S.D. Acree, and Richard Wilkin, Ph.D. to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (09RC06-001) - Review of LANL *Well Screen Analysis Report (WSAR), Rev.2,* (Exhibit 6) the study of water quality data alone cannot determine whether the changed water chemistry surrounding a well screen can again provide representative and reliable water samples. The LANL WSAR, Rev. 2, (AR 14684) which relied on water quality data, much of it from no-purge Westbay wells, was carelessly approved by the NMED in September 2007, despite three (3) earlier EPA Laboratory reports pointing out the error of reliance on groundwater sampling data and the inability to determine whether sampling results were correct.

After the NMED approval of the WSAR, Rev. 2 and the Groundwater Background Investigation Report (GBIR), the March 9, 2009 EPA Laboratory Memorandum once

again rejects the methodology of relying on groundwater sampling data. The 3/10/09 EPA Kerr Laboratory (Id.) memorandum states:

> "The most significant concerns noted in review of the current versions of the WSAR and the GBIR are related to three areas:
>
> - The results of the WSAR and related assessments have not been fully validated using site-specific data from laboratory and field studies.
> - The criteria rely heavily on the 'background' data obtained from long-screened production wells and springs that do not necessarily represent water quality upgradient of the hydrogeologic characterization monitoring wells.
> - The reliability of criteria used to evaluate the Representativeness of groundwater samples from well screens following transformation of residual organic drilling additives and the return of groundwater samples to oxidized conditions is uncertain due to a lack of direct assessments of the site-specific mineralogical transformations and the reliance on groundwater sampling data."

The supposed "rehabilitation" of the compromised screen intervals at LANL monitoring wells is based on the study of water quality data alone. The data cannot be used to determine that the impacted wells have "cleaned up" from the damage caused by the large quantity of organic drilling additives that were forced into the screened intervals by the use of improper and unnecessary drilling methods. This would invalidate affected well screens as sampling points. NMED has continued the knowing acceptance of LANL's Well Screen Analysis Report, Rev. 2 in the face of the factors of: significant lack of validation of screening results, uncertain background conditions, and the impossibility to clearly assess the nature of the reactive iron mineralogy surrounding the well screens by examining water quality alone.

The 2009 EPA Kerr Laboratory Memorandum (Exhibit 6) recommended "upgradient well installations;" laboratory studies to "quantify sorption of the inorganic constituents of concern onto the materials used during well construction at LANL, and; "the installation of new well(s) drilled without the use of additives in the screened zone near the impacted well(s)."

Mandatory requirements have not been met or enforced for more than a decade at LANL's regulated units to provide:

- monitoring wells in the RCRA prescribed point of compliance locations relative to the regulated units (40 CFR 264.95);
- upgradient monitoring wells for the determination of background water quality;
- downgradient monitoring wells at the point of compliance;
- accomplishment of representative and reliable water sampling unaffected by drilling additives, and;
- purging before sample collection. (*See, e.g.,* 40 CFR 264.97).

The knowing, willful and continuing pattern and practice of using monitoring wells that do not and cannot provide representative and reliable water samples and compiling such information in LANL reports with NMED acceptance and approval of those reports constitute the furnishing of false and incorrect information by DOE/LANL in its permit application and is reason for the Court to deny the Draft Permit. (*See,* 40 CFR 270.41-43).

Unfortunately, as shown above, groundwater monitoring data has not been collected in accordance with:

- Module VIII of the 1990 EPA permit;
- Hydrogeologic Workplan (1998),
- DOE Order 450.1 (see DOE/IG-0703 Inspection Report, p.2)
- EPA standards as required by 40 CFR 264.91-100;
- EPA Draft Technical Guidance for Groundwater Monitoring,
- The Consent Order, and;
- Accepted industry procedures, e.g., as set forth by TechLaw, Inc supra.

Nevertheless, the incorrect water sampling data has been knowingly and willfully provided from defective wells at LANL. NMED has ignored numerous scientific reports that describe the defective monitoring wells at LANL. NMED nevertheless continues to issue approval for reports containing incorrect data contained in LANL reports. NMED and LANL have wasted hundreds of millions of taxpayer dollars in the construction of worthless wells that furnish sham data.

Recommendations

1. 40 CFR § 264.90(a)(2) imposes the groundwater monitoring requirements of 40 CFR § 264.91-.100 and that should be clearly stated in the Draft Permit Sections 9, 10 and 11 instead of the regulatory loophole that is being put on the table. All regulated units must have a minimum of one upgradient monitoring well, three down-gradient monitoring wells for detection monitoring. Where contamination has been/is identified, compliance monitoring must be established.
2. LANL must identify all regulated units and submit a closure plan and post closure plan for all regulated units. The Draft Permit must contain a Closure Plan and Post-Closure Care Permits must be submitted for the regulated units along with the Long Term Monitoring and Maintenance Plans.
3. NMED must impose the proper detection and compliance groundwater monitoring networks at all regulated units as required in 40 CFR 264.91-100.
4. The Draft Permit must contain a section identifying the expanded public participation requirements and those provide opportunities, especially for workplans related to groundwater well monitoring workplans.
5. NMED must deny all versions of the Well Screen Analysis Reports without opportunity for revision.
6. NMED must redesign the well monitoring network at LANL and impose the 40 CFR 264.91-100 groundwater monitoring requirements for *inter alia,* upgradient background

water quality data, point of compliance monitoring wells, purging of the monitoring wells before sampling at the regulated units, sealing off of aquifer zones.
7. NMED must abandon the use of prior data and the Monte Carlo computer model for positioning of monitoring wells and speed of groundwater travel.
8. Monitoring data obtained from damaged wells must be discontinued for use in annual groundwater monitoring reports and not relied upon for decision making for remedies at LANL.
9. The Interim Facility Groundwater Monitoring Plan must be opened for public comment and public hearing if requested.
10. Mud rotary drilling must be discontinued at LANL. Additives may only be used in intervals above the target zone if telescoping casings are used and the additives do not enter the area to be screened.
11. The use of Westbay multi-screened monitoring wells must be discontinued.
12. Wells screens that are damaged or cannot be sampled after purging must be plugged and abandoned. Well screens that are damaged but usable for monitoring water level may be utilized.

I SWEAR UNDER THE PENALTY OF PERJURY UNDER THE LAWS OF THE STATE OF NEW MEXICO THAT THE FOREGOING IS TRUE TO THE BEST OF MY KNOWLEDGE.
Dated:March 19, 2010

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Well R-22 is completed with 5 screened intervals in the regional aquifer. No intermediate perched groundwater is present at this location. The characterization sampling has been completed and a geochemistry report has been published describing the analytical results (Longmire, 2002c). As described in the geochemistry report (Longmire, 2002c) and in the answer to Question 3 in this document, screens 1, 3, 4, and 5 have not equilibrated and are affected by residual drilling fluids. However, screen 2 provides water samples that are probably representative of pre-drilling conditions.

A summary of what has been found and reported at R-22 by Longmire (2002c):

- There have been no detections of americium-241, cesium-137, iodine-129, plutonium-238, plutonium-239, plutonium-240, or strontium-90 in any groundwater samples from R-22.
- Technetium-99 was only detected in water from well R-22 at concentrations of 4.3 pCi/L (screen 4) and 4.9 pCi/L (screen 3) during the first characterization sampling round (Longmire, 2002c). These values are near the IDL and are not 100% certain. Technetium-99 was not detected in the subsequent 5 sampling rounds at well R-22.
- Natural uranium above background is present in screen 3; uranium below background is present in screens 1, 4, and 5. Uranium at background levels is present in screen 2.
- Tritium is present in screens 1 and 5. The most consistent concentrations occur in screen 5, which is 565 ft below the regional water table.
- Thirty-one volatile and semivolatile organic compounds have also been detected in water from well R-22. Only two of these, pentachlorophenol (1 detection, 6.2 ppb, MCL = 1 ppb) and benzo(a)pyrene (2 detections, 0.24 ppb, MCL = 0.2 ppb), were present at concentrations above the MCL (Longmire, 2002c). Monitoring for organic compounds at R-22 will continue.

Gilkeson (2004) suggests that radionuclides (americium-241, cesium-137, iodine-129, plutonium-238, plutonium-239, plutonium-240, strontium-90, and technetium-99) are present in the regional aquifer at the location of well R-22. However, with the exception of technetium-99, none of these radionuclides have been detected in groundwater samples from well R-22.

Gilkeson (2004) presents a graph of technetium-99 values over time. As with R-7, most of the points on the graph actually are the method detection limits for technetium-99. The two detected values of technetium-99 are in the first round of sampling in screens 3 and 4, although the values are uncertain based on low concentrations of this isotope near the instrument detection limit using gamma spectroscopy. The instrument detection limit decreases during that period because matrix interferences decreased as the well equilibrates with groundwater. After the first sampling round, technetium-99 was not detected, despite the improved ability to detect it.

At this time in R-22, there are no detectable concentrations of americium-241, cesium-137, iodine-129, plutonium-238, plutonium-239, plutonium-240, strontium-90, or technetium-99. There are measurable concentrations of tritium, volatile organic compounds, and semivolatile organic compounds which warrant continued monitoring.

Question 6: How does Los Alamos National Laboratory provide the public with groundwater information?

Concerns that regulators and the public have been misinformed about the activities under the Hydrogeologic Workplan are expressed in the Gilkeson (2004) report. Extensive information, including the

MAR 2010
DOCKETED BY THE
HEARING CLERK BEFORE THE
SECRETARY OF ENVIRONMENT

STATE OF NEW MEXICO
BEFORE THE SECRETARY OF ENVIRONMENT

IN THE MATTERS OF THE APPLICATION OF
THE UNITED STATES DEPARTMENT OF ENERGY
AND LOS ALAMOS NATIONAL SECURITY LLC
FOR A HAZARDOUS WASTE FACILITY PERMIT
FOR LOS ALAMOS NATIONAL LABORATORY
AND THE NOTICE OF INTENT TO DENY A PERMIT
FOR OPEN BURN UNITS TA-16-388 AND TA-16-399 FOR
LOS ALAMOS NATIONAL LABORATORY

HWB 09-37 (P)
HWB 10-04 (P)

CITIZEN ACTION NEW MEXICO
STATEMENT OF INTENT TO PRESENT TECHNICAL TESTIMONY

My name is David B. McCoy and I am the Executive Director of Citizen Action New Mexico (CA). Pursuant to 20.1.4.300 NMAC, on behalf of Citizen Action, I intend to provide a technical written statement as well as oral testimony concerning the above-captioned New Mexico Environment Department (NMED) permitting matters for Los Alamos National Laboratory (LANL).

My office address is:

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EDUCATION AND WORK BACKGROUND

I attended Western State University College of Law where I received a Bachelor of Laws and Juris Doctor degrees. I am admitted to the California State Bar (#170737).

I have been employed as Executive Director for Citizen Action since July, 2006

and will be testifying in the capacity as Director. During that time I have participated in Resource Conservation and Recovery Act (RCRA) legal proceedings for the Sandia National Laboratories ("Sandia") Mixed Waste Landfill, Chemical Waste Landfill Closure Plan and Post Closure Plan, the Sandia RCRA Draft Part B Permit, and the Kirtland Air Force Base RCRA Draft Part B OB/OD Permit. The RCRA proceedings for the Chemical Waste Landfill ("CWL"), which is a RCRA "regulated unit," resulted in plans to install a network of groundwater monitoring wells at CWL that were compliant with 40 CFR 264.91-100. The network of groundwater monitoring wells at CWL were required to be three down gradient monitoring placed at the Point of Compliance under 40 CFR 264.95 and one upgradient background well.

I have reviewed and provided both written and oral comments about proposals and reports of the Department of Energy (DOE), Sandia, LANL, and the New Mexico Environment Department. I have reviewed many groundwater reports for Sandia, LANL and Kirtland Air Force Base with Registered Geologist Robert Gilkeson from the perspective of whether legal compliance and adequate enforcement of RCRA requirements exist at those facilities and their hazardous waste areas. I have reviewed public participation requirements of RCRA. Citizen Action has presented allegations to the Defense Nuclear Facility Safety Board regarding the operation of a Sandia nuclear reactor and hot cell facility in a building that cannot be made safe from the design basis earthquake.

Citizen Action has worked diligently within the regulatory process to address issues – to ensure enhanced public participation in the processes. Citizen Action has co-

ordinated efforts and information sharing with other environmental organizations within New Mexico, such as Southwest Research Information Center, Concerned Citizens for Nuclear Safety, Citizens for Alternatives to Radioactive Dumping and others. This has included obtaining RCRA documents through the Freedom of Information FOIA by successful lawsuit and/or the administrative appeals process.

I was co-counsel *pro hac vice* with Attorney Nancy Simmons in the lawsuit *New Mexico Environment Department v. Citizen Action* (D0101-CV20070-2626) that resulted in the release of some 3,700 pages of approximately 221 public records that the NMED held secret for ten years that were written by TechLaw, Inc. and AQS and that are relevant to the instant proceedings for the LANL RCRA Draft Part B Permit.

From 1998 to 2005, I provided pro bono consultation, research and writings for the Environmental Defense Institute (EDI) and Keep Yellowstone Nuclear Free (KYNF) for RCRA permitting matters related to Idaho National Laboratory's ("INL") INTEC nuclear incinerators, the New Waste Calcining Facility ("Calciner") and the Waste Experimental Reduction Facility ("WERF"), High Level Liquid Waste Evaporators("HLLWE"), Process Equipment Waste Evaporator ("PEWE"), INTEC Liquid Waste Management System, Liquid Effluent Treatment and Disposal ("LET&D"), and safety issues for the Advanced Test Reactor ("ATR").

With EDI and KYNF, I jointly drafted Notices of Intent to Sue for failure to have RCRA permits for the Calciner and WERF incinerators that resulted in closure and cleanup.

I was lead for drafting and filing a petition with the US Environmental Protection

Office of Inspector General (OIG) regarding failure of the Department of Energy to comply with hazardous waste permitting laws at INL. Upon review of the allegations, the EPA OIG agreed with numerous permitting deficiencies and made recommendations for changes. http://www.epa.gov/oig/reports/2004/20040205-2004-00006.pdf

I was formerly an intervener before the Nuclear Regulatory Commission in the matters of the Trojan Nuclear Reactor Spent Fuel Pool expansion and Control Building hearings, 50-344.

I am a current member of the Board of Directors for the Environmental Defense Institute in Idaho.

Citizen Action has members both downwind and downstream of LANL in Santa Fe and Albuquerque. Santa Fe is receiving drinking water from municipal wells that indicate contamination from radionuclides and the potential for additional contamination from LANL. Albuquerque is receiving drinking water supplies from the Rio Grande that can receive contamination from LANL.

SUMMARY OF CITIZEN ACTION POSITION ON THE LANL DRAFT PERMIT

Citizen Action is opposed generally to Draft Permit Sections 9, 10 and 11. The basis for the opposition is that all "regulated units" at LANL have not been appropriately identified. The regulated units, MDA G, H and L are inappropriately defined as "permitted units." The regulated units G, H and L are required to comply with ground water monitoring requirements under 40 CFR 264.91-100. The regulated units G, H and

L lost interim status in 1985 and are long overdue for meeting the requirements to submit closure plans and post-closure plans. The closure and post –closure permits are not provided for in the Draft Permit and the Draft Permit is currently legally defective for those omissions. The Consent Order does not meet the requirement for closure and post closure.

The Draft Permit incorrectly assumes that the 2005 Compliance Order on Consent (Consent Order) is an "enforceable document" so that the regulated units at LANL can apply alternate groundwater monitoring requirements. The Consent Order was not publicly noticed to be an enforceable document and public participation was not provided for that purpose. Alternatives that would be as protective of public health and the environment as the 40 CFR 264.91-100 requirements were not formulated, presented to the public for comment and then approved by the Secretary for the NMED. The public was assured by the NMED that the Consent Order would not be used for Closure and Post-Closure, but that those plans would be part of the RCRA Part B Permit. NMED kept the public from being fully informed about technical issues at LANL by keeping public records secret and not disclosing their existence. The documents are relevant to identified issues that may remain unresolved to the present.

No groundwater monitoring plan for the regulated units at LANL exists that meets the Consent Order requirements, EPA requirements, RCRA requirements or industry standards. At a minimum, groundwater monitoring for the regulated units would require the one upgradient and three Point of Compliance downgradient monitoring wells (40 CFR 264.95). Compliance monitoring requirements must be

included.

Numerous publications call into question the ability of the groundwater monitoring wells at LANL to provide reliable and representative water samples. The claimed "rehabilitation" of groundwater monitoring wells contaminated with drilling muds and bentonite clay is unproven by LANL. Alternative requirements would not be protective of the public health and environment. The Draft Permit should apply and NMED should enforce the requirements for monitoring of regulated units as provided for in 40 CFR 264.91-100. Because the permit does not define a requirement for a point of compliance for each regulated/permitted unit, contamination is allowed to migrate for miles before reaching a Los Alamos County drinking water well or the site boundary.

My full testimony is attached to this affidavit.

I estimate my testimony will require no more than 1 hour.

EXHIBITS

EXHIBIT 1
63 Federal Register 56710 (October 22, 1998)

EXHIBIT 2
LANL Characterization Well R-22 Geochemistry Report (LA-13986-MS, Issued: September 2002)

EXHIBIT 3
New Mexico Environment Department v. Citizen Action (D0101-CV20070-2626)

EXHIBIT 4
Plans and Practices for Groundwater Protection at the Los Alamos National Laboratory: Final Report, (2007)

EXHIBIT 5
Ford, R., S.D. Acree, and R.R. Ross. 2006. Memorandum to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (05RC06-001) - Review of LANL *Well Screen Analysis Report* - Ada, Oklahoma: United States Environmental Protection Agency, National Risk Management Research Laboratory, Ground Water and Ecosystems Restoration Division. Final Report, February 16, 2006

EXHIBIT 6
S.D. Acree, and Richard Wilkin, Ph.D. Memorandum to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (09RC06-001) - Review of LANL *Well Screen Analysis Report (WSAR), Rev.2* (LA-UR-07-2852) Groundwater Background Investigaton Report (GBIR) Rev. 3.(LA-UR-07-2853) United States Environmental Protection Agency, National Risk Management Research Laboratory, Ground Water and Ecosystems Restoration Division. March 30, 2009.

EXHIBIT 7
December 4, 2009 NMED Department of Energy Oversight Bureau and Hazardous Waste Bureau document, *Proposals for Independent Environmental Monitoring at Los Alamos National Laboratory, New Mexico,* December 4, 2009

EXHIBIT 8
July 12, 2001 from Lindsay A. Lovejoy, Jr., Assistant Attorney General to the New Mexico Environment Department Hazardous Waste Bureau Chief James Bearzi

EXHIBIT 9
New Mexico Assistant Attorney General Lindsay Lovejoy Letter July 30, 2002

EXHIBIT 10
Ford, R., S.D. Acree, and R.R. Ross. 2005. Memorandum to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (01RC06-001) Impacts of Well Construction Practices. Ada, Oklahoma: United States Environmental Protection Agency, National Risk Management Research Laboratory, Ground Water and Ecosystems Restoration Division. Draft Version, September 30, 2005.

EXHIBIT 11
Ford, R., S.D. Acree, and R.R. Ross. 2006. Memorandum to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (05RC06-001) Impacts of Hydrogeologic Characterization Well Construction Practices. Ada, Oklahoma: United States Environmental Protection Agency, National Risk Management Research Laboratory, Ground Water and Ecosystems Restoration Division. Final Report, February 10, 2006.

TESTIMONY OF DAVID B. McCOY

The Los Alamos National Laboratory (LANL) Resource Conservation and Recovery Plan (RCRA) Part B Draft Permit is required to provide protection of the public and environment through the application of discrete enforcement standards contained in RCRA and other documents. Some 21,000,000 cubic feet of hazardous, mixed hazardous and radioactive waste from nuclear weapons production have been buried at LANL legacy waste dumps across LANL mesas. The pathway for the contamination is through the vadose zone to the regional aquifer. A second set of the waste inventory is the large uncharacterized volume of liquid wastes released from outfalls discharging into canyon settings causing surface contamination and remobilized by wind and water providing contamination to the stream bottoms for transport to the Rio Grande. A third source of contamination is in shallow soils randomly remobilized by surface run-off and wind erosion. Seepage ponds sometimes called evaporation ponds were used as outfalls and overflowed directly into the canyons. The dangerous contamination at LANL buried in unlined pits and trenches and on the soil surface is provided a pathway down canyons by groundwater and surface water runoff to enter municipal drinking water wells for the cities of Los Alamos and Santa Fe. LANL contamination flows into the Rio Grande River that provides drinking water to downstream New Mexico municipalities and residents. (LANL Site Wide Environmental Impact Statement, p.).

The Draft Permit, by purporting that the Compliance Order on Consent ("Consent Order") is an "enforceable document," sets up a method to thwart the requirements of 40 CFR 264.91-100 for groundwater monitoring at the regulated units at LANL. MDA G, MDA H and MDA L are "regulated units" under 40 CFR §264.90(a)(2) because the three facilities received RCRA hazardous waste after July 26, 1982. These regulated units do not meet the exceptions contained in§264.90(b) for the application of alternatie groundwater monitoring requirements.[1] As will be discussed below, the Consent Order did not meet the public participation and the technical requirements of 40 CFR 270.1(c) to become an "enforceable document." The Draft Permit would allow the existing inchoate groundwater monitoring for the regulated units to remain in place by the incorrect assertion that the Consent Order is an enforceable document. The Draft Permit at 11.3.1 leads the reviewer to the mistaken belief that the Draft Permit will require groundwater monitoring for all regulated units as defined in 40 CFR 264.90(a)(2), which provide the requirements of 40 CFR 264.91-100 for regulated units.

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[1] **Under RCRA, "regulated units" must comply with the requirements of 40 CFR 264.91 through 264.100 for groundwater monitoring.** 40 CFR § 264.90(a)(2) provides:

> "All solid waste management units must comply with the requirements in §264.101. **A surface impoundment, waste pile, and land treatment unit or landfill that receives hazardous waste after July 26, 1982 (hereinafter referred to as a "regulated unit") must comply with the requirements of §§ 264.91 through 264.100 in lieu of § 264.101 for purposes of detecting, characterizing and responding to releases to the uppermost aquifer.** The financial responsibility requirements of § 264.101 apply to regulated units."

However, the Draft Permit, at sections 9.3 (Closure Requirements for Regulated Units), 10.1.1 (Post Closure Care Plan), and 11.1 (Corrective Action), vitiates the groundwater monitoring requirements for regulated units by incorrectly presenting that the Consent Order is an "enforceable document" for the purposes described in 40 CFR 270.1(c).[2] The Draft Permit incorrectly assumes that alternative groundwater monitoring requirements, different from 40 CFR 264.99-100, may be imposed on the regulated units. The strict groundwater monitoring standard set forth at 11.3.1 sharply conflicts with Section 9.3, 10.1.1 and 11.1 of the Draft Permit. Rather than imposing 40 CFR 264.91-100 requirements, Section 9.3, 10.1.1 and 11.1 would apply "alternative" closure standards for groundwater monitoring taken from the Consent Order. Section 9.3 states:

> "The Consent Order is an enforceable document that sets forth alternative closure requirements in accordance with 40 CFR § 264.110(c)."

Section 11.1 states:

> "The Consent Order is an enforceable document pursuant to 40 CFR §§ 264.90(f), 264.110(c), and as defined in 40 CFR § 270.1(c)(7)."

The Consent Order does not refer to either 40 CFR §§ 264.90(f), 264.110(c)[3] for the application of alternative groundwater monitoring requirements.

The Fact Sheet demonstrates that NMED intends to allow lesser alternative for groundwater monitoring than those required by 40 CFR 264.91-100 (AR 31819, p.103):

> "If waste is left in place at any closed HWMU, residual contamination is present at concentrations greater than established cleanup levels, or groundwater

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[2] 40 CFR 270.1 (c) requires in pertinent part that:
"Owners and operators of hazardous waste management units must have permits during the active life (including the closure period) of the unit. Owners and operators of surface impoundments, landfills, land treatment units, and waste pile units that received waste after July 26, 1982, or that certified closure (according to §265.115 of this chapter) after January 26, 1983, must have post-closure permits, unless they demonstrate closure by removal or decontamination as provided under §270.1(c)(5) and (6), or obtain an enforceable document in lieu of a post-closure permit, as provided under paragraph (c)(7) of this section." (Emphasis supplied).

[3] 40 CFR § 264.110(c) provides for alternative groundwater monitoring requirements by the use of enforceable documents under 40 CFR 270.1(c):
"(c) The Regional Administrator may replace all or part of the requirements of this subpart (and the unit-specific standards referenced in § 264.111(c) applying to a regulated unit), with alternative requirements set out in a permit or in an enforceable document (as defined in 40 CFR 270.1(c)(7)), where the Regional Administrator determines that:
(1) The regulated unit is situated among solid waste management units (or areas of concern), a release has occurred, and both the regulated unit and one or more solid waste management unit(s) (or areas of concern) are likely to have contributed to the release; and
(2) It is not necessary to apply the closure requirements of this subpart (and those referenced herein) because the alternative requirements will protect human health and the environment and will satisfy the closure performance standard of § 264.111 (a) and (b)."

contamination is present in the vicinity of any closed HWMU, the Permittees must conduct post-closure care, which must include groundwater monitoring in accordance with 40 CFR §§ 264.91 through 264.100. **The Department may replace all or some of the requirements of 40 CFR §§ 264.91 through 264.100 with alternative requirements, as set forth in a permit or other enforceable document, in accordance with 40 CFR § 264.90(f). Currently, the Consent Order is the enforceable document under which groundwater investigation and monitoring is conducted.** If any or all of MDAs G, H, or L are closed with waste left in place or residual contamination in environmental media present at concentrations greater than established cleanup levels, groundwater monitoring is required as part of post-closure care." (Emphasis supplied).

MDAs G, H and L received hazardous waste for disposal after July 26, 1982 and are "regulated units" that must comply with §§264.91 through 264.100.

40 CFR § 264.90 provides for the applicability of groundwater monitoring requirements:

"Applicability.

(a)(1) Except as provided in paragraph (b) of this section, the regulations in this subpart apply to owners or operators of facilities that treat, store or dispose of hazardous waste. The owner or operator must satisfy the requirements identified in paragraph (a)(2) of this section for all wastes (or constituents thereof) contained in solid waste management units at the facility, regardless of the time at which waste was placed in such units."

LANL does not qualify to meet the exceptions of 264.90(b):

"(b) The owner or operator's regulated unit or units are not subject to regulation for releases into the uppermost aquifer under this subpart if:

(1) The owner or operator is exempted under §264.1; or

(2) He operates a unit which the Regional Administrator finds:

(i) Is an engineered structure,

(ii) Does not receive or contain liquid waste or waste containing free liquids,

(iii) Is designed and operated to exclude liquid, precipitation, and other run-on and run-off,

(iv) Has both inner and outer layers of containment enclosing the waste,

(v) Has a leak detection system built into each containment layer,

(vi) The owner or operator will provide continuing operation and maintenance of these leak detection systems during the active life of the unit and the closure and post-closure care periods, and

(vii) To a reasonable degree of certainty, will not allow hazardous constituents to migrate beyond the outer containment layer prior to the end of the post-closure care period."

LANL does not comply with the above exceptions of 264.90(b). The unlined pits, trenches, shafts and surface impoundments at MDAs G, H and L are not engineered structures. The MDA G, H and L RCRA "regulated unit" disposal facilities do not have leak detection systems. The unlined surface impoundments, pits and shafts at MDA L

received liquid waste. The unlined shafts at MDA L contain a large inventory (> 10,000 gallons?) of solvents in corroding 55-gallon drums. The unlined pits and shafts at MDA G received liquid waste. The MDA G, H and L RCRA "regulated unit" disposal facilities were not designed and operated to exclude liquid, precipitation and other run-on and run-off. The MDA G, H and L RCRA "regulated unit" disposal facilities do not have inner and outer layers of containment enclosing the waste. DOE and LANS did not provide continuing operation and maintenance of leak detections systems during the active life of the MDA G, H and L RCRA "regulated unit" disposal facilities. DOE and LANS will not provide continuing operation and maintenance of leak detections systems during the closure and post-closure care periods of the MDA G, H and L RCRA "regulated unit" disposal facilities. To a reasonable degree of certainty, DOE and LANS will allow hazardous constituents to migrate beyond the outer containment layer prior to the end of the post-closure care period.

Consistency between the LANL Draft Permit and other documents must be maintained. A conflict with the Draft Permit section 9.3 giving alternative closure requirements is created with the prior existing Technical Area 54 Well Evaluation and Network Recommendations (July 31, 2007 AR 16395) approved by NMED (8/31/07 AR 30474). The groundwater monitoring MDAs for G, H and L as regulated units must be accomplished under 40 CFR 264.90-99 at the sites of MDAs G, H and L. NMED recognized the monitoring requirements of 264.90-99 in the NMED approved Technical Area 54 Well Evaluation and Network Recommendations, Revision 1 Work Plan of October 2007 that states (AR 30479, p.5):

> "The following requirements from 40 CFR 264.90-.99, Subpart F apply to permitted units or regulated units that received waste after July 26, 1982. The regulations apply throughout the active life of the units and the closure and post-closure period if the units are not "clean-closed" under RCRA."

AR 16395 (http://www.lanl.gov/environment/h2o/docs/TA-54-Well-Eval.pdf) provides for Point of compliance monitoring as follows:

> "The point of compliance applied for the permitted units at TA-54 is the vertical surface located at the hydraulically downgradient limit of the waste management area that extends down into the uppermost aquifer underlying the regulated units. At TA-54, this is interpreted as being at the regional aquifer immediately beneath each aggregate of regulated units at MDAs H, L, and G. An integrated groundwater-monitoring system must consist of a sufficient number of near-field wells and downgradient monitoring wells installed at appropriate locations and depths to obtain representative groundwater samples from the uppermost aquifer. These samples must represent both the quality of background water not affected by the regulated unit and the quality of groundwater passing beneath the regulated unit to allow for detection of contamination in the uppermost aquifer."

The requirements of the approved work plan take precedence over the permit that cannot incorporate MDAs G, H and L into the permit as permitted units. Section 1.9.18 Approval of Submittals indicates that "such documents, as approved, shall control over any contrary or conflicting requirements of this Permit."

The history of the March 1, 2005, as revised in 2008, Compliance Order on Consent (Consent Order) demonstrates that it is not an "enforceable document" for reasons that:

1. Public Participation requirements of notice and opportunity for comment of the Consent Order as an enforceable document were not met, and; NMED secrecy prevented meaningful opportunity for public participation.
2. The Consent Order itself provides no notice that it is an enforceable document within the meaning of 40 CFR 270.1(c) for use in lieu of a post-closure permit and required ground water monitoring requirements of 40 CFR part 264; and,
3. The groundwater monitoring standards and program used at LANL are not as protective as 40 CFR 264.91-100.
4. NMED specifically represented to the public thus creating an estoppel by matter of record that: "The closure plans for MDA's G, H and L will be incorporated in the draft permit. The public will have the opportunity for a hearing when the draft permit is released for public review." (*New Mexico Environment Department's Response to Public Comments on the Proposed Compliance Order on Consent for Los Alamos National Laboratories* (February 18, 2005) Response to Comment 13, AR 16251, p.5).

The Compliance Order on Consent (Consent Order) issued March 1, 2005 and Revised June 18, 2008 did not meet public participation requirements because the public notice did not inform the public that the draft Order was to be an Enforceable Document within the meaning of 40 CFR 270.1(c)(7). (*See,* 63 Fed. Reg. 56710, 56714, (October 22, 1998) (True and Correct Copy attached hereto as EXHIBIT 1). The Draft Order of May 2, 2002 (AR 16010) eventually culminated in a Compliance Order on Consent (Consent Order) issued March 1, 2005 (AR 16255) and Revised June 18, 2008 (AR 32111). The Consent Order was for the stated purpose of investigation and corrective action at LANL. On May 2, 2002 a New Mexico Environment Department (NMED) News Release stated (AR 16034) "the New Mexico Environment Department issued a draft order to LANL requiring a comprehensive investigation and cleanup of contaminated sites at LANL."[4] On the same day a Fact Sheet issued announcing a public comment period to begin on May 2, and ending on July 1, 2002 (AR 16031).[5] On June 24, 2002 NMED issued a Dear Concerned Citizen letter, Subject: Issuance of an Order to Los Alamos National Laboratory extended the comment period to July 31, 2002. <u>The May 2, 2002 news release, the Fact Sheet and the Concerned Citizen letter did not state anywhere that the draft Order to be issued to LANL would be an "enforceable document" in lieu of a closure or post-closure permit for regulated units at LANL (40 CFR 270.1(c)(7).</u>

NMED has met no legal requirements to use the Consent Order as an enforceable document. The LANL Draft Permit attempts to circumvent the regulatory requirements for TA-54 regulated units to have a closure plan, a post closure care permit and associated ground water monitoring requirements by bringing in the use of the Consent

[4] State Environment Department Schedules Public Informational Meetings Concerning Draft Order for Investigation and Cleanup of Contamination at Los Alamos National Laboratory May 2, 2002.
[5] Fact Sheet, Order Issuance Los Alamos National Laboratory May 2, 2002.

Order as an "enforceable document" with the intention to use 40 CFR 264.90(f) for "Alternative Requirements" instead of 40 CFR 264.91-100. This plan to use alternative requirements by NMED and LANL would: 1). allow LANL to continue furnishing unreliable monitoring data from the existing non-compliant network of monitoring wells that hides knowledge of contamination, and the acceptance of that incorrect data by NMED; and, 2). allow whatever installation of monitoring wells NMED deems fit at LANL without meeting the groundwater monitoring requirements contained in 40 CFR 264.91-.100. This is all contrary to the duties of LANL to furnish true and correct information and for the NMED to verify.

The Draft Permit continues to fail to provide for closure and post-closure of all the RCRA regulated units at LANL and does not apply the correct state and federal regulations for protection of the public and the environment. The RCRA Draft Permit permit does not comply with federal requirements of RCRA (42 U.S.C. §§ 6901-6992k, §6924(o) and (p)) for groundwater monitoring to protect the public and the environment from releases that may occur from where hazardous wastes and mixed radioactive were disposed. Special groundwater monitoring requirements exist for the "regulated units" at LANL that have not been adhered to. (40 CFR 264.90-100). 40 CFR 264.97 (a)(3) provides requirements for the early detection of contamination of groundwater to the uppermost aquifer.

The termination of interim status, requirement for closure and post closure permit at regulated units G, H and L, and concern for public participation is described in a letter dated July 12, 2001 from Lindsay A. Lovejoy, Jr., Assistant Attorney General to the New Mexico Environment Department Hazardous Waste Bureau Chief James Bearzi, as follows True and Corect Copy attached as EXHIBIT 8 (AR 11676)):

> "Our concerns about the need for public participation particularly relate to the Hazardous and Solid Waste Amendments ("HSWA") [RCRA] remediation process. We understand that the corrective action order will, inter alia, address HSWA remediation at Material Disposal Areas ("MDA") G, H. and L. We have pointed out to NMED that these MDAs were long ago required to stop receiving waste, have an appropriate closure plan, and close, but this has not happened. MDAs G and L were required to close under 40 CFR §§ 265.112(d)(3)[6] and 265.113(b) after NMED accepted LANL's withdrawal of its request for a permit for these area in April 1985, terminating interim status under 40 CFR § 270.73(a). MDAs G, H, and L were also required to close based on loss of interim status in November 1985, under 42 U.S.C. § 3005(e)(2) and 40 CFR § 270.73(c). However, to date they have been neither closed nor permitted (p.1).

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[6] 40 CFR 265.112 (d)(3)
The owner or operator must submit his closure plan to the Regional Administrator no later than 15 days after:
(i) Termination of interim status except when a permit is issued simultaneously with termination of interim status; or
(ii) Issuance of a judicial decree or final order under section 3008 of RCRA to cease receiving hazardous wastes or close.

On July 30, 2002, the New Mexico Assistant Attorney General Lindsay Lovejoy informed HWB Chief James Bearzi again of "the need to take and respond to public comment during remediation." (True and correct copy attached as EXHIBIT 9 (AR 16083).

During the period when the draft Order was under consideration until the time of its adoption in 2005 and thereafter, the NMED did not disclose public records from TechLaw, Inc. to the public that had bearing on permitting and clean up issues at TA-54 and other regulated units at LANL. The May 2002 draft Order side-stepped any issues of the long overdue closure plan and post-closure requirements that were applicable to the TA-54 regulated units when they lost interim status in 1985. The public was not informed of the requirement for a closure plan and a post-closure permit that existed for regulated units G, H and L at TA-54 after the loss of interim status in 1985, including the groundwater monitoring requirements of 40 CFR 264.91-100 identified in TechLaw, Inc. documents. Examples are cited infra.

The groundwater monitoring at LANL is not protective of the public health and environment because: 1). individual monitoring wells have not and do not provide reliable and representative groundwater samples, and 2). the monitoring wells fail to collectively form a reliable network as required by 40 CFR 264.91.-100 for detection monitoring and compliance monitoring. Numerous studies confirm that the wells were not constructed in accordance with the requirements of RCRA and do not yield reliable and representative water samples.

The *TA-54 Evaluation and Network Recommendations* (LA-UR-07-5042 EP2007-0443) (July 2007) requires (AR 16395, p. 6, para 2):

> "2. Establish a groundwater-monitoring network that meets the requirements for "detection monitoring" and subsequent "compliance monitoring" at permitted units at TA-54.
>
> "The following requirements from 40 CFR 264, Subpart F apply to permitted units or regulated units that received waste after July 26, 1982. The regulations apply throughout the active life of the units and the closure and post-closure period if the units are not "clean-closed" under RCRA. The groundwater-monitoring network and facility process must be able to detect, evaluate, and respond to releases of hazardous waste or hazardous waste constituents into the uppermost aquifer. Detection monitoring is required to establish that a release has occurred. It is assumed that because of the significant depth to groundwater beneath TA-54, vadose-zone monitoring will be a key component of the overall monitoring program in support of both CMEs and the RCRA Part B permit.
>
> "The point of compliance applied for the permitted units at TA-54 is the vertical surface located at the hydraulically downgradient limit of the waste management area that extends down into the uppermost aquifer underlying the regulated units. At TA-54, this is interpreted as being at the regional aquifer immediately beneath each aggregate of regulated units at MDAs H, L, and G. An integrated

groundwater-monitoring system must consist of a sufficient number of near-field wells and downgradient monitoring wells installed at appropriate locations and depths to obtain representative groundwater samples from the uppermost aquifer. These samples must represent both the quality of background water not affected by the regulated unit and the quality of groundwater passing beneath the regulated unit to allow for detection of contamination in the uppermost aquifer."

The July 2007 *Technical Area 54 Well Evaluation and Network Recommendations,* describes the detection and compliance monitoring requirements that are necessary with regard to the point of compliance monitoring under 40 CFR 264.95. A revised October 2007 Revision 1 that was approved by NMED removed the point of compliance language to substitute "near-field wells" which does not reflect RCRA requirements that down gradient monitoring wells be at the point of compliance under 264.95. Although the language of the *Technical Area 54 Well Evaluation and Network Recommendations* requires compliance monitoring, the requirement has not been enforced by NMED. Compliance monitoring for regulated units at TA-54 was *not* initiated after finding the RCRA hazardous constituents (Volatile Organic Compounds (VOCs) and Semi-VOCs) at regional well R-22:

From page 28 in *LANL Characterization Well R-22 Geochemistry Report* (LA-13986-MS, Issued: September 2002):

"Several VOCs and SVOCs (validated results) were detected at well R-22 including acetone (2.5 to 32 μg/L) [μg/L = micrograms per liter or parts per billion (ppb)]; benzoic acid (3 to 12.5 μg/L); toluene (0.2 to 0.76 μg/L); methylene chloride (0.62 and 2.2 μg/L); chloroform (0.94 μg/L); pentachlorophenol (6.2 μg/L); phenol (19 and 32 μg/L); 4-methylphenol (44 to 210 μg/L); and 2-butanone (6.9 to 8.9 μg/L) (Appendix A). Several substituted benzene compounds also werenidentified at the well, including isopropylbenzene (0.16 to 0.54 μg/L); 1,4-dichlorobenzene (0.16 to 0.23 μg/L); and 1,3,5-trinitrobenzene (0.12 μg/L). Methylene chloride is a laboratory solvent used during SVOC, pesticide, herbicide, and polychlorinated biphenyls (PCB) analyses using gas chromatography mass spectrometry (GCMS). Bis(2ethylhexyl)phthalate, a constituent of plastic, was detected at concentrations of 1.0 and 3.9 μg/L in the regional aquifer during the first and fourth sampling events."

From page 35 in *Response to Concerns About Selected Regional Aquifer Wells at Los Alamos National Laboratory* (LA-UR-046777, Issued September 1, 2004) states (AR 13899, p. 35):

"Thirty-one volatile and semivolatile organic compounds have also been detected in water from well R-22. Only two of these, pentachlorophenol (1 detection, 6.3 ppb, MCL = 1 ppb) and benzo(a)pyrene (2 detections, 0.24 ppb, MCL = 0.2 ppb), were present at concentrations above the MCL (Longmire, 2002c). Monitoring for organic compounds at R-22 will continue."

From page 23 in *LANL Characterization Well R-22 Geochemistry Report* (LA-13986-MS, Issued: September 2002) (EXHIBIT 2).

> "An activity of 109 pCi/L tritium was measured near the regional water table (883 ft) during drilling of well R-22 (Ball et al. 2002, 71471). Since 2000, activities of tritium measured in screen #1 (907.0 ft) averaged 2.38 pCi/L (Table 5.1-1), which suggests that some recent recharge to the regional aquifer has occurred."

The failure of NMED to enforce compliance monitoring after detection of RCRA volatile and semi-volatile compounds measured repeatedly in the water in R-22 cannot be considered to be protective and does not comply with the requirements of 264.91-100 or 40 CFR 264.90(f)(2).

The failure to conduct compliance monitoring can readily be seen from the limited number of monitoring wells presented in Figure 2.3-13 "Regional monitoring wells, water supply wells, and groundwater gradient" in LANL Report MDA G CME Report-Rev 1 (LA-UR-09-5509 September 2009 AR 32022 See EXHIBIT 12). The monitoring wells are not at the point of compliance for the TA-54 regulated units and are very limited in number.

The requirement of § 264.110(c) that regulated units G, H and L be situated among SWMUs causing releases has not been met for use of alternatives to 264.91-100. There is no clear statement in the Draft Permit explaining what the specific SWMUs are that supposedly are among the regulated units G, H and L. If LANL did not want areas G, H and L to become regulated units, LANL could have closed the units prior to July 26, 1982 but failed to do so. Regulated units G, H and L continued receiving waste after that date.

The Draft Permit statement at section 11.1 overlooks an important proviso within 264.110 (c) that alternative requirements must be set forward as defined in 40 CFR 270.1(c)(7). However, there is no reference to 40 CFR 264.110(c) in the Consent Order. There is no reference in the Consent Order to any groundwater monitoring standards contained in 40 CFR 264.90-100, nor is there any mention that "alternatives" to those regulations will be made or that the alternatives will satisfy the closure requirements of 264. 111(a) and be as protective for the public health and environment.

NMED secrecy denied public participation for implementation of the requirements for Closure and Post-closure for the TA-54 regulated units that lost interim status in 1985. NMED secrecy defeated the requirements of RCRA and Due Process for informed, meaningful public participation in the adoption of the Consent Order.

The Hazardous Waste Bureau (HWB) has a 10-year history of placing into a secret section of the HWB Library technical documents that may have contradicted NMED permitting positions and/or that could provide different legal and technical information from other sources.

One of the most fundamental elements for state programs is the broad information gathering powers and duties of the State. Not only are States required to have the right to gather information from regulated entities, but States owe a duty to the public to actually obtain relevant information and to make that information available to the public. RCRA section 6926(f) is quite clear:

> "No state program may be authorized by the Administrator under this section unless:
>
> "(1) such program provides for the public availability of information obtained by the State regarding facilities and sites for the treatment, storage, and disposal of hazardous waste; and
>
> "(2) such information is available to the public in substantially the same manner and to the same degree as would be the case if the Administrator was carrying out the provisions of this subchapter in such state."

As a result of a lawsuit that NMED lost against *Citizen Action, New Mexico Environment Department v. Citizen Action* (D0101-CV20070-2626) (True and correct copy attached as EXHIBIT 3), NMED released some 13,000 pages of TechLaw, Inc. and AQS documents concealed for up to a decade and that cost the taxpayers millions of dollars. The technical documents are relevant to widespread toxic contamination and/or permitting actions throughout New Mexico at Los Alamos National Laboratories, Sandia Labs, Triassic Park, Safety-Kleen Systems, military bases at Kirtland AFB, Fort Wingate, Holloman AFB, Ft. Bliss, White Sands Test Facility and oil company refineries Western Refining SW (Gallup), Bloomfield Refinery (Farmington), Navajo Refining Co. (Artesia). Over 3000 documents relevant to Los Alamos Laboratories were obtained by Citizen Action and had to be inserted into the administrative record.

NMED failed to comply with RCRA administrative record keeping requirements and for furnishing actual reports, records or information to the public. NMED failed to keep non-public information, as determined by NMED, summarized in a disclosable way so as to make it available to the public or officers, employees or representatives of the United States. (42 U.S.C. 6927 and OSWER Dir. 9833.3A-1).

Deliberate NMED secrecy aided and abetted establishing the Compliance Order on Consent (May 2005) that resulted in a process that side-stepped permitting requirements, cut the public out of all substantive deliberation, and provided complete discretion for the NMED and hence for LANL. The draft Order process began in 2002 and the 2002 TechLaw, Inc. documents would have been highly useful and relevant to the public for their review of legal requirements and to speak out for imposition of closure and post-closure standards at LANL compared to the Consent Order. By denying timely access to TechLaw, Inc. documents, NMED effectively excluded the public from review of the required administrative process for closure and post-closure of TA-54. The public was denied access to technical materials that left unanswered questions that could have been used for mounting a challenge to NMED's failure to impose closure and post-closure permit requirements. TechLaw, Inc. reports, paid for by the taxpayer, preliminarily reviewed by Citizen Action, are pertinent to the formal standards and regulations

applying to TA-54 for closure and post-closure permit requirements and contaminant fate and transport modeling.

January 9, 2002 TechLaw Inc. report Finite Element Heat and Transfer (FEHM) (AR 32400) is specific to TA-54 Material Disposal Area (MDA) G. The report discusses numerous other documents related to groundwater flow and radionuclide transport in the vadose zone beneath Area G. The report is critical of the technical deficiency for a LANL computer code used to model contaminant flow and transport through the complex geology associated with LANL. The code was apparently used by LANL but not subjected to a rigorous, independent review by the NMED. **LANL admits that the FEHM does not work for thin geologic layers that are an important control on travel of contaminants and that are common for the Pajarito Plateau** (p.2):

> "...LANL has noted that FEHM cannot always effectively handle units that are thin (e.g., Guaje Pumice bed) relative to the other units being analyzed. In cases where these thin units exhibit properties that differ from the immediately overlying and underlying units, valuable information on flow and/or transport can be lost."

Unanswered questions still exist from this report held in secret for 8 years as to NMED not taking actions for peer review of the FEHM and whether governmental regulatory agencies accept the FEHM model:

> "Because the code was developed by LANL and has not been subjected to a rigorous, independent review by the NMED, these documents should be formally requested of LANL for consideration in determining if the results of FEHM model simulations are suitable for regulatory applications. LANL should provide these and any other peer-reviewed articles on the development and/or verification of the FEHM code. <u>LANL should identify instances where FEHM generated results have been accepted by governing regulatory agencies</u> and documentation, including the names of contacts at the approving agencies, should be submitted." (Emphasis supplied).

TechLaw, Inc. points to the inappropriateness of assumptions by LANL about low dose calculations and how uncertainty is addressed by LANL at MDA G and the importance to acquire data to reduce uncertainty regarding the physical properties controlling transport of contaminants at waste disposal sites below the canyons and below the mesas, ie., the 65 acre waste dump at regulated unit MDA G (p.3):

> "Upon review of Vadose Zone Flow and Transport Model of Los Alamos Canyon, it appears that at least some of the simulations will be repeated once additional data are gathered and used to better characterize flow and transport beneath the site. Conversely, Simulations of Groundwater Flow and Radionuclide Transport in the Vadose and Saturated Zones beneath Area G stands in contrast to this position. <u>The report text implies that refinements that address many of the uncertainties in the present model formulations are unwarranted due to the relatively low doses calculated in the saturated zone</u>."

The dose in the fractured zone cannot be calculated because of the many uncertainties. What are the uncertainties and what has been done to reduce those uncertainties?

More recently, and echoing TechLaw, the National Academy of Sciences *Plans and Practices for Groundwater Protection at the Los Alamos National Laboratory: Final Report*, (2007) (True and correct copy attached as EXHIBIT 4) reported failed monitoring wells and uncertainty in modeling because the data does not exist beneath the mesas where the large inventory of wastes are buried:

> p.42 "An update to the regional aquifer model is provided by Keating et al. who state that "predicted flux through older basalts in the aquifer can vary by a factor of three . . . the true uncertainty of our predictions, including the impact of possible conceptual errors, is likely to be larger and is difficult to quantify" (Keating et al., 2005, p.653).
>
> p. 43- "Overlooking conceptual, non-modeled, uncertainties can lead to results that give an overly optimistic perception of the current state of knowledge about present and future groundwater contamination."

TechLaw (January 9, 2002) raises a question as to whether experiments to gain knowledge of the travel through the basalt has been conducted. Whether NMED encouraged LANL to conduct the experiments remains unanswered (p.4).

> "Section 8.0 describes one-dimensional modeling using FEHM performed in support of upcoming infiltration monitoring experiments. The section does an excellent job of describing how the modeling results were used in designing the experiments. Data collection activities are proposed that will vastly improve the conceptual model for the basalt units. LANL should be encouraged to conduct these experiments and refine the FEHM model formulations affected by the results."

TechLaw, Inc. finds too many uncertainties to be able to confirm whether the FEHM model offers a valid representation of MDA G and that the model cannot overcome the uncertainties in the data to calculate how much groundwater contamination can be caused by the wastes buried at MDA G (p.5).

> "However, without a complete review of all information sources, it is <u>difficult to determine if the model formulations used in the analyses adequately reflect hydrologic conditions at MDA G</u> and, thus, offer a valid representation of the site. <u>Site characteristics must be reflected in the model formulations so that information useful in making regulatory decisions concerning the site can be made.</u> After reviewing the document, the effect of all surrogate data sources and assumptions is unknown and, as stated above, some of the results must be viewed as indications of likelihood (e.g., doses below the performance objectives) or trends rather than as benchmarks or 'final', quantified results."

The March 12, 2002 TechLaw, Inc. Task 8 A Deliverable Administrative Completeness Review of the LANL TA-55 PART B Permit Application (AR 32409).The TechLaw Review cover letter reveals what may be the continuing pattern and practice of NMED to allow LANL to avoid closure outside the permit by using corrective action. "In general, the application was lacking in detail and was found to be severely deficient:"

"The application also lacks detail regarding corrective actions. The application states that final assessment and remediation will be integrated and coordinated under corrective actions of the LANL Environmental Restoration Project (application Section 4.4), which would take the closure process outside of the permit. NMED may want to further investigate LANL's choice to close these areas as RCRA corrective action areas rather than addressing them in the application. In seeking RCRA permitted status for these units, LANL should address their closure within the application rather than as corrective action under the LANL Environmental Restoration Project. If NMED agrees with the status of administratively incomplete, specification of corrective actions may need to be addressed in a compliance schedule."

The April 8, 2002 TechLaw, Inc. Summary of TechLaw Reviews and Comments on Technical Documents Related to TA-54 (AR #32418) This TechLaw report summarized numerous reviews of technical literature by TechLaw and points out numerous deficiencies in information, unsupported assumptions and the need to redesign the monitoring network at LANL:

(p.2)"The reviews identified numerous incidents where information was presented but not supported in the way needed for regulatory submittals. Many points brought out in the documents were left unsupported, possibly because they seemed obvious to the author(s). For example, many detected chemicals were eliminated without adequate justification from the conceptual site model described in Section 6 of the TA-54 RFI report. In formulating the conceptual and numerical models for transport in the subsurface below MDA L, LANL described their approach but did not always justify the actions taken, thus, giving the impression that the approach relied upon unjustified assumptions. (Emphasis supplied).

(p.2) "TechLaw recommends that NMED continue to push LANL to develop a complete understanding of the fate and transport of hazardous constituents in the subsurface of TA-54 and to incorporate that understanding in conceptual models and numerical simulations, as appropriate.
"As stated in the summary, TechLaw supports the redesign of monitoring program at TA-54 MDA L. However, provisions for some short-term modeling (i.e., quarterly) should be retained as LANL' s documents do not convey an ability to positively identify causes of elevated readings in a timely fashion."

(p.4) "TechLaw noted that statements made in the Davenport document implied that the fractures act as transport pathways within the Bandelier Tuff Clearly, these fractures could serve as conduits for releases from the various waste management units at TA-54, including Material Disposal Areas (MDAs) G, H, and L."

(p.5) "It was not clear from the document text whether vapor retardation was addressed in FEHM, RIP, or other fate and transport modeling or not. Vapor retardation was addressed in subsequent documents (see Reference 31) and it was

not included in the formulation of the conceptual model and the numerical model for MDA L. **[Note: See TechLaw, Inc. FEHM comments above].**

(p.15) "TechLaw felt that the Revised Conceptual Model for TA-54 was not complete in that it did not identify primary and secondary transport pathways, off-site transport, exposure routes and receptors, or demographics and land use (current and future). In addition, much of the information and assumptions contained within the Model were not adequately substantiated.

"TechLaw found that LANL had eliminated several chemicals detected at MDAs G, H, and L from their respective conceptual site models without adequate justification. These include: mercury, silver, and selenium detected in surface soils and any organic that was not detected in at least 4 of 8 air samples at MDA G; Lead and tritium detected in sediments, Acetone detected at MDA H during surface flux sampling, and Copper detected in the subsurface at MDA H; and Cadmium, selenium, and silver with reporting limits that exceeded the laboratory background levels, Plutonium-238 detected in sediments, and Cadmium, mercury, uranium. Chromium and barium detected in boreholes 54-1010 and 54-1011 at MDA L.

"Also, LANL assumed, without adequate support, that detections of bis-2-ethylhexyl phthalate at MDAs H and L and di-n-butyl phthalate and pentachlorophenol at MDA L are laboratory artifacts. TechLaw also stated that LANL should address several additional transport mechanisms before the Model is viewed as encompassing all possible contaminant transport pathways. These include:

- Treatment of the subsurface solute transport pathway at MDA L;
- Further consideration of advection in the transport of VOCs and tritium in the subsurface;
- Consideration of wet and dry deposition processes for particles and vapors entering the atmosphere from T A-54; and
- Consideration of exposure of ecological receptors, and possibly humans, through the food chain.

"Further, TechLaw felt that a clear understanding of the influence of fracture flow on contaminant transport was not demonstrated.

"In Section 6.1.3.3, TechLaw recommended that a figure illustrating the location of all the boreholes where samples were taken at MDA L be provided.

"In Section 6.1.3.3, the text states that some analytes were detected above background levels at discrete sampling depths. These compounds are not identified and the locations of the detections are not illustrated in a figure. A reference to the location of the sampling results or to figures illustrating the results should be provided for these analytes.

(p.16) "Further, Section 6.1.3.3 states that tritium is the only radionuclide in the subsurface at MDA L. While the text implies that sampling results for radionuclides other than tritium were analyzed to determine if a pattern indicative of a release was present the analysis is not described. The text should be modified to present the locations of the detections and describe the analyses performed that led to the stated conclusion.

"The second paragraph on page 6-33 states that an analysis was performed to evaluate the potential for VOC flux. The text should be revised to describe the analysis in detail or provide a reference to the location of such a description.

"Reference citations should be provided in the text for previous work performed at TA-54 that supports the conclusions stated in Section 6.1.3.4. For example, a reference should be provided to the document that indicates that the tuff may be ' ... homogeneous media subject to atmospheric pressure variations ...'

"In Section 6.2.1.1, the first full paragraph on page 6-36 provides estimates of the percentage of pit, impoundment, and disposal shaft volume actually occupied by waste. The text reads as if LANL is not confident in any of the estimates. For example, an estimate of 10% is offered for the pit based on ' ... limited data ...' LANL should reference all information sources used to develop these estimates.

"For disposal units where uncertainty exists, TechLaw recommended that a range of possible volumes occupied be reported.

"The first paragraph at the top of page 6-37 includes unsupported statements concerning present day surface fluxes at TA-54, releases appear to have reached, or surpassed, steady-state release conditions, pore gas concentrations are steadily decreasing, and that the tritium inventory will be halved about every 12 years. TechLaw recommended that these statements, and others contained in this paragraph, be accompanied by references to LANL documents that support the claims.

"While laboratory investigators have estimated the time it would take for cliff retreat to expose the wastes in the subsurface, there is no discussion of how cliff retreat influences the fate and transport of vapor contamination beneath the MDAs. Such a discussion should be provided.

"With respect to leaching, references to LANL documents that identify the probable source of the liquid that led to metals migration and that characterize the level of residual pore water at MDA L should be provided.

"Section 6.2.13 hypothesized that alternating periods of high and low barometric pressure and changes in atmospheric temperature may influence subsurface VOC migration and, thus, flux at the surface. Because advective transport had been discounted in previous analyses, any analysis that has been performed to

investigate the source of the seasonal variation in the surface flux of tritium should be referenced in the text and made available for review."

(p.18) "The Mendoza and Frind paper referenced in Reference 12 described a sensitivity analysis performed on a model derived to determine the importance of advection in the transport of organic vapors. <u>However, the physical scenario considered in Mendoza and Frind differed from the physical conditions at TA-54. LANL applied the results of the Mendoza and Frind analysis to TA-54 without documenting the applicability of the study to conditions at TA-54.</u> Further, it is not clear that consideration was given to chemical property values such as vapor pressure, Henry's Law constant, and molecular weight as suggested by Mendoza and Frind. TechLaw recommended that LANL relate the conditions and findings from the Mendoza and Frind paper to TA-54 as originally suggested in the reviewer comments on Reference 12." (Emphasis supplied).

On July 8, 2002, NMED received a *Task 14 Deliverable, Draft Post-Closure Plan for LANL TA-54 MDAs G, H and L* for container units submitted by TechLaw, Inc. (AR 32428). The document was withheld from the public in a secret area of the NMED Hazard Waste Bureau (HWB) until obtained by Citizen Action in January 2010. TechLaw, Inc. stated the requirements for a post-closure plan for MDAs G, H and L (p.G-1):

"This post-closure plan is submitted to comply with the New Mexico Administrative Code, Title 20, Chapter 4, Part 900 [(20.4.1.900 NMAC) and incorporating 40 CFR §270.14(b)(13)], and describes the activities necessary to comply with post-closure care requirements specified in 20.4.1 NMAC §270.14(b)(13); 20.4.1 NMAC, Subpart V, Part 264, Subpart G; and 20.4.1 NMAC §§264.258 and 264.310 [6-14-00] for the land disposal units at Technical Area 54 (TA54) at the Los Alamos National Laboratory (LANL) Facility."

TechLaw stated the requirements for groundwater monitoring at TA-54 (p. G-1):

"As regulated units, MDAs G, Hand L are subject to groundwater monitoring requirements under 20.4.1.500 NMAC (incorporating 40 CFR §§264.91 through 100)."

TechLaw stated the requirements for groundwater monitoring in the Regional Aquifer Groundwater at TA-54 (p. G-7, 8):

"3.1.2 Regional Aquifer Groundwater

"Monitoring of the regional aquifer will be conducted as part of post-closure care. The groundwater monitoring strategy to be implemented at the Facility will be based upon needs as described in the Order.

"Consistent with the site characterization and following a determination of the need for monitoring, the detection-type monitoring prescribed in 20.4.1 NMAC §264.98 will be initiated.

"Detection is defined in 20.4.1 NMAC §264.91(a)(1) as statistically significant evidence of contamination, as described in 20.4.1 NMAC §264.98(f). A monitoring system and compliance period consistent with 20.4.1 NMAC

§§264.96 and 264.97 will be utilized. In accordance with 20.4.1 NMAC §264.98(f), LANL will determine whether there is statistically significant evidence of contamination for any chemical parameter or hazardous constituent. An appropriate frequency for sample collection and statistical analysis will be proposed to the NMED that will be capable of determining statistically significant evidence of contamination, as required by 20.4.1 NMAC §264.98(d}. Data will be collected that are appropriate for the statistical methodology applied, sufficient in sample size, and utilizing sampling procedures and frequencies of sample collection established by the Groundwater Protection Program to ensure that potential contaminant release(s) from the regulated units can be detected, in accordance with 20.4.1 NMAC §264.97"

[**Note:** DOE and LANS have not installed the necessary networks of monitoring wells at the RCRA "regulated units" MDAs G, H and L to meet the 40 CFR § 264.97 General ground-water monitoring requirements.]

TechLaw stated the Reporting requirements for the detection monitoring program at TA-54 (p. G-10,11):

"3.3 Reporting

"Post-closure care will also include reporting consistent with 20.4.1 NMAC, Subpart V, Part 264, Subpart F and 20.4.1 NMAC §264.31 0, as appropriate.

"Consistent with 20.4.1 NMAC §264.98, LANL will notify the Secretary of the NMED if, under the detection monitoring program, it is determined [in accordance with 20.4.1 NMAC §264.98(f)] that there is statistically significant evidence of contamination for chemical parameters or hazardous constituents at any of the monitoring wells. This notification will be provided in writing within seven days of the determination. The notification will indicate what chemical parameters or hazardous constituents have shown statistically significant evidence of contamination.

"If a more comprehensive monitoring program is established based upon the results of the Order, and consistent with 20.4.1 NMAC §264.99, LANL will analyze samples from monitoring wells for all 20.4.1 NMAC, Subpart V, Part 264, Appendix IX constituents at least annually, in accordance with 20.4.1 NMAC 264.99(g). This analysis will be used to determine whether additional hazardous constituents are present in the uppermost aquifer and, if so, at what concentration, pursuant to the procedures in 20.4.1 NMAC §264.98(f). ..."

These above requirements were based on references that included (p. G-12):

EPA, 1998, "Standards Applicable to Owners and Operators of Closed and Closing Hazardous Waste Management Facilities: Post-Closure Permit Requirement and Closure Process; Final Rule," 63 Federal Register 56710-56735. (Emphasis supplied).

LANL, 2001, "Los Alamos National Laboratory General Part A Permit Application," Revision 0.0/0.111.0/2.0, Los Alamos National Laboratory, Los Alamos, New Mexico.

LANL, 1985, "Closure and Post-Closure Plans for TA 54-Area G Landfill at Los Alamos National Laboratory," September 1985, Los Alamos National Laboratory, Los Alamos, New Mexico.

September 30, 2002 TechLaw, Inc. provided *Attachment F, Draft Closure Plan for Technical Area 54, Areas G, L, H and West.* (AR 32437). The TechLaw, Inc. document set forth closure and post-closure for regulated units and the groundwater monitoring requirements of 40 CFR 264.91-100 as applicable to TA-54 and described Container Storage Units Closure and Land disposal units.

> "F.1.2.2 Land Disposal Units Hazardous waste, including mixed waste, and source, special nuclear, and by-product materials, as defined in the AEA, have been disposed of at TA-54 MDA's G, H, and L since the 1950's. According to Permittees, hazardous waste was disposed of at MDA's G, H, and L until 1990. Consequently, MDA's G, H, and L are subject to closure and post-closure requirements under 20.4.1.500 NMAC (incorporating 40 CFR Part 264, Subpart G), and are regulated units as defined at 20.4.1.500 NMAC (incorporating 40 CFR §264.90(a)(2)) subject to the groundwater monitoring requirements under 20.4.1.500 NMAC (incorporating 40 CFR §§91 through 100). Source, special nuclear, and by-product material as defined in the AEA are currently disposed of at MDA G."

Public participation requirements were not met for the Consent Order to be an enforceable document. Public participation requirements must ensure a meaningful opportunity for public involvement. At a minimum, that would require that the public first be informed that the Consent Order was to be used *as an enforceable document in lieu of a post closure permit.* (*See.* 40 CFR 265.121(b) and 63 Fed. Reg. 56710, 56714). The Consent was not presented as anything other than a document for corrective action.

The Consent Order does not meet the requirements of 270.1(c)(7) to become an "enforceable document" as contemplated by that section. The Consent Order states that it is an enforceable document in only two sections, III.U and III.W.6. Neither those two sections nor anywhere else in the Consent Order indicates that the Consent Order would be an enforceable document within the meaning of or for the purposes of 40 CFR 270.1(c)(7), i.e., as a document that can be used *in lieu of providing a post-closure permit.* The Consent Order (III.A) Purposes are for corrective action and not the use of the Consent Order in lieu of a post closure permit.

The Consent Order did not put the public on notice of an enforceable document within the meaning of 40 CFR 270.1 (c) in: 1). NMED Schedules for Public Meeting, 2). the NMED Fact Sheet, or 3). in the Consent Order itself. The development of the Consent Order began in 2002 when NMED issued a finding of "imminent and substantial

endangerment," and culminated in 2005, when the parties signed the final compliance order. The May 2, 2002 *State Environment Department Schedules Public Informational Meetings Concerning Draft Order for Investigation and Cleanup of Contamination at Los Alamos National Laboratory* (*See,* http://www.nmenv.state.nm.us/OOTS/Public%20Notices/LANL%20Order%20PubMtgsPDF.pdf and http://www.nmenv.state.nm.us/OOTS/Public%20Notices/LANL%20Order%20Final.PDF the Fact Sheet (AR 16031) for the draft order do not provide the public with any notice whatsoever that the draft order would become an enforceable document within the meaning of 40 CFR 270.1(c) to be used in lieu of a post closure permit as per 270.1(c)(7). Nor were the requirements for obtaining such an enforceable document set forth in the Fact Sheet. http://www.nmenv.state.nm.us/hwb/lanl/LANL_Order_Fact_Sheet.pdf

Because using the Consent Order as an enforceable document is not referenced anywhere in the notices above, a reasonable person cannot be said to have had notice that the Consent Order was to be used in lieu of obtaining post closure care permits at LANL. (40 CFR 270.1 (c)(7)). The public was excluded from participation in the negotiations that took place between May 2, 2002 that began as a draft Order for investigation and clean up and subsequently emerged in the 2005 issuance of a Compliance Order on Consent between DOE, LANL and the NMED. Public participation requirements for enforceable documents are codified at 265.121(b). (Exhibit 1, 63 Fed. Reg. 56710, 56714).

The public meeting for the Consent Order, as issued in 2002, was for the Consent Order to become the vehicle for corrective action only. The Consent Order at III.W.6 states that the Consent Order is to be the only enforcement instrument for corrective action. Moreover, the Secretary of the NMED did not make the determinations required under 40 CFR 270.1(c)(7) as to what the "alternative methods" to 40 CFR Subpart F would be to groundwater monitoring requirements. Nor does the Consent Order refer to alternatives. Nor did the Secretary make the determination that the alternative methods would be equally protective of public health and the environment as required by 40 CFR 264.111. Nor does the Consent Order make any reference to 40 CFR 264.111. The Consent Order makes no reference to the Corrective action program that is set forth at 40 CFR 264.100 which requires corrective action to ensure that regulated units are in compliance with the ground-water protection standard under §264.92.

Other than the current recitals contained in the Draft Permit and the Fact Sheet, there is no agreement between the Department and LANL that the Consent Order was an enforceable document for purposes of 40 CFR § 270.1(c)(7). The Consent Order itself does not contain the statement of any such intended purpose or agreement under 40 CFR § 270.1(c).

NMED denied that the Consent Order would be used in lieu of closure and post-closure requirements and is estopped by the record to now claim otherwise. NMED issued a *Response to Public Comments on the Proposed Compliance Order on Consent for Los Alamos National Laboratory* (February 18, 2005). The Response to Comment 13 states (AR 16251):

"**Response:** The Consent Order does not address closure or post-closure requirements for operating units at LANL, nor does the Order address the continued disposal of wastes at Area G. Section III.W.1 of the Consent Order specifically provides that the closure and post-closure care requirements for operating units at LANL, under section 20.4.1.500 NMAC, will be addressed in the hazardous waste facility permit and not in the Consent Order. ... The closure plans for MDA's G, H and L will be incorporated in the draft permit. The public will have the opportunity for a hearing when the draft permit is released for public review. The Department is working on the permit, but it is not certain when the draft permit will be issued."

The LANL Draft Permit at section 9.1 now seeks to accomplish a definitional sleight of hand to equate "permitted units" with "regulated units." Consent Order section III.W.1 provides an exception for the use of the Consent Order for (2) the closure and post-closure care requirements of 20.4.1.500 NMAC (incorporating 40 C.F.R. Part 264, Subpart G), as they apply to "operating units" at the Facility. However, for reasons described below and also the historical reasons stated above, MDAs G, H and L are not RCRA permitted units. The Consent Order Consent Order (AR 16255 and 32111) at III.W.A asserts that it fulfills the requirements for:

"3) groundwater monitoring, groundwater characterization and groundwater corrective action requirements for regulated units under Subpart F and for miscellaneous units under Subpart X of 40 C.F.R. Part 264 and 20.4.1.500 NMAC (incorporating 40 C.F.R. Part 264)." (Emphasis supplied).

This language of III.W.A provides no indication that alternative requirements, as distinguished from the 40 CFR 264.91-100 requirements of Subpart F, will be used for the regulated units.

Are the regulated units G, H and L "permitted units" within the meaning of RCRA?
No. As discussed below, Citizen Action disagrees that the LANL Draft Permit definition for permitted unit is correct for purposes of the Resource Conservation and Recovery Act (RCRA). The regulated units G, H and L have not met the RCRA criteria for being permitted units. Regulated units G, H and L lost interim status and were required by RCRA to undergo closure and obtain post-closure permits. The Draft Permit is required to but does not provide the appropriate closure and post-closure requirements for groundwater monitoring for regulated units G, H and L.

The LANL Draft Permit Section 1.2 asserts:

"This Permit also establishes standards for closure and post-closure care of permitted units at LANL pursuant to the HWA and HWMR."

Under the Post-closure Section 9 of the Draft Permit, the regulated units G, H and L are listed as one of three types of "permitted units:"

"9.1 INTRODUCTION

This Permit Part addresses the three categories of permitted units at the Facility. They are identified as follows:

(1) regulated units (*i.e.*, material disposal areas G, H, L);" ...

The Draft Permit regulatory shell game is to allow regulated units G, H and L to avoid the groundwater monitoring requirements of 264.91-100. The Fact Sheet beginning at p.21 [page 102, new Fact Sheet] incorrectly attempts to equate the term "operating unit" to the term used in the Draft Permit of "permitted unit." Consent Order section III.W.1 provides an exception for the use of the Consent Order for (2) the closure and post-closure care requirements of 20.4.1.500 NMAC (incorporating 40 C.F.R. Part 264, Subpart G), as they apply to "operating units" at the Facility. The Draft Permit now would equate operating units with permitted units with regulated units. This is incorrect and the definitions for Operating Unit, Permitted Unit and Regulated Unit differ substantially from each other but are being blurred together by NMED.

The March 1, 2005 LANL Consent Order defines Operating Unit as follows:

> "Operable Unit" or "OU" means any individual SWMU or AOC or a group of SWMUs or AOCs based on geographic location (i.e., technical area or test area) or grouped by similar construction, transport pathways, exposure routes, receptors, potential risk, and potential locations for Contaminants to accumulate."

The LANL Draft Permit provides a definition for permitted unit that is not compatible with RCRA and that is also incompatible with the LANL Consent Order definition. Under the Draft Permit Definitions (p.18):

> **"Permitted Unit** means a hazardous waste management unit: 1) that is not an interim status unit; and 2) that is authorized by this Permit and listed in Attachment J (*Hazardous Waste Management Units*), Table J-1 (*Active Portion of the Facility*), or Table J-2 (*Permitted Units Undergoing Post-Closure Care*)."

Under the LANL 2005 Consent Order definitions, "Permit" means the RCRA Permit issued to the Respondents for the Facility to operate a hazardous waste treatment and storage facility, EPA ID No. NM0890010515, as it may be modified or amended.

RCRA provides a regulatory framework for obtaining a RCRA Permit. The regulated units G, H and L did not meet the RCRA criteria to become permitted units. Under RCRA, a permit application consists of two parts, part A (see 40 CFR §270.13) and part B (*see*, 40 CFR §270.14 and applicable sections in §§270.15 through 270.29). In order to be on the RCRA Part B application, a unit must be on the RCRA Part A.

The requirements of 40 CFR 270.1 (b) for MDAs G, H and L to be permitted units have not been met. MDAs G, H and L dropped off of the Part A application for the LANL permit in 1985. The LANL Draft Permit definition would allow LANL to bootstrap units such as MDAs G, H and L onto the permit by merely listing them in Table J although the units are absent from the RCRA Part A application. All three regulated units have operated illegally for more than a decade without the required closure plan that was required 15 days after closing and the post closure permits.

Interim status terminated on November 8, 1985 for land disposal units, unless the owner/operator submitted a Part B permit application and certified compliance with groundwater monitoring before November 8, 1984. Interim status terminated for regulated units Area G, H and L because the Part B application submitted on May 1, 1985 had no request for disposal at regulated units Area G, H and L.

The 7/6/2009 Fact Sheet (AR 31819) states (p.27):

> In addition, under 40 CFR § 270.73(c), interim status for land disposal facilities which were granted interim status before November 8, 1984 terminated on November 8, 1985, unless the owner/operator submitted a Part B permit application and certified compliance with ground water monitoring before that date. **This provision would also call for termination of interim status at Areas G, H and L. The Permitees recognized that interim status at Area L terminated under 40 CFR 270.73(c) on November 8, 1985 (DOE letter, Nov. 25, 1985). Areas G, H and L, as interim status facilities, were each required to have a closure and postclosure care plan for the entire "facility."** (40 CFR §§ 265.110-120)(45 Fed. Reg. 33242-43)(May 19, 1980). **No later than 15 days after termination of interim status**, the owner or operator was required to submit a closure plan to the Department (HWMR § 206.C.2.(c)(3)(a)). Regulations provided a process for Department approval and, thereafter, execution of the closure plan. (HWMR 206.C.2.(d)(2)). EPA stated that the "current regulations [in 1985] specify that the owner or operator and a professional engineer must certify that the facility (including all partial closures) has been closed in accordance with the closure plan." (50 Fed. Reg. at 11074). Thus, certification must establish that 'the entire facility has been closed in accordance with the approved closure plan. (51 Fed. Reg. at 16430).'" (Emphasis provided).

The Fact Sheet recognizes that "No later than 15 days after termination of interim status, the owner or operator must submit a closure plan to the Department." LANL failed to timely submit a closure plan for the units. LANL also failed to submit applications for the post closure care permits for the units. EPA and/or NMED failed to enforce the closure and post closure permit requirements that would have provided public notice and opportunity for a public hearing.

Because the regulated units G, H and L <u>did not obtain permits</u> and are closing with hazardous waste in place, the availability of imposing what may be lesser alternative groundwater monitoring requirements under 40 CFR 264.90 (f) for regulated units co-located with other SWMUs are <u>not available</u> for use by the State RCRA authority (NMED). NMED incorrectly takes the position that "site specific requirements may be used in lieu of full Subpart F requirements" for regulated units G, H and L.

Citizen Action disagrees with NMED's incorrect position that the EPA is allowing "site specific" use of alternative groundwater monitoring requirements as set forth in the Fact Sheet (p. 103) as follows:

"Under the Consent Order, the Permittees are in the process of investigating groundwater contamination in the vicinity of MDAs G, H, and L and evaluating the existing wells that comprise part of a groundwater monitoring network around TA-54. The Permittees are required to establish a groundwater monitoring network for all regulated units as defined in 40 CFR § 264.90(a)(2). Alternative groundwater monitoring requirements contained in an enforceable document may be used in stated circumstances pursuant to 40 CFR § 264.90(f). Title 40 CFR § 270.1(c)(7) defines "enforceable document" and states, further, that an enforceable document for post-closure care must impose the requirements of 40 CFR § 265.121. Section 265.121, in turn, states that the full terms of 40 CFR §§ 264.91-100 must be met; therefore, it might be read to state that alternative requirements are effectively unavailable. However, EPA has explained that "site-specific requirements" may be used in lieu of full Subpart F requirements. (63 Fed. Reg. 56710, 56714)(Oct. 22, 1998)."

That lesser groundwater monitoring requirements are not available is realized from the distinction between an *unpermitted regulated unit* leaving wastes in place and a *permitted unit.*

The NMED Fact Sheet (AR 31819) analysis ignores the actual stated intent and applicable standard of 63 Fed. Reg. 56710, 56715 for groundwater monitoring applicable to regulated units at facilities closing with waste in place (Exhibit 1):

> 63 FR 56715 III.B. – "*Post closure care under alternatives to permits.*
> "...Facilities that close with waste in place, without obtaining a permit, and then use non-permit mechanisms in lieu of a permit to address post-closure responsibilities, will have to meet three important requirements that apply to facilities that receive permits: (1) <u>the more extensive groundwater monitoring required under Part 264, as they apply to regulated units</u>; (2) certain requirements for information about the facility found in Part 270 that enable the overseeing agency to implement the Part 264 monitoring requirements; and (3) facility-wide corrective action for SWMUs as required under § 264.101. These requirements are set out in new §265.121, which applies to interim status" (Emphasis supplied)).

63 Fed. Reg. 56716 explains further: "As to groundwater monitoring, this rule will substitute the stricter Part 264 requirements for the original part 265 requirements.

The closure and post-closure permit applications and the imposition of groundwater monitoring requirements at regulated units G, H and L are more than a decade overdue. EPA and NMED allowed regulated units G, H and L to illegally continue to accept waste after the loss of interim status. Area G is still receiving hazardous waste without a RCRA permit. Regulated units G, H and L lost interim status in 1985 and now require closure and obtaining post-closure permits. (See, 40 CFR 270.73- Termination of Interim Status). All operating facilities are required to have RCRA permits. The Consent Order states (p.77)(AR 16255 & 32111):

> "MDA G at TA-54 Area G was used as the Facility's primary radioactive disposal facility from 1957 until 1997. Solid and liquid wastes were disposed at MDAs G, H, and L. Area L is currently a hazardous and mixed waste container storage area. Currently, Area G is used for the disposal of low-level radioactive waste in pits, and for the storage of mixed and transuranic waste. The Respondents report that hazardous and mixed wastes were disposed of in pits, trenches, and shafts at MDA G until 1990. MDA H is an inactive hazardous and radioactive waste disposal area that received classified or sensitive wastes and debris contaminated with radioactive, hazardous, and explosive constituents between 1960 and 1989. MDA L at TA-54 Area L was used between 1959 and 1986 for disposal of mostly liquid hazardous and radioactive wastes into pits, trenches, and shafts. Environmental investigations at TA-54 show that contaminant releases have occurred at MDAs G, H, and L. None of the radioactive materials and waste management activities at TA-54 are subject to this Consent Order."

The current permit cannot include or regulate the regulated units G, H and L as "permitted units" so as to apply alternative groundwater monitoring requirements under the Consent Order as an enforceable document. The Consent Order does not qualify as an enforceable document for reasons stated above. There were no timely applications for closure and post closure permits for regulated units G, H and L. No clean closure was provided for regulated units G, H and L. No groundwater monitoring was put into place that accorded with post-closure care requirements of 264.91-100. The inclusion of G, H and L in the current permit is improper because the three units lost interim status, were required to close and did not again become listed on a Part A application at any time and cannot now be part of a Part B application.

As will be discussed in more detail below, whatever the "alternative requirements" may be that are used by NMED and LANL, they do not protect groundwater. Unfortunately, the inchoate groundwater monitoring at LANL has provided less protection than the requirements provided for by 40 CFR 264.91.-100 for collecting reliable water sampling data.

Many scientific reports over nearly a decade have described the overall failure of the DOE/LANL to comply with groundwater monitoring requirements to protect the precious groundwater resources from contamination by LANL chemical and nuclear wastes. The Environmental Protection Agency (EPA), the DOE Inspector General, the National Academy of Sciences (NAS) and Registered Geologist Robert Gilkeson have written detailed reports that describe the major problems in the DOE/LANL groundwater protection practices and lack of compliance with regulations.

Although written standards for groundwater monitoring have been in place on paper for more than a decade, first described by the EPA permit Module VIII (1990) as the "prescriptive" requirements of 264.91-100, enforcement has not been accomplished of those legal groundwater monitoring requirements to obtain representative and reliable water samples at LANL's regulated units.

A May 30, 1995 NMED letter to LANL identified TA-54 G, H and L and several other regulated units as being subject to groundwater monitoring requirements when NMED denied a DOE request for groundwater monitoring waivers. NMED ordered DOE and LANL to prepare a Hydrogeologic Workplan. The pertinent excerpt from the letter is pasted below:

> "Los Alamos National Laboratory (LANL) has provided inadequate and incomplete information pertaining to the unsaturated and saturated conditions across the Pajarito Plateau in support of ground-water monitoring waivers for the various RCRA-regulated units (TA-54 Area G & L, TA-16 Surface Impoundment & Area P Landfill, TA-35-125 & 85 Surface Impoundments, and TA-53 Surface Impoundments). Basic geology, hydrogeology, and pathways for contaminant transport have not been adequately addressed to date."

The Hydrogeologic Workplan (May 22, 1998) recognized the requirement for groundwater monitoring to be 40 CFR 264.91 – 100 (AR 13191) (p.1-13):

> "**1.5.5 Other Requirements**
>
> "The structured groundwater monitoring requirements applied to regulated units under RCRA are prescriptive [Footnote omitted]. The New Mexico Annotated Code, Title 20, Chapter 4, Part 1 (20 NMAC 4.1) Subpart VI, Sections 264.91 - 100 establish three progressive monitoring programs that, unless a demonstration can be made that no potential for migration of liquid from the regulated unit to the uppermost aquifer exists, may be necessary to implement for detecting and addressing releases to groundwater. To adequately establish a monitoring network under any of these programs, it is necessary to characterize the subsurface (including groundwater) in a comprehensive manner."

Section IV.A.1 of the Consent Order stated: "The requirements of this Consent Order replace the requirements of the Hydrogeologic Workplan." The former Hydrogeologic Workplan was required to be implemented by the 1995 NMED letter of denial to LANL's request for waivers of groundwater monitoring.[7] However, the NMED did not require LANL to accomplish the former prescriptive RCRA requirements of 40 CFR 264.91-100 of the Hydrogeologic Workplan.[8]

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[7] It is procedurally questionable whether the Consent Order could have replaced the Hydrogeologic Workplan without a modification of the 1990 EPA permit. (See, 40 CFR 270.42 Appendix I). No public notice was given for the Consent Order to modify the 1990 EPA permit.

[8] The Hydrological Workplan cited the EPA 1990 HSWA Module VI11 Requirements for well construction.

> "Special permit conditions included in the HSWA Module VI11 requirements (EPA 1990) apply to the construction of monitoring wells. In particular, the following permit language is relevant to the construction of the wells proposed in this Workplan.
>
> "The monitoring wells installed under this and following sections of this permit shall be constructed using flush-joint, internal upset, threaded (or an equivalent method of joining without rivets, screws and glues) casing manufactured from inert materials. The boreholes for casings and screens shall be a minimum of six (6) inches greater in diameter than the well casing or screen outer diameter. Filter pack and screen slot openings shall be sized based on formation grain size

In fact, basic geology, hydrogeology, and pathways for contaminant transport were *not* adequately addressed by the LANL *Hydrogeologic Workplan* for the RCRA regulated units and *still* have not been adequately addressed to the present time. A serious deficiency is that the only RCRA regulated units that are identified in the LANL Consent Order and the draft Part B RCRA Permit are the three regulated units MDAs G, H and L, However, the NMED documents and LANL RCRA reports reviewed by Citizen Action establish that the minimum number of RCRA "regulated units" at LANL is ten (10) units (TA-54 Area G, H and L, TA-16 Surface Impoundment and Material Disposal Area P, TA-21 MDA T, TA-35, TA-125 and TA-85 Surface Impoundments, and TA-53 Surface Impoundments, Liquid Coolant Water from TA-21 Steam Plant and the associated seepage pit and disposal well).

For the sake of argument, even if the standard of 40 CFR 264.90(f) were found to be applicable to allow alternative groundwater monitoring for the regulated units at LANL, the history of the groundwater monitoring at the regulated units demonstrates overall failure of the monitoring wells at TA-54 to furnish the reliable and representative water data under 40 CFR 264.91-100 so as to be protective of human health and the environment. The current groundwater monitoring at LANL does not adequately provide upgradient background water quality data for LANL. Downgradient monitoring wells are not located at the point of compliance as described by 264.95. The Draft Permit must impose the full requirements for groundwater monitoring including detection and compliance monitoring at LANL to prevent further abuse.

The record of groundwater monitoring performance at LANL demonstrates that the Consent Order requirements have been routinely violated and fail to be protective of public health and the environment. The record shows the LANL has not installed a reliable groundwater monitoring network. The record shows the knowing lack of enforcement of groundwater monitoring requirements and the acceptance and approval of unreliable monitoring well data by the NMED.

The Compliance Order on Consent (AR 32111) provides for groundwater investigation to include EPA and industry accepted methods and procedures as follows:

"IV.A.3 Groundwater Investigation

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and characteristics. Well screen lengths shall be no more that (10) ten feet in length. The filter pack shall extend no more than (2) two feet above the top of the screen and shall not cross any clay layers which may act as aquitards. If a bentonite seal is used, the bentonite shall be allowed to hydrate a minimum of (12) twelve hours before emplacement of grout. Grout shall be emplaced using a tremie pipe to ensure a consistent seal at depths greater than 5 feet, and grout shall be allowed to set a minimum of twelve hours before initiating development."

"Development procedures shall include purging of the well until contaminants introduced during drilling can be assured of being removed. Development shall also include surging with a surge plug, and either bailing or pumping until the nephelometric turbidity units (N.T.U.) can be consistently measured at five (5) or less, if possible. Well head construction shall include a well pad keyed into the well annulus and a system to secure the well from traffic and unauthorized access."

> The Respondents shall conduct investigations of groundwater in accordance with Department approved work plans to **fully characterize the nature, vertical and lateral extent, fate, and transport of groundwater contamination originating from the Facility to determine the need for, and scope of, corrective action.** The investigation shall include an evaluation of the physical, biological and chemical factors influencing the transport of contaminants in groundwater. The Respondents shall implement the groundwater investigation requirements in accordance with the schedule set forth in Section XII of this Consent Order. **All data shall be collected according to EPA and industry accepted methods and procedures, and in accordance with Section IX of this Consent Order."**

The Consent Order includes provision for groundwater monitoring, characterization and corrective action at "regulated units."

> **"III.A PURPOSES AND SCOPE OF CONSENT ORDER**
> The purposes of this Consent Order are: 1) to fully determine the nature and extent of releases of Contaminants at or from the Facility; 2) to identify and evaluate, where needed, alternatives for corrective measures, including interim measures, to clean up Contaminants in the environment, and to prevent or mitigate the migration of Contaminants at or from the Facility; and 3) to implement such corrective measures.
> Except as provided in Section III.W.1, this Consent Order fulfills the requirements for: 1) **corrective action** for releases of hazardous waste or hazardous waste constituents under sections 3004(u) and (v) and 3008(h) of RCRA, 42 U.S.C. §§ 6924(u) and (v) and 6928(h), sections 74-4-4(A)(5)(h) and (i), 74-4-4.2(B), and 74-4-10(E) of the HWA, and their implementing regulations at 40 C.F.R. Part 264, subpart F (incorporated by 20.4.1.500 NMAC); 2) corrective action for releases of groundwater contaminants listed at 20.6.2.3103 NMAC, toxic pollutants listed at 20.6.2.7.VV NMAC, Explosive Compounds, nitrate, and perchlorate pursuant to section 74-9-36(D) of the SWA; 3) **groundwater monitoring, groundwater characterization and groundwater corrective action requirements for regulated units under Subpart F** and for miscellaneous units under Subpart X of 40 C.F.R. Part 264 and 20.4.1.500 NMAC (incorporating 40 C.F.R. Part 264); and 4) additional groundwater information required in Part B permit applications under 40 C.F.R. § 270.14(c) and (d)(3) and 40 C.F.R. § 270.23(b) (incorporated by 20.4.1.900 NMAC)."

NMED has not applied the groundwater monitoring requirements of 40 CFR 264 Subpart F to the regulated units at LANL. Subpart F includes 40 CFR 264.90-101. Since the Consent Order does not cite the specific groundwater monitoring requirements of 40 CFR 264.91-100 of Subpart F, NMED has chosen to ignore the rigorous application and enforcement of the 264.91-100 portion of Subpart F to LANL regulated units.

In or about 2005, scientific concerns about the reliability and representativeness of the groundwater quality data obtained from characterization wells drilled beneath the Pajarito Plateau. This was because the LANL scientists used mud-rotary drilling methods which allowed organic drilling fluids and foams and/or bentonite clay muds to invade all of the

screened intervals. These organic additives and muds have known properties to mask present and future radionuclides and toxic and hazardous contaminants. The problems with the LANL characterization wells were brought to the attention of the DOE Office of Inspector General (IG). In September 30, 2005, the DOE IG wrote a report entitled *Characterization Wells at Los Alamos National Laboratory* (AR 13953) that described the failure of DOE/LANL to meet the requirements of the Resource Conservation and Recovery Act (RCRA) and DOE Order 450.1 to install monitoring wells that produce reliable and representative water samples for the detection of LANL contaminants.

Numerous reports have rejected the reliability and representativeness of groundwater water quality data from LANL monitoring wells including rejecting the ability of the monitoring wells to be "rehabilitated." See the following:

> DOE/IG. 2005. United States Department of Energy Office of Inspector General Inspection Report 0703 – *Characterization Wells at Los Alamos National Laboratory,* DOE/IG-0703, September 2005. (AR 13953)
>
> Ford, R., S.D. Acree, and R.R. Ross. 2005. Memorandum to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (01RC06-001) Impacts of Well Construction Practices. Ada, Oklahoma: United States Environmental Protection Agency, National Risk Management Research Laboratory, Ground Water and Ecosystems Restoration Division. Draft Version, September 30, 2005. (AR 14175) (True and correct copy attached as EXHIBIT 10).
>
> Ford, R., S.D. Acree, and R.R. Ross. 2006. Memorandum to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (05RC06-001) Impacts of Hydrogeologic Characterization Well Construction Practices. Ada, Oklahoma: United States Environmental Protection Agency, National Risk Management Research Laboratory, Ground Water and Ecosystems Restoration Division. Final Report, February 10, 2006. (True and correct copy attached as EXHIBIT 11).
>
> Ford, R., S.D. Acree, and R.R. Ross. 2006. Memorandum to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (05RC06-001) – Review of LANL *Well Screen Analysis Report* – Ada, Oklahoma: United States Environmental Protection Agency, National Risk Management Research Laboratory, Ground Water and Ecosystems Restoration Division. Final Report, February 16, 2006. (True and correct copy attached as EXHIBIT 5).
>
> S.D. Acree, and Richard Wilkin, Ph.D. Memorandum to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (09RC06-001) – Review of LANL *Well Screen Analysis Report (WSAR), Rev.2* (LA-UR-07-2852) Groundwater Background Investigaton Report (GBIR) Rev. 3.(LA-UR-07-2853) United States Environmental Protection Agency, National Risk

Management Research Laboratory, Ground Water and Ecosystems Restoration Division. March 30, 2009. (True and correct copy attached as EXHIBIT 6).

An August 17, 1995 NMED letter (AR 12648) expressed concerns for groundwater contamination and protection at the Laboratory in the Hydrogeologic Workplan (AR 13191) (p. 1-10 through 1-11):

> "The letter further stated that NMED was evaluating work to be conducted to assure compliance with both the hydrogeologic requirements of the HSWA Module of the Laboratory's RCRA operating permit (EPA, 1990) and the requirements for groundwater monitoring of RCRA regulated units (A letter from NMED providing this evaluation was received in August, 1996). The August 17, 1995 letter stated the following determination:
>
> > 'a RCRA site-wide hydrogeologic Workplan should be developed and submitted to NMED and EPA for review and approval. A site-wide hydrogeologic Workplan developed under the driver of RCRA will provide a mechanism to assure a compliance schedule with specific tasks to meet the permit objectives. The Workplan should address both the HSWA hydrogeologic permit requirements and RCRA regulatory ground-water monitoring requirements.'
>
> "This determination by NMED is the primary driver for preparation of this Workplan."

The Consent Order section IV.A.3 requires:

> "All data **shall be collected** according to EPA and industry accepted methods and procedures, and in accordance with Section IX of this Consent Order." (Emphasis supplied).

The Consent Order section X.B. Drilling Methods requires (p. 174):

> **"X.B DRILLING METHODS**
>
> Groundwater monitoring wells and piezometers must be designed and constructed in a manner which will yield high quality samples, ensure that the well will last the duration of the project, and ensure that the well will not serve as a conduit for contaminants to migrate between different stratigraphic units or aquifers. The design and construction of groundwater monitoring wells shall comply with the guidelines established in various EPA RCRA guidance, including, but not limited to:
>
> • U.S. EPA, *RCRA Groundwater Monitoring: Draft Technical Guidance*, EPA/530-R-93-001, November, 1992;
>
> • U.S. EPA, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, OSWER-9950.1, September, 1986; and
>
> • Aller, L., Bennett, T.W., Hackett, G., Petty, R.J., Lehr, J.H., Sedoris, H., Nielsen, D.M., and Denne, J.E., *Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells*, EPA 600/4-89/034, 1989.

The U.S. EPA, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, OSWER-9950.1, September, 1986 for design and construction of monitoring wells is required by the Consent Order to be implemented at LANL. Nevertheless, Bentonite clay drilling muds and organic drilling fluids were routinely and improperly used up to the present in LANL groundwater monitoring wells. The EPA Groundwater Monitoring Technical Enforcement Guidance identifies the adverse effect for an assessment of aquifer characteristics by the use of Bentonite muds that provide an environment for bacterial growth, which, in turn, reduces the reliability of sampling results.

The DOE/IG, 2005 United States Department of Energy Office of Inspector General Inspection Report 0703 – *Characterization Wells at Los Alamos National Laboratory,* DOE/IG-0703, September 2005 (AR 15953) cited the RCRA Ground-Water Monitoring Draft Technical Guidance. The DOE/IG concluded that monitoring well design and construction at LANL did not meet the applicable requirements of 40 CFR 264.97:

- "LANL's use of mud rotary drilling methods during well construction was allowable under applicable RCRA guidance, as well as the Compliance Order on Consent. However, LANL did not adhere to specific constraints established in the RCRA guidance when using muds and other drilling fluids, and, as a result, LANL could not assure that certain residual drilling fluids were removed; and
- " Muds and other drilling fluids that remained in certain wells after construction created a chemical environment that could mask the presence of radionuclide contamination and compromise the reliability of groundwater contamination data."

The DOE/IG stated further:

> "Documentation indicates that LANL used muds and other drilling fluids during the drilling of 24 of the 32 characterization wells. For example, 28,250 pounds of bentonite clay were used during the drilling of well R-14, and 51,100 pounds of finely ground sodium bentonite (Quick Gel) were used during the drilling of well R-16."

The prohibition for cross-contamination of different zones during drilling and to the groundwater was violated by several monitoring wells.

A September 2004 LANL *Response to Concerns About Wells at LANL* (LA-UR-04-6777) (See true and correct copy attached as figure __ to this testimony) Longmire found and reported in 2002 that regional monitoring well R-22 well screens 1, 3, 4, and 5 "have not equilibrated and are affected by residual drilling fluids." A summary of what Longmire found along with radionuclides Technetium, uranium and Tritium included (p.35):

> "Thirty-one volatile and semivolatile organic compounds have been detected in water from well R-22. Only two of these, pentachlorophenol (1 detection, 6.2 ppb, MCL = 1 ppb) and benzo(a)pyrene (2 detections, 0.24 ppb, MCL = 0.2 ppb), were present at concentrations above the MCL.
>
> ...

"At this time there are measureable concentrations of tritium, volatile organic compounds, and semivolatile organic compounds which warrant continued monitoring."

These findings constitute "statistically significant evidence of contamination" at R-22 (40 CFR 264.98) for detection monitoring at LANL. The imposition of compliance monitoring is required under 40 CFR 264.99. Compliance monitoring has not been initiated although the contamination by RCRA contaminants was described eight years ago.

The Sept. 30, 2005 EPA Kerr Lab report in described the importance to seal the borehole section that was drilled with organic drilling additives before drilling into the regional aquifer. The EPA Kerr Lab stated ((AR 14175, p.10):

"5.At locations determined to be critical to the detection monitoring program, consider replacement of wells that were drilled using bentonite or organic additives with wells installed without additives in the screened zones. As noted above, data available from installation of the hydrogeologic characterization wells at these locations will allow specific intervals to be targeted for screening. Drilling additives may be used in intervals above the target screened zone. However, a casing should be pressure grouted in place and the hole cleaned prior to drilling into the screened zone and subsequent well installation

The Consent Order states (AR 32111, p. 174):

"Precautions shall be taken to prevent the migration of contaminants between geologic, hydrologic, or other identifiable zones during drilling and well installation activities. Contaminant zones shall be isolated from other zones encountered in the borings."

p. 194 "Contamination and cross-contamination of groundwater and aquifer materials during drilling shall be avoided."

(p.195). "The drilling method shall allow for the collection of representative groundwater samples. Drilling fluids (which includes air) shall be used only when minimal impact to the surrounding formation and groundwater can be ensured."

Further, the NMED HWB has not enforced the requirement in the LANL Consent Order for the LANL monitoring wells to comply with RCRA technical guidance. Consent Order Section X.B., states (p.189):

"The design and construction of groundwater monitoring wells shall comply [emphasis added] with the guidelines established in various EPA RCRA guidance, including, but not limited to:

• U.S. EPA, RCRA Groundwater Monitoring: Draft Technical Guidance, EPA/530-R-93-001, November, 1992 [also known as the EPA RCRA Manual].

The drilling activities at e.g., regional groundwater monitoring well R-40 did not comply with the guidance in the EPA RCRA Manual for the installation of casing to prevent

cross-contamination between the perched zone and the regional aquifer. The pertinent excerpt from the RCRA Manual is states (p. 4-11):

> "Drill the boreholes using techniques that minimize the danger of cross-contamination between water-bearing zones. Such techniques typically involve drilling an initial borehole partially into the possible confining layer, installing (grouting in) an exterior casing, emplacing grout in the cased portion of the borehole, and drilling a smaller diameter hole through the cased off/grouted portion of the borehole (i.e., telescoping casing) through the confining layer."

The use of mud rotary drilling methods results in slower Ksat values that can underestimate the contaminant transport time for the wastes to reach the regional aquifer. A special situation presents itself from the use of bentonite clay in screen 2 in monitoring well R-26 providing for the very low Ksat value of 0.002 ft/day that was measured. The Consent Order (IV.A.3 Groundwater Investigation) requires knowledge for the transport of contaminants in groundwater. Screen 2 does not produce water samples because the screened interval is so tightly plugged by the bentonite clay introduced by the mud-rotary drilling method and also by a mistake in well construction that surrounded the well screen with the bentonite clay grout. The presence of the bentonite clay in screen 2 was described in the LANL Evaluation of the Suitability of Wells Near Technical Area 16 for Monitoring Contaminant Releases from Consolidated Unit 16-021(c)-99, Revision 1 (LA-UR-07-6433, September 2007) (TA-16 Well Evaluation Report). (AR 30191) The pertinent excerpts from the report are pasted below:

> "R-26: Bentonite is present at Screen 2. The source of this bentonite is not known, but it was probably introduced during well completion. The presence of bentonite may result from a seal integrity problem or from the presence of residual drilling mud (p. 22)."
>
> **"4.2.3.8 R-26**
> R-26 has one screen (Screen 2) in the regional aquifer. During sampling at Screen 2 in 2005, it was discovered that the lower port was plugged with bentonite. In November 2005, the transducer was relocated to another port in the same screened interval. Still, collected pressure data are suspect because bentonite was present in the screen (p. 30)."

A NMED November 24, 2009 Notice of Disapproval (NOD) (AR 32236) was issued for the new multiple-screen monitoring well R-40. The NOD described the 60-day period that water contaminated with organic drilling products in a perched zone of saturation was allowed to flow down the open multiple-screen well and into the regional aquifer. The NMED approved the drilling work plan that allowed the cross-flow between the perched zone and the regional aquifer. NMED approved the work plan despite the fact that the plan allowed drilling through two perched zones of saturation with organic drilling products. Monitoring wells were installed in the two perched zones although the zones were drilled through with organic drilling foam.

The LANL 2008 Interim Facility-Wide Monitoring Plan (AR 31663)acknowledges the presence of organic drilling additives in two of the new regional aquifer monitoring wells that were drilled into the regional aquifer only with air and water. The pertinent excerpts from Appendix F are pasted below:

p. F-60 R-36 (Regional) Minor presence of residual organic drilling products is steadily clearing up.

p. F-62. R-42 (Regional) Minor presence of residual organic drilling products is steadily clearing up.

The Consent Order's (AR 16255) requirement to purge well screens before sampling is routinely violated by the LANL Westbay monitoring wells that have multiple well screens and cannot be purged prior to sampling. Thus, the data from Westbay monitoring wells is not reliable and representative of the formation water. The Consent Order describes the requirement for **Well Purging** at (IX.B.2.i.i):

> "All zones in each monitoring well shall be purged by removing groundwater prior to sampling and in order to ensure that formation water is being sampled. Purge volumes shall be determined by monitoring, at a minimum, groundwater pH, specific conductance, dissolved oxygen concentrations, turbidity, redox potential, and temperature during purging of volumes and at measurement intervals approved by the Department in writing. The groundwater quality parameters shall be measured using a flow-through cell and instruments approved by the Department in writing." (Emphasis supplied).

The December 4, 2009 NMED Department of Energy Oversight Bureau and Hazardous Waste Bureau document, *Proposals for Independent Environmental Monitoring at Los Alamos National Laboratory, New Mexico,* December 4, 2009 (True and correct copy attached as EXHIBIT 7) illustrates that the data provided by LANL from no-purge Westbay monitoring wells has been accepted by the NMED for over a decade:

> "Beginning in 1998 and as part of the LANL groundwater characterization program, 15 regional wells and one intermediate aquifer well were installed and equipped with Westbay multiport-sampling systems. Samples from these wells are collected without prior purging. Subsequent water-quality data collected from these wells suggested that many of the wells were not providing representative samples, and that some type of assessment and corrective action were warranted. It was concluded that residual drilling fluids present within the sampling area (screen, filter pack, and formation) were the cause of the poor sample quality..."
>
> "... Field data and hydrochemical data indicate that the groundwater being pumped was not representative of the formation and was impacted by drilling fluids."

It is a violation of RCRA for NMED to have knowingly accepted the incorrect data from the Westbay monitoring wells. (42 U.S.C. 6928).

The National Academy of Sciences *Plans and Practices for Groundwater Protection at the Los Alamos National Laboratory: Final Report*, (2007) (Exhibit 4) reported failed

monitoring wells and uncertainty in modeling because the data does not exist beneath the mesas where the large inventory of wastes are buried:

> (p.42) An update to the regional aquifer model is provided by Keating et al. who state that "predicted flux through older basalts in the aquifer can vary by a factor of three . . . the true uncertainty of our predictions, including the impact of possible conceptual errors, is likely to be larger and is difficult to quantify" (Keating et al., 2005, p. 653).
> (p.46) "Although LANL is using a numerically sophisticated multiphase model for vadose and regional groundwater modeling, it is not yet possible to predict with confidence when, where, or if a contaminant might appear in the regional aquifer."
> (p. 46) ... "the detailed knowledge needed to predict subsurface flow paths does not exist. Lack of understanding of these phenomena, coupled with rapid flow in the alluvium and apparent rapid flow facilitated by perched waters, was central to the surprise over detection of chromium near the water supply wells. An improved knowledge of these inter-watershed processes is needed to design an effective, early warning monitoring program."
> (p. 49) "Many if not all of the wells drilled into the regional aquifer under the Hydrogeologic Workplan appear to be compromised in their ability to produce water samples that are representative of ambient groundwater for the purpose of monitoring."
> (p. 51) "Previous problems in installing well screens at LANL have been reported to include excessively long screens, screens installed at the wrong depths to intercept contaminants, too many screens per well, and screen materials that corrode in groundwater (Gilkeson, 2006b). The use of overly long screens can cause dilution of sampled contaminants. Multiple screens, on occasion as many as nine screens in some LANL wells, can cause dilution or possibly cross-contamination of samples if there is leakage between screens."
> (p. 53) "There is general agreement that the use of bentonite clay and organic additives has compromised the ability of at least some R-wells to yield water samples that are truly representative of the ambient, undisturbed groundwater conditions (LANL, 2005d; Ford et al., 2006; Ford and Acree, 2006; NMED, 2006). Robert Gilkeson, a registered geologist and former advisor to LANL, stated that bentonite clay and/or organic drilling additives had invaded the screened intervals in all of the LANL characterization wells (Gilkeson, 2006a,b). He illustrated a conceptual model of how these materials can set up a "reactive capture barrier" that would tend to remove contaminants from sampled groundwater; see Figure 5.2 (also see Chapter 3, Figure 3.2)."
> (p. 53) "Because the construction of these wells was expensive, some $1 million to $2 million for each well (Broxton, 2006), LANL began work in 2006 to try to recover some of the compromised screened intervals (LANL, 2005d, 2006e,f). This rehabilitation effort is itself controversial (Gilkeson, 2006a,b; LANL, 2004d). The New Mexico Environment Department's (NMED's) notice of disapproval of the Well Screen Analysis Report (letter dated September 18, 2006)

indicated continued disagreement on a number of important issues regarding the rehabilitation work."

(p. 54) "Geologist Robert Gilkeson described concepts of how drilling fluids could form a zone that removes contaminants from sampled groundwater."

(p. 59) "**SIDEBAR 5.3 Citizens' Concern for Radionuclides Reported in Drinking Water**

"Near the end of this study, the non-governmental organization Concerned Citizens for Nuclear Safety (CCNS) and Robert H. Gilkeson, a registered geologist, brought to the committee's attention data in LANL's Draft Site-Wide Environmental Impact Statement (SWEIS; DOE, 2006) that indicated contamination of drinking water supply wells by neptunium and other radionuclides, including plutonium, americium, strontium, and cesium. CCNS and Gilkeson pointed out that data tables in the draft SWEIS showed, for example, that neptunium (Np-237) was detected in 4 of 13 samples from Los Alamos County supply wells and in 2 of 3 samples from the Buckman well field that supplies over 40 percent of the drinking water for residents of the city of Santa Fe. Mean concentrations of Np-237 were 10.6 and 10.3 pCi/L, respectively. These reported concentrations approach the EPA limit of 15 pCi/L for alpha-particle emitting nuclides in drinking water.

"In its memorandum to the committee, CCNS and Gilkeson stated: "We are surprised at the high levels of neptunium. This contamination may be because of the poor precision of the gamma spectroscopy analytical method. The LANL scientists claim the neptunium contamination doesn't exist and the detects are 'false positives.' Nevertheless, the contamination is presented as *valid detections* in the data tables in the draft LANL SWEIS" (Gilkeson and Arends, 2007, p. 5).

"In responding to CCNS, LANL did in fact attribute the reported data to 'false positives,' stating: "Detections of LANL-derived contaminants, such as plutonium, americium, and strontium, have occurred sporadically in water supply wells. . . . Because the overall frequency of detection is low, we believe that these sporadic detections are false positives or caused by problems at the analytical laboratory. This conclusion is supported by numerous reanalyses of these samples and by lack of consistent detections in paired samples" (Phelps, 2007, p. 2).

"This exchange between CCNS and LANL is a good example of why the committee is concerned about LANL's representations of groundwater sampling data. Whether or not the data were statistically significant, and the committee takes no position on this, the data were reported by LANL in its draft SWEIS and, reasonably, taken as real concerns by public stakeholders."

According to the March 30, 2009 Memorandum of S.D. Acree, and Richard Wilkin, Ph.D. to Richard Mayer, U.S. EPA, Region 6: Los Alamos National Laboratory, Los Alamos, NM (09RC06-001) – Review of LANL *Well Screen Analysis Report (WSAR), Rev.2,* (Exhibit 6) the study of water quality data alone cannot determine whether the changed water chemistry surrounding a well screen can again provide representative and reliable water samples. The LANL WSAR, Rev. 2, (AR 14684) which relied on water quality data, much of it from no-purge Westbay wells, was carelessly approved by the NMED in September 2007, despite three (3) earlier EPA Laboratory reports pointing out

the error of reliance on groundwater sampling data and the inability to determine whether sampling results were correct.

After the NMED approval of the WSAR, Rev. 2 and the Groundwater Background Investigation Report (GBIR), the March 9, 2009 EPA Laboratory Memorandum once again rejects the methodology of relying on groundwater sampling data. The 3/10/09 EPA Kerr Laboratory (Id.) memorandum states:

> "The most significant concerns noted in review of the current versions of the WSAR and the GBIR are related to three areas:
>
> - The results of the WSAR and related assessments have not been fully validated using site-specific data from laboratory and field studies.
> - The criteria rely heavily on the 'background' data obtained from long-screened production wells and springs that do not necessarily represent water quality upgradient of the hydrogeologic characterization monitoring wells.
> - The reliability of criteria used to evaluate the Representativeness of groundwater samples from well screens following transformation of residual organic drilling additives and the return of groundwater samples to oxidized conditions is uncertain due to a lack of direct assessments of the site-specific mineralogical transformations and the reliance on groundwater sampling data."

The supposed "rehabilitation" of the compromised screen intervals at LANL monitoring wells is based on the study of water quality data alone. The data cannot be used to determine that the impacted wells have "cleaned up" from the damage caused by the large quantity of organic drilling additives that were forced into the screened intervals by the use of improper and unnecessary drilling methods. This would invalidate affected well screens as sampling points. NMED has continued the knowing acceptance of LANL's Well Screen Analysis Report, Rev. 2 in the face of the factors of: significant lack of validation of screening results, uncertain background conditions, and the impossibility to clearly assess the nature of the reactive iron mineralogy surrounding the well screens by examining water quality alone.

The 2009 EPA Kerr Laboratory Memorandum (Exhibit 6) recommended "upgradient well installations;" laboratory studies to "quantify sorption of the inorganic constituents of concern onto the materials used during well construction at LANL, and; "the installation of new well(s) drilled without the use of additives in the screened zone near the impacted well(s)."

Mandatory requirements have not been met or enforced for more than a decade at LANL's regulated units to provide:

- monitoring wells in the RCRA prescribed point of compliance locations relative to the regulated units (40 CFR 264.95);
- upgradient monitoring wells for the determination of background water quality;
- downgradient monitoring wells at the point of compliance;

- accomplishment of representative and reliable water sampling unaffected by drilling additives, and;
- purging before sample collection. (*See, e.g.,* 40 CFR 264.97).

The knowing, willful and continuing pattern and practice of using monitoring wells that do not and cannot provide representative and reliable water samples and compiling such information in LANL reports with NMED acceptance and approval of those reports constitute the furnishing of false and incorrect information by DOE/LANL in its permit application and is reason for the Court to deny the Draft Permit. (*See*, 40 CFR 270.41-43).

Unfortunately, as shown above, groundwater monitoring data has not been collected in accordance with:

- Module VIII of the 1990 EPA permit;
- Hydrogeologic Workplan (1998),
- DOE Order 450.1 (see DOE/IG-0703 Inspection Report, p.2)
- EPA standards as required by 40 CFR 264.91-100;
- EPA Draft Technical Guidance for Groundwater Monitoring,
- The Consent Order, and;
- Accepted industry procedures, e.g., as set forth by TechLaw, Inc supra.

Nevertheless, the incorrect water sampling data has been knowingly and willfully provided from defective wells at LANL. NMED has ignored numerous scientific reports that describe the defective monitoring wells at LANL. NMED nevertheless continues to issue approval for reports containing incorrect data contained in LANL reports. NMED and LANL have wasted hundreds of millions of taxpayer dollars in the construction of worthless wells that furnish sham data.

Recommendations

1. 40 CFR § 264.90(a)(2) imposes the groundwater monitoring requirements of 40 CFR § 264.91-.100 and that should be clearly stated in the Draft Permit Sections 9, 10 and 11 instead of the regulatory loophole that is being put on the table. All regulated units must have a minimum of one upgradient monitoring well, three down-gradient monitoring wells for detection monitoring. Where contamination has been/is identified, compliance monitoring must be established.
2. LANL must identify all regulated units and submit a closure plan and post closure plan for all regulated units. The Draft Permit must contain a Closure Plan and Post-Closure Care Permits must be submitted for the regulated units along with the Long Term Monitoring and Maintenance Plans.
3. NMED must impose the proper detection and compliance groundwater monitoring networks at all regulated units as required in 40 CFR 264.91-100.
4. The Draft Permit must contain a section identifying the expanded public participation requirements and those provide opportunities, especially for workplans related to groundwater well monitoring workplans.
5. NMED must deny all versions of the Well Screen Analysis Reports without opportunity for revision.
6. NMED must redesign the well monitoring network at LANL and impose the 40 CFR 264.91-100 groundwater monitoring requirements for *inter alia,* upgradient background

Well R-22 is completed with 5 screened intervals in the regional aquifer. No intermediate perched groundwater is present at this location. The characterization sampling has been completed and a geochemistry report has been published describing the analytical results (Longmire, 2002c). As described in the geochemistry report (Longmire, 2002c) and in the answer to Question 3 in this document, screens 1, 3, 4, and 5 have not equilibrated and are affected by residual drilling fluids. However, screen 2 provides water samples that are probably representative of pre-drilling conditions.

A summary of what has been found and reported at R-22 by Longmire (2002c):

- There have been no detections of americium-241, cesium-137, iodine-129, plutonium-238, plutonium-239, plutonium-240, or strontium-90 in any groundwater samples from R-22.
- Technetium-99 was only detected in water from well R-22 at concentrations of 4.3 pCi/L (screen 4) and 4.9 pCi/L (screen 3) during the first characterization sampling round (Longmire, 2002c). These values are near the IDL and are not 100% certain. Technetium-99 was not detected in the subsequent 5 sampling rounds at well R-22.
- Natural uranium above background is present in screen 3; uranium below background is present in screens 1, 4, and 5. Uranium at background levels is present in screen 2.
- Tritium is present in screens 1 and 5. The most consistent concentrations occur in screen 5, which is 565 ft below the regional water table.
- Thirty-one volatile and semivolatile organic compounds have also been detected in water from well R-22. Only two of these, pentachlorophenol (1 detection, 6.2 ppb, MCL = 1 ppb) and benzo(a)pyrene (2 detections, 0.24 ppb, MCL = 0.2 ppb), were present at concentrations above the MCL (Longmire, 2002c). Monitoring for organic compounds at R-22 will continue.

Gilkeson (2004) suggests that radionuclides (americium-241, cesium-137, iodine-129, plutonium-238, plutonium-239, plutonium-240, strontium-90, and technetium-99) are present in the regional aquifer at the location of well R-22. However, with the exception of technetium-99, none of these radionuclides have been detected in groundwater samples from well R-22.

Gilkeson (2004) presents a graph of technetium-99 values over time. As with R-7, most of the points on the graph actually are the method detection limits for technetium-99. The two detected values of technetium-99 are in the first round of sampling in screens 3 and 4, although the values are uncertain based on low concentrations of this isotope near the instrument detection limit using gamma spectroscopy. The instrument detection limit decreases during that period because matrix interferences decreased as the well equilibrates with groundwater. After the first sampling round, technetium-99 was not detected, despite the improved ability to detect it.

At this time in R-22, there are no detectable concentrations of americium-241, cesium-137, iodine-129, plutonium-238, plutonium-239, plutonium-240, strontium-90, or technetium-99. There are measurable concentrations of tritium, volatile organic compounds, and semivolatile organic compounds which warrant continued monitoring.

Question 6: How does Los Alamos National Laboratory provide the public with groundwater information?

Concerns that regulators and the public have been misinformed about the activities under the Hydrogeologic Workplan are expressed in the Gilkeson (2004) report. Extensive information, including the

STATE OF NEW MEXICO
BEFORE THE SECRETARY OF ENVIRONMENT

IN THE MATTERS OF THE APPLICATION OF
THE UNITED STATES DEPARTMENT OF ENERGY **HWB 09-37 (P)**
AND LOS ALAMOS NATIONAL SECURITY LLC **HWB 10-04 (P)**
FOR A HAZARDOUS WASTE FACILITY PERMIT
FOR LOS ALAMOS NATIONAL LABORATORY
AND THE NOTICE OF INTENT TO DENY A PERMIT
FOR OPEN BURN UNITS TA-16-388 AND TA-16-399 FOR
LOS ALAMOS NATIONAL LABORATORY

ENTRY OF APPEARANCE ON BEHALF OF
CITIZEN ACTION NEW MEXICO

COMES NOW Citizen Action New Mexico ("CA") and notices its appearance in this proceeding pursuant to 20.1.4.300A(1) NMAC.

CA has submitted comments on the Los Alamos National Laboratory RCRA Draft Part B Permit and requested a public hearing in the matter and to be included as a party to the proceedings.

Appearing for CA in this matter is David B. McCoy.

He may be contacted at:

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Respectfully submitted,

David B. McCoy

CERTIFICATE OF SERVICE

I hereby certify that on this March 19, 2010, a copy of the
NOTICE OF ENTRY OF APPEARANCE FOR CITIZEN ACTION NEW MEXICO (CA)

CITIZEN ACTION NEW MEXICO STATEMENT OF INTENT TO PRESENT TECHNICAL TESTIMONY
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federal register

Thursday
October 22, 1998

Part II

Environmental Protection Agency

40 CFR Parts 264, 265, 270, and 271

Standards Applicable to Owners and Operators of Closed and Closing Hazardous Waste Management Facilities: Post-Closure Permit Requirement and Closure Process; Final Rule

EXHIBIT
1

LA-13986-MS

Issued: September 2002

Characterization Well R-22

Geochemistry Report

Patrick Longmire

Los Alamos
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Los Alamos NM 87545

EXHIBIT
2

atmosphere. Temperature, specific conductance, and pH were measured with an Orion meter (model 1230); turbidity was measured with a HACH® meter (model 53600-00). Both meters were calibrated daily using buffer solutions (pH 4.0 and 7.0) and known standards for turbidity. Dissolved oxygen was measured with a spectrophotometer (HACH® meter, model DR/2010) only during the fourth sampling round. Field measurements were recorded with daily activity logs submitted to the ER Project and are included in the analytical results. Turbidity values for these samples were generally less than 5 nephelometric turbidity units ([NTUs] Tables 4.2-1a through 4.2-1e), with a value as high as 39.5 NTUs in screen #1.

Measurements of water temperature on land surface recorded at well R-22 ranged from 16.7 to 24.2°C within the regional aquifer. The lowest temperature measurements were recorded in the winter of 2001. Variation in temperature reflects ambient surface temperature, even though temperature measurements were recorded immediately during sample collection.

Table 4.2-1a
Field-Measured Parameters for Groundwater Samples Collected at Well R-22, Screen #1

Geologic Unit	**Cerros del Rio lavas**	**Cerros del Rio lavas**	**Cerros del Rio lavas**	**Cerros del Rio lavas**
Depth (ft)	**907.0**	**907.0**	**907.0**	**907.0**
Date sampled (mo/d/yr)	**03/13/01**	**06/19/01**	**011/30/01**	**02/27/02**
pH (standard units)	7.21	6.93	7.16	7.08
Dissolved oxygen (mg/L)	Not measured	Not measured	Not measured	2.0
Temperature (°C)	19.6	23.0	18.0	19.3
Specific conductance (µS/cm[a])	458	495	558	549
Turbidity (NTU[b])	9.3	4.0	39.5	23.7

[a]µS/cm = microsiemens per centimeter.
[b] NTU = nephelometric turbidity unit.

Table 4.2-1b
Field-Measured Parameters for Groundwater Samples Collected at Well R-22, Screen #2

Geologic Unit	**Cerros del Rio lavas**	**Cerros del Rio lavas**	**Cerros del Rio lavas**	**Cerros del Rio Lavas**
Depth (ft)	**962.5**	**962.5**	**962.5**	**962.5**
Date sampled (mo/d/yr)	**03/12/01**	**06/20/01**	**12/03/01**	**02/28/02**
pH (standard units)	8.35	7.68	8.36	8.13
Dissolved oxygen (mg/L)	Not measured	Not measured	Not measured	6.4
Temperature (°C)	17.0	22.0	18.9	18.1
Specific conductance (µS/cm[a])	153	148	153	149
Turbidity (NTU[b])	0	0.6	0.9	0.3

[a]µS/cm = microsiemens per centimeter.
[b] NTU = nephelometric turbidity unit.

regional aquifer ranged from 0.11 to 14.9 mg/L, suggesting that the regional aquifer groundwater adjacent to well screens #1, #4, and #5 is reducing with respect to iron. Calculated oxidation-reduction potential (Eh) values ranged between +40.0 millivolts (mV) at pH 7.08 (14.9 mg/L ferrous iron, screen #1, fourth sampling round and +66.2 mV at pH 7.23 (1.53 mg/L ferrous iron concentration, screen #5, fourth sampling round). The following half-cell reaction was used to calculate Eh based on the $Fe^{2+}/Fe(OH)_3$ redox couple (20°C):

$$Fe(OH)_3 + 3H^+ + e^- = Fe^{2+} + 3H_2O. \qquad \text{Eq. 2}$$

This redox couple is electrochemically reversible at concentrations of ferrous iron above 10^{-5} molal (0.56 mg/L) (Langmuir 1997, 56037) and may provide a partial control on Eh at well R-22 (screens #1, #4, and #5).

Oxidation-reduction potential (ORP) was measured for three groundwater samples collected from screens #1, #3, and #5 on August 29, 2002. The ORP values were –125, –135, and –76 mV for samples collected from screens #1, #3, and #5, respectively. Eh values calculated from corrected ORP measurements (addition of +212.9 mV for 3N KCl-Ag/AgCl at 20°C) were +87.9 mV (screen #1), +77.9 mV (screen #3), and +136.9 mV (screen #5). Field ORP measurements conducted at well R-22 probably represent mixed redox couples consisting of H_2O/O_2, Mn^{2+}/MnO_2, $Fe^{2+}/Fe(OH)_3$, and H_2S^0/SO_4^{2-} pairs, which typically occur in groundwater under circumneutral pH conditions (Langmuir 1997, 56037). The dissolved oxygen, manganese, and sulfur redox couples, however, are not as electrochemically active as the iron couple and, therefore, they provide less control on redox. Relatively oxidizing conditions were stable as well R-22 prior to drilling. Residual drilling fluids, however, have enhanced manganese, iron, and sulfate reduction.

Concentrations of total (nonfiltered) iron detected within portions of the regional aquifer ranged from 0.02 to 19.3 mg/L (Appendix A). Significant differences between total and dissolved iron, up to a factor of 69 (screen #2, third sampling event), indicated the presence of suspended material, possibly clay minerals and ferric oxyhydroxide, that are stable under oxidizing conditions in the absence of reductants (DOC and TOC).

Concentrations of natural iron within the regional aquifer exceeded both the EPA secondary standard for drinking water (0.3 mg/L) and the NMWQCC standard for water supply (1.0 mg/L) for several sampling rounds. Concentrations of manganese in the regional aquifer exceeded both the EPA secondary standard of 0.05 mg/L and the NMWQCC standard of 0.2 mg/L for domestic water supply for several sampling rounds.

Concentrations of barium and strontium ranged from 0.013 (screen #2) to 0.360 mg/L (screen # 4) and from 0.043 (screen #2) to 1.10 mg/L (screen #4) (Tables 5.1-2 and 5.1-4), respectively. Concentrations of these two solutes were elevated in screen #4 relative to those in screens #1, #2, #3, and #5. Barium and strontium adsorb onto ferric oxyhydroxide (Langmuir 1997, 56037), and their presence in groundwater (screen #4) is possibly related to dissolution of ferric oxyhydroxide under reducing conditions. Elevated concentrations of these naturally occurring metals are the result of reducing conditions in the presence of residual drilling fluid. Concentrations of trace elements, including antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), lead (Pb), mercury (Hg), molybdenum (Mo), nickel (Ni), selenium (Se), silver (Ag), strontium (Sr), thallium (Tl), uranium (U), vanadium (V), and zinc (Zn), were within the low-to-moderate µg/L range and were less than their respective EPA and NMWQCC standards.

An activity of 109 pCi/L tritium was measured near the regional water table (883 ft) during drilling of well R-22 (Ball et al. 2002, 71471). Since 2000, activities of tritium measured in screen #1 (907.0 ft) averaged 2.38 pCi/L (Table 5.1-1), which suggests that some recent recharge to the regional aquifer has occurred.

Dilution of native groundwater during aquifer-performance (slug-injection) testing prior to well completion may account for decreased tritium activities observed near the regional water table during characterization sampling. Activities of tritium measured in screen #5 (1448.0 ft) averaged 8.42 pCi/L during characterization sampling. Possible sources of detectable tritium at well R-22 include atmospheric fallout and/or Laboratory discharges, subject to aqueous and vapor-phase movement, that have entered the regional water table upgradient of the well. This hypothesis of upgradient recharge is consistent with measurements of higher tritium activities observed in screen #5, while it generally was not detected in screens #2, #3, and #4. The nondetection of tritium in screens #2, #3, and #4 suggests that the regional aquifer (from 947 to 1385 ft) has not received recharge in the past 50 years, which predates the beginning of nuclear testing. Perched zones were not encountered during the drilling of R-22, suggesting that vertical recharge through the vadose zone at the well site is unlikely.

According to calculations using the well-mixed and piston-flow models presented by Blake et al. (1995, 49931), the age of the regional aquifer beneath Pajarito Plateau, the springs discharging in White Rock Canyon, and the San Ildefonso areas ranges between 3000 (≤1.6 pCi/L tritium using the well-mixed model) and 10,000 (≤0.5 pCi/L tritium) years. Because activities of tritium were generally less than detection (≤0.22 pCi/L) at well R-22, it is very likely that the age of the groundwater ranges between 3000 and 10,000 years in some portions of the regional aquifer (screens #2, #3, and #4).

Activities of selected radionuclides are provided in Tables 5.1-1 through 5.1-5. Americium-241, cesium-137, plutonium-238, plutonium-239,240, and strontium-90 were not detected in the groundwater samples collected from well R-22 (Appendix A). Gross alpha and gross beta activities were less than 4 pCi/L in a nonfiltered sample collected from screen #1 (Table 5.1-1). Measurable gross gamma (251 pCi/L) was attributed to isotopes within the natural uranium-238, uranium-235, and thorium-232 decay chains (Langmuir 1997, 56037) (Table 5.1-1). Activities of uranium-238, uranium-235, and uranium-234 were generally less than 0.5 pCi/L in groundwater samples collected from well R-22 (Tables 5.1-1 through 5.1-5). Similar activities of uranium were measured in supply wells during 2000 (ESP 2002, 71301).

Elevated activities of uranium-234, uranium-235, and uranium-238 and concentrations of natural uranium were measured in groundwater samples collected from screen #3 during the first and second sampling rounds. Additional analyses were conducted on groundwater samples collected from screen #3 using thermal ionization mass spectrometry (TIMS) at LANL. This analytical method provides the most precise measurement of uranium and plutonium isotopes. Natural uranium is characterized by an atom ratio of uranium-238/uranium-235 equal to 137.88, which is calculated from the natural abundance of uranium-238 (99.2745 percent) divided by that of uranium-235 (0.720 percent). Enriched uranium is characterized by an atom ratio for these two isotopes of less than 137.88, and depleted uranium has an atom ratio that is greater than 137.88. Groundwater samples (filtered) collected from screen #3 during the second and third sampling rounds were characterized by atom ratios of uranium-238/uranium-235 of 137.83 ±0.18 and 137.97 ±0.18, respectively (Appendix A). The most likely source of the elevated isotopic uranium observed in screen #3 is from bentonite used as annular fill between well screens. Bentonite from Wyoming contains natural uranium in the 1–10 mg/kg range. Concentrations of uranium decreased to 3 µg/L during characterization sampling in screen #3 at well R-22.

The presence of technetium-99 is not absolutely certain because of its low activity, measured just above IDL at well R-22. Technetium-99 was detected slightly above the IDL (liquid scintillation) in two groundwater samples collected from screens #3 and #4 during the first characterization sampling round (Tables 5.1-3 and 5.1-4). The activity of technetium-99 measured in screen #3 was 4.9 ± 3.6 (3σ) pCi/L with an MDA of 3.5 pCi/L. The activity of technetium-99 measured in screen #4 was 4.3 ± 3.8 (3σ) pCi/L with an MDA of 3.8 pCi/L. Activities of technetium-99 were less than detection in the last three sampling

Groundwater samples collected from screens #1 through #5 at well R-22 were analyzed for $\delta^{15}N_{AIR}$-NO_3, with results ranging from +0.6 to +6.4‰ (Tables 5.1-1 through 5.1-5). These ratios fell within the range of volcanic deposits reported by Clark and Fritz (1997, 59168). The negative isotopic value measured in a groundwater sample collected from 1273.5 ft suggests slight enrichment of nitrogen-14, whereas positive values indicate enrichment of nitrogen-15. The range of $\delta^{15}N_{AIR}$-NO_3 ratios showed fractionation of nitrogen (increasing positive isotopic ratios), possibly resulting from denitrification during the sampling events. Concentrations of nitrate plus nitrite (as N) in the perched zone ranged from 0.01 to 0.72 mg/L, which is similar to natural nitrate (as N) measured in supply wells on the Pajarito Plateau (ESP 2000, 68661, and ESP 2002, 71301). Concentrations of ammonium (as N) were less than detection in some samples, and it was not possible to measure $\delta^{15}N_{AIR}$-NH_3 in every groundwater sample because of limited sample volume.

Groundwater samples collected from the regional aquifer at well R-22 were also analyzed for $\delta^{15}N_{AIR}$-NH_3, with results ranging from +1.4 to +3.7‰ (Tables 5.1-1, 5.1-4, and 5.1-5). The positive values indicate slight enrichment of nitrogen-15. The range of $\delta^{15}N_{AIR}$-NH_3 ratios showed some fractionation of nitrogen, which was probably derived from breakdown of polyamide functional groups present in residual EZ-MUD®. Concentrations of detectable ammonium (as N) in the regional aquifer ranged from 0.52 to 1.80 mg/L.

Several VOCs and SVOCs (validated results) were detected at well R-22 including acetone (2.5 to 32 µg/L); benzoic acid (3 to 12.5 µg/L); toluene (0.2 to 0.76 µg/L); methylene chloride (0.62 and 2.2 µg/L); chloroform (0.94 µg/L); pentachlorophenol (6.2 µg/L); phenol (19 and 32 µg/L); 4-methylphenol (44 to 210 µg/L); and 2-butanone (6.9 to 8.9 µg/L) (Appendix A). Several substituted benzene compounds also were identified at the well, including isopropylbenzene (0.16 to 0.54 µg/L); 1,4-dichlorobenzene (0.16 to 0.23 µg/L); and 1,3,5-trinitrobenzene (0.12 µg/L). Methylene chloride is a laboratory solvent used during SVOC, pesticide, herbicide, and polychlorinated biphenyls (PCB) analyses using gas chromatography mass spectrometry (GCMS). Bis(2-ethylhexyl)phthalate, a constituent of plastic, was detected at concentrations of 1.0 and 3.9 µg/L in the regional aquifer during the first and fourth sampling events (Appendix A).

The occurrence of acetone at well R-22 can be regarded as a false positive for several reasons. QUIKFOAM® used during drilling consists of isopropyl alcohol, which has a molecular weight of 60.1 atomic mass units (amu). Acetone has a mass of 58.08 amu, which is very similar to that of isopropyl alcohol. These compounds will elute in nearly the same retention time on a typical GC/MS system following SW-846 Method 8260. The mass units for isopropyl alcohol are (mass/charge, m/z) 45, 43, 59, and 58, and the mass units for acetone are 43 and 58. For qualification purposes, the mass spectrometer uses the mass units and retention time. The analyte must elute in a certain retention-time window and have the correct corresponding mass units for identification. Because of the similar retention times and mass units for both acetone and isopropyl alcohol, these two compounds can be misidentified. This explanation is supported by the mass spectra data. Acetone can be misidentified because the secondary ion for isopropyl alcohol is 43, which is the primary ion for acetone. This misidentification also occurred in groundwater samples collected from wells R-7, R-12, and R-19.

High-explosive (HE) compounds were falsely detected only during the first sampling event at well R-22 and included 1,3,5-trinitrobenzene (0.12 µg/L) (screen #2); octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine ([HMX] 1.3 µg/L) (screen #4); 4-amino-2,6-dinitrotoluene (0.42 µg/L) (screen #1); 2-amino-4,6-dinitrotoluene (0.51 µg/L) (screen #1); and hexahydro-1,3,5-trinitro-1,3,5-triazine ([RDX] 0.34 µg/L) (screen #5). The reported results for the HE compounds and their degradation products can also be regarded as false positives for several reasons. The EZ-MUD® drilling agent consists of a polyacrylamide-polyacrylate copolymer that is made up of nitro and amino functional groups similar to the functional groups present in the HE compounds and their degradation products. Thus, residual EZ-MUD® constituents may be significant interferents in the liquid chromatography mass spectrometry method.

ENDORSED
First Judicial District Court
OCT - 7 2008
Santa Fe, Rio Arriba &
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FIRST JUDICIAL DISTRICT COURT
COUNTY OF SANTA FE
STATE OF NEW MEXICO

No. D-0101-CV-2007-02627

NEW MEXICO ENVIRONMENT DEPARTMENT,

Plaintiff,

vs.

CITIZEN ACTION NEW MEXICO,
a New Mexico organization,

Defendant,

and

THE ATTORNEY GENERAL OF NEW MEXICO,

Intervenor.

ORDER DENYING
PLAINTIFF'S MOTION FOR SUMMARY JUDGMENT
AND
ORDER DISMISSING COMPLAINT FOR DECLARATORY JUDGMENT
AS A MATTER OF LAW

THIS MATTER comes before the Court upon the New Mexico Environment Department's Motion for Summary Judgment on its Complaint for Declaratory Judgment, and the Court, having reviewed the pleadings and heard argument, finds and determines as follows:

A. The TechLaw Report does not constitute "thought processes" and is a public document under the Right to Inspect Public Records Act.

1. Under the Right to Inspect Public Records Act (or "Act"), Section 14-2-1, NMSA 1978 (2005), thought processes are not public records. *Sanchez v. Board of Regents*, 82 N.M. 672, 675, 486 P.2d 608, 611 (1971).

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2. In *Sanchez*, the Court reasoned:

> [W]e must determine whether we should give legal character to the demands of the curious who cannot patiently await the final result of a salary contract negotiation. We would deny the right to inspect these records of the Board of Regents on the subject of salary contract negotiations before the task was completed. It would not seem fair that the general public should know the contents of an offer of salary to an individual conceivably prior to the receipt of the offer by the contemplated employee. As indicated in the *MacEwan* case . . . we would not take away the right of the Petitioners to know about salary matters, but would merely suspend or defer the privilege of inquiry until the Board of Regents reaches its final conclusion, *i.e.*, the culmination of the contract between the board and the individual.

82 N.M. at 675-76, 486 P.2d at 611-12.

3. The Court distinguished *MacEwan v. Holm*, 359 P.2d 413 (Or. 1961), stating:

> In *MacEwan*, . . . the defendant sought to inspect data relating to nuclear radiation sources collected by the Oregon State Board of Health. The Oregon Supreme Court held that the data involved were 'public records' for purposes of inspection by the public. This case can be readily distinguished from the instant case inasmuch as scientific data obtained is the result of testing of at least one facet of the over-all purpose of the research. In *MacEwan* . . . , this phase of the research had been completed, whereas in our case we only have an offered contract with no finality attached to it.

Sanchez, 82 N.M. at 674-75, 486 P.2d at 610-11.

4. In *State ex rel. Newsome v. Alarid*, 90 N.M. 790, 795, 568 P.2d 1236, 1241 (1977),

the Court quoted the following excerpt from *MacEwan*:

> "Writings coming into the hands of public officers in connection with their official functions should generally be accessible to members of the public so that there will be an opportunity to determine whether those who have been entrusted with the affairs of government are honestly, faithfully and competently performing their function as public servants. 'Public business is the public's business. The people have the right to know. Freedom of information (about public records and proceedings) is their just heritage. . . . Citizens . . . must have the legal right to . . . investigate the conduct of (their) affairs.'"

(Internal citations omitted) (alterations in original).

5. Having conducted an *in camera* review of the TechLaw Report, and accepting the Department's factual assertions in the light most favorable to the Department, even though the Department is the moving party, this Court finds that the situation before it is more akin to that of *MacEwan* than to that presented in *Sanchez*. The Report is an expert, objective, scientifically-oriented assessment rather than evolving thought processes preliminary to actions like contract negotiations; scientific analyses and conclusions are at least one facet of the overall purpose of the report; and TechLaw's function as an objective expert was complete when it submitted its Report and the Report has sufficient finality attached to it. *See Sanchez*, 82 N.M. at 674-75, 486 P.2d at 610-11 (distinguishing *MacEwan*); *cf. State ex rel. Blanchard v. City Comm'rs of Clovis*, 106 N.M. 769, 771, 750 P.2d 469, 471 (Ct. App. 1988) (rejecting the opportunity to expand the "thought processes" exception set forth in *Sanchez* so as to exclude from public inspection employment applications, resumes, and references received for a government position that the government argued were part of a preliminary employment negotiation process).

6. This matter involves more than individuals' impatient curiosity in the salaries of publicly-paid employees. *Compare Sanchez*, 82 N.M. at 675, 486 P.2d at 611. Instead, it implicates the public's confidence in whether its government is acting in accordance with its statutory obligations, with its publicly-held positions, and with objective, expert assessments.[1] *See Newsome*, 90 N.M. at 795, 568 P.2d at 1241 (quoting *MacEwan*, 359 P.2d at 418).

7. Rather than pointing to the type of preliminary negotiating data at issue in *Sanchez*, it appears that the Department is essentially attempting to use this case to establish a general

[1] Nothing in this Order should be read to suggest that the TechLaw Report contains any indication that the Environment Department is not acting in the public's interests or pursuant to its statutory authority.

principle. *See* Mem. in Support of Mtn. at. e.g., 12, 27. An agency should not fear revelation of the objective technical information provided by the experts it has retained, and the Department's general concerns that "'dissemination could easily lead to misinformation or false conclusions about the [Department's] business'" can be readily addressed by the Department explaining to the public its reasons for the choices it makes, thereby deterring the speculation and presumption of improper motives that secrecy engenders and allowing the public to judge for itself whether the Department is acting in accordance with its statutory obligations. *See id.* at 12. As noted by our Supreme Court, "'[p]ublic business is the public's business.'" *Newsome*, 90 N.M. at 795, 568 P.2d at 1241 (internal citations omitted).

8. Under the Act, the TechLaw Report is a public document and not merely thought processes.

B. Non-disclosure is not justified by "countervailing public policies."

1. "[A] citizen has a fundamental right to have access to public records. The citizen's right to know is the rule and secrecy is the exception. Where there is no contrary statute or countervailing public policy, the right to inspect public records must be freely allowed." *Newsome*, 90 N.M. at 797, 568 P.2d at 1243.

2. The rationale and analyses set forth in paragraphs 4 through 7 of subpart A, as well as subpart C, of this Order are also pertinent to weighing "the benefits to be derived from non-disclosure against the harm which may result if the records are not made available." *See Newsome*, 90 N.M. at 797, 568 P.2d at 1243. The harm that may result from secrecy is depriving the public of the the "opportunity to determine whether those who have been entrusted with the affairs of government are honestly, faithfully and competently performing their function as public servants."

Id. The Department's fear of inhibiting intra-agency candor and confusing the public does not outweigh the potential harm to the public caused by nondisclosure in that the Department can explain to the public the way the Report would be used and its reasons for its choices.

3. The TechLaw Report is markedly different from the type of information at issue in *Newsome*. There, the government had solicited personal information from individuals that was vital to the government entity's employment procedure, the entity had promised the individuals that the information would remain confidential, and the promise of confidentiality coincided with a reasonable public policy justification. *See id.* at 798, 568 P.2d at 1244. The Court concluded that divulging that information would not have been in the public interest, presumably because it would jeopardize the public's trust rather than promote it. *See id.* Here, secrecy would jeopardize the public trust. The Department's general concern about protecting intra-agency candor is not a countervailing public policy that outweighs the potential harm from non-disclosure or the benefits to be derived from disclosure. *Cf. id.* at 797, 568 P.2d at 1243.

C. Executive privilege is an exception to disclosure under the Act's "otherwise provided by law" provision, but executive privilege does not justify nondisclosure of the TechLaw Report.

1. The "as otherwise provided by law" exception contained in Section 14-2-1.A(12) did not create, but necessarily encompasses judicially-recognized constitutional privileges. *Cf. State ex rel. Attorney General v. First Judicial Dist. Court*, 96 N.M. 254, 257, 629 P.2d 330, 333 (1981) (indicating that although "[n]either the Rules of Evidence nor other rules of this Court provide for an executive privilege. . . . recognition of an executive privilege is required by the Constitution of the State of New Mexico").

2. Privileges based on the constitutional separation of powers cannot be legislatively

eradicated. *Cf. Estate of Romero v. City of Santa Fe*, 2006-NMSC-028, ¶¶ 16-17, 139 N.M. 671, 677, 137 P.3d 611, 617; *First Judicial Dist. Ct.*, 96 N.M. at 258, 629 P.2d at 334. The Act gives no indication that the Legislature intended to require disclosure of constitutionally privileged information. The Legislature ostensibly included the catchall exception in the Act in order to provide for exceptions required by other sources of law, which include valid statutes, regulations, constitutional provisions, and case law.

3. This Court will not interpret the executive privilege under the Act's "otherwise provided by law exception" any more broadly or narrowly than the privilege has been defined by the appellate courts of this State. *Cf. Blanchard*, 106 N.M. at 771, 750 P.2d at 471 (foregoing opportunity to expansively interpret recognized exception).

4. While Defendant has requested access to the TechLaw Report pursuant to the Act and not through discovery or evidentiary rules, this Court finds guidance in the Supreme Court's executive-privilege analysis set forth in *First Judicial District Court*. *Compare Romero*, 2006-NMSC-028, at ¶ 18, 139 N.M. at 678, 137 P.3d at 618 (indicating that rather than finding that the Act's exclusions created evidentiary privileges, the Court was using the Act "to guide [it] in appraising public policy concerns based on legislation enacted by the legislature pursuant to its general police powers").

5. A member of the executive branch of state government enjoys the right to claim executive privilege, but the right is not absolute. *Cf. First Judicial Dist. Court*, 96 N.M. at 258, 629 P.2d at 334. More specifically:

> The mere fact . . . that the executive department holds information and claims executive privilege does not of itself render the information exempt from judicial process. Nor does the fact that the privilege is of constitutional origin make the

> privilege absolute. An absolute privilege would conflict with the constitutional duty of the courts to do justice in matters brought before it.

Id.

6. "[W]hen this privilege comes into confrontation with other values or interests which are also protected by law, a balancing of the protected interests must be undertaken by the courts." *First Judicial Dist. Court*, 96 N.M. at 258, 629 P.2d at 334.

7. The primary purpose of the Act is to provide access to public records. *See Romero*, 2006-NMSC-028, at ¶ 18, 139 N.M. at 677, 137 P.3d at 617; *accord Newsome*, 90 N.M. at 795, 568 P.2d at 1241 (quoting *MacEwan*, 359 P.2d at 418). The Department reaffirms that purpose, indicating that the statute's purpose is "disclosure to the public of the workings of government." Mem. in Support of Mtn. at 1. The Supreme Court has referred to a citizen's right to have access to public records as "fundamental," and has said that "[t]he citizen's right to know is the rule and secrecy is the exception." *Newsome*, 90 N.M. at 797, 568 P.2d at 1243.

8. Although the Environment Department is within the executive branch, the Department is a legislatively-created entity with legislatively-determined functions, and the Department's executive privilege claim must be balanced with other interests that are also protected by law. *See generally Romero*, 2006-NMSC-028, at ¶ 16, 139 N.M. at 677, 137 P.3d at 617; *First Judicial Dist. Court*, 96 N.M. at 258, 629 P.2d at 334; *Newsome*, 90 N.M. at 795, 568 P.2d at 1241 ("Writings coming into the hands of public officers in connection with their official functions should generally be accessible to members of the public so that there will be an opportunity to determine whether those who have been entrusted with the affairs of government are honestly, faithfully and competently performing their function as public servants"); *cf.* NMSA 1978, § 9-7A-3

(1991) ("The purpose of the Department of Environment Act is to establish a single department to administer the laws and exercise the functions relating to the environment formerly administered and exercised by the health and environment department."); NMSA 1978, § 9-7A-4 (2005) ("There is created in the executive branch the 'department of environment'. The department shall be a cabinet department . . . .").

9. Assuming that TechLaw should be viewed as an employee of the Department for purposes of this analysis, this Court balances the general interests of the Department and of the public in promoting intra-governmental candor against Defendant's interest as a member of the public in assessing whether the Department is acting in accordance with its statutory obligations, the Defendant's interest in having confidence in the Department's use of objective, expert findings, and against the policy reasons behind the Act as well as the statutes creating the Environment Department. *Cf. First Judicial Dist. Court*, 96 N.M. at 258, 629 P.2d at 334. The means by which an agency's legislatively-directed action is tested is by members of the public having access to information that will enable them to evaluate and challenge that action. *Cf. Newsome*, 90 N.M. at 795, 568 P.2d at 1241 (quoting *MacEwan*, 359 P.2d at 418). The Legislature created the Department in order to administer the laws it enacts, the public's access to the type of report at issue here is an interest protected by law, and allowing access to the scientifically-based final report respects the separation of powers. *Cf. First Judicial Dist. Court*, 96 N.M. at 257-58, 629 P.2d at 333-34. The Department points to no information that would harm the public if disclosed but only to a general concern over protecting the Department's "business."

10. This Court concludes that the balancing favors disclosure of the TechLaw Report to Defendant. *Cf. First Judicial Dist. Court*, 96 N.M. at 258, 629 P.2d at 334.

IT IS THEREFORE ORDERED that the New Mexico Environment Department's Motion for Summary Judgment on the issue of disclosing the TechLaw Report is **DENIED**.

IT IS FURTHER ORDERED that the Department's Complaint for Declaratory Judgment is **DISMISSED AS A MATTER OF LAW.**

ENTERED this 6th day of October, 2008.

Daniel Sanchez

DANIEL A. SANCHEZ, District Judge
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OFFICE OF
RESEARCH AND DEVELOPMENT

March 30, 2009

MEMORANDUM

SUBJECT: Los Alamos National Laboratory (LANL), Los Alamos, NM (09RC06-001)
Well Screen Analysis Report (WSAR), Rev. 2 (LA-UR-07-2852)
Groundwater Background Investigation Report (GBIR), Rev. 3 (LA-UR-07-2853)

FROM: Steven D. Acree, Hydrologist
Applied Research & Technical Support Branch

Richard T. Wilkin, Ph.D., Environmental Scientist
Subsurface Remediation Branch

TO: Richard Mayer
U.S. EPA, Region 6

As requested, the referenced documents have been reviewed by the above named staff of the National Risk Management Research Laboratory (NRMRL) – Ground Water and Ecosystems Restoration Division. Additional review was provided by Dr. Bruce Pivetz of Shaw Environmental, Inc. Shaw is an on-site contractor providing technical support services to this laboratory. The review focused on the methods and conclusions of the WSAR. The GBIR was reviewed in the context of its use in the WSAR. The review and recommendations contained in this memorandum represent a technical evaluation of site-specific conditions based on the current state of the science and are neither policy nor prescriptive guidance.

As in the review of previous versions of these documents (Ford and Acree to Mayer, 2/16/06), this review is focused on the evaluation of the effects of drilling additives on the collection of representative samples from wells installed under the hydrogeologic characterization program. It is noted that factors other than the effects of drilling additives (*e.g.*, screen length, position within the hydrostratigraphic section, location with respect to potential contaminant source areas, groundwater sampling methods) may have a greater impact on whether groundwater samples are suitable for the purpose of early detection of contaminant releases or migration. Such location-specific issues are beyond the scope of this review.

Although the current versions of the documents attempt to address several of the issues raised during the previous reviews, there is still a relatively high degree of uncertainty in the results reported in the WSAR. For example, additional species indicative of a range of contaminant reactivity have been incorporated into the evaluations. However, several potential indicators are

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not routinely measured or available. The uncertainty related to this issue is illustrated by the following example. At locations where bentonite additives were used, the WSAR (Section 4.11) concludes that indicators suitable for directly evaluating the reliability of non-detects of highly adsorbing radionuclides are not available. Consequently, this section of the document concludes that it was not possible to evaluate the affected well screen intervals for detections of strongly adsorbing radionuclides. The document appears to modify this conclusion in later sections and indicates that these non-detect results would be accepted as representative of actual conditions if the well passed all other applicable criteria. Regardless of the conclusion stated in Section 4.11, the WSAR ultimately determines that some well screens drilled using bentonite, such as well R-32, screen 1 (Table 4-5) produce reliable samples for highly sorbing constituents such as plutonium (Table 6-4). Such assessments appear to be contradictory and are, at best, confusing. Given the lack of appropriate indicators, a more conservative and defensible approach would appear to be the one advocated in Section 4.11 rather than the approach ultimately used. Many similar issues contribute to the uncertainty inherent in the screening results.

In general, the criteria used to evaluate wells in the WSAR are complex and may ultimately prove to be unreliable. The most significant concerns noted in review of the current versions of the WSAR and GBIR are related to three areas:

- The results of the WSAR and related assessments have not been fully validated using site-specific data from laboratory and field studies.

- The criteria rely heavily on "background" data obtained from long-screened production wells and springs that do not necessarily represent water quality upgradient of the hydrogeologic characterization monitoring wells.

- The reliability of criteria used to evaluate the representativeness of groundwater samples from well screens following transformations of residual organic drilling additives and the return of groundwater samples to oxidized conditions is uncertain due to a lack of direct assessments of the site-specific mineralogical transformations and the reliance on groundwater sampling data.

Each of these issues increases the uncertainty in the conclusions of the WSAR and is discussed in detail below.

Validation of the Screening Results

As noted by the National Research Council (2007: National Research Council, Plans and Practices for Groundwater Protection at the Los Alamos National Laboratory, Final Report), evidence regarding the conditions surrounding the monitoring well screens is indirect. Additional laboratory and field investigations to better determine the nature and evolution of the interactions between the drilling, well construction, and aquifer materials; quantify sorption parameters; and to demonstrate the accuracy of the screening results presented in the WSAR are

recommended to validate the results. Without such validation, assessments of the impacts on the representativeness of groundwater samples should be considered to be of uncertain quality.

Uncertain Background Conditions

The WSAR criteria rely heavily on comparisons between data obtained from the impacted well screens and data reported in the GBIR. The data used to characterize "background" conditions is sparse, derived mainly from sources representing mixtures of water that are significantly different from the samples obtained from the hydrogeologic characterization wells, and are representative of significantly different flow paths and residence times within the aquifer. Actual background values at the locations of the individual characterization well screens may be significantly different from the proposed values.

As noted many times in the GBIR, water chemistry is determined by the lithologies of aquifer materials through which the water migrates and the residence time. Data from springs near the Rio Grande and the long-screened production wells does not necessarily represent the flowpaths monitored by the individual short-screened characterization wells. The GBIR recognizes this limitation. However, it indicates that the appropriate data (*i.e*, data from similarly screened wells immediately upgradient of the regulated units) may never be available. This approach introduces unavoidable uncertainty in evaluations of screens with residual effects because it does not allow for spatially distinctive geochemical zones or variability in groundwater chemistry in different aquifer lithologies.

It is quite possible that constituent concentrations observed in unimpacted monitoring wells may be significantly different from the data provided in the GBIR. For example, it appears the well R-35B was recently installed near the top of the regional aquifer without the use of harmful drilling additives within the screened interval. Concentrations of zinc measured in filtered groundwater samples have varied from approximately 40 ug/l to 60 ug/l. This range is above the maximum value of approximately 32 ug/l reported in Table 4.2-3 of the GBIR and is at or above the maximum value reported in Table 4-3a of the WSAR. This example illustrates the uncertainty inherent in using "background" data obtained from sources that are not constructed to monitor the same flowpaths as the monitoring wells in question.

It is also noted that the current evaluation methods may not fully identify conditions representative of the unimpacted regional aquifer. Footnote K in Table E2 indicates that although screens 6, 7, and 8 of well R-25 had a perfect score in the evaluation, the screens may still be impacted by water from perched zones above the regional water table.

Continuing Impacts to Aquifer Materials after Return to Oxidizing Conditions

The geochemical analysis appears to rely heavily on a determination of the overall redox status of groundwater as inferred from water quality parameters, such as dissolved oxygen, oxidized forms of nitrogen (nitrate) and sulfur (sulfate), low dissolved concentrations of iron and manganese, and detection of contaminants in oxidized forms. Part of the analysis includes an

evaluation of potential solid-phase processes (modification of surface-active minerals, changes to carbonate mineral stability) based upon the groundwater chemistry. Modification of in situ redox conditions is clearly an important aspect of the problem being dealt with here. As pointed out, the organic drilling fluids provide a source of carbon for native microbial populations in the aquifer. These organisms can have long-term impacts on water chemistry and aquifer mineralogy in the vicinity of the well screen. In general, anaerobic conditions resulting from the respiration of microbes shift the types of minerals and contaminant-reactivity of mineral surfaces that may be in equilibrium or near equilibrium with the specific water chemistry.

Using criteria established in this report, an undesirable component of uncertainty will persist regarding screen impacts because it is not possible to understand all possible mineral-contaminant interactions solely by evaluating water chemistry. As an example, consider a well that shows redox-status evolution from iron-reducing conditions, linked to residual drilling fluids, to oxidizing conditions comparable to the targeted background conditions. In this case, the geochemical criteria would suggest that water chemistry has achieved or is approaching pre-drilling conditions and, furthermore, that contaminant species can be monitored accordingly for their presence or absence. During the evolution of this system, when native microbes supported mobilization of ferrous iron, it is possible that reactive Fe(II)-bearing minerals formed in the available pore spaces adjacent to the well screen. As portrayed in the conceptual model presented in the WSAR (*e.g.*, Figure 4-9), possible phases include ferrous carbonate, ferrous sulfide (in sulfate-reducing compartments or micro-environments), but also could include green rust minerals, ferrous hydroxycarbonate, and magnetite. These Fe(II)-bearing phases are all known to interact with and possibly sequester potential contaminants of concern (*i.e.*, nickel, cadmium, cobalt, arsenic, zinc, americium, technetium, chromium, uranium). In this scenario, as organic carbon is consumed and levels of dissolved oxygen begin to increase, these previously formed Fe(II)-bearing minerals would be anticipated to undergo oxidative transformation to hydrous ferric oxide or iron oxyhydroxides. It might be further anticipated that these newly formed Fe(III)-bearing phases would be very fine-grained and highly sorbent, again with the ability to sequester contaminant species of concern. So along with the shift to oxidizing conditions, as indicated in water chemistry parameters, comes an anticipated shift in reactive iron mineralogy. Based on the criteria proposed, it is not possible to clearly assess: i) how long reduced, Fe(II)-bearing minerals might persist, and ii) what type of mineral phase or assemblage would result as a consequence of the return to more oxidizing conditions.

The critical point is that the nature of the reactive iron mineralogy cannot be assessed by examining water chemistry alone. In order to have a sense of the reactive nature of the aquifer solids, other testing would be required. At some point, it would be expected that any reactive minerals present in the system may become saturated or modified to the extent that they would no longer influence water chemistry in regions adjacent to the well screen. However, there are no compelling lines of evidence provided in the report that would indicate when this desired point is ultimately reached.

Recommendations to Reduce Uncertainty

Due to uncertainties in the mineralogical alterations induced by the drilling additives, uncertainty in the utility of aqueous chemistry assessments for the determination of whether samples are fully representative of aquifer conditions, and the lack of appropriate data for the assessment of water quality immediately upgradient of the impacted characterization wells, it is recommended that additional laboratory/field studies be designed to reduce uncertainty and validate the results of the WSAR. In this regard, the following studies may significantly improve the understanding of the site-specific impacts of the drilling additives and the potential time frames over which the impacts may be expected to continue.

1. **Upgradient Well Installations.** Install wells immediately upgradient of the regulated units of most concern, screening intervals equivalent to those of monitoring wells located downgradient of the regulated units. If such wells were installed without the use of harmful drilling additives in the screened zone, the data should be useful in better defining pre-drilling conditions within the particular hydrostratigraphic units of interest. The data would also provide insight into the representativeness of the "background" ranges used in the WSAR.

2. **Laboratory Investigations.** Laboratory studies could be performed to more fully understand impacts of the drilling additives on the evolution of redox conditions and secondary mineral formation. Subsequently, impacted materials from the studies could be subjected to redox conditions representative of the unimpacted aquifer allowing investigation of the evolution of mineral phases. Aquifer materials obtained during these studies could be used to quantify interactions with contaminants of concern. The results could be used as a baseline to understand the geochemical behavior of subsurface materials and validate conceptual models for the transformations that are occurring as well as aid in the validation of the criteria proposed in the WSAR. It is noted that similar studies were recommended by the National Research Council (2007: National Research Council, Plans and Practices for Groundwater Protection at the Los Alamos National Laboratory, Final Report). Laboratory studies could also be performed to quantify sorption of the inorganic constituents of concern onto the materials used during well construction at LANL.

3. **Field Studies.** Ultimately, lines of evidence from field studies will be needed to reduce uncertainty in the validation of criteria used in the WSAR. Useful lines of evidence would include: characterization of aquifer solids obtained from impacted wells, evaluation of the effects of well purging prior to sampling of impacted wells, and push-pull tests to directly examine sorption properties at impacted wells. A primary line of evidence would also be the installation of new well(s) drilled without the use of additives in the screened zone near impacted well(s). A comparison of water quality data from the two wells would provide direct evidence of the degree of impact and the effects on water quality. Such installations could be performed near regulatory units of greatest concern to maximize the benefits of the data.

If you have any questions concerning this review, please do not hesitate to call us (Acree: 580-436-8609; Wilkin: 580-436-8874) at your convenience. We look forward to future interactions with you concerning this and other sites.

cc: Mike Fitzpatrick (5303W)
Vince Malott, Region 6
Terry Burton, Region 6

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OFFICE OF
RESEARCH AND DEVELOPMENT

February 16, 2006

MEMORANDUM

SUBJECT: Los Alamos National Laboratory, Los Alamos, NM (05RC06-001)
Well Screen Analysis Report (LA-UR-05-8615)

FROM: Robert Ford, Ph.D., Environmental Scientist
Subsurface Remediation Branch

Steven D. Acree, Hydrologist
Applied Research & Technical Support Branch

TO: Richard Mayer
U.S. EPA, Region 6

As requested, the referenced document has been reviewed by the above named staff of the National Risk Management Research Laboratory (NRMRL) – Ground Water and Ecosystems Restoration Division. The review and recommendations contained in this memorandum represent a technical evaluation of site-specific conditions based on the current state of the science and are neither policy nor prescriptive guidance. In general, the criteria used to evaluate the representativeness of ground-water samples from well screens installed under the hydrogeologic characterization program still fail to consider impacts that may be present following biodegradation of residual organic drilling additives and the return of oxidizing conditions. This issue and other concerns regarding the evaluation criteria proposed by LANL are discussed in detail below.

1. Tier 2.2 screening analysis for impacts from organic drilling additives focused on assessing removal of organic compounds and the return of oxidizing conditions.

The current focus of the screening process for assessing impact of organic drilling fluids is directed towards determining the persistence of the organic additives and reducing conditions resulting from biodegradation of these compounds. While this is an important objective for the screening analysis, it should not be the sole objective. Specifically, this analysis approach does not address the potential impact of changes to aquifer mineralogy adjacent to the well screen. The changes in aquifer mineralogy resulting from iron- and sulfate-reducing conditions established by biodegradation of

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organic drilling additives can significantly alter the sorption characteristics for reactive site contaminants. The changes in aquifer sorption properties and, therefore, reactive contaminant movement to impacted well screens will not be adequately reflected by the LANL criteria. It is recommended that this potential impact be evaluated through expansion of the current approach. One possible tool that could be used is expansion of the list of input parameters employed in the principal component analysis (PCA) (Section 5 of the Well Screen Analysis Report) to capture a more representative range of sorption reactivity for site contaminants, as discussed below.

2. Issues concerning the use of multivariate statistical analysis as a screening tool to assess the return of ground-water chemistry to pre-drilling conditions for well screens impacted by residual drilling fluids.

The application of multivariate statistical analysis provides a very useful tool to screen comparability of water chemistry data obtained from characterization wells and from appropriate background locations. However, it needs to be recognized that the ability of this tool to evaluate potential impacts of residual drilling fluids is predicated on the use of a suite of input parameters that captures all potential impacts. In this regard, the current choice of input parameters appears to be sufficiently comprehensive to capture comparative patterns in components that may be leached from residual drilling fluids as well as the persistence of reducing conditions resulting from biodegradation of organic drilling fluids. However, the input parameters do not sufficiently represent the range of sorption characteristics associated with potential contaminants of concern. Thus, the analysis fails to capture the potential impact of changes in aquifer mineralogy that may alter the transport characteristics of potential contaminants of concern adjacent to impacted well screens.

This limitation may be addressed through expansion of the list of input parameters that are implemented in the principal component analysis (PCA). Based on evaluation of data presented in the Groundwater Background Investigation Report (LANL, 2005), there are several analytes that could be added to this list to provide more comprehensive coverage of contaminant reactivity. These candidate analytes include: europium, thorium, and uranium. These analytes provide more comprehensive coverage of sorption affinity for site contaminants (*e.g.*, Bradbury and Baeyens, 2005). Of these three analytes, insufficient or no data currently exist to include europium and thorium into the PCA. It is recommended that consideration be given to the routine inclusion of these analytes for ground-water trace element analyses. Based on analysis of existing ground-water data, it is unclear why uranium was not included in the list of 'metals/trace elements' considered for statistical analysis. Uranium meets the criterion of having less than 50% nondetects for alluvial, intermediate, and regional ground-water samples collected thus far. In addition, while vanadium was included in the list of 'metals/trace elements' input into the PCA, no information is provided to explain why this trace element was not listed in the principal components identified in Table 5-1.

3. Issues concerning the use of only the most recent analytical data in the tiered analysis.

The well screen assessment only utilizes data from the most recent sampling rounds. This approach is appropriate for determining whether oxidizing conditions have been restored but, as noted above, may not be a good indicator of the representativeness of the sample for reactive constituents that may sorb to the minerals formed when reducing conditions were present. For wells that passed the Tier 2.2 evaluation, it is recommended that this assessment also be applied to data obtained soon after well installation to determine whether previous geochemical conditions may have resulted in continuing sorption of contaminants.

There is an additional concern regarding the use of only the three most recent measurements in these assessments without examination of trends that may be present. As noted on page 23 of the Well Screen Analysis Report, well R-16 Screen 3 passed the test criteria but exhibited a declining sulfate trend that clearly indicated continuing impact. Examination of trends provides another line of evidence regarding the condition of impacted well screens and should be formally included in these evaluations.

4. Issues regarding the strong reliance on uncertain background conditions.

The LANL criteria rely heavily on comparisons between data obtained from the potentially impacted well screens and data obtained from the Groundwater Background Investigation Report (LANL, 2005). The data used to characterize background conditions appear to be sparse, derived from sources representing mixtures of water that are significantly different from the samples obtained from the hydrogeologic characterization wells, and are representative of significantly different flow paths within the aquifer. Actual background values at the locations of the individual characterization well screens may be significantly different from the proposed values. Therefore, the strong reliance on these uncertain background conditions for the evaluation of the impacts of residual drilling additives increases the uncertainty in these assessments.

5. Inclusion of analogs that represent the full range of contaminant reactivity.

Where applicable, comparison of chemistry data for suspected well screens impacted by bentonite and/or organic polymers to background concentrations should include constituents that represent the full range of reactivity for potential site contaminants of concern. Examples of inorganic constituents that may be anticipated in background ground-water samples that represent a useful range of sorption reactivity (and mechanism) with respect to potential site contaminants of concern include zinc (Zn), strontium (Sr), molybdenum (Mo), cesium (Cs), barium (Ba), europium (Eu), thorium (Th), and uranium (U). The current criteria are structured to make use of comparisons between background values and data obtained from characterization wells for some but not all of these constituents. It is recommended that the utility of the constituents not currently used in the well assessment criteria be considered.

6. Issues related to sample collection and preservation.

Both approaches (the tiered analysis and the principal component analysis) used to evaluate the recovery of well screens to pre-drilling conditions are predicated on the accuracy of field and/or laboratory measurements. The overall accuracy of these measurements relative to representing the water chemistry adjacent to the sample well screen is dependent on two primary factors:

1) the accuracy of instrumental performance relative to quantitation of a given analyte, and
2) the reliability of sample collection and preservation methods to prevent alteration of the chemical conditions of collected ground-water samples.

Validation of achieving the first factor is insufficient to insure that the second factor has been appropriately addressed. Failure to address both factors can ultimately result in water chemistry data that are not representative of the aquifer conditions adjacent to the well screen.

As stated on pg. 4 of the Well Screen Analysis Report, field data 'are not currently subjected to the same level of qualification, beyond verification of instrument calibrations and checks.' This statement is made relative to the level of qualification applied to assessment of laboratory data reliability. This is an important consideration given the stated assumption (Section 3.0, pg. 8) that 'field-based measurements…provide reliable qualitative indicators for the presence of sulfate-reducing conditions…'. For the purpose of this review, it is assumed that field data presented in Table C-4 were derived from instruments that passed verification of instrument calibrations and checks. However, there appear to be significant inconsistencies in the reported field data that bring into question the adequacy of methods employed for water sample collection and preservation to insure that changes in water chemistry have not occurred prior to laboratory analyses. In particular, reported values for ORP, dissolved oxygen, and total sulfide (or combinations thereof) at some well locations conflict with general patterns observed for oxidized or reduced ground water. Two example screen intervals that illustrate this situation are provided in Table 1.

These two examples may provide 'worst case' situations relative to other screened intervals. However, they are not isolated situations. Data from many of the well screens appear to be inconsistent or suspect. The concern is not simply that a given screen was appropriately identified to have 'failed' or 'passed' a specified tier criterion. Rather, these data comparisons raise serious concerns relative to the accuracy of the field data for use in the screening process (even in a qualified sense) and, more importantly, the degree to which laboratory measurements were made on water samples that were no longer representative of the condition that existed within the aquifer adjacent to the well screen. This latter concern would impact the reliability of both the tiered analysis and the multivariate statistical analysis performed by LANL.

Table 1. Comparison of measured ORP, dissolved oxygen, and total sulfide for ground-water samples collected from two screened intervals. Red shading indicates measurements for a given sampling date that are in conflict, while green shading indicates measurements which appear to be internally consistent. Data were obtained from Table C-4 of the Well Screen Analysis Report.

Well Screen	Date	ORP (mV)	Dissolved Oxygen (mg/L)	Total Sulfide (mg/L)
CdV-R-15-3 5	20-Oct-04	--		
	5-Apr-05	-99		0.290
	20-Apr-05	--		
	12-Jul-05			--
R-16 2	18-May-04	-65		0.473
	13-Oct-04	--		
	2-Dec-04	--		
	13-Jun-05			--

7. Use of dissolved zinc as the sole analog for evaluations in LANL criterion 2.1-2c.

It is important to identify analytes that are transported less conservatively than the contaminants of concern. Dissolved zinc is proposed for screening the condition of wells impacted by bentonite relative to the possible loss of cesium-137, cobalt-60, europium isotopes, and neodymium-147 onto residual bentonite solids adjacent to the impacted well screen (LANL criterion 2.1-2c). One significant limitation to this approach is that zinc has not been universally detected in site ground water. LANL (2005) reports non-detectable zinc in about 56% of the samples evaluated. Thus, non-detectable zinc at a given well screen could indicate either sorption onto residual bentonite or the lack of this constituent at measurable concentration in the native ground water at the interval sampled by the well screen. In addition, there are some published ion exchange selectivity series that indicate cobalt partitions more strongly than zinc to clay minerals (including bentonite). Thus, detection of zinc would not preclude loss of cobalt-60 on residual bentonite. LANL criterion 2.1-2 should be re-evaluated in an effort to identify a more reliable replacement or supplemental candidate to zinc. Barium presents a potential alternative/additional candidate (99% detect in area ground water), although it is unclear how prevalent this metal may be as a site contaminant of concern.

8. Inclusion of technetium-99.

It is noted that technetium-99 is not mentioned in Table 4-8. It appears that this potential contaminant should be included. As noted in Table 4-7, samples for technetium-99 obtained from screens impacted by reducing conditions may not be representative of pre-drilling conditions.

9. Criteria validation.

Due to uncertainties in the utility of aqueous chemistry assessments for the determination of whether samples are fully representative of aquifer conditions, it is recommended that laboratory and field studies be designed to validate these or similar criteria.

If you have any questions concerning this review, please do not hesitate to call us (Acree: 580-436-8609; Ford: 580-436-8872) at your convenience. We look forward to future interactions with you concerning this and other sites.

cc: Mike Fitzpatrick (5303W)
Rafael Gonzalez (5204G)
Vince Malott, Region 6
Terry Burton, Region 6

References

LANL, 2005. Groundwater Background Investigation Report, LA-UR-05-2295. Los Alamos National Laboratory, Los Alamos, NM.

Bradbury, M. H. and Baeyens, B. 2005. Modelling the sorption of Mn(II), Co(II), Ni(II), Zn(II), Cd(II), Eu(III), Am(III), Sn(IV), Th(IV), Np(V) and U(VI) on montmorillonite: Linear free energy relationships and estimates of surface binding constants for some selected heavy metal and actinides. Geochimica et Cosmochimica Acta, 69: 875-892.

Proposals for Independent Environmental Monitoring at Los Alamos National Laboratory, New Mexico

Submitted by NMED Department of Energy Oversight Bureau and Hazardous Waste Bureau, December 4, 2009

EXHIBIT
7

Sampling and Analysis Plan for Purging of Westbay Wells
Draft 12.02.09

The New Mexico Environment Department (NMED) plans to collect groundwater samples from three multi-screened Westbay wells at Los Alamos National Laboratory (LANL). Pumping and sampling of the Westbay wells CdV-37-2 (screen 3), R-5 (screens 2 & 4), and R-26 (screen 1) will be conducted by Besst, Inc. (*Besst*). LANL will contract and oversee the pumping operations. *Besst* will utilize their Hydrobooster purging/pumping and sampling device. The Hydrobooster is capable of pumping and purging groundwater from a specified screen without the removal of the Westbay sampling system, hence, no mixing occurs between screens.

Beginning in 1998 and as part of the LANL groundwater characterization program, 15 regional wells and one intermediate aquifer well were installed and equipped with Westbay multiport-sampling systems. Samples from these wells are collected without prior purging. Subsequent water-quality data collected from these wells suggested that many of these wells were not providing representative samples, and that some type of assessment and corrective action were warranted. It was concluded that residual drilling fluids present within the sampling area (screen, filter pack, and formation) were the cause of the poor sample quality. Recently, several regional wells have been rehabilitated whereby the Westbay systems were removed and replaced with submersible pumps. In 2007, LANL published the Well Screen Analysis Report (hereafter, the Report). The purpose of the report was to present findings specific to the capability of well screens to produce representative water-quality results. The criteria for rating each screen were based on geochemical comparisons. The Report was reviewed and commented on by several organizations including NMED's Hazardous Waste Bureau, EPA, and Concerned Citizens for Nuclear Safety. For further details concerning the Report, see: LANL, Well Screen Analysis Report, Revision 2, LA-UR-07-2852.

A simple approach to determine with near 100% confidence whether the water being sampled from the Westbay systems is representative is to pump and analyze samples collected from the Westbay screens. This simple approach was conducted in 2003 when Westbay well R-16 was pumped using *Besst's* Hydrobooster for several hours. Field data and hydrochemical data indicate that the groundwater being pumped was not representative of the formation and was impacted by drilling fluids.

Besst will purge each of the four screens for approximately one week. The estimated range of flow rate is 0.1 to 0.3 gpm. The pumping will provide approximately 1400 gallons of total purge volume at each screen. Nine samples for fixed-laboratory analyses for trace metals Al, As, Fe, Li, Sr, and Zn and carbonate/bicarbonate alkalinity will be collected from each screen with sample collection times being dependent on the flow rate and total cumulative volume purged. These constituents were selected based on their reaction sensitivity within changing redox conditions. The field parameters temperature, specific conductance, pH, dissolved oxygen, turbidity, and oxidation-reduction potential and real-time analyses for sulfate, nitrate, ferrous iron and total iron will be collected and performed, respectively, throughout the pumping event.

The following table identifies the proposed analytes to be measured for this project, analytical methods, detection limits, individual costs, and total cost.

Line Item	Water	Analytical Method	Short Description	RL	Cost Per Sample	Number of Samples	Total Cost
210	Filtered	6020 ICP/MS	Individual Metals Al, As, and Zn	2 ug/L	$65	36	$2,340
201	Filtered	6010B/7000	Individual Metals Fe, Li and Sr	10 - 50 ug/L	$49	36	$1,764
221	NA	3005/3010/3050	Acid Digestion for Total Metals	NA	$15	36	$540
531	Filtered	310.1	Alk + Carbonate & Bicarbonate	Varies	$15	20	$300
					Total Analytical Project Cost:		***$4,944***

Sampling and Analysis Plan for CLEANUP VERIFICATION of former Radioactive Waste Water Treatment Plant drainage in North Fork Acid Canyon, TA-45, PRS 1-002

DOE OB will independently collect fifteen soil/sediment samples in North Fork Acid Canyon from within the effluent drainage of the site formerly known as the TA-45 Radioactive Waste Water Treatment Plant (PRS 1-002). Results from this sampling effort are intended to verify a cleanup effort conducted by LANL in 2001 where a significant amount of hot spot soil and sediment was removed after being characterized as such according to measured activities of Pu239/240. In 2001, LANL/DOE, NMED and EPA agreed to an average cleanup level of 280 pCi/g for Pu239/240. Following the remediation activities, LANL's final cleanup report concluded that this goal was met based on a thorough round of verification sampling results. The drainage was then physically restored along with the installation of jute mat erosion control measures in several areas. Since 2001, seasonal storm water flows have scoured the channel and banks of the drainage as well as washed away most of the jute matting. The focus of the Bureau's verification will be to test whether remaining soil and sediment in the drainage still meets the original average cleanup level of 280 pCi/g for Pu239/240. Samples will also be collected for TAL metals and total Uranium since high levels were also measured in the in the drainage prior to the 2001 cleanup. The sample locations will be jointly identified by DOE OB with input from LANL and several local citizen groups to include certain geomorphic units from post laboratory operations (>1945). Post laboratory geomorphic units were identified by Reneau et al (1999) in-part: by their stratigraphic position above the current channel bottom (now at bedrock in most of this drainage), and by their incorporation of visible debris, such as a 55 gallon drum and 1950's era tires. Since much of the original material meeting these descriptions was removed in 2001, Bureau staff will use LANL's original site maps to select several sample locations in areas where the highest alpha activity was recorded prior to cleanup. Because this area is highly accessible by the public (a park), our strategy is to concentrate sampling efforts on the middle reach of this drainage before it merges with Acid Canyon (a length of approximately 800 feet).

The results from the sampling effort will be used for the following purposes:

(1) to test whether remaining soil and sediment in the drainage still meets the original average cleanup level of 280 pCi/g for Pu239/240
(2) to provide confirmation to DOE, LANL, and the public that the 2001 remediation of the site performed by LANL, now a Los Alamos County park, remains effective in 2010

TA-45 is located in the Los Alamos Town site northeast of the intersection of Canyon Road and Central Avenue, adjacent to Acid Canyon. The property was first used as an industrial waste discharge area and it subsequently served as LANL's first radioactive liquid waste treatment facility. Untreated and treated effluent was released from the facility between 1944 and 1964. The facility included a vehicle decontamination area, a sewage lift station and a transformer station. The site was decommissioned and all of the buildings were removed except the sewage lift station. The County of Los Alamos now owns the site.

LANL has performed extensive sampling (mesa top and canyon bottom) at former TA-45 and

vicinity as part of the Formerly Utilized MED/AEC Sites Remedial Action Program (FUSRAP) and as part of an RFI for PRSs in TA-45. Samples were analyzed for radionuclides, TAL metals, VOCs, SVOCs, and HE.

DOE OB will use various soil coring methods to collect fifteen (15) sediment/soil samples from selected locations within the old TA-45 effluent drainage that empties into Acid Canyon for analysis of RCRA metals, total uranium and plutonium-239/240. Two samples from a pre-determined location will be a QA/QC check analyzed for all parameters (duplicate samples). All plutonium-239/240 results will be averaged to test whether remaining soil and sediment in the drainage still meets the original target cleanup level of 280 pCi/g (an average). All sampling results will be evaluated and provided in a final report.

Total estimated cost for laboratory analytical work is $5,475.00 (Table 1), including two QA/QC samples. Four DOE OB staff members will spend approximately 16 hours at the site.

Site workers must have 40-hour hazardous waste operations and Rad Worker 2 training. Access will be by hiking down into the drainage channel from the Los Alamos pool parking lot.

Table 1

Line Item	Matrix	Analytical Method	Short Description	RL	Cost Per Sample	Number of Samples	Total Cost
203	soil	ICP/MS; combined 6010/6020 methods	TAL List Metals plus Total U	See Table 2 below	$205	15	$3,075.00
221	soil		Acid digestion for total metals (GFAA)	N/A	$15	15	$225.00
311	soil	HASL 300, Eichrom	Isotopic Plutonium (Pu-239/240, Pu-238)	0.1 pCi/L	$145	15	$2,175.00
Totals							$5,475.00

Table 2 – METALS (MDL/MDA for solid)

Line Item # 200 - 204	Method - 6010B		TAL Metals List	ALUMINUM		786	ug/Kg
				ANTIMONY		583	ug/Kg
				ARSENIC		205	ug/Kg
				BARIUM		8.91	ug/Kg
				BERYLLIUM		12.9	ug/Kg
				CADMIUM		16.1	ug/Kg
				CALCIUM		822	ug/Kg
				CHROMIUM		29.8	ug/Kg
				COBALT		57.4	ug/Kg
				COPPER		48.7	ug/Kg
				IRON		586	ug/Kg
				LEAD		63.3	ug/Kg
				MAGNESIUM		727	ug/Kg
				MANGANESE		16.1	ug/Kg
				MERCURY		0.202	ug/Kg
				NICKEL		45.7	ug/Kg
				POTASSIUM		7310	ug/Kg
				SELENIUM		336	ug/Kg
				SILVER		75.6	ug/Kg
				SODIUM		3790	ug/Kg
				THALLIUM		314	ug/Kg
				VANADIUM		36.3	ug/Kg
				ZINC		87.4	ug/Kg

Sampling and Analysis Plan for Oxalate in LANL Groundwater Monitoring Network

The New Mexico Environment Department (NMED) DOE Oversight Bureau plans to collect groundwater samples of inorganic oxalate from the Los Alamos National Lab (LANL) groundwater monitoring network. This project will help in evaluating the potential impact of drilling fluid additives on the ability for monitoring wells to provide representative data. The expected cost for analysis will be approximately $10,000.00

Three separate aquifer regions have been identified in the complex geologic environment of the Pajarito Plateau. The aquifer regions consist of alluvial saturation in canyon bottoms, intermediate perched saturation below alluvial systems and regional saturation below the entire plateau. LANL has installed an extensive groundwater monitoring network in order to accurately characterize the impact historic contaminants have had on the groundwater system. Drilling fluid additives, such as QUIK-FOAM, were used when drilling intermediate and regional wells to ensure effective and timely construction of wells. Well development is supposed to remove any residual drilling fluid additives and ensure monitoring wells provide reliable and representative samples of groundwater.

In 2007 LANL investigated the potential impact of drilling fluids on the ability of regional and intermediate wells to provide reliable and representative water data. It was found that an appreciable fraction of wells showed some potential impact from drilling fluid additives. Oxalate is an analyte not present in LANL's suite that is linked exclusively with drilling fluid additives and will elucidate the amount of impact a well has from poor well development.

Thirty three oxalate samples will be collected from a combination of background sites and potentially impacted wells. The background samples will provide a baseline for natural oxalate that will highlight the increased concentrations associated with drilling fluid additive impact. Samples will be collected in the Sierra de Los Valles where much of the water recharging the regional aquifer in the Pajarito Plateau originates. Samples will also be collected from intermediate and regional wells free of and suspected of having legacy contamination. Analysis of oxalate will be performed by ALS Laboratory Group in Fort Collins, CO. They will be able to provide detection limits of 1 ppb.

Line Item	Analyte	Water	Cost/Sample	# of Samples	Total Cost
568	Inorganic Oxalate	NF/NA	$ 300	33	$ 9,900

Sampling and Analysis Plan for Oxyanions in LANL Groundwater

The New Mexico Environment Department (NMED), DOE Oversight Bureau plans to sample a suite of oxyanions (bromate, chlorate, chlorite, iodate) from the groundwater monitoring network at Los Alamos National Labs (LANL). This Analytes from this project will serve as both an early warning for contaminant movement and help characterize the Pajarito Plateau.

Bromate, chlorate, chlorite and iodate function as conservative tracers. This means that under the conditions expected in the Pajarito Plateau aquifer system they react very little with their environment. Thus as constituents of contaminant plumes with little retardation they will be amongst the first chemical species to indicate the approach of a plume.

NMED OB will sample 16 stations throughout the Pajarito Plateau focusing on canyon systems. The analysis will be performed by ALS Laboratory Group and the analytical method will be LC/MS/MS. Each sample will cost ~$300 with an expected project cost of $5,000. Field water-quality parameters, such as pH, specific conductance, dissolved oxygen and ORP, will be collected. All meters will be calibrated and checked with reference standards prior to sampling.

Line Item	Analyte	Water	Cost/Sample	# of Samples	Total Cost
567	Oxyanions	F/EDA	$ 300	16	$ 4,800

Sampling and Analysis Plan for LANL Watershed Storm Water

The New Mexico Environment Department, DOE Oversight Bureau collected surface water samples from the Los Alamos Canyon watershed during the 2009 summer months to identify potential off site LANL impacts. This project will supplement current efforts by NMED, LANL, and Santa Fe and Albuquerque administrations to evaluate water quality in the Rio Grande. Potential analytical cost for this project would be $30,020.00.

The Los Alamos National Laboratory is located on the Pajarito Plateau and previous storm water monitoring has identified LANL legacy contaminant transport to the Rio Grande. New Santa Fe and Albuquerque community water supply systems are being developed on the Rio Grande. Albuquerque has recently completed a water diversion structure, and Santa Fe is currently constructing a water diversion structure along the Rio Grande. Proposed cost of the Santa Fe community water project is 280 million dollars plus. New regulatory criteria are also being proposed by New Mexico for some radioactive elements (americium-241, cesium-137, plutonium-239/340, and strontium-90).

Since the Cerro Grande fire in 2000, stormwater monitoring at Los Alamos has identified radionuclide, metals, dioxins and furans, and PCB constituents transported to the Rio Grande, specifically from the Los Alamos watershed. The ephemeral Los Alamos watershed empties into the Rio Grande three miles above the Santa Fe city water diversion. Since these observations have been made; the city administrations, LANL, and state agencies have been working cooperatively to protect the Rio Grande water resource.

Twenty two samples have been collected and are prepared for submittal to ALS Laboratory Group, a commercial analytical laboratory. Automated ISCO samplers collected 16 samples over the summer from three stations in the Los Alamos Canyon watershed during three storm events; eight samples from two locations E050 (Los Alamos Canyon above the confluence with Pueblo Canyon), and E059 (Pueblo Canyon above the wetlands expanded by a new wastewater treatment plant) during a July 6 storm event; four samples from E059 during a July 5 storm event; and four samples from E110 (Los Alamos Canyon above the Rio Grande) during a October 13 storm event. The automated samplers also collected six samples from 3 stations on the Rio Grande, Lyden, Buckman Landing, and at the Otowi Bride above the Los Alamos confluence, from two storm events (September 2 and October 13.

These samples in conjunction with stormwater samples collected from a regional Rio Grande study will be used to evaluate contaminant transport originating from global fallout and LANL discharges identified in this study. The evaluation will also help the state quantify potential ranges of these contaminants in the Rio Grande and place those levels in perspective with their proposed criteria.

The regional storm water samples will be submitted to commercial analytical laboratories for analytical suites frequently used by NMED to monitor storm water within the Los Alamos watershed. They include radionuclides, metals, and suspended sediment concentrations. Total measurements of radionuclides in water, and dissolved measurements of metals in water will be made.

This study will also supplement a joint NMED and LANL project to identify regional PCB concentrations, and a LANL base line flow study of contaminants for the Rio Grande. NMED and LANL are participating in a regional PCB study that will include Rio Grande storm water identified by this project. NMED and LANL are also currently collecting bi-monthly samples to establish chemical conditions in water for base flow in the Rio Grande.

Current efforts are underway at LANL to reduce contaminated sediment transport from their facility. Data generated by this work will also be used to monitor potential reduction of contaminant transport from LANL.

The samples identified for submittal to a commercial laboratory, the analysis, individual costs, and the total project price are contained in the following spreadsheet.

LSW11 Not Submitted			Isotopic Plutonium (Pu-239/240, Pu-238) Total in Water	Isotopic Plutonium (Pu-239/240, Pu-238) in Suspended Sediment from SSC analysis	Suspended Sediment Concentration (SSC)	Gross Alpha/Beta Total in Water	Strontium-90 (Sr-90) Total in Water	Gamma Emitters: Cs-137, Total in Water	Isotopic Uranium (U234, U235, U238) Total in Water	Radium 226 Total in Water	HF Digestion	Radium 228 Total in Water
LSW11	*Line Item No.*		305	305	534	331	336	321	314	903.1	536	904
9.03.09-Not Submitted (LSW Stormwater	*Price per Sample*		$290.00	$290.00	$150.00	$55.00	$105.00	$170.00	$145.00	$110.00	$50.00	$110.00
NMED - Sample ID	Date	Time										
E050 7-6-09 15:34	7/6/2009	15:34	1	1	1	1	1	1	1			
E050 7-6-09 16:19	7/6/2009	16:19	1		1	1	1	1	1			
E050 7-6-09 17:04	7/6/2009	17:04	1		1	1	1	1	1			
E050 7-6-09 17:49	7/6/2009	17:49	1		1	1	1	1	1			
E059 7-6-09 14:17	7/6/2009	14:17	1	1	1	1	1	1	1			
E059 7-6-09 15:01	7/6/2009	15:01	1		1	1	1	1	1			
E059 7-6-09 15:46	7/6/2009	15:46	1		1	1	1	1	1			
E059 7-6-09 16:32	7/6/2009	16:32	1		1	1	1	1	1			
E059 7-5-09 14:31	7/5/2009	14:31	1	1	1	1	1	1	1			
E059 7-5-09 15:16	7/5/2009	15:16	1		1	1	1	1	1			
E059 7-5-09 16:01	7/5/2009	16:01	1		1	1	1	1	1			
E059 7-5-09 16:47	7/5/2009	16:47	1		1	1	1	1	1			
E110 10-13-09 08:12	10/13/2009	8:21	1	1	1	1	1	1	1	1	1	1
E110 10-13-09 08:57	10/13/2009	8:57	1	1	1	1	1	1	1	1	1	1
E110 10-13-09 09:42	10/13/2009	9:42	1	1	1	1	1	1	1	1	1	1
E110 10-13-09 10:27	10/13/2009	10:27	1	1	1	1	1	1	1	1	1	1
Lyden 10-13-09 07:30	10/13/2009	7:30	1		1	1	1	1	1			
Buckman 9-2-09 01:05	9/2/2009	1:05	1		1	1	1	1	1			
Buckman 10-13-09 13:03	10/13/2009	13:03	1		1	1	1	1	1			
Buckman 10-13-09 10:40	10/13/2009	10:40	1		1	1	1	1	1			
Otowi 10-13-09	10/13/2009		1		1	1	1	1	1	1	1	1
Otowi 10-13-09 12:16	10/13/2009	12:16	1		1	1	1	1	1	1	1	1
Relinquished By:	Total No. of Samples		22	7	22	22	22	22	22	6	6	6
			6380	2030	3300	1210	2310	3740	3190	660	300	660
David Englert	Sign											

Sampling and Analysis Plan for White Rock Canyon Springs Monitoring

The New Mexico Environment Department (NMED), DOE Oversight Bureau plans to collect groundwater samples from six springs discharging along the Rio Grande near the southern portion of White Rock Canyon. These springs represent natural discharge from the regional aquifer and serve as facility boundary monitoring points to detect possible discharge of contaminated groundwater from beneath the Laboratory into the Rio Grande. Water from these springs discharges down gradient of firing sites and underground testing sites involving high explosives at TA-49, TA-33 and TA-39. In addition to high explosives, solvents were used extensively at TA-16, also up gradient from the springs we propose to sample.

We will sample six springs (Ancho Spring, Spring 6, Spring 6A, Spring 9, Spring 9A, and Spring 9B) for High Explosives and VOC analyses. The sensitive, low level detection method LC/MS/MS will be used to analyze the High Explosive samples.

The analytical cost for the referenced sampling will be approximately $4,000 (Table 1). The selection of sampling stations and associated analytical suite is based on past and present contaminant-release sources/areas and the interpretation of historical LANL and OB hydrochemical data. Field water-quality meters, such as pH, specific conductance, dissolved oxygen and ORP, etc. will be calibrated and checked with a known standard prior to sampling.

Table 1

Line Item	Water	Analytical Method	Short Description	RL	Cost Per Sample	Number of Samples	Total Cost
104	Non-Filtered/HCL	8260	Appendix IX VOCs	Various	$200	6	$1,200
551	Filtered/NA	LC/MS/MS	High Explosives + 6 additional	0.5 or less	$450	6	$2,700
					Total Analytical Project Cost:		***$3,900***

12 July 2001

James Bearzi, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 E. Rodeo Park Drive, Building E
Santa Fe, NM 87505-6303

Dear James:

The Attorney General's Office has been following with great interest the progress of the Environment Department's ("NMED") reissuance of the Hazardous Waste Act ("HWA") permit for Los Alamos National Laboratory ("LANL"). One of our particular concerns has been to ensure ample opportunities for public participation in the process.

We understand that in the fall of 2001 NMED plans (a) to begin issuing in stages a draft of a new HWA permit for LANL and (b) to issue a corrective action order under 74-4-10.E, NMSA 1978, and 42 U.S.C. § 3008(g). We have been told by NMED personnel that there will be an opportunity for public comment on the terms of the order, but no details of the public comment process have been related.

Our concerns about the need for public participation particularly relate to the Hazardous and Solid Waste Amendments ("HSWA") remediation process. We understand that the corrective action order will, inter alia, address HSWA remediation at Material Disposal Areas ("MDA") G, H, and L. We have pointed out to NMED that these MDAs were long ago required to stop receiving waste, have an approved closure

EXHIBIT 8

plan, and close, but this has not happened. MDAs G and L were required to close under 40 CFR §§ 265.112(d)(3) and 265.113(b) after NMED accepted LANL's withdrawal of its request for a permit for these areas in April 1985, terminating interim status under 40 CFR § 270.73(a). MDAs G, H, and L were also required to close based on loss of interim status in November 1985, under 42 U.S.C. § 3005(e)(2) and 40 CFR § 270.73(c). However, to date they have been neither closed nor permitted. At present, drilling is planned for the general area pursuant to the Hydrogeologic Workplan (1998), but locations have not been established. A RCRA Facility Investigation (RFI) report for MDAs G, H, and L has been submitted, but NMED directed on December 27, 2000, that LANL resubmit an RFI report for MDA H alone, with RFI reports on MDAs G and L to follow at an unspecified date.

What particularly strikes us about this situation is that opportunities for public participation in determining the remedies for historical contamination have been almost nonexistent. Although 40 CFR § 265.112(d)(4) requires NMED to make a closure plan public, to receive public comments, to request modifications, and ultimately to approve the plan or issue its own revised closure plan, NMED did not respond publicly to proposed closure plans submitted for disposal areas at MDAs G, H, and L. Neither has the permitting process, with its opportunities for participation, gone forward. The Hydrogeologic Workplan (1998) was adopted without opportunity for public comment. The HSWA corrective action process for these disposal areas has proceeded since the permit was adopted in 1989 without opportunity for public comment.

In this situation, we urge that NMED include opportunities for public participation at critical stages of environmental restoration at MDAs G, H, and L

addressed by the forthcoming corrective action order. We assume that, given the present state of knowledge, a corrective action order as to MDAs G, H, and L will not specify a final remedy. Rather, the order may contain a schedule for compliance and specify the content of major reports, such as RCRA Facility Investigation ("RFI") reports and Corrective Measures Studies ("CMS"). Presumably, later corrective action orders will specify a remedy and, ultimately, conclude the process. In this context, the public should have an opportunity to consider a NMED proposal, comment upon it, and receive NMED's response to comments with its decision at the following stages:

1. Schedule of compliance: Comment must be received on the schedule for corrective action and on any later significant change in that schedule. When corrective action is regulated by a permit module, the public may comment when the permit is issued or renewed, and EPA has pointed out that the level of public participation should not be significantly reduced when corrective action orders are used. See EPA, RCRA Public Participation Manual at 4-8 (1996).
2. RFI scope, conditions, and schedule: When the elements of an RFI or the content of an RFI report are specified in a corrective action order or significantly changed, public comment must be taken. Thus, the opportunity to comment will not be reduced by the use of a corrective action order rather than a permit. EPA, RCRA Public Participation Manual at 4-9 (1996).
3. CMS workplan scope and schedule: A similar comment opportunity must be accorded when CMS requirements are included in a corrective action order or

are significantly changed by a later order. Thus, the use of a corrective action order will not curtail the opportunity for public comment.

4. Remedy selection: EPA has stated that mandatory public involvement requirements include an opportunity to comment on the proposed remedy, following the submission of the RFI report and the CMS report and before the final selection of remedy. The justification for the proposed remedy should be contained in a document issued by the agency, the Statement of Basis. See EPA-OSWER, Guidance for Public Involvement in RCRA Section 3008(h) Actions, May 5, 1987. The opportunity for comment should be no less under a corrective action order than under a permit. See 40 CFR § 265.121(b); EPA, Corrective Action for Releases from Solid Waste Management Units at Hazardous Waste Management Facilities; Proposed Rule, 61 Fed. Reg. 19432, 19454 (May 1, 1996); EPA, RCRA Public Participation Manual, at 4-13 (1996).

5. Corrective Measures Implementation Plan: The specification of particulars, conditions and schedule of corrective measures would clearly be a Class 3 modification to a permit, on which public comment must be received. Thus, when such matters are incorporated into a corrective action order, a similar level of comment and response should be allowed. See EPA, RCRA Public Participation Manual at 4-15 (1996).

6. Remedy Completion: The determination under a permit that no further action is called for requires an opportunity for comment. See EPA, RCRA Public

Participation Manual at 4-16 (1996). A similar opportunity should be accorded under a corrective action order. Id. See also 40 CFR § 265.121(b).

In sum, a corrective action order cannot govern remediation at MDAs G, H, and L without public input. Plainly, public comment can contribute significantly. We urge NMED to allow for public participation as outlined above in its issuance and implementation of a corrective action order.

Very truly yours,

LINDSAY A. LOVEJOY, JR.
Assistant Attorney General

LALJr:laljr

Attorney General of New Mexico

PATRICIA A. MADRID
Attorney General

STUART M. BLUESTON
Deputy Attorney General

July 30, 2002

James Bearzi, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 E. Rodeo Park Drive, Building E
Santa Fe, NM 87505-6303

Dear James:

This letter forwards comments on behalf of the New Mexico Attorney General's Office (AGO) concerning the proposed Corrective Action Order (CAO) issued by the Environment Department on May 2, 2002 concerning environmental restoration at Los Alamos National Laboratory (LANL).

Our office has reviewed the administrative record concerning the Environmental Restoration program and has developed comments on the status of that program at various LANL Technical Areas. The comments are set forth on an attached table, together with references to the schedule called for in the proposed CAO.

In addition to revising the schedule as indicated, it is vitally important that the Environment Department (NMED) carefully design the procedure to be used in carrying out the CAO. We have previously called the attention of NMED to the need to take and respond to public comment during remediation. See our letter dated July 12, 2001. The need for public participation at several stages bears reemphasis. After the CAO is made final, NMED and LANL will implement it through a series of studies, reports, and further

EXHIBIT 9

orders. NMED will direct a remedy and, ultimately, conclude the process. In this context, the public should have an opportunity to consider a proposed remedy, comment upon it, and receive NMED's response to comments with its decision at the following stages:

1. Schedule of compliance: Comment should be received on the schedule for corrective action. EPA has pointed out that public participation should not be significantly reduced when a schedule is issued by corrective action order. See EPA, RCRA Public Participation Manual at 4-8 (1996). This is being done in the current process.
2. RFI scope, conditions, and schedule: When the elements of an RFI or the content of an RFI report are specified in a corrective action order public comment should be taken. EPA, RCRA Public Participation Manual at 4-9 (1996). This is also being done in the current process.
3. CMS work plan scope and schedule: Comment should be taken when CMS requirements are included in a corrective action order. This is also being done now.
4. Remedy selection: The public should have an opportunity to comment on the proposed remedy, including the justification for the remedy set forth in a Statement of Basis issued by NMED. See EPA-OSWER, Guidance for Public Involvement in RCRA Section 3008(h) Actions, May 5, 1987; see 40 CFR § 265.121(b); EPA, Corrective Action for Releases from Solid Waste Management Units at Hazardous Waste Management Facilities; Proposed

Rule, 61 Fed. Reg. 19432, 19454 (May 1, 1996); EPA, RCRA Public Participation Manual, at 4-13 (1996).

5. Corrective Measures Implementation Plan: The specification of particulars, conditions and schedule of corrective measures should be the subject of public comment and response. See EPA, RCRA Public Participation Manual at 4-15 (1996).

6. Remedy Completion: The determination that no further action is called for requires an opportunity for comment. See EPA, RCRA Public Participation Manual at 4-16 (1996); see also 40 CFR § 265.121(b).

In addition, to facilitate public participation, NMED and LANL should take full advantage of the possibilities of electronic communication. In preparing the CAO, NMED has created an index to all of its files concerning hazardous waste regulation at LANL. This index may now be examined as a paper copy at NMED's offices. It would be far more useful to the public if the index were available on the Internet and were searchable to find items by subject matter.

Further, the CAO will call for the submission of numerous RFI work plans, RFI reports, CMS plans, CMS reports, and so forth. NMED should publish such documents on its Internet site or should direct LANL to do so. Previously, the LANL ER web site carried current ER reports; this pattern should be revived. Moreover, it is possible to receive public comment via the Internet as well. The comments and NMED's responses could easily be incorporated into the administrative record.

The AGO urges NMED to allow for public participation as outlined above in its issuance and implementation of a corrective action order.

Very truly yours,

LINDSAY A. LOVEJOY, JR.
Assistant Attorney General

LALJr:laljr

New Mexico Attorney General's Office
Comments on Draft Los Alamos National Laboratory Corrective Action Order
July 30, 2002

TA	OU	SWMU	Proposed CAO requirement	Comments
1	1078		No order.	Some remedial action in this townsite area has been taken on an emergency basis, *e.g.*, at Hillside 138, but most of the sites have not progressed beyond the receipt of RCRA Facility Investigation (RFI) reports and supplemental information. LANL should be required in 2002 to submit a proposal to delete Potential Release Sites (PRSs) in OU-1078 from the permit or, alternatively, to conduct a Corrective Measures Study (CMS) and promptly complete a CMS report on such PRSs.
3	1114	3-010(a)	Ground Water IWP 9/30/02; Investigation Report 4/30/04.	PRS 3-010(a) is a site of releases of lead, mercury, and radionuclides. A Phase II RFI Work Plan was submitted in 1994. In 1995 a RFI report was filed. A response to a Notice of Deficiency (NOD) was filed in 1996. NMED in 1999 requested further characterization of groundwater impacts, and LANL submitted a plan. Such characterization should be completed in 2002 and a report submitted promptly.
10	1079	10-003(a-o), 10-007	Investigation Work Plan 3/31/04; Investigation Report 6/30/05.	TA-10 is now largely public. There have been at least four RFI reports concerning various PRSs in TA-10, but none of them has been approved. There was also a Voluntary Corrective Action (VCA) in Bayo Canyon in approximately 1995. NMED does not seem to have stated to LANL whether these sites require further action. The AGO suggests that NMED direct the completion of whatever additional sampling needs to be done in these PRSs in 2002 and, as appropriate, the submission of CMS work plans and the carrying out of such plans in 2003-2004.
15	1086		No order.	This area (former OU-1086) contains numerous TA-15 firing sites. NMED files indicate that after initial RFI and interim action reports in 1996, and a NOD response in 1997, Phase II investigations were conducted in 1998, and a revised RFI report and SAP were due in 1999. They do not seem to have been submitted. They should be listed for completion in 2002.
16	108	16-003(o)	Investigation Work Plan 12/31/03; Investigation Report	This TA-16 area, known as the Fish Ladder, was investigated in 1995 and 1997 but the data were not reported. Since data are available, we suggest that the

	2		5/31/05.	existing information be reported in 2002 and such report be the basis for further planning.
16	1 0 8 2	16-008(a)	Investigation Work Plan 12/31/03; Investigation Report 8/31/04.	This TA-16 area, known as the 90's Line Pond, was investigated in 1998 and 1999 but the data were not reported. Since data are available, we suggest that the existing information be reported in 2002 and such report be the basis for further planning.
16	1 0 8 2	16-018 (MDA P), TA-16-387	Closure Report 10/31/02; Ground Water and Storm Water Monitoring Plan 4/30/04.	MDA P is in the closure process. The AGO concurs in the schedule proposed.
16	1 0 8 2	16-021(c), 16-003(k)	Interim Measures report 7/31/02; Investigation Work Plan for additional wells 12/31/02; CMS Report for surface/alluvial ground water 7/31/03; Phase III RFI Report 7/31/03; CMI Plan for surface/alluvial ground water 7/31/04; Investigation Report for groundwater 4/30/05; CMS Report for Intermediate, Regional Ground Water 3/31/06; CMI Plan for Intermediate, Regional Ground Water 3/31/07.	TA-16 has various high explosive problem areas. The 260 outfall, PRS 16-021(c), is now undergoing a CMS, which, pursuant to addendum dated September 1999, includes the effects upon regional ground water. The problems being investigated are among the most serious at the facility. We strongly suggest that a schedule be set that includes such wells penetrating the regional aquifer as are called for to measure the extent of the contamination and that a deadline of no later than 2003 be established for the completion of investigations a 2004 for preparation of a CMS report.
18	1 0 9 3	18-001 (a, b, c)	No order.	TA-18 is a criticality test area. RFI reports have been filed, and in 1995 an Expedited Cleanup Plan for SWMU 18-003(e) was filed. In 1996 an Expedited Cleanup Completion Report on SWMU 18-001(b) and a Voluntary Corrective Action Completion Report for PRS 18-001(a) were filed. In 1997 a Sampling and Analysis Plan (SAP) was under consideration, but in 1999 LANL requested to defer all corrective measures to FY 03. There are unresolved questions of ground water contamination here. Both the SAP and fieldwork pursuant to the SAP should be scheduled for 2002, with a

				CMS plan promptly thereafter.
21	1106	21-011(k)	Voluntary Corrective Measures Plan 4/30/02; Voluntary Corrective Measures report 3/31/04.	The AGO suggests that any approved interim action in connection with outfalls 21-024(i) and 21-011(k) should be carried out in 2002.
21	1106	21-014 (MDA A)	Investigation Work Plan 2/28/06; Investigation Report 5/31/07.	TA-21 includes MDAs T, U, B, A, and V and several major outfalls. NMED has several times advised LANL that the material disposal areas in TA-21 have high priority. However, even though the RFI work plan for these areas was approved in 1992, a Phase Report 1A was filed in 1993, Phases 1B and 1C were filed in 1993 and 1994, and certain other reports have been filed, NMED was still reviewing sampling plans and overseeing sampling in 1997-98, and the completion of sampling and submission of a final report based thereon has not been accomplished. The AGO suggests that LANL be required to complete all planned sampling in 2002-2003 and finish investigatory reports based thereon in 2003-2004.
21	1106	21-015 (MDA B)	Investigation Work Plan 9/30/04; Investigation Report 9/30/05.	A SAP was filed for MDA B in September 1998, and there has been little activity since. The AGO suggests that LANL be required to complete all planned sampling in 2002-2003 and finish investigatory reports based thereon in 2003-2004.
21	1106	21-016(a-c) (MDA T)	Investigation Work Plan 2/28/03; Investigation Report 5/31/04.	A SAP was filed for MDA T in March 1996, and there has been little activity since. The AGO suggests that LANL be required to complete all planned sampling in 2002-2003 and finish investigatory reports based thereon in 2003-2004.
21	1106	21-017(a-c), 21-022(f) (MDA U)	Investigation Work Plan 8/31/04; Investigation Report 11/30/05.	A SAP was filed for MDA U in September 1998, and there has been little activity since. The AGO suggests that LANL be required to complete all planned sampling in 2002-2003 and finish investigatory reports based thereon in 2003-2004.
21	1106	21-013(b, g), 21-018(a, b) (MDA V)	Investigation Work Plan 12/31/05; Investigation Report 12/31/06.	A RFI report on MDA V was filed in 1996, a response to a NOD in 1997, and an Interim Measures Plan in 2000. There is no indication that the interim measures were implemented. The AGO suggests that LANL be required to complete the interim measures and complete any further needed investigations in 2002.
21	1106	21-024(i)	Voluntary Corrective Measures Plan 8/31/02; Voluntary Corrective Measures	The AGO suggests that any approved interim action in connection with outfalls 21-024(i) and 21-011(k) should be carried out in 2002.

			Report 8/31/03.	
32	1079		No order.	An RFI report has been submitted concerning the PRSs in TA-32, and a Phase II investigation was apparently planned. Voluntary Corrective Action (VCA) plans wer also submitted for several PRSs. However, none of thes documents has been approved by NMED. This office suggests that NMED direct that any needed additional sampling to be completed and that RFI report supplementation be completed in 2002-2003.
33	1122		No order.	TA-33 is the location of firing sites and mesa-top disposal areas. Based on initial sampling, EPA in February 1998 pointed out the presence of significant radiological contamination and the risks of migration to nearby springs. Additional sampling is called for to determine the extent of contamination, and a report should be furnished. This should be done in 2002-2003.
35	1129		No order.	TA-35 housed a wastewater treatment facility. Several RFI reports were submitted in 1996 and one in 1998. A response to a Request for Supplemental Information (RSI) was filed in 1999. The June 1996 RFI Report stated that further inquiry was required at several sites. In 1997 and in early 2002 SAPs were filed for most of the PRSs needing further investigation. The investigation should continue to complete Phase II sampling in 2002, and a report should be filed soon thereafter.
36	1130		No order.	TA-36 contains firing sites and surface disposal areas. In 1996 LANL filed a response to a NOD for PRSs in TA-36. In 1997 NMED determined that the RFI report on several of these PRSs was "grossly deficient." LANL thereafter proposed to remedy the deficiencies in a new SAP, scheduled to be delivered by September 1998, a date later extended to December 1998. This SAP apparently has not been filed, and the AGO suggests that filing of the SAP, and the execution of the SAP, should be completed in 2002.
39	1132		No order.	TA-39 contains firing sites and disposal areas within Ancho Canyon. In 1997 NMED called in the RFI report for PRSs in this area, having identified it as "high priority for review." The RFI report was submitted in March 1997, and in November 1997 NMED issued a RSI, specifying additional work to be completed both in the field and in analysis. In December 1997 LANL responded, agreeing that the RFI report is deficient and requesting until September 1998 to complete the report. Later LANL requested a further extension to September

				1999, which was granted. The report has not been filed. NMED should schedule this RFI report for completion in 2002.
48	1129		No order.	A RFI report was filed on PRSs, mainly outfalls, connected to the TA-48 radiochemistry site in 1995, and a response to a NOD in 1996, a SAP was filed in 1997, and a RFI report addendum was filed in late 1997. EPA in 1998 advised NMED that the outfall sampling was inadequate. The AGO suggests that in 2002 additional sampling at these PRSs and a report be scheduled soon thereafter.
49	1144	49-001(a-g), 49-003, AOC C-49-008(d) (MDA AB, Areas 1, 3, 4, 11, 12)	Investigation Work Plan 4/30/06; Investigation Report 8/31/07.	TA-49 contains the Frijoles Mesa hydronuclear experiment sites. In 1996 NMED determined that MDA AB, PRSs 49-001 (a-g) had high priority; organics had been detected in the regional aquifer in well DT-9, and NMED requested LANL to accelerate the RFI. A stabilization plan for MDA AB was submitted in late 1998, and a best management practices report in 1999. An RFI Report dated August 1997 has been filed for PRSs in Areas 5, 6, 10, and 11. It is not clear why the completion of investigations and submission of reports on them should be delayed beyond 2003.
49	1144	49-005(a), 49-006, AOCs C-49-002, C-49-005(b), C-49-008(a, b) (Areas 5, 6, 10)	Investigation Work Plan 3/31/08; Investigation Report 4/30/09.	See the comments on TA-49, above.
50	1147	50-009 (MDA C)	Investigation Work Plan 10/31/02; Investigation Report 2/29/04.	TA-50 contains MDA C, PRS 50-009, a major waste disposal area. Drilling pursuant to the RFI Work Plan was conducted in 1995. RFI Reports were filed in 1995 and 1996 concerning PRSs investigated through soil sampling. However, no RFI report and no recommendation as to further action have been submitted concerning MDA C. It should be noted that drilling results contained in materials produced in response to an NMED document demand show significant contamination emanating from MDA C. An RFI report should be completed in 2002-2003 with a recommendation for further action soon thereafter.
53	110	53-002(a, b)	Investigation Report 4/30/03.	TA-53 contains three surface impoundments. Records of the HWB show that a combined RFI Work Plan and SAP were submitted in 1998 and, after further submittals,

	0			approved in August 2000. Completion of any sampling and analysis and submission of an RFI report should be scheduled for 2002-2003.
54	1 1 4 8	54-004 (MDA H)	Investigation Report Addendum 5/31/02; CMS Report 12/31/02; CMI Plan 12/31/03.	TA-54 contains MDAs G, H, and L. These are RCRA-regulated units, and NMED has required submission and execution of RCRA closure plans. Under the HSWA process, an RFI Report for channel sediment pathways from MDAs G, H, J, and L was filed in 1996. In 1997 RFI Reports were filed on tritium in surface soils at MDA G. An RFI Report concerning MDAs G, H, and L was filed in March 2000. Concerning MDA H, a CMS Plan for MDA H was filed in March 2001, followed by an RFI Report and a Plan for Supplemental Sampling in May 2001. An RFI Report Addendum was scheduled for submission in April 2002 but has not been filed. A monitoring Compliance Demonstration for MDA H was filed in April 2002. NMED should require that RFI reporting concerning MDAs G, H, and L be completed in 2002 and that a CMS be conducted and reports be submitted before the end of 2003.
54	1 1 4 8	54-006 (MDA L)	Investigation Work Plan 2/28/03; Investigation Report 9/30/03; CMS Plan 7/31/04.	See the discussion of MDA H above. In addition a RCRA closure plan was filed in April 2002. NMED should require that RFI reporting concerning MDAs G, H, and L be completed in 2002 and that a CMS be conducted and reports be submitted before the end of 2003.
54	1 1 4 8	54-013(b), 54-014(b-d), 54-015(k), 54-017, 54-018, 54-019, 54-020 (MDA G)	Investigation Work Plan 1/31/03; Investigation Report 7/31/03; Corrective Measures Study Plan 4/31/04.	See the discussion of MDA H above. In addition a RCRA closure plan was filed in April 2002. NMED should require that RFI reporting concerning MDAs G, H, and L be completed in of 2002 and that a CMS be conducted and reports be submitted before the end of 2003.
73	1 0 7 1	73-001(a-d), 73-004(d) (Airport Landfill) (Drainage s)	Interim Measures Report 6/31/03.	Concerning the Los Alamos airport landfill sites, PRSs 73-001(a-d) and 73-004(d), a RFI report was submitted by LANL in November 1998 and reviewed by EPA. Since this area is partially open to the public, corrective measures should not be further delayed. A CMS has not been carried out, nor has an implementation plan been prepared. The AGO recommends that sufficient

				planning, risk assessment, and fieldwork, including a CMS and interim measures to reduce the public hazards, be completed in 2002.
73		73-001(a-d), 73-004(d) (Airport Landfill) —Mesa Top	Phase I Investigation Work Plan 9/30/02; Phase II Investigation Work Plan 4/30/04; Investigation Report 12/31/06.	See the discussion of TA-73 drainages above.
73		73-002	Investigation Work Plan 5/31/05; Investigation Report 2/28/06.	See the discussion of TA-73 drainages above.
LA/Pueblo watershed				
R-1			Well Completion Report 12/31/04	This well cannot now be deleted; sufficient if done in FY 04.
R-2			Well Completion Report 12/31/03	To characterize Pueblo Canyon; should be completed by FY 03.
R-3			Well Completion Report 12/31/03	To characterize Pueblo Canyon; should be completed by FY 03.
R-4			Well Completion Report 12/31/03	To characterize Pueblo Canyon; should be completed by FY 03.
R-6			Well Completion Report 12/31/05	To characterize Los Alamos Canyon; should be completed by FY 03.
R-8			Well Completion Report 12/31/02	Should be completed in FY 02.
Mortandad Watershed				
R-13			Well Completion Report 12/31/02	Should be completed in FY 02.
R-14			Well Completion Report 12/31/02	Should be completed in FY 02.
R-16			Well Completion Report 12/31/03	To characterize lower Mortandad Canyon; should be completed in FY 04.
Water Canyon/ Cañon de Valle watershed				

R-23			Well Completion Report 12/31/04	To characterize Potrillo Canyon; should be complete FY 04.
R-24			Well Completion Report 12/31/04	To characterize upper Cañon de Valle; should be completed by FY 04.
R-26			Well Completion Report 12/31/05	To characterize upper Water Canyon; should be completed by FY 04.
R-27			Well Completion Report 12/31/02	To characterize Water Canyon; should be completed in FY 02.
R-28			Well Completion Report 12/31/04	To characterize Water Canyon; should be completed in FY 03.
R-29			Well Completion Report 12/31/05	To characterize Water Canyon; should be completed in FY 04.
Sandia Watershed				
R-10			Well Completion Report 12/31/03	To characterize Sandia Canyon; should be completed in FY 03.
R-11			Well Completion Report 12/31/02	To characterize Sandia Canyon; should be completed in FY 02.
Pajarito Watershed				
R-17			Well Completion Report 12/31/04	To characterize Twomile Canyon; should be completed in FY 03.
R-18			Well Completion Report 12/31/02	To characterize Pajarito Canyon; should be completed in FY 02.
R-20			Well Completion Report 12/31/02	To characterize Pajarito Canyon; should be completed in FY 02.
R-21			Well Completion Report 12/31/02	To characterize Pajarito Canyon; should be completed in FY 02.
Ancho Watershed				
R-30			Well Completion Report 12/31/03	To characterize the TA-49 sites; should be completed in FY 03.
R-32			Well Completion Report 12/31/05	To characterize Ancho Canyon; should be completed in FY 04.
Ancho/ Chaquehui/Indio Canyons			Investigation Work Plan 6/30/05; Investigation Report 2/28/07	The Canyons Core Document calls for completion of a report on Ancho, Chaquehui, and Indio Canyons by December 15, 2003. NMED should require that this date be met.
LA/Pueblo Canyons			Investigation Work Plan Addendum 5/31/03; Investigation Report 7/31/04	The Canyons Core Document calls for reports on reaches in Los Alamos/Pueblo Canyon by May 1998. Some have been filed. NMED should require that such reports be completed within one year of the date of the CAO.
Mortand			Investigation Report	The Mortandad Canyon Work Plan, incorporating the

ad Canyon			1/7/00; Ground Water Investigation Work Plan 3/31/03; Investigation Report 10/31/04	Canyons Core Document, calls for a report by January 7, 2000. Such report has not been filed. We suggest that NMED allow one year from the date of the CAO to complete such report.
North Canyons			Investigation Report 5/31/07	The North Canyons Work Plan, incorporating the Canyons Core Document, calls for a report on Guaje, Bayo, Barrancas, and Rendija Canyons by September 30, 2005. NMED should require that such date be met.
Pajarito Canyon			Investigation Report 3/31/05	The Pajarito Canyon Work Plan, incorporating the Canyons Core Document, calls for a report by December 27, 2000. Such report has not been filed. NMED should allow such report to be filed one year from the date of the CAO.
Potrillo/ Fence Canyons			Investigation Work Plan 7/31/05; Investigation Report 10/31/06	The Canyons Core Document calls for completion of a report on Potrillo and Fence Canyons by November 30, 2004. NMED should require that this date be met.
Sandia Canyon/ Cañada del Buey			Investigation Report 5/31/05	The Sandia Canyon/Cañada del Buey Work Plan, incorporating the Canyons Core document, calls for a report by December 13, 2001. Such report has not been filed. NMED should allow such report to be filed one year from the date of the CAO.
Water Canyon/ Cañon de Valle			Investigation Work Plan 3/31/03; Investigation Report 11/30/04	The Canyons Core Document calls for completion of a report on Water Canyon and Cañon de Valle by January 3, 2003. NMED should allow such report to be filed one year from the date of the CAO.

September 30, 2005

MEMORANDUM

SUBJECT: Los Alamos National Laboratory, Los Alamos, New Mexico (01RC06-001)
Impacts of Well Construction Practices

FROM: Robert Ford, Ph.D., Environmental Scientist
Subsurface Remediation Branch

Steven D. Acree, Hydrologist
Randall R. Ross, Ph.D., Hydrologist
Applied Research & Technical Support Branch

TO: Richard Mayer
U.S. EPA, Region 6

As requested, various documents concerning well construction practices and water quality evaluations at the Los Alamos National Laboratory (LANL) have been reviewed by Greg Davis, a consultant to Dynamac Corporation, and us. Dynamac is an off-site contractor providing technical support services to this laboratory. The focus of this review has been on the questions posed by the Northern New Mexico Citizens= Advisory Board (NNMCAB) in a memorandum from DeLong to Mayer dated 1/4/05. The questions which were posed center on the capability of the existing hydrogeologic characterization wells to provide representative ground-water samples for all site-related constituents of concern. The specific questions are summarized below:

Issue 1: If LANL decides to convert characterization wells to monitoring wells, can wells drilled with bentonite clay or commercial fluids, such as EZ-MUD, Quik-FOAM, TORKEASE, and LIQUI-TROL, ever be developed and cleaned up adequately to provide analytical data representative of the ground water in the aquifer unit being sampled?

Issue 2: Will the use of commercial drilling fluids and bentonite clay preclude any contaminants from being accurately sampled even after well cleanup? If so, which ones?

Issue 3: Are tritium and other mobile constituents suitable indicators of possible impacts for the entire suite of site-specific constituents at LANL?

EXHIBIT
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Issue 4: (a) Can LANL derive an independent estimate of background concentrations of potential contaminants from accumulated ground-water data without using analytical results from the wells associated with the Hydrogeologic Work Plan? (b) Would such data constitute reliable criteria for judging when wells are suitable as monitoring wells?

The issues which have been raised by the NNMCAB are valid and, in many cases, difficult to reliably answer. The NNMCAB and the LANL are correct in identifying intrusion of bentonite and organic-based polymer drilling fluids as a potential problem for reactive contaminants of concern. These drilling fluids can introduce new reactive solid phases within the screened interval that may retard contaminant transport relative to un-impacted zones within the aquifer that the screened interval is intended to sample. Alteration of aquifer material reactivity results from one of two processes: 1) introduction of a reactive clay mineral, bentonite, that has significant sorption capacity for many of the site contaminants of concern, and 2) alteration of in-situ aquifer mineralogy via stimulation of biological manganese (Mn)-, iron (Fe)- and sulfate-reduction processes that result in the accumulation of reactive mineral phases such as Mn/Fe carbonates, Mn/Fe sulfides, and/or reduced Mn/Fe (hydr)oxides (Figure 1). Based on review of information presented in Table 1 of Bitner *et al.* (2004), intrusion of polymer-based drilling fluids is likely to have occurred in one or more screened intervals of all of the well locations whereas the intrusion of bentonite-based drilling fluids is likely to have occurred in fewer wells due to the more limited use that was reported (Table 1).

In an attempt to explain the possible impacts of these two classes of drilling fluids, two diagrammatic conceptual models were introduced in Figures 6 and 7 of Bitner *et al.* (2004) to depict the evolution of aqueous and solid phase chemistry within the impacted zone of a well screen. According to Figure 6 and accompanying discussion, degradation of polymer-based drilling fluids leads to reducing conditions that result in dissolution of Mn and Fe (hydr)oxides (with stated concomitant increases in dissolved Mn and Fe) and the reduction of sulfate, nitrate, and some site-specific contaminants of concern. These processes will also result in the production of dissolved carbonate (from organic carbon degradation) and dissolved sulfide (from sulfate reduction). It is implied that dissolved Mn and Fe derived from reductive dissolution of the original Mn- and Fe-bearing aquifer 'mineral coatings' will be conservatively transported from the zone of influence adjacent to the impacted well screen. However, a more probable scenario is the re-precipitation of Mn and Fe as carbonates and sulfides on aquifer solids within the zone of influence concomitant with increased production of dissolved carbonate and sulfide during degradation of polymer-based drilling fluids. Upon recovery of more oxidizing conditions, these newly-formed reactive mineral phases can subsequently be re-oxidized to their oxide forms with no net loss of Fe and Mn from the formation. This overall scenario is presented schematically in Figure 2 with changes in the relative abundance of specific aqueous and solid phase components documented as a function of the evolution of the aquifer adjacent to an impacted well screen.

The mineralogical alterations depicted in Figure 2 will result in changes to the chemical reactivity of aquifer solids within the impacted zone adjacent to the well screen. A likely outcome resulting from a change in aquifer solids reactivity is that contaminants of concern that may be transported through the aquifer will interact with altered aquifer solids within the

impacted zone adjacent to the well screen in a manner distinct from the unaltered aquifer solids at similar depth (Figure 3). Since the contaminants of concern relevant to LANL's ground-water characterization effort represent a wide range of chemical affinity for sorption onto aquifer solids, the potential exists for inaccurate identification of contaminant-specific transport. There is currently no direct evidence of the types and amounts of mineral alteration products within the impacted zones adjacent to well screens. Thus, there is no reliable means to assess whether a non-detect concentration (or a value below "background") of a strongly-sorbing contaminant of concern is indicative of 1) lack of transport of the contaminant through the aquifer to the well screen or 2) sorption of the contaminant within the impacted zone of the well screen. Based on review of technical communications from LANL, it is not clear that this factor has been given sufficient consideration relative to the development of assessment criteria for determining the adequacy of individual well screens to provide chemical data for ground water that are representative of pre-drilling aquifer conditions.

The implications of this conceptual model of biogeochemical conditions at well screen impacted by drilling fluids, the technical aspects regarding each issue identified by the NNMCAB, an evaluation of the current information, and recommendations for resolution of the issues are provided below.

Issue 1: It is possible that some impacted wells may ultimately be capable of providing representative samples provided that: 1) large quantities of additives did not infiltrate the screened zone, 2) methods that include purging of water prior to sampling are used, 3) protocol(s) to better evaluate return of aquifer materials to background conditions are established, and 4) implementation of sample collection, preservation and analysis procedures that minimize changes in chemical speciation of redox-sensitive parameters. Resolution of Issue 1 first requires identification of the wells that are sufficiently impacted by drilling fluids as to affect the chemistry in the aquifer surrounding the well screen. In this regard, the LANL has proposed draft criteria for determining impacts. An evaluation and recommendations concerning these criteria are provided below.

1. The proposed criteria are based on analysis of water chemistry. It should be noted that while analysis of changes in aqueous chemistry at a given well screen presents one potential tool for characterizing well recovery, there is a high degree of uncertainty associated with this avenue of analysis. Specifically, aqueous chemistry data cannot be used to infer the distribution of mass (between water and solids) of a given contaminant within the impacted zone adjacent to a well screen without knowledge of the initial concentration of the contaminant interacting with altered aquifer solids. Determination of the true fate of a particle-reactive contaminant within the aquifer can accurately be assessed only with knowledge of its mass distribution between water and solids within the impacted zone. Comparison of measured concentrations of indicator parameters (or contaminants of concern) to background ground-water concentrations are useful only when the chosen background condition is representative of the un-impacted aquifer adjacent to the well screen being sampled. Reliance on an uncertain background condition to assess apparent well recovery limits the reliability of this approach (see additional discussion under Issue 4).

The data used to characterize background conditions (LANL, 2005) appear to be too

sparse, derived from sources representing mixtures of water that are significantly different from the samples obtained from the hydrogeologic characterization wells, and are representative of significantly different flow paths within the aquifer. It is recommended either that background data be obtained from monitoring wells screened within the specific units of interest and installed without the use of additives within the screened interval or that much less dependence be placed on the use of background data in this evaluation.

Due to the relatively large spatial variability and/or variability associated with rock type, the proposed trigger values may not be conservative enough to identify some impacted wells due to uncertainty in the appropriate background values. For example, criteria 2.1-2a and 2.1-2b use the minimum background concentrations for strontium and uranium as triggers to flag data as possibly non-representative. Actual background values at the locations of the characterization wells may be significantly different from the proposed values.

A cursory application of these criteria illustrates the uncertainty in the use of the minimum background values for strontium. Bitner *et al.* (2004) report that screen 3 in well R-22 appears to be impacted by residual bentonite based on elevated sodium and sulfate concentrations. Data obtained from Longmire (2002) indicate that strontium concentrations are above the minimum background values and may be declining with time. Evaluation of the data from this well screen using proposed criterion 2.1-2b would indicate that the strontium data are representative despite the large impacts evident in the sodium and sulfate data and the trend in the strontium data. Based upon this analysis, it does not appear that the strontium data should be considered representative. It is not clear that a detection of either strontium or uranium that is above a minimum background value demonstrates that there has been no impact due to small quantities of residual bentonite. Neither is it clear that detections of a parameter at a concentration above a maximum background value is a firm indication that bentonite is the source for the elevated constituent, as stated in criterion 2.1-1a. The logic supporting these assumptions should be described in detail and provided for review.

2. Development of a tiered process to assess the evolution of water chemistry at impacted well screens does provide one of several tools that should be implemented to judge the appropriate disposition of ground-water wells. The decision process should be based on comparison of measured ground-water chemistry to the anticipated chemical conditions based on the presumed conceptual model of the geochemical evolution of impacted well screens. Based on analysis of the current conceptual model proposed by the LANL, it is recommended that the proposed tiered review process be re-evaluated and revised to more appropriately represent the conceptual model depicted in Figures 1 and 2 of this review. It is recommended that this process be preceded by a screen-by-screen determination of where organic-based, bentonite, or both drilling fluids were used. Examination of these data on a well-by-well basis indicates that all wells are impacted by organic-based drilling fluids, and some wells are also impacted by bentonite. If it is determined that all screens are impacted by organic-based drilling fluids (*i.e.*, these fluids were used during drilling in the screened interval) some re-structuring of the flow of the tiered process may be required. In addition, the following three issues should also be considered with respect to the choice of analytes that are used in criteria to assess apparent well recovery:

A. A subset of the analytes chosen for assessing impact of drilling fluid at a given well screen should be a component of the drilling fluid and have concentrations that are much higher than typical for site ground-water background conditions,
B. Analytes chosen to assess geochemical conditions or possible contaminant sequestration should not be susceptible to changes in chemical speciation during sample collection and preservation, and
C. Analytes chosen to assess the possible sequestration of contaminants of concern on aquifer solids surrounding impacted screens should possess a higher affinity for partitioning to the unaltered/altered aquifer solids.

With regard to issue (A), it appears that the currently recommended list of analytes used to assess drilling fluid impact is not adequate. A summary of deionized water extraction data made available for review is shown in Table 2. Analytes highlighted in yellow for a subset of drilling fluids would serve as appropriate indicators of the continued presence of several of the drilling fluids. It should be noted that no data were available for review for a number of the drilling fluids that were frequently employed during drilling operations (including EZ-MUD, Quik-FOAM, TORKEASE, and LIQUI-TROL). These data should also be obtained and evaluated as part of revisions to the analyte list.

With regard to issue (B), there is concern that sulfate may not be a reliable indicator under reducing conditions. Specifically, it is possible to obtain a false positive for the presence of sulfate due to inappropriate collection and preservation that will result in the oxidation of dissolved sulfide. This problem is magnified by the water collection configuration employing Westbay samplers. Based on our on-site observation of ground-water sampling activities at well R-22 on June 28, 2005, it is evident that there are no controls implemented to limit oxygen intrusion into water samples retrieved from the well screen. First, sampling vessels that are lowered to the well screen are sources of oxygen exposure to sampled water, even though the sampling vessels are deployed under vacuum. Quality control data were not available for this review to assess the reliability of this sampling configuration to prevent oxidation of dissolved sulfide [and Fe(II) or Mn(II)] during the timeframe of a typical sampling event. Secondly, oxygen exposure again occurs during transfer of collected water to individual containers prior to submission for laboratory analysis, since sample transfer is not conducted without air exposure. Based on our observation in the field, it appears that dissolved sulfide is not measured in the field, so there is no analytical mechanism in place to evaluate whether sulfate measured in the laboratory represents the true concentration at the well screen, the concentration following oxidation of dissolved sulfide after sample collection, or some combination thereof. This is of particular concern since sulfate is used as one of the initial criteria (2.2-2) for screening the impact of residual organic drilling fluids. It should also be noted that the existence of sulfate-reducing conditions does not preclude the presence of sulfate in water. The concentration of sulfate and dissolved sulfide in ground water within a sulfate-reducing zone will depend on two factors: 1) the kinetics of sulfate reduction relative to the concentration of sulfate (*i.e.*, supply of sulfate may exceed capacity for its reduction leading to continued persistence of sulfate in ground water), and 2) the relative concentrations of dissolved ferrous iron and sulfide produced by sulfate reduction. If ferrous iron is present in molar excess of sulfide (*i.e.*, moles Fe(II) > moles dissolved sulfide), then precipitation of iron sulfides could effectively sequester biologically-produced sulfide and prevent its detection in the dissolved phase. The current

uncertainties associated with sulfate measurements limit the reliability of this analyte for screening the condition of wells impacted by organic-based polymer drilling fluids.

For issue (C), it is important to identify analytes that are transported less conservatively than the contaminants of concern. Dissolved zinc is proposed for screening the condition of wells impacted by bentonite relative to the possible loss of cesium-137, cobalt-60, europium isotopes, and neodymium-147 onto residual bentonite solids adjacent to the impacted well screen (criterion 2.1-2). One significant limitation to this approach is that zinc has not been universally detected in site ground water. LANL (2005) reports non-detectable zinc in about 56% of the samples evaluated. Thus, non-detectable zinc at a given well screen could indicate either sorption onto residual bentonite or the lack of this constituent at measurable concentration in the native ground water at the interval sampled by the well screen. In addition, there are some published ion exchange selectivity series that indicate cobalt partitions more strongly than zinc to clay minerals (including bentonite). Thus, detection of zinc would not preclude loss of cobalt-60 on residual bentonite. Screening criterion 2.1-2 should be re-evaluated in an effort to identify a more reliable replacement or supplemental candidate to zinc. Barium presents a potential alternative/additional candidate (99% detect in area ground water), although it is unclear how prevalent this metal may be as a site contaminant of concern.

3. There is also concern regarding the use of only the three most recent measurements in these assessments without examination of trends. Although the concentrations of the parameters used as indicators in criteria 2.1-1, 2.1-2a, and 2.1-2b may change with time and eventually meet the proposed triggers, this does not imply that the data are now representative of the aquifer for each of the listed parameters. In general, these criteria may be most useful for identifying the degree of impact to a well screen rather than whether the well in question now produces fully representative data for many of the constituents.

4. The Tier 2.2 criteria are designed under the assumption that once oxidizing conditions have been re-established the sorption characteristics of the aquifer material immediately adjacent to the well screen have returned to pre-drilling conditions. This is not necessarily the case. As described above, the reducing conditions established by biodegradation of organic-based polymer drilling fluids are likely to alter the mineralogical composition of the aquifer solids adjacent to impacted well screens. These processes generally increase the mass of reactive minerals resulting in an increase in the sorption capacity of aquifer materials impacted by biodegradation of organic-based polymer drilling fluids. Thus, contaminant concentration data collected from impacted well screens may be biased low relative the actual concentration of contaminants in un-impacted aquifer materials in the same flow path. Without collection and characterization of altered aquifer materials, it is difficult to determine the extent of this problem on a screen-by-screen basis. A potential indirect method of assessing changes in sorption reactivity between impacted and un-impacted aquifer materials would be to conduct push-pull tests at impacted and un-impacted well screens that sample from a similar lithology using a range of dissolved constituents that capture the particle-reactivity of site contaminants of concern. In addition, it may be beneficial to attempt removal of mineral alteration products via physical or chemical processes that mobilize or dissolve these phases.

5. It is noted that technetium is not mentioned under these criteria and should be included.

6. Due to uncertainties in the utility of aqueous chemistry assessments for the determination of whether samples are fully representative of aquifer conditions, it is recommended that field studies be designed to validate these or similar criteria. As noted above, it is possible that push-pull tests using a conservative tracer and surrogates for the contaminants of concern may provide a qualitative evaluation of differences in sorptive capacity, if performed in impacted wells and adjacent wells of similar design that were installed without additives in the screened zone. Although detailed quantitative interpretations of such tests would likely be uncertain in this setting, the data may still provide one of the few available insights into the current well conditions.

It is recommended that such studies be considered for locations determined to be critical to the monitoring program. The results may then be used to evaluate the need for additional studies or well installations at other locations. One possible location for additional study is near well R-22 which demonstrates impacts from both bentonite and polymer-based additives. Based on previous studies at this location, single-screen well completions could be installed in the most important monitoring zones. Comparisons of aqueous chemistry between R-22 and the new well cluster and the results of studies such as push-pull tracer tests may provide much insight into the magnitude and long-term impacts of the problems associated with residual additives at other locations.

7. The proposed criteria did not specify specific actions to be taken, other than flagging of data, if evaluations indicated impacts due to drilling additives. It is recommended that the criteria be expanded to specify precisely what flagging the data means with respect to data limitations, usability, and corrective actions such as well re-development or replacement.

Issue 2: Site-specific contaminants of concern include americium, cesium, iodine, plutonium, strontium, technetium, uranium, chlorinated solvents, perchlorate, and others. Whether samples obtained from the hydrogeologic characterization wells following re-development are representative of aquifer conditions will depend on the degree to which residual drilling fluids and altered aquifer materials have been removed or returned to their unaltered states. This question can only be answered following re-development and demonstration that the geochemical properties of the aquifer materials surrounding the well screen have not been altered with respect to geochemical/sorption characteristics for the contaminants for which sorption or geochemical environment is a significant concern, such as strontium-90, americium-241, cesium-137, strontium-90, and isotopes of plutonium. Studies such as those discussed above will be necessary to validate predictions made based on aqueous chemistry.

As noted in Bitner (2004), analyses for contaminants that may undergo biological transformations, such as chlorinated solvents and perchlorate, may not provide representative results as long as reducing conditions caused by degradation of organic carbon associated with polymer-based drilling additives exist adjacent to impacted well screens. Continued monitoring of redox-sensitive parameters may be used to determine when the polymer materials have been degraded, an oxidizing environment has been re-established, and samples for these constituents may be considered representative.

Other issues affecting whether samples from the hydrogeologic characterization wells are representative of aquifer conditions include the design and construction of these wells. Many of the wells, particularly those constructed at the top of the regional aquifer, use screens as long as approximately 60 ft. This type of construction often results in significant dilution of any contaminants that may be present unless the contaminant is pervasive throughout the entire screened interval. Interval sampling using a pump/packer system may provide information concerning differences in water chemistry within the screen and the possible effects of dilution. Although the use of long screens may extend the useful life of the well in a setting where the regional water table is declining, it may render early detection of contaminants highly uncertain.

In addition, the use of a long screen increases the risk of cross connection of different hydrostratigraphic units. Cross connection of different units may result in significant vertical flow within the well and the transport of contaminants, if present, to other parts of the aquifer system. The existence of a vertical flow field within the well may also be characterized using a sensitive electromagnetic or heat-pulse borehole flowmeter as described in Young *et al.* (2000). Additional information and advice regarding design and use of borehole flowmeter surveys to characterize both the vertical flow within a well and the zones from which water enters a long-screened well during purging and sampling can be provided, if desired.

At other locations, it appears either that the uppermost well screen may be installed far below the top of the regional aquifer or that one of more of the most transmissive intervals was not screened, making early detection of contaminants highly uncertain. The former is illustrated by screen #1 in well R-16, where the screen is isolated within the casing, due to problems encountered during well installation (*e.g.*, drillers unable to withdraw casing and thereby abandoned casing in place). The end result is that the upper 200+ feet of the regional aquifer is not being monitored at this location. Additionally, based on the as-built diagram of R-16, screen #4 appears to be impacted by slough materials. The latter may be illustrated by specific intervals of well R-22, where geophysical logging appears to indicate the presence of numerous water bearing zones which could contribute to the transport of contaminants of concern.

As the focus of the issues raised by the NNMCAB appeared to relate to the effects of drilling additives, a detailed evaluation of the individual well constructions was not performed. However, it is recommended that such an analysis be performed before wells are determined to meet criteria normally applied in a detection monitoring program. In summary, factors other than the effects of drilling additives may also impact whether ground-water samples are suitable for the purpose of early detection of contaminant releases or migration and should be considered during specification of a detection monitoring network.

Issue 3: The contaminants of concern vary in their mobility in the environment due to differences in their physical/chemical properties. In principle, accurate knowledge of the concentrations of the most mobile contaminants, particularly tritium, can be used as an indicator of the maximum extent of the less mobile contaminants of concern, such as the isotopes of

plutonium. However, this type of evaluation assumes that all of the contaminants of concern in a given area were spatially and temporally co-disposed and that the concentration of the mobile contaminant was sufficiently high in the waste stream to allow detection at a given distance from the disposal point. It is further noted that Bitner *et al.* (2004) also consider nitrate and perchlorate to be conservative environmental tracers that travel at the speed of the ground water. However, these constituents may be subject to removal under certain conditions, such as in a reducing environment surrounding wells screens impacted by polymer based additives. Therefore, well-specific evaluations using these compounds should be performed with care.

Documents provided for this review did not include information concerning the analyses of historical waste streams. Therefore, this issue was not evaluated in detail. Based on experience at other sites, it is quite likely that the available information may only allow a screening-level evaluation to be performed. Tritium activity is also used as an indicator of the ground-water age or elapsed time since ground water entered the subsurface. This evaluation is useful in assessing the potential for contaminants of concern to be present. However, care must be exercised in the interpretation of these data due to the effects of dilution of samples within long-screened wells, uncertainty with respect to the effects of biological processes in impacted well screens sampled using a no-purge technique, and related factors.

Issue 4: An evaluation of Abackground@ ground-water chemistry is provided in LANL (2005). In this study, sources for the data determined to reflect conditions in the regional aquifer were limited to springs and long-screened water production wells located at significant distances from many of the characterization wells. These types of sources generally produce water that is a mixture of contributions from different lithologic units and different areas. This type of study may provide useful information on Abackground@ constituent concentrations for the purpose of siting a water supply well. However, it does not appear to be appropriate for detailed comparisons with water samples obtained from monitoring wells that provide samples from discrete zones and likely represent much smaller volumes of the aquifer and different flow paths within the aquifer. Although the information in LANL (2005) provides insight into the possible range of Abackground@ conditions, data from monitoring wells located upgradient of waste management units/disposal areas are required to allow reliable comparisons with wells located downgradient of these units. Therefore, the current Abackground@ data should not be used as a sole indicator of whether samples are representative of aquifer conditions.

Recommendations

Identification of Impacts: It is recommended that all well screens impacted by residual drilling additives be identified, corrective actions to be taken be specified, and field studies performed to verify these evaluations. LANL has proposed a tiered approach, dated September 6, 2005, to support these assessments. Comments and recommendations concerning this approach are provided above.

Future Well Installations: The following recommendations for improvement during the drilling and construction of future monitoring wells should allow installation of wells that provide the most representative samples possible for the contaminants of concern at LANL.

1. Drill boreholes using no bentonite or organic additives within screened intervals. Additives may be used in intervals above the target monitoring zone if a telescoping construction is used and the hole is adequately cleaned before drilling the final footage within the interval to be screened. Although this may require the use of significant quantities of water to control heaving in the saturated zone, the effects of potable water are minimal and can be mitigated during well development. This will likely necessitate the use of single-screen well completions. Such constructions allow for more effective development and greater confidence in both the chemical data and estimates of hydrogeologic parameters. Targeting of monitoring intervals prior to drilling should be possible at locations where data from the existing characterization wells are available.

2. Limit screened intervals to no more than approximately 10 ft to 20 ft in length, depending on the formation characteristics at a given site, to minimize dilution and the potential for interconnection of separate aquifer units.

3. Eliminate the use of pipe-based screens with openings drilled in the field. This screen construction likely renders uniform development of the borehole wall more difficult than if rod-based screens or similar materials are used.

4. Minimize the time between drilling and well development. During well development, use aggressive methods that result in water movement into and out of the well screen within the constraints imposed by the depth to the ground water.

5. At locations determined to be critical to the detection monitoring program, consider replacement of wells that were drilled using bentonite or organic additives with wells installed without additives in the screened zones. As noted above, data available from installation of the hydrogeologic characterization wells at these locations will allow specific intervals to be targeted for screening. Drilling additives may be used in intervals above the target screened zone. However, a casing should be pressure grouted in place and the hole cleaned prior to drilling into the screened zone and subsequent well installation.

Summary: Most of the hydrogeologic characterization wells at LANL appear to have been installed using drilling additives that may impact the quality of data obtained from the affected well screens. Some of these impacts have been documented in various LANL publications. However, a systematic study to identify impacted screens and assess data usability has not been performed. In general, it is likely that many of these screens may not produce representative samples for constituents that strongly sorb to clays or whose fate in the environment is sensitive to changes in redox conditions. In particular, the constituents of concern that may be most affected by the residual drilling additives are certain radionuclides, such as americium, cerium, plutonium, radium, strontium, uranium, many stable metal cations, and organic compounds that may be degraded in the impacted environment near the well screens.

The impacts are not well understood due, in part, to the difficulty in directly characterizing aquifer materials adjacent to the screen. Thus, predictions of the time frames for the impacted intervals to return to natural conditions should not be considered to be reliable. It

is also likely that the inability to fully remove the additives which were used during drilling has reduced the hydraulic conductivity of some or most of the impacted screened zones. The use of the Westbay sampling system employing the MOSDAX method of no-purge sampling in the impacted screens likely maximizes the effects of the drilling additives since the sample is obtained from the region immediately adjacent to the well screen.

The path for resolution of issues concerning the impacts of drilling additives on the quality of ground-water samples should include identification of all well screens impacted by drilling additives, specification of the corrective actions to be taken, and field studies performed to verify these evaluations. Based on the uncertainty in characterizing the condition of aquifer materials adjacent to the well screens and the potentially long time frames that some impacts may last, installation of replacement wells at critical locations should also be considered. If you have any questions concerning these comments, please do not hesitate to call us (Acree: 580-436-8609; Ford: 580-436-8872; Ross: 580-436-8611) at your convenience. We look forward to future interactions with you concerning this and other sites.

cc: Mike Fitzpatrick (5303W)
Jo Ann Griffith (5202G)
Vince Malott, Region 6
Dr. Stephen G. Schmelling, GWERD

References

Bitner, K., D. Broxton, P. Longmire, S. Pearson, and D. Vaniman, 2004. Response to Concerns About Selected Regional Aquifer Wells at Los Alamos National Laboratory, LA-UR-04-6777, Los Alamos National Laboratory, Los Alamos, NM.

Longmire, P., 2002. Characterization Well R-22 Geochemistry Report, LA-13986-MS, Los Alamos National Laboratory, Los Alamos, NM.

LANL, 2005. Groundwater Background Investigation Report, LA-UR-05-2005, Los Alamos National Laboratory, Los Alamos, NM.

Young, S.C., H.E. Julian, H.S. Pearson, F.J. Molz, and G.K. Boman, 1998. Application of the Electromagnetic Borehole Flowmeter, EPA/600/R-98/058, U.S. Environmental Protection Agency, Cincinnati, OH.

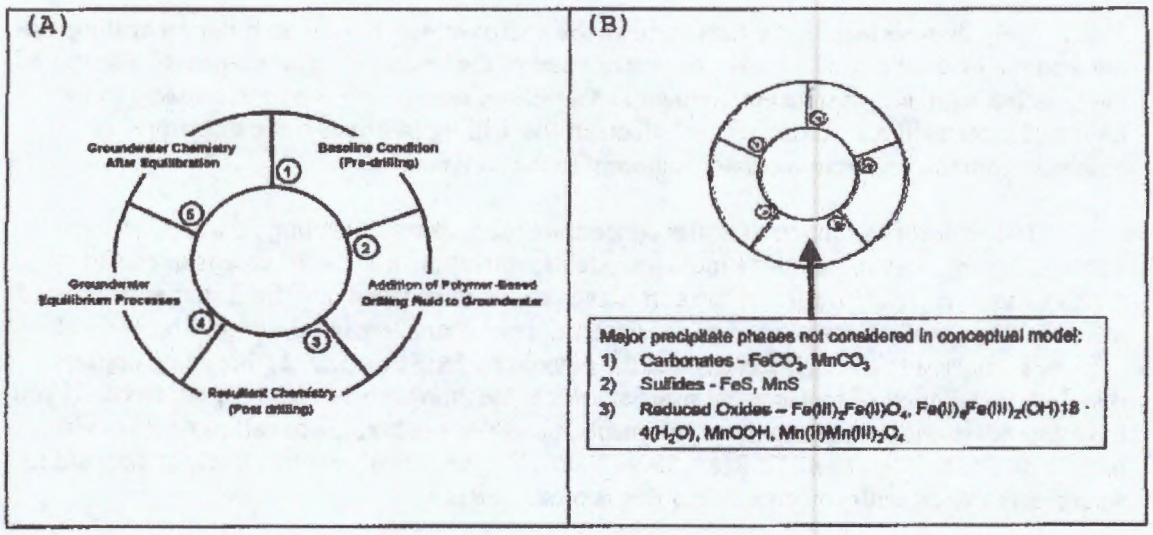

Figure 1. Illustration of certain aspects of solid phase chemistry not considered in the Bitner *et al.* (2004) conceptual model describing the evolution of aqueous and solid phase chemistry at well screens impacted by biodegradation of polymer-based drilling fluids. (A) Simplified depiction of the LANL conceptual model relative to the various stages of geochemical evolution in the impacted zone adjacent to the well screen. (B) Precipitation of major precipitate phases that can occur during Stage 3 reduction processes.

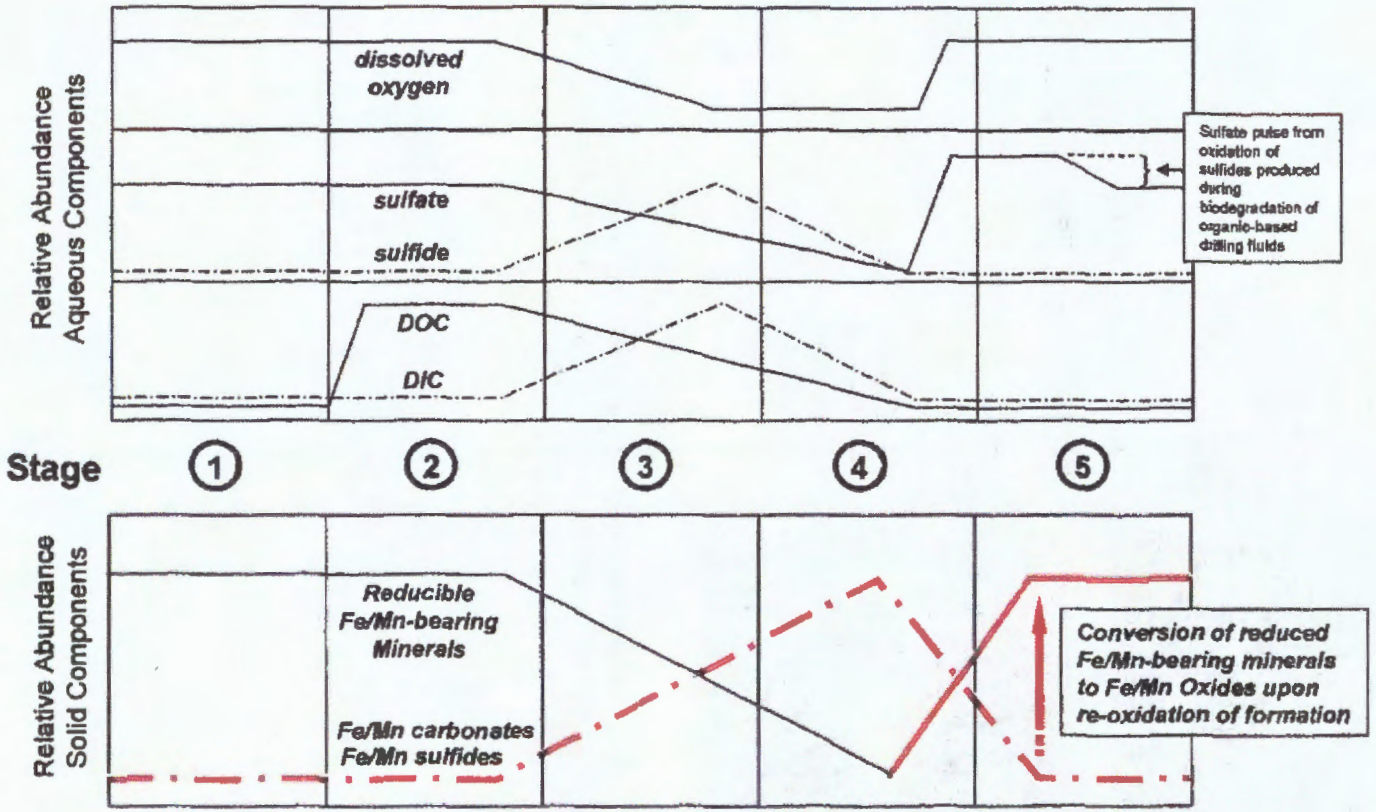

Figure 2. Schematic diagram depicting the evolution of aqueous and solid phase chemical components within the impacted zone of the aquifer adjacent to well screens impacted by the biodegradation of organic-based polymer drilling fluids. Changes in relative abundance of individual chemical components are depicted based on the current state-of-knowledge of mineral alterations that accompany organic biodegradation reactions (*i.e.*, microbially-driven iron-, manganese-, and sulfate-reduction) in subsurface environments.

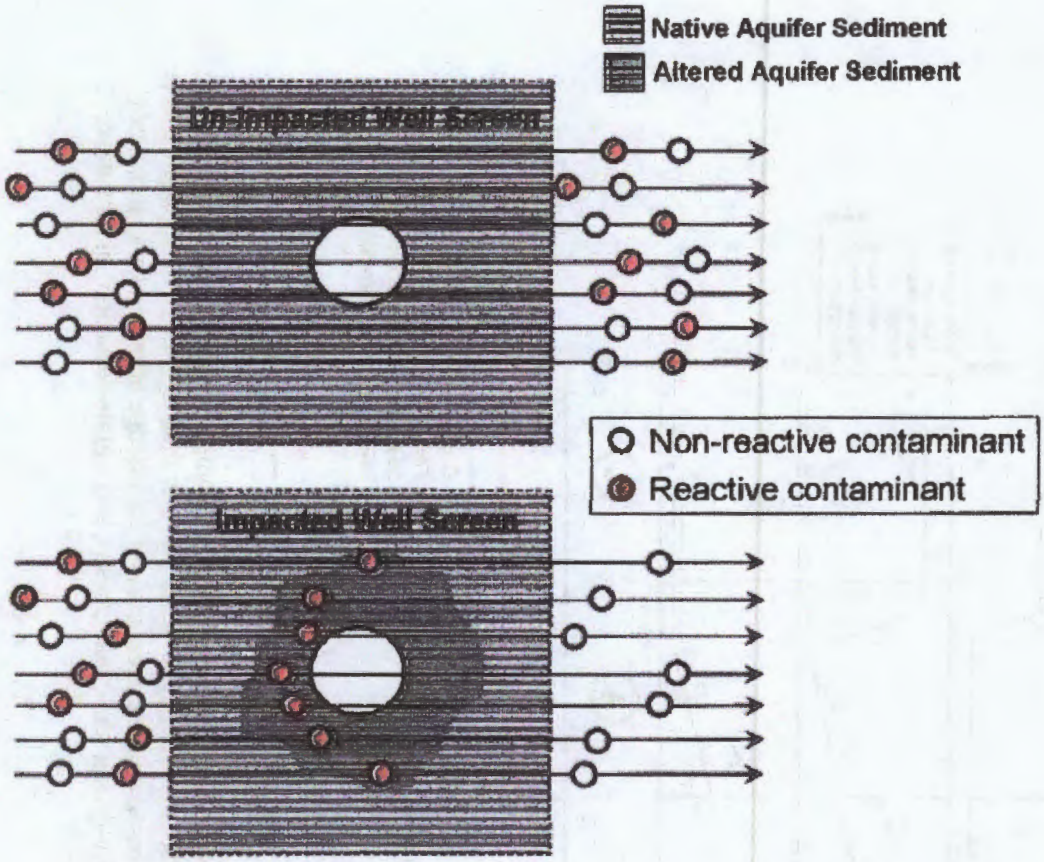

Figure 3. Schematic illustrating differential transport behavior of site contaminants of concern within the impacted zone adjacent to well screens influenced by biodegradation of organic-based polymer drilling fluids.

Table 1. Listing of drilling additives employed during implementation of the hydrogeologic characterization program at LANL.

Well	Elapsed Time Before Development (Days) **	Drilling Fluid *										Impact Category		
		EZ-MUD	QUIK-FOAM	TORKEASE	LIQUI-TROL	PAC-L	Bentonite	QUICK-GEL	N-SEAL	Magma Fiber	Soda Ash	Biodegradation	Bentonite	Both
		Polymer-based					Bentonite-based		Other					
R-1	11													
R-2	7													
R-4	10													
R-5	12													
R-7	18													
R-8	11													
R-9	115													
R-11	No report													
R-12	26													
R-13	33													
R-14	17													
R-15	Chrono uncertain													
R-16	16													
R-19	Chrono uncertain													
CdV-R-15-3	~92													
CdV-R-37-2	~25													
R-20	9													
R-21	170 mb file - gotta be kidding													
R-22	~40													
R-23	20													
R-25	84													
R-26	12													
R-28	30													
R-31	~31													
R-32	11													
MCOBT-4.4	~23													
MCOBT-8.5	No well													
R-9i	Chrono uncertain													
CdV-16-1(i)	No report													
CdV-16-2(i)	No report													
CdV-16-3(i)	No report													

* Based on information presented in Table 1 of LA-UR-04-6777 (September 2004).
** Determined as the time from completion of the entire borehole to initiation of development activities.

Table 2. Listing of water-leachable chemical constituents present in drilling fluids employed during implementation of the hydrogeologic characterization program at LANL.

Analyte*	Concentration Unit	Bentonite	EZ-MUD	Quik-FOAM	TORKEASE	LIQUI-TROL	PAC-L	Soda Ash	Quick-gel	megma-fiber	n-seal	Regional Aquifer	Intermediate Perched Zones
Ag	ppm	<0.009					<0.2		<0.01		<0.01		
Al	ppm	0.229					3.860		1.006		5.971		
Alk(Lab)	ppm CaCO3	—					86557.377	1052213.087	17595.519		75253.552	150.000	65.000
As	ppm	1.374					<0.2		0.091		<0.01	<0.007	<0.007
B	ppm	1.008					<2		0.302		0.378		
Ba	ppm	0.018					1.103		0.101		0.209		
Be	ppm	<0.009					<0.2		<0.01		<0.01		
Br	ppm	0.275					<4		6.336		<0.2		
C DIC	ppm	—					295.915		156.866		25.779		
C DOC	ppm	—					196663.745		94.232		30.423	<12	<12
C TIC	ppm	—					—		—		—		
C TOC	ppm	—					—		—		—		
Ca	ppm	9.984					115.793		137.778		593.286	38.000	16.000
Cd	ppm	<0.009					<0.2		<0.01		<0.01		
Cl	ppm	118.332					20769.162		65.067		3.951	9.100	71.000
ClO3	ppm	<0.09					<4		<0.2		<0.2		
ClO4	ppm	1.191					—		—		—		
Co	ppm	<0.009					<0.2		<0.01		<0.01		
CO3	ppm	—					0.000	602459.000	886.000		910.000		
Cond.(F)	uS/cm	—					—		—		—		
Cond.(L)	uS/cm	—					—		—		—		
Cr	ppm	0.052					2.941		0.070		0.009		
Cs	ppm	<0.009					<0.2		0.020		<0.01		
Cu	ppm	0.062					3.492		0.131		0.171		
F	ppm	7.236					1630.287		10.560		16.017		
Fe	ppm	<0.09					5.514		0.503		<0.1		
Hardness	CaCO3 ppm	—					—		—		—		
HCO3	ppm	—					104380.000	58700.000	19665.000		89959.000		
Hg	ppm	0.002					<0.02		<0.001		<0.001		
I	ppm	—					—		—		—		
K	ppm	6.046					33.084		15.387		60.084	5.100	7.500
Li	ppm	0.247					<0.2		0.704		0.265		
Mg	ppm	1.282					16.642		13.778		0.853		
Mn	ppm	0.016					0.368		0.080		<0.01		
Mo	ppm	2.473					<0.2		0.825		<0.01		
Na	ppm	1346.520					93553.127		5390.440		64.162	31.000	38.000
NH4	ppm	—					—		—		—		
Ni	ppm	0.016					0.368		0.040		0.019		
NO2	ppm	0.183					<4		<0.2		<0.2		
NO3	ppm	198.940					<4		237.340		<0.2	0.910	0.600
OH	ppm	—					—		—		—		
Oxalate	ppm	4.855					<4		<0.2		<0.2		
Pb	ppm	<0.0009					0.368		<0.01		<0.01		
pH	Lab	—					7.970	11.380	9.090		9.470		
PO4	ppm	6.504					10586.759		<0.5		<0.5		
Rb	ppm	0.011					<0.2		0.040		0.171		
Sb	ppm	0.056					<0.2		<0.01		0.020		
Se	ppm	0.092					<0.2		0.191		0.066		
Si	ppm	204.268					110.279		159.903		211.347		
SiO2	ppm calc	437.134					235.996		342.192		452.283		
SO4	ppm	1007.600					<4		9483.563		95.722	17.200	11.300
S2O3	ppm	—					—		—		—		
Sn	ppm	<0.009					<0.2		<0.01		<0.01		
Sr	ppm	0.030					0.551		2.011		1.137		
Th	ppm	<0.009					<0.2		<0.01		0.023		
Ti	ppm	<0.009					<0.4		<0.02		<0.02		
Tl	ppm	<0.009					<0.2		<0.01		0.023		
U	ppm	0.070					<0.2		0.040		0.023		
V	ppm	0.128					<0.4		<0.02		0.152		
Zn	ppm	<0.009					<0.4		<0.02		<0.02		
TDS	ppm	—					231339.313		36259.586		92184.029		
Acetate	ppm	++					+		-		-		
Formate	ppm	++					+		-		-		

No data reported for these analytes.

Indicates analyte with elevated concentration that may serve as a useful indicator for water quality in impacted well screens.

* Data were copied from Excel file (Drilling_Additives.xls) provided by Patrick Longmire/LANL to Richard Mayer/R6 via e-mail on April 19, 2005.

** Data were derived from Table 4.3-1 (Draft, 06-Sep-05) and/or LA-UR-05-2295, Appendix C.

Table 2. Listing of water-leachable chemical constituents present in drilling fluids employed during implementation of the hydrogeologic characterization program at LANL.

Analyte *	Concentration Unit	Bentonite	EZ-MUD	Quik-FOAM	TORKEASE	LIQUI-TROL	PAC-L	Soda Ash	Quick-gel	magma-fiber	n-seal	Regional Aquifer	Intermediate Perched Zones
Ag	ppm	<0.009					<0.2		<0.01		<0.01		
Al	ppm	0.229					3.860		1.006		5.971		
Alk(Lab)	ppm CaCO3	—					85557.377	1052213.087	17595.519		75263.552	150.000	85.000
As	ppm	1.374					<0.2		0.091		<0.01	<0.007	<0.007
B	ppm	1.008					<2		0.302		0.379		
Ba	ppm	0.018					1.103		0.101		0.209		
Be	ppm	<0.009					<0.2		<0.01		<0.01		
Br	ppm	0.276					<4		8.336		<0.2		
C DIC	ppm	—					285.815		136.886		25.779		
C DOC	ppm	—					196663.745		94.232		30.423	<12	<12
C TIC	ppm	—					—		—		—		
C TOC	ppm	—					—		—		—		
Ca	ppm	9.964					115.793		137.778		593.288	38.000	16.000
Cd	ppm	<0.009					<0.2		<0.01		<0.01		
Cl	ppm	116.332					20789.182		55.087		3.981	9.100	71.000
ClO3	ppm	<0.09					<4		<0.2		<0.2		
ClO4	ppm	1.191					—		—		—		
Co	ppm	<0.009					<0.2		<0.01		<0.01		
CO3	ppm	—					0.000	902459.000	886.000		910.000		
Cond.(F)	µS/cm	—					—		—		—		
Cond.(L)	µS/cm	—					—		—		—		
Cr	ppm	0.082					2.941		0.070		0.009		
Cs	ppm	<0.009					<0.2		0.020		<0.01		
Cu	ppm	0.062					3.492		0.131		0.171		

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL RISK MANAGEMENT RESEARCH LABORATORY
GROUND WATER AND ECOSYSTEMS RESTORATION DIVISION
P.O. Box 1198 Ada, OK 74820

OFFICE OF
RESEARCH AND DEVELOPMENT

February 10, 2006

MEMORANDUM

SUBJECT: Los Alamos National Laboratory, Los Alamos, New Mexico (05RC06-001)
Impacts of Hydrogeologic Characterization Well Construction Practices

FROM: Robert Ford, Ph.D., Environmental Scientist
Subsurface Remediation Branch

Steven D. Acree, Hydrologist
Randall R. Ross, Ph.D., Hydrologist
Applied Research & Technical Support Branch

TO: Richard Mayer
U.S. EPA, Region 6

As requested, various documents concerning well construction practices and water quality evaluations at the Los Alamos National Laboratory (LANL) have been reviewed by Greg Davis, a hydrogeological consultant to Dynamac Corporation, and the above named staff of the National Risk Management Research Laboratory (NRMRL) – Ground Water and Ecosystems Restoration Division. Dynamac is an off-site contractor providing technical support services to this laboratory. The review and recommendations contained in this memorandum represent a technical evaluation of site-specific conditions based on the current state of the science and are neither policy nor prescriptive guidance. This memorandum is provided to clarify issues discussed in our memorandum to you dated September 30, 2005, and contains the material provided in the previous memorandum with modifications intended to better convey the requested information. The current review does not include the recent document entitled, "Well Screen Analysis Report" (LANL, 2005c), which will be reviewed under separate cover.

The focus of this review has been on the questions posed by the Northern New Mexico Citizens' Advisory Board (NNMCAB) in a memorandum from DeLong to Mayer dated 1/4/05. The questions which were posed center on the capability of the existing hydrogeologic characterization wells to provide representative ground-water samples for all site-related constituents of concern. The specific questions are summarized below:

Issue 1: If LANL decides to convert characterization wells to monitoring wells, can wells drilled with bentonite clay or commercial fluids, such as EZ-MUD, Quik-FOAM, TORKEASE, and LIQUI-TROL, ever be developed and cleaned up adequately to

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provide analytical data representative of the ground water in the aquifer unit being sampled?

Issue 2: Will the use of commercial drilling fluids and bentonite clay preclude any contaminants from being accurately sampled even after well cleanup? If so, which ones?

Issue 3: In public reports, LANL indicates that contamination from LANL operations has not reached certain ground-water regions. LANL bases these statements on analytical results which show that certain fast-moving contaminants, such as tritium, that are not affected by drilling fluids or clays have not been detected in concentrations above background in samples from the wells. Are tritium and other mobile constituents suitable indicators of possible impacts for the entire suite of site-specific constituents at LANL?

Issue 4: (a) Can LANL derive an independent estimate of background concentrations of potential contaminants from accumulated ground-water data without using analytical results from the wells associated with the Hydrogeologic Work Plan? (b) Would such data constitute reliable criteria for judging when wells are suitable as monitoring wells?

The issues which have been raised by the NNMCAB are valid and, in many cases, difficult to reliably answer. The NNMCAB and LANL are correct in identifying intrusion of bentonite and organic drilling fluids as a potential problem for reactive contaminants of concern. The following review attempts to answer the questions, where possible, to provide insight into the scientific aspects of the individual issues, and to recommend additional types of studies that may be useful in filling existing data gaps. It should be noted that this review does not provide a detailed list of contaminants that are affected by the residual drilling additives at each impacted well screen. Examples of constituents that are most likely to be affected are given at appropriate points in the discussion. However, preparation of a comprehensive list for each well screen is beyond the scope of this review and would require better knowledge of the degree of impact at each screen and would be expected to change with time, particularly for the screens impacted by organic additives, as the geochemical environment in the impacted zone changes.

In general, it is often difficult to obtain fully representative samples of subsurface materials, particularly in a highly complex setting such as at LANL. This does not imply that available data are always appropriate regardless of objectives and intended data uses. This review highlights potential data quality problems and uncertainties. Since data quality objectives (DQOs) were not explicitly stated in the limited set of documents available for review, it is recommended that the DQOs addressing the specific requirements for the samples and the intended use of the data from the wells impacted by residual drilling fluids at LANL be reviewed to determine the applicability of the suggestions provided below.

For convenience, the review is divided into an executive summary describing findings related to the core issues of the effects of residual drilling additives on ground-water samples, a discussion of background information describing the effects of the drilling additives used at

LANL in more technical terms, and sections corresponding to the individual issues raised by the NNMCAB followed by a brief summary. Recommendations for additional studies or changes in practices are included under each section, where appropriate.

Executive Summary

One of the central issues to be addressed as part of this review is whether representative ground-water samples can be obtained from wells installed as part of the Hydrogeologic Work Plan, considering the methods and techniques used by LANL to drill the boreholes, install, develop and sample the wells. There are two questions that must be answered in order to provide a complete answer to this question:

1) Has the introduction of drilling fluids, including bentonite and biodegradable organic polymers, resulted in changes in ground-water chemistry from pre-drilling conditions?

2) Will alterations of the aquifer material around a well, either through the introduction of bentonite or changes brought about by the break-down of organic drilling fluids, alter how contaminants move toward the well screen, relative to pre-drilling conditions?

The ability to answer the central question of whether 'ground-water samples are representative' depends on how much we know about existing geochemical conditions next to the well screen and in areas that have not been affected by drilling fluids, further into the formation. Analytical results of ground-water samples indicate that drilling additives have changed the geochemical conditions around numerous wells. As acknowledged by LANL, these well screens should not be considered to currently provide samples representative of reactive contaminants of concern.

The second question cannot be addressed through direct measurements without acquiring samples of aquifer solids in the affected zone adjacent to the well screens. For wells drilled using bentonite additives, the inability to sample and directly measure the level of residual bentonite in sediments adjacent to screened intervals makes the representativeness of water samples for strongly sorbing contaminants uncertain. These contaminants include isotopes of americium, cerium, plutonium and radium. For wells drilled using organic polymer additives, the alteration of aquifer sediments is of particular concern for well screens impacted by biodegradation, since these reactions are known to result in alterations of iron- and manganese-bearing minerals. This is a critical issue, since these minerals often exert a dominant influence on the movement of inorganic contaminants in the subsurface. Changes to the aquifer minerals can result in the removal of many of the more reactive inorganic contaminants of importance to LANL and make water samples from the impacted well screens non-representative of aquifer conditions. The extent and time period of this impact will depend on the types of new minerals that are formed and the persistence of these new minerals after the complete break-down of the organic polymer.

Since determining how much the geochemistry of an aquifer has changed due to drilling, well installation, and sampling activities depends on a *best estimation* based on a range of direct measurements and inferences, the answer to this question is complex and uncertain. The

question concerning whether changes in water chemistry have occurred may be answered directly by analyzing water samples and comparing the results with those obtained from suitable background samples. However, using changes in water chemistry to determine changes in aquifer mineralogy and the resulting changes in sorptive properties of the aquifer materials is not as straight forward.

The problem with using water quality data to determine changes in the sorptive properties of aquifer materials is illustrated by the following analogy. Suppose one wanted to determine the temperature of water in a glass sitting on a table. Two approaches to this problem, each with different levels of confidence, are: 1) use a calibrated instrument (*e.g.*, thermometer) to directly measure the temperature of the water with a level of confidence dependant on the accuracy of the thermometer, and 2) use an indirect method to estimate a temperature range. For example, if the water is not solid (*i.e.*, ice) or bubbling (*i.e.*, boiling), then it could be assumed that the water temperature is between 32°F/0°C and 212°F/100°C. However, it would be difficult to accurately determine the water temperature without using a thermometer. Similarly, trying to determine changes in aquifer properties resulting from reducing conditions using only water chemistry data would result in a wide range of possible values. The use of more direct methods would be necessary to determine the extent of mineralogical changes to aquifer materials following the return of oxidizing conditions near the well screen.

Relative to addressing the question of whether ground-water samples are representative of the undisturbed aquifer chemistry, water quality data alone provide an unreliable indication of whether there is sustained impact to sediment sorption characteristics. The margin of error of determining, through measurements of water chemistry, what sediment minerals exist at any given point in time at a well screen is comparable to the level of uncertainty in estimating the temperature of a glass of water solely through visual observations. This is a limitation of the approach proposed for determining the condition of screened intervals at wells for which alterations have been identified by LANL. In many cases, the reducing environment established by the degradation of organic drilling additives has exposed the aquifer minerals to conditions far different from the conditions that have been established by many years of undisturbed ground-water flow. This is a significant limitation for the purpose of using these wells for assessing potential contaminant transport, in light of independent research that documents the extent that iron- and sulfate-reducing conditions may alter sediment mineralogy.

None of the documents available for review provide definitive evidence of the types of new minerals that have been formed or the degree of alteration of the aquifer materials. Consequently, a detailed evaluation of the changes in the degree to which reactive contaminants would be removed from water passing through the screened zone cannot be reliably performed. Further, the altered minerals will remain for some period of time following the return of oxidizing conditions. The time frame for this continuing impact to the representativeness of ground-water samples may be years to decades, depending on the types and degree of alterations. Documents provided for review by LANL do not explicitly acknowledge this potentially long-term data quality limitation.

Background

In order to respond to the issues raised by the NNMCAB, the nature of the impacts due to the presence of residual drilling additives must be understood. The following background information and assessment is provided to facilitate this understanding. The drilling fluids used at LANL can introduce new reactive minerals into the screened interval that may retard contaminant transport relative to un-impacted zones within the aquifer. Alteration of aquifer sediment reactivity results from one of two processes: 1) introduction of a reactive clay mineral, bentonite, that has significant sorption capacity for many of the site contaminants of concern, and 2) alteration of in-situ aquifer mineralogy during degradation of residual organic additives that results in the production of new reactive mineral phases such as Mn/Fe carbonates, Mn/Fe sulfides, and/or reduced Mn/Fe oxides and hydroxides (Figure 1). Based on a review of information presented in Bitner *et al.* (2004), intrusion of organic drilling fluids may have occurred in one or more screened intervals at all of the well locations whereas the intrusion of bentonite-based drilling fluids is likely to have occurred in fewer wells due to the more limited use that was reported (Table 1).

In an attempt to explain the possible impacts of these two classes of drilling fluids, two diagrammatic conceptual models were introduced in Figures 6 and 7 of Bitner *et al.* (2004) to depict the evolution of aqueous and solid phase chemistry within the impacted zone of a well screen. According to Figure 6 and accompanying discussion, degradation of organic drilling fluids leads to reducing conditions that result in dissolution of Mn and Fe (hydr)oxides (with stated concomitant increases in dissolved Mn and Fe) and the reduction of sulfate, nitrate, and some site-specific contaminants of concern (Bitner *et al.*, 2004). These processes will also result in the production of dissolved carbonate from organic carbon biodegradation and dissolved sulfide from microbial sulfate reduction. It is implied that dissolved Mn and Fe derived from reductive dissolution of the original Mn- and Fe-bearing aquifer 'mineral coatings' will be conservatively transported from the zone of influence adjacent to the impacted well screen. However, a more probable scenario is the re-precipitation of Mn and Fe as new mineral phases in the presence of elevated concentrations of carbonate and sulfide produced during biodegradation of organic polymer drilling additives. The amount of these new mineral phases and the time frame over which they may be produced will depend on 1) the amount of organic polymer drilling additive introduced into the aquifer, 2) the amount of sulfate transported in ground water at a particular well screen, and 3) the concentrations of Mn and Fe within the original aquifer sediments. It is not possible to project amounts or time frames at a given well screen with any certainty without knowledge of the amount of organic polymer additives that may have been introduced into the aquifer. Upon recovery of more oxidizing conditions, these newly-formed reactive mineral phases can subsequently be re-oxidized to their oxide forms with no net loss of Fe and Mn from the formation. This overall scenario is presented schematically in Figure 2 with changes in the relative abundance of specific aqueous and solid phase components documented as a function of the evolution of the aquifer adjacent to an impacted well screen.

The types of mineral transformations alluded to in the previous discussion have been identified in a number of experimental systems. Examples of the reported observations of transformations in Fe-bearing oxide minerals are documented in Table 2. These experimental systems replicate the type of conditions (*i.e.*, iron- and sulfate-reducing) observed in some of the

well screens as documented in Bitner *et al.* (2004). A visual depiction of the impact of iron-reducing conditions on changes in the mineralogy of iron oxide coated sands is shown in Figure 3 (Benner *et al.*, 2002). Thus, the current state of technical knowledge supports the contention that stimulation of microbial processes that lead to iron- and sulfate-reducing conditions within an aquifer can significantly alter the characteristics of redox-sensitive minerals. However, the extent of knowledge relative to the persistence of mineral alteration products following the return to oxidizing (pre-drilling) conditions is limited. No studies have been documented in the scientific literature or within written materials provided for this review to properly assess

1) how long the reduced mineral phases will survive, or
2) to what type of mineral phase(s) they will transform back to following the return of more oxidizing conditions.

The body of research that has examined redox processes active in soils and sediments indicates that significant time periods (years to decades) may be necessary for aquifer sediments to return to a condition that resembles the initial condition that existed prior to a significant change in redox chemistry. For well screens impacted by reducing conditions established during degradation of organic polymer drilling additives, any projections relative to the time to recovery or the characteristics of the 'recovered' aquifer sediments would need to be verified by direct observations in order to reduce the uncertainty associated with establishing whether ground-water samples are representative of pre-drilling conditions within the aquifer. In this respect, any information that could be obtained relative to the amounts and types of minerals produced at impacted well screens due to biodegradation of organic polymer additives would be very useful in the screening analysis of the utility of existing well installations for the collection of representative ground-water samples.

For screened intervals at which aquifer sediments may have been collected and retained during the drilling program, implementing microcosm studies similar to those illustrated in Table 2 could be beneficial. These microcosm studies could incorporate representative amounts of organic polymer drilling additives and, thus, provide an indirect assessment of in-situ aquifer sediment conditions that may exist for those well screens impacted by biodegradation of organic polymer additives introduced during drilling. In addition, the sediments obtained from these microcosm studies would provide a representative material that could be used to evaluate the extent that site contaminants of concern may be sorbed (and thus not detected) at well screens impacted by biodegradation reactions. This would provide a useful constraint to evaluating the extent to which this may be a concern for the various ground-water flow paths being sampled by the existing well network.

The mineralogical alterations depicted in Figures 2 and 3 will result in changes to the chemical reactivity of aquifer solids within the impacted zone adjacent to the well screen. A likely outcome resulting from a change in aquifer solids reactivity is that contaminants of concern will interact with altered aquifer solids to various degrees and some will be retarded or removed from solution (Figure 4). Since the contaminants of concern relevant to LANL's ground-water characterization effort represent a wide range of chemical affinity for sorption onto aquifer solids, the potential exists for inaccurate assessment of the concentrations of contaminants under the given conditions at an impacted well screen.

There is currently no definitive identification of the specific new mineral phases that are being formed and the amounts of mineral alteration products within the impacted zones adjacent to affected well screens. This lack of information increases the uncertainty as to whether a non-detect concentration (or a value below "background") of a strongly-sorbing contaminant of concern is indicative of 1) the absence of the contaminant in that portion of the aquifer being sampled or 2) sorption of the contaminant within the impacted zone surrounding wells where residual drilling additives resulted in significant alteration of the geochemical environment.

Issue 1: If LANL decides to convert characterization wells to monitoring wells, can wells drilled with bentonite clay or commercial fluids, such as EZ-MUD, Quik-FOAM, TORKEASE, and LIQUI-TROL, ever be developed and cleaned up adequately to provide analytical data representative of the ground water in the aquifer unit being sampled?

With respect to screens where bentonite-based additives were used, it is possible that even trace amounts of residual bentonite that remain following development may render ground-water samples non-representative for highly sorbing constituents. This situation would be difficult to accurately characterize. Therefore, the quality of samples for constituents such as isotopes of americium, cerium, plutonium, and radium obtained from these screens will likely remain uncertain even after re-development.

With respect to screened intervals where organic additives were used, it is possible that development procedures used in some wells following installation may have been sufficient to remove enough of the additives to prevent significant alteration of the geochemical environment surrounding the well screen. Vigorous redevelopment may be useful in removing additional quantities of the residual organic materials from some impacted screens and shorten the time frame for the return to oxidizing conditions, particularly if large quantities of additives did not infiltrate the screened zone. However, it is unlikely that the new mineral phases formed during biodegradation of the organic materials would be fully removed during re-development using conventional physical techniques. It is possible that some or all of these impacted wells may be capable of providing representative samples following degradation of the residual organic additives, the return of oxidizing conditions, and transformation of the altered minerals. Sampling methodologies that may aid in ultimately obtaining representative samples from such wells and better assessing the representativeness of those samples include: 1) use of methods that include purging of water prior to sampling to minimize retention time in the impacted zone and 2) sample collection, preservation and analysis procedures that minimize changes in chemical speciation of redox-sensitive parameters. It is recommended that current sampling procedures be critically evaluated and the potential benefits of any possible modifications in these areas be considered.

Resolution of Issue 1 first requires identification of the wells that may be sufficiently impacted by drilling fluids as to affect the chemistry in the aquifer surrounding the well screen. In this regard, LANL proposed draft criteria, dated September 6, 2005, for determining impacts (LANL, 2005b), which have been included in this review. The reviewed criteria are attached to this document and labeled as Appendix A. An evaluation and recommendations concerning the

September 6, 2005, version of these criteria are provided below. It is noted that a recent report (LANL, 2005c) may contain updated criteria and will be reviewed under separate cover.

1. The proposed criteria are based on analysis of water chemistry. It should be noted that while analysis of changes in aqueous chemistry at a given well screen presents one potential tool for characterizing well recovery, there is a high degree of uncertainty associated with this avenue of analysis. Specifically, aqueous chemistry data cannot be used to infer the distribution of contaminant mass (between water and solids) within the impacted zone adjacent to a well screen without knowledge of the initial concentration of the contaminant entering the impacted zone (*i.e.*, background constituent concentrations). In addition, comparison of measured concentrations of indicator parameters (or contaminants of concern) to background ground-water concentrations are useful only when the chosen background condition is representative of the un-impacted aquifer adjacent to the well screen being sampled. Reliance on an uncertain background condition to assess apparent well recovery limits the reliability of this approach (see additional discussion under Issue 4).

In this regard, the data used to characterize background conditions (LANL, 2005a) appear to be too sparse, derived from sources representing mixtures of water that are significantly different from the samples obtained from the hydrogeologic characterization wells, and representative of significantly different flow paths within the aquifer. It is recommended either that additional background data be obtained from monitoring wells screened solely within the specific units of interest and installed without the use of additives within the screened interval or that much less dependence be placed on the use of currently available background data in this evaluation.

2. Due to the relatively large variability observed in the background data set (LANL, 2005a), the trigger values proposed by LANL may not be conservative enough to identify some impacted wells due to uncertainty associated with appropriate background values. For example, LANL criteria 2.1-2a and 2.1-2b (Appendix A) use the minimum background concentrations for strontium and uranium as triggers to flag data as possibly non-representative. Actual background values at the locations of the characterization wells may be significantly different from the proposed values for reasons stated in the discussion under Issue 4 below. In similar fashion, it is not clear that detections of a parameter at concentrations above a maximum background value are a firm indication that bentonite is the source for the elevated constituent, as stated in LANL criterion 2.1-1a.

3. Where applicable, comparison of chemistry data for suspected well screens impacted by bentonite and/or organic polymers to background concentrations should include constituents that represent the full range of reactivity for potential site contaminants of concern. Examples of inorganic constituents that may be anticipated in background ground-water samples that represent a useful range of sorption reactivity (and mechanism) with respect to potential site contaminants of concern include zinc (Zn), strontium (Sr), molybdenum (Mo), cesium (Cs), barium (Ba), europium (Eu), thorium (Th), and uranium (U). The current criteria are structured to make use of comparisons between background values and data obtained from characterization wells for some but not all of these constituents. If present in background water from the monitoring zones of interest, these may be useful indicators in an assessment of the range of

impacts of the drilling additives. It is recommended that the utility of the constituents not currently used in the well assessment criteria be considered.

4. Development of a tiered process to assess the evolution of water chemistry at impacted well screens does provide one of several tools that should be implemented to judge the appropriate disposition of ground-water wells. The decision process should be based on comparison of measured ground-water chemistry to the anticipated chemical conditions derived from the presumed conceptual model of the geochemical evolution of impacted well screens. Based on analysis of the current conceptual model proposed by LANL, it is recommended that the tiered review process be re-evaluated and revised to more appropriately represent the conceptual model depicted in Figures 1 and 2 of this review. It is also recommended that the tiered review process be preceded by a screen-by-screen determination of where organic, bentonite, or both drilling fluids were used and the approximate quantities that were used. Our examination of the data provided by LANL on a borehole-by-borehole basis regarding this issue indicates that all boreholes were drilled using organic drilling fluids, and some boreholes were also drilled using bentonite. If it is determined that all screened intervals were drilled using organic drilling fluids, some re-structuring of the flow of the tiered process may be appropriate.

The following three issues should be considered with respect to the choice of analytes that are used in criteria to assess apparent well recovery:

A. A subset of the analytes chosen for assessing impact of drilling fluid at a given well screen should be a component of the drilling fluid and have concentrations that are much higher than typical for site ground-water background conditions,
B. Analytes chosen to assess geochemical conditions or possible contaminant sequestration should not be susceptible to changes in chemical speciation during sample collection and preservation, and
C. Analytes chosen to assess the possible sequestration of contaminants of concern on aquifer solids surrounding impacted screens should possess a higher affinity for partitioning to the unaltered/altered aquifer solids.

With regard to issue (A), it appears that the currently recommended list of analytes used to assess drilling fluid impact may not be complete. A summary of deionized water extraction data made available for review by LANL is shown in Table 3. Analytes highlighted in yellow for a subset of drilling fluids may serve as appropriate indicators of the continued presence of several of the drilling fluids. It should be noted that no data were available for review for a number of the drilling fluids that were frequently employed during drilling operations (including EZ-MUD, Quik-FOAM, TORKEASE, and LIQUI-TROL). These data should also be obtained and evaluated as part of revisions to the analyte list.

With regard to issue (B), there is concern that sulfate may not be a reliable indicator under reducing conditions. Specifically, it is possible to obtain a false positive for the presence of sulfate due to inappropriate collection and preservation that will result in the oxidation of dissolved sulfide. This problem is magnified by a water collection method using a no-purge technology. Based on our on-site observation of ground-water sampling activities at well R-22 on June 28, 2005, it appeared that there were few controls implemented to limit oxygen intrusion

into water samples retrieved from the well screen. First, sampling vessels that are lowered to the well screen are potential sources of oxygen exposure to sampled water, even though the sampling vessels are deployed under vacuum. Quality control data were not available for this review to assess the reliability of this sampling configuration to prevent oxidation of dissolved sulfide [and Fe(II) or Mn(II)] during the timeframe of a typical sampling event. Secondly, oxygen exposure again may occur during transfer of collected water to individual containers prior to submission for laboratory analysis, since sample transfer was not conducted without air exposure. Based on our observations in the field, it did not appear that dissolved sulfide was measured in the field, so there was no analytical mechanism in place to evaluate whether sulfate measured in the laboratory represents the true concentration at the well screen, the concentration following oxidation of dissolved sulfide after sample collection, or some combination thereof. This is of particular concern since sulfate is used as one of the initial criteria (LANL criterion 2.2-2) for screening the impact of residual organic drilling fluids.

It should also be noted that the existence of sulfate-reducing conditions does not preclude the presence of sulfate in water. The concentration of sulfate and dissolved sulfide in ground water within a sulfate-reducing zone will depend on two factors: 1) the kinetics of sulfate reduction relative to the concentration of sulfate (*i.e.*, supply of sulfate may exceed capacity for its reduction leading to continued persistence of sulfate in ground water), and 2) the relative concentrations of dissolved ferrous iron and sulfide produced by sulfate reduction. If ferrous iron is present in molar excess of sulfide (*i.e.*, moles Fe(II) > moles dissolved sulfide), then precipitation of iron sulfides could effectively sequester biologically-produced sulfide and prevent its detection in the dissolved phase (*i.e.*, ground water).

No methods are available to directly measure ferrous iron, sulfate, or dissolved sulfide within the well screen; these parameters require measurement by various analytical techniques following collection of a water sample. Reliable field methods exist for the determination of ferrous iron and dissolved sulfide in ground water. For analytes like ferrous iron or dissolved sulfide that are susceptible to transformations following sample collection (*e.g.*, exposure to air), the most reliable method of sampling usually involves continuous pumping of water from the well screen followed by immediate analysis using these field methods. Continuous pumping (or purging) of the well screen during sample collection helps ensure that the field technician can collect water samples for measurement of these parameters exactly at the time at which the analysis can be made. This also allows the field technician to collect additional fresh samples in the event that some level of dilution is required prior to analysis. Delays in sample processing for field measurements generally result in unreliable water chemistry data. Current uncertainties associated with the no-purge method of water sampling from the impacted well screens and the observed practices used to preserve sample integrity prior to analytical measurements limit the reliability of these parameters for screening the condition of wells impacted by organic drilling fluids.

For issue (C), it is important to identify analytes that are transported less conservatively than the contaminants of concern. Dissolved zinc is proposed for screening the condition of wells impacted by bentonite relative to the possible loss of cesium-137, cobalt-60, europium isotopes, and neodymium-147 onto residual bentonite solids adjacent to the impacted well screen (LANL criterion 2.1-2). One significant limitation to this approach is that zinc has not been

universally detected in site ground water. LANL (2005a) reports non-detectable zinc in about 56% of the samples evaluated. Thus, non-detectable zinc at a given well screen could indicate either sorption onto residual bentonite or the lack of this constituent at measurable concentration in the native ground water at the interval sampled by the well screen. In addition, there are some published ion exchange selectivity series that indicate cobalt partitions more strongly than zinc to clay minerals (including bentonite). Thus, detection of zinc would not preclude loss of cobalt-60 on residual bentonite. LANL criterion 2.1-2 should be re-evaluated in an effort to identify a more reliable replacement or supplemental candidate to zinc. Barium presents a potential alternative/additional candidate (99% detect in area ground water), although it is unclear how prevalent this metal may be as a site contaminant of concern.

5. The LANL Tier 2.2 criteria are designed under the assumption that once oxidizing conditions have been re-established the sorption characteristics of the aquifer material immediately adjacent to the well screen have returned to pre-drilling conditions. This is not necessarily the case. As described above, the reducing conditions established by biodegradation of organic drilling fluids are likely to alter the mineralogical composition of the aquifer solids adjacent to impacted well screens. These processes generally increase the mass of reactive minerals resulting in an increase in the sorption capacity of aquifer materials impacted by biodegradation of organic drilling fluids. Thus, contaminant concentration data collected from impacted well screens where oxidizing conditions have returned may still be biased low relative to the actual concentration of contaminants in un-impacted aquifer materials in the same flow path. Without collection and characterization of altered aquifer materials, it is difficult to determine the extent of this problem on a screen-by-screen basis. In this regard, it may be beneficial to attempt removal and analysis of mineral alteration products via physical or even chemical processes that mobilize or dissolve these phases. However, it should be noted that the use of chemical extraction may affect future analyses and may only be appropriate if a well is determined to be too impacted for use in the current monitoring program or is replaced by another well to meet appropriate data quality objectives for that particular monitoring location.

6. There is also concern regarding the use of only the three most recent measurements in these assessments without examination of trends. Although the concentrations of the parameters used as indicators in the LANL criteria may change with time and eventually meet the proposed triggers, this does not imply that the data are now representative of the aquifer for each of the listed parameters for the reasons stated above.

7. It is noted that technetium is not mentioned under these criteria and should be included.

8. Due to uncertainties in the utility of aqueous chemistry assessments for the determination of whether samples are fully representative of aquifer conditions, it is recommended that field studies be designed to validate these or similar criteria. It is possible that push-pull tests using a conservative tracer and surrogates for the contaminants of concern may provide a qualitative evaluation of differences in sorptive capacity, if performed in impacted wells and, possibly, adjacent wells of similar design that were installed without additives in the screened zone or if performed in well screens with different degrees of impact. Although detailed quantitative interpretations of such tests would likely be uncertain in this setting and the test would require injection of surrogates for contaminants of concern, the data may still provide one of the few

available insights into the current well conditions. It is unlikely that this type of invasive test would provide sufficient information to fully understand or characterize the impacts to the representativeness of samples and may negatively impact future analyses of some samples from the tested well screen. However, limited use of this type of test may serve as one line of evidence within a more comprehensive investigation. Push-pull tests designed to characterize various aquifer parameters, including sorption, are discussed in more detail in a variety of references, including Istok *et al.* (1999).

Another line of evidence may be direct comparisons between water samples obtained from impacted screens and new wells installed without additives at locations determined to be critical to the monitoring program. The results may then be used to help evaluate the need for additional studies or well installations at other locations. One possible location for additional study is near well R-22 which demonstrates impacts from polymer-based additives. Comparisons of aqueous chemistry between R-22 and a new well cluster combined with the results of studies such as analyses of altered minerals from microcosms, analysis of aquifer materials extracted from well screens that are too impacted to meet DQOs, and push-pull tracer tests may provide much insight into the magnitude and long-term impacts of the problems associated with residual additives at other locations.

9. The proposed criteria did not specify specific actions to be taken, other than flagging of data, if evaluations indicated impacts due to drilling additives. It is recommended that the criteria be expanded to specify precisely what flagging the data means with respect to data limitations, usability, and corrective actions such as well re-development or replacement, given the DQOs for each monitoring location.

Issue 2: Will the use of commercial drilling fluids and bentonite clay preclude any contaminants from being accurately sampled even after well cleanup? If so, which ones?

Site-specific contaminants of concern include isotopes of americium, cesium, iodine, plutonium, strontium, technetium, and uranium, as well as chlorinated solvents, perchlorate, and others. Whether samples obtained from the hydrogeologic characterization wells following re-development are representative of aquifer conditions will depend on the degree to which residual drilling fluids and altered aquifer materials have been removed or returned to their unaltered states. This question can only be answered following demonstration that the geochemical properties of the aquifer materials surrounding the well screen have not been altered with respect to sorption characteristics for the contaminants for which sorption or geochemical environment is a significant concern. Studies such as those discussed above will be necessary to validate predictions made based on aqueous chemistry.

Other issues affecting whether samples from the hydrogeologic characterization wells are representative of aquifer conditions include the design and construction of these wells. Many of the wells, particularly those constructed at the top of the regional aquifer, use screens as long as approximately 60 ft. This type of construction can result in significant dilution of any contaminants that may be present unless the contaminant is pervasive throughout the entire screened interval, regardless of the location of the contaminated zone within the screened interval. In some instances, interval sampling using a pump/packer or other discrete interval

sampling system may provide information concerning differences in water chemistry within the screen and the possible effects of dilution. Although the use of long screens may extend the useful life of the well in a setting where the regional water table is declining and may offer an opportunity to sample a larger portion of the aquifer than possible with a more conventional monitoring well design, it may render early detection of contaminants more uncertain. It is recommended that the DQOs for this type of well be reviewed to determine whether the long-screened construction and associated possibility of significant dilution are acceptable before incorporation into a detection monitoring program.

In addition, the use of a long screen increases the risk of cross connection of different hydrostratigraphic units. Cross connection of different units may result in significant vertical flow within the well and the transport of contaminants, if present, to other parts of the aquifer system. The existence of a vertical flow field within the well may be characterized using a sensitive electromagnetic or heat-pulse borehole flowmeter as described in Young *et al.* (2000). Additional information and advice regarding design and use of borehole flowmeter surveys to characterize both the vertical flow within a well and the zones from which water enters a long-screened well during purging and sampling can be provided, if desired.

Of even greater importance is the choice of screened intervals within the target hydrostratigraphic section. As the focus of the issues raised by the NNMCAB concerned the effects of drilling additives, a detailed evaluation of the individual well constructions and screened intervals was not performed. However, it is recommended that such an analysis be performed before wells are determined to meet criteria normally applied in a detection monitoring program. In summary, factors other than the effects of drilling additives may have a greater impact on whether ground-water samples are suitable for the purpose of early detection of contaminant releases or migration and should be considered during specification of a detection monitoring network.

Issue 3: In public reports, LANL indicates that contamination from LANL operations has not reached certain ground-water regions. LANL bases these statements on analytical results which show that certain fast-moving contaminants, such as tritium, that are not affected by drilling fluids or clays have not been detected in concentrations above background in samples from the wells. Are tritium and other mobile constituents suitable indicators of possible impacts for the entire suite of site-specific constituents at LANL?

The contaminants of concern vary in their mobility in the environment due to differences in their physical/chemical properties. In principle, accurate knowledge of the concentrations of the most mobile contaminants, particularly tritium, can be used as an indicator of the maximum extent of the less mobile contaminants of concern, such as the isotopes of plutonium. However, this type of evaluation assumes that all of the contaminants of concern in a given area were disposed at approximately the same time and location and that the concentration and mass of the mobile contaminant were sufficiently high to allow detection at a given distance from the disposal point. Documents provided for this review did not include information concerning the analyses of historical waste streams or sufficient details concerning site hydrogeology to estimate potential migration pathways and the effects of dispersion. Therefore, this potential use of tritium data at LANL could not be evaluated in detail. Based on experience at other sites, it is

quite possible that the available information may only allow a screening-level evaluation to be performed.

Tritium activity is also used as an indicator of the ground-water age or elapsed time since the water entered the subsurface. This evaluation should be useful at LANL in assessing the potential for contaminants of concern to be present based on whether the water entered the subsurface before or after disposal activities began. However, care must be exercised in the interpretation of these data due to the effects of dilution within long-screened wells, uncertainty with respect to the effects of biological processes in impacted well screens sampled using a no-purge technique, and related factors.

It is further noted that Bitner *et al.* (2004) also consider nitrate and perchlorate to be conservative environmental tracers that travel at the speed of the ground water. However, these constituents may be subject to removal under certain conditions, such as in a reducing environment surrounding well screens impacted by polymer-based additives. Therefore, well-specific evaluations using these compounds may be useful at LANL but should be performed with care.

Issue 4: (a) Can LANL derive an independent estimate of background concentrations of potential contaminants from accumulated ground-water data without using analytical results from the wells associated with the Hydrogeologic Work Plan? (b) Would such data constitute reliable criteria for judging when wells are suitable as monitoring wells?

An evaluation of "background" ground-water chemistry is provided in LANL (2005a). In this study, sources for background data determined to reflect conditions in the regional aquifer were limited to a few springs and long-screened water production wells located at significant distances from many of the characterization wells. These types of sources generally produce water that is a mixture of contributions from different lithologic units and different areas. This type of study may provide useful information concerning "background" constituent concentrations for the purpose of siting a water supply well. However, it does not appear to be appropriate for detailed comparisons with water samples obtained from monitoring wells that provide samples from discrete zones and likely represent much smaller volumes of the aquifer and different flow paths within the aquifer. Although the information in LANL (2005a) provides insight into the possible range of "background" conditions, data from monitoring wells located upgradient of waste management units/disposal areas would be needed to allow more reliable comparisons with wells located downgradient of these units. Therefore, the current "background" data should not be used as the sole indicator of whether samples are representative of aquifer conditions.

Summary

Most of the hydrogeologic characterization wells at LANL appear to have been installed using drilling additives that have the potential to impact the quality of data obtained from the affected well screens. Some of these impacts have been documented in various LANL publications. A systematic study to identify impacted screens based on aqueous chemistry has recently been performed (LANL, 2005c) and will be reviewed under separate cover. In general,

it is likely that many of these screens may not produce representative samples for constituents that strongly sorb to clays or whose fate in the environment is sensitive to changes in redox conditions for some period of time. In particular, the constituents of concern that may be most affected by the residual drilling additives are certain radionuclides (*e.g.*, isotopes of americium, cerium, plutonium, radium, strontium, uranium), many stable metal cations, and organic compounds that may be degraded in the impacted environment near the well screen.

Predictions of the time frames for the impacted intervals to return to natural conditions are uncertain. It is also likely that the inability to fully remove the additives which were used during drilling has reduced the hydraulic conductivity of many of the impacted screened zones. Due to the difficulty in assessing the damage that may be caused by the presence of residual drilling additives in the screened zone of a well, it is recommended that the need for continued use of additives within the screened interval of monitoring wells be reassessed. The following recommendations for improvement during the drilling and construction of future monitoring wells may allow installation of wells that provide the most representative samples possible for all of the contaminants of concern at LANL. It is noted that many of these techniques are successfully used at the Idaho National Laboratory (INL) to avoid the use of drilling additives, other than water to control heaving, in the screened zone. Although the drilling conditions at no two sites are identical, similar problems, such as heaving materials, consolidated and unconsolidated formations, and depths in excess of 1000 ft are also encountered at INL and successfully drilled using techniques similar to those described below.

1. Strive to drill boreholes using no bentonite or organic additives within screened intervals. Additives may be used in intervals above the target monitoring zone if telescoping casing constructions are used and the hole is adequately cleaned before drilling the final footage within the interval to be screened. Targeting of monitoring intervals prior to drilling should be possible at locations where data from the existing characterization wells are available.

2. Use screen types and well designs that maximize the open area of the screen and allow for the most uniform and effective well development. Use aggressive development methods that result in water movement into and out of the well screen.

3. Minimize the time between drilling and well development, particularly if additives have been used within the screened zone. As indicated in Table 1, many of the hydrogeologic characterization wells were not developed in a timely fashion following well completion. It should be noted that the time between the drilling of any given interval in a multi-completion well and the development of that interval is often longer than the time lag calculated in this table. This time lag will often exacerbate the difficulties in removing residual drilling fluids.

4. At locations determined to be critical to the detection monitoring program, consider replacement of wells that were drilled using bentonite or that exhibit impacts due to organic additives with wells installed without additives in the screened zones, if needed to meet the DQOs for that monitoring location.

The path for resolution of issues concerning the impacts of drilling additives on the quality of ground-water samples should include identification of all well screens impacted by

drilling additives, specification of the corrective actions to be taken, and field studies performed to verify these evaluations. Based on the uncertainty in characterizing the condition of aquifer materials adjacent to the well screens and the potentially long time frames that some impacts may last, installation of replacement wells at critical locations should also be considered.

If you have any questions concerning this review, please do not hesitate to call us (Acree: 580-436-8609; Ford: 580-436-8872; Ross: 580-436-8611) at your convenience. We look forward to future interactions with you concerning this and other sites.

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References

Benner, S.G., C.H. Hansel, B.W. Wielinga, T.M.Barber, and S. Fendorf, 2002. Reductive dissolution and biomineralization of iron hydroxide under dynamic flow conditions. Environmental Science & Technology, 36: 1705-1711.

Bitner, K., D. Broxton, P. Longmire, S. Pearson, and D. Vaniman, 2004. Response to Concerns About Selected Regional Aquifer Wells at Los Alamos National Laboratory, LA-UR-04-6777. Los Alamos National Laboratory, Los Alamos, NM.

Hansel, C.M., S.G. Benner, and S. Fendorf, 2005. Competing Fe(II)-induced mineralization pathways of ferrihydrite. Environmental Science & Technology, 39: 7147-7153.

Hansel, C.M., S. Benner, P.S. Nico, and S. Fendorf, 2004. Structural constraints of ferric (hydr)oxides on dissimilatory iron reduction and the fate of Fe(II). Geochimica et Cosmochimica Acta, 68: 3217-3229.

Hansel, C.M., S. Benner, A. Dohnalkova, P.K. Kukkadapu, and S. Fendorf, 2003. Secondary mineralization pathways induced by dissimilatory iron reduction of ferrihydrite under advective flow. Geochimica et Cosmochimica Acta, 67:2977-2992.

Istok, J.D., J.A. Field, M.H. Schroth, T.E. Sawyer, and M.D. Humphrey, 1999. Laboratory and field investigation of surfactant sorption using single-well, "Push-Pull" tests. Ground Water, 37:589-598.

Kukkadapu, R.K., J.M. Zachara, J.K. Fredrickson, and D.W. Kennedy, 2004. Biotransformation of two-line silica-ferrihydrite by a dissimilatory Fe(III)-reducing bacterium: Formation of carbonate green rust in the presence of phosphate. Geochimica et Cosmochimica Acta 68: 2799-2814.

Longmire, P., 2002. Characterization Well R-22 Geochemistry Report, LA-13986-MS. Los Alamos National Laboratory, Los Alamos, NM.

LANL, 2005a. Groundwater Background Investigation Report, LA-UR-05-2295. Los Alamos National Laboratory, Los Alamos, NM.

LANL, 2005b. Screening Tables Template. Draft well assessment criteria provided by electronic mail, dated September 6, 2005, Los Alamos National Laboratory, Los Alamos, NM.

LANL, 2005c. Well Screen Analysis Report, LA-UR-05-8615. Los Alamos National Laboratory, Los Alamos, NM.

Poulton, S.W., M.D. Krom, and R. Raiswell, 2004. A revised scheme for the reactivity of iron (oxyhydr)oxide minerals towards dissolved sulfide. Geochimica et Cosmochimica Acta, 68: 3703-3715.

Wersin, P., P. Hohener, R. Giovanoli, and W. Stumm, 1991. Early diagenetic influences on iron transformations in a fresh-water lake sediment. Chemical Geology, 90: 233-252.

Young, S.C., H.E. Julian, H.S. Pearson, F.J. Molz, and G.K. Boman, 1998. Application of the Electromagnetic Borehole Flowmeter, EPA/600/R-98/058, U.S. Environmental Protection Agency, Cincinnati, OH.

Zachara, J.M., R.K. Kukkadapu, J.K. Fredrickson, Y.A. Gorby, and S.C. Smith, 2002. Biomineralization of poorly crystalline Fe(III) oxides by dissimilatory metal reducing bacteria (DMRB). Geomicrobiology Journal, 19: 179-207.

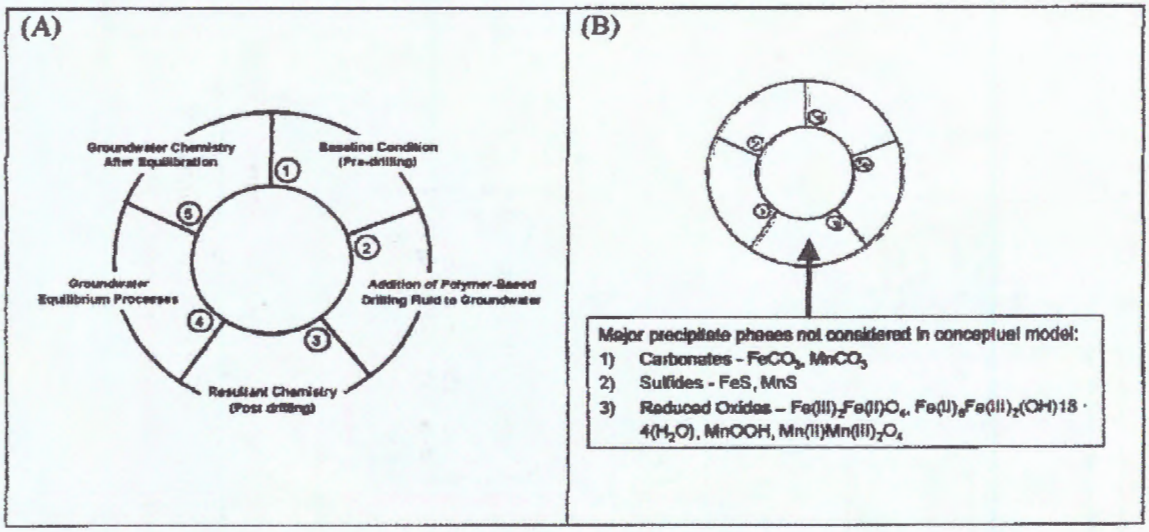


Figure 1. Illustration of certain aspects of solid phase chemistry not considered in the Bitner *et al.* (2004) conceptual model describing the evolution of aqueous and solid phase chemistry at well screens impacted by biodegradation of polymer-based drilling fluids. (A) Simplified depiction of the LANL conceptual model relative to the various stages of geochemical evolution in the impacted zone adjacent to the well screen. (B) Precipitation of major solid phases that can occur during Stage 3 reduction processes.

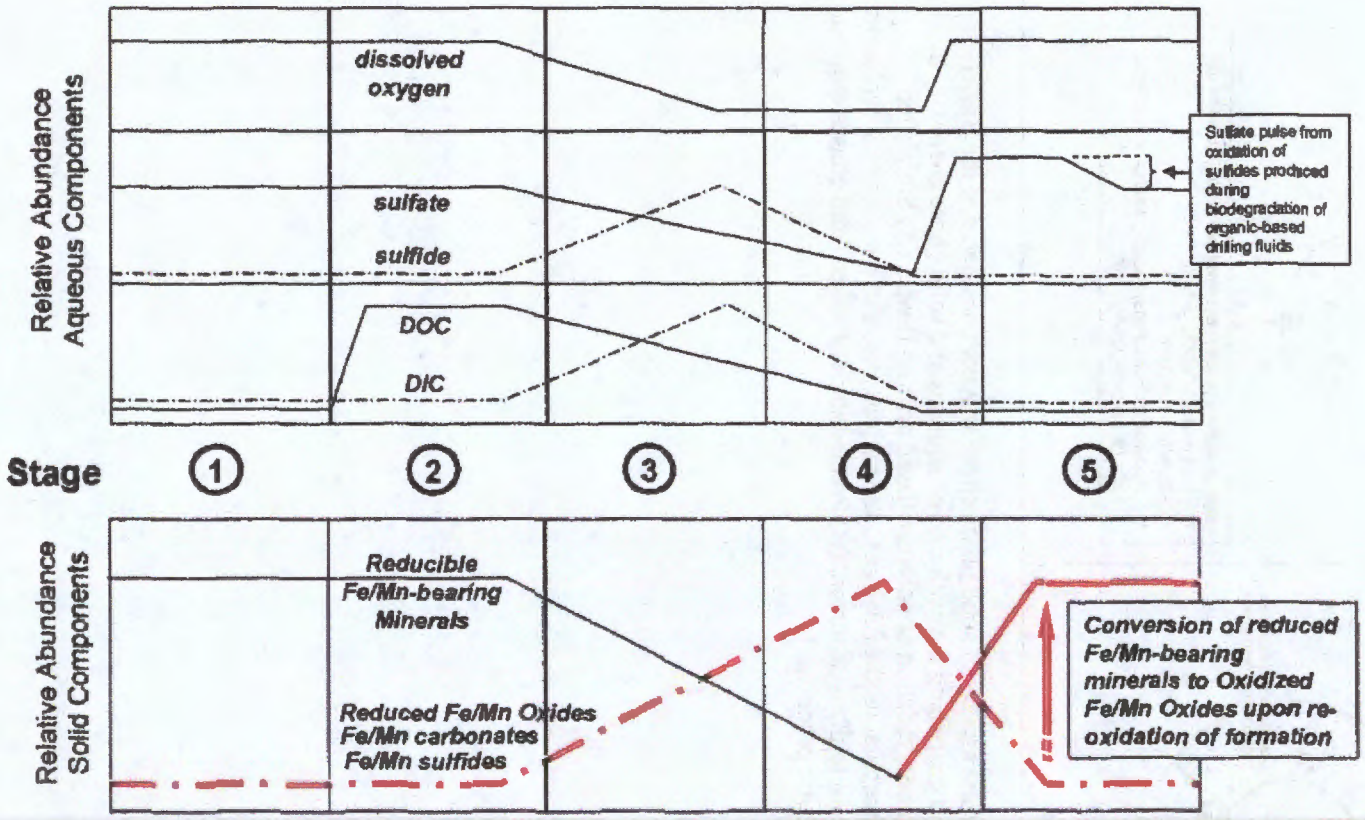


Figure 2. Schematic diagram depicting the evolution of aqueous and solid phase chemical components within the impacted zone of the aquifer adjacent to well screens impacted by the biodegradation of organic-based polymer drilling fluids. Changes in relative abundance of individual chemical components are depicted based on the current state-of-knowledge of mineral alterations that accompany organic biodegradation reactions (*i.e.*, microbially-driven iron-, manganese-, and sulfate-reduction) in subsurface environments.

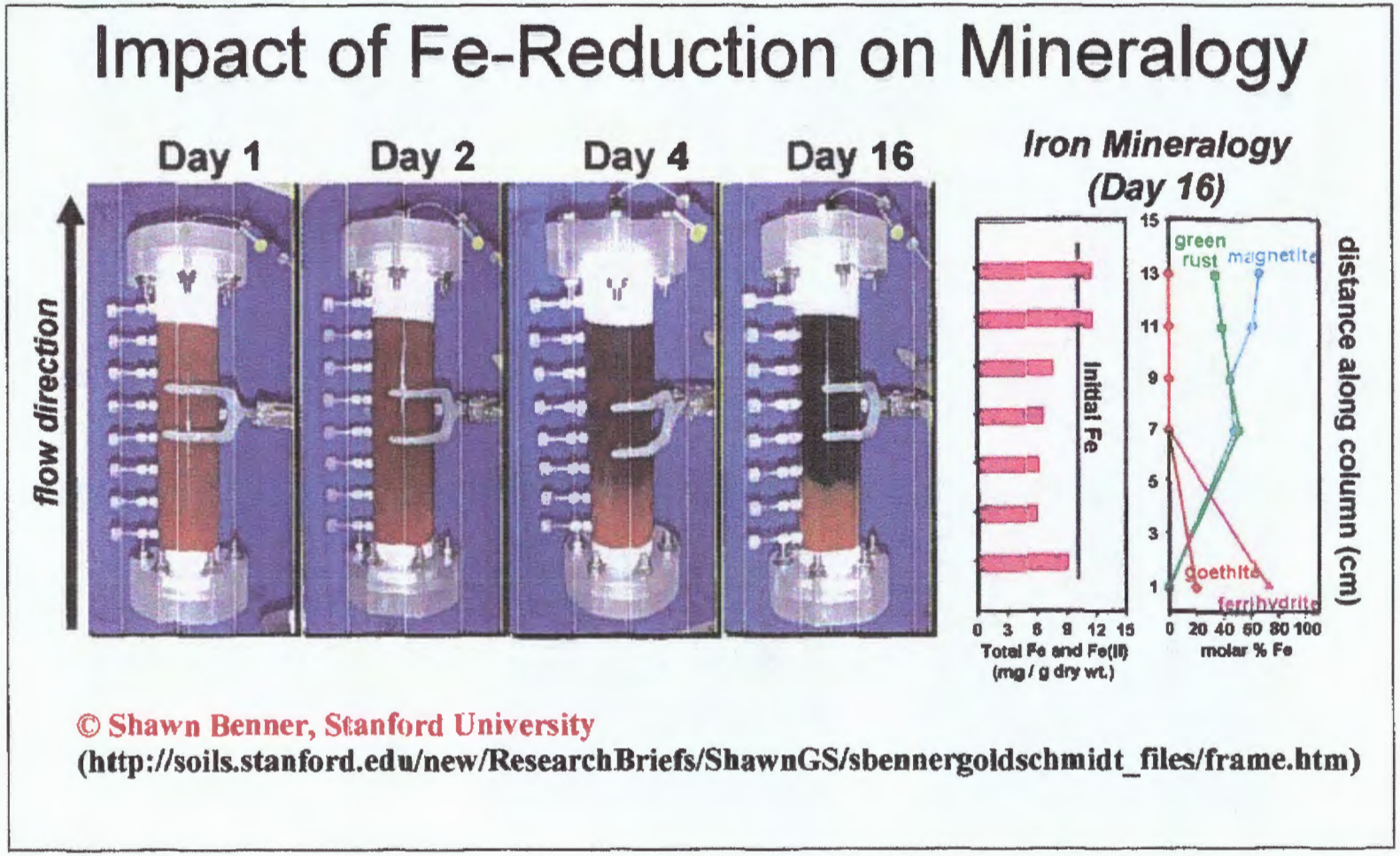


Figure 3. Illustration of transformations in iron oxide mineralogy induced by microbial processes that generate iron-reducing conditions. The starting Fe-bearing mineral was ferrihydrite, which was transformed to a mixture of ferrihydrite, goethite, magnetite, and green rust by day 16. The details of this experimental research are documented within Benner *et al.* (2002).

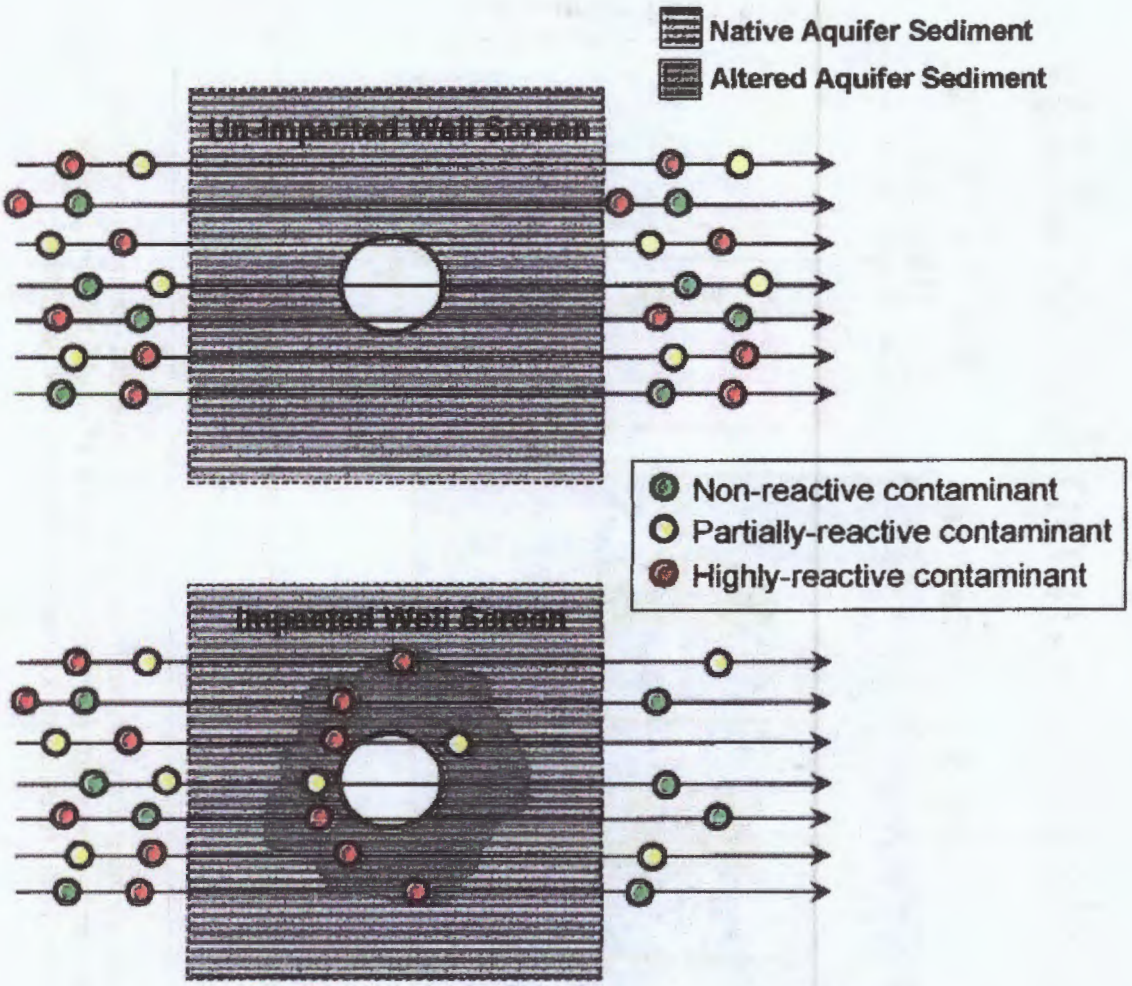


Figure 4. Conceptual schematic illustrating differential transport behavior of contaminants within the impacted zone adjacent to a well screen influenced by biodegradation of organic-based drilling fluids.

Table 1. Listing of drilling additives employed during implementation of the hydrogeologic characterization program at LANL.

Well	Elapsed Time Before Development (Days) **	Drilling Fluid *										Impact Category		
		EZ-MUD	QUIK-FOAM	TORKEASE	LIQUI-TROL	PAC-L	Bentonite	QUICK-GEL	N-SEAL	Magma Fiber	Soda Ash	Biodegradation	Bentonite	Both
		Polymer-based					Bentonite-based		Other					
R-1	11	■	■											
R-2	7	■	■			■	■				■		■	■
R-4	10	■	■			■	■				■		■	■
R-5	12	■	■											
R-7	16	■	■											
R-8	11	■	■											
R-9	115	■	■											
R-11	No report	■	■											
R-12	26	■	■	■										
R-13	33	■	■											
R-14	17	■			■		■						■	■
R-15	Chrono uncertain	■	■	■										
R-16	16	■	■		■			■	■	■	■			■
R-19	Chrono uncertain	■	■											
CdV-R-15-3	~92	■	■											
CdV-R-37-2	~25	■	■											
R-20	9		■		■	■		■	■				■	■
R-21	8	■	■											
R-22	~40	■	■											
R-23	20		■		■	■	■	■	■	■	■		■	■
R-25	64	■	■	■										
R-26	12	■	■											
R-28	30	■	■											
R-31	~31	■	■											
R-32	11	■	■		■	■		■	■	■			■	■
MCOBT-4.4	~23	■	■											
MCOBT-8.5	No well	■	■											
R-9i	Chrono uncertain	■												
CdV-16-1(i)	No report	■	■											
CdV-16-2(i)	No report	■	■											
CdV-16-3(i)	No report	■	■											

* Based on information presented in Table 1 of Bitner *et al.* (2004).

** Determined as the time from completion of the entire borehole to initiation of development activities.

Table 2. Documented examples where microbial degradation of organic compounds resulted in alteration of iron mineralogy under iron- and sulfate-reducing conditions.

Starting Mineralogy	Reducing Conditions	Resultant Mineralogy	Reference
ferrihydrite	Iron-reducing	lepidocrocite, goethite, magnetite	Hansel *et al.*, 2005
ferrihydrite	Iron-reducing	magnetite, green rust, vivianite	Kukkudapu *et al.*, 2004
ferrihydrite	Iron-reducing	goethite, hematite, lepidocrocite, siderite, vivianite, magnetite, green rust	Zachara *et al.*, 2002
goethite, hematite	Iron-reducing	Fe(II) sorbed to goethite/hematite	Hansel *et al.*, 2004
poorly crystalline Fe(III) oxide	Iron- & sulfate-reducing	iron sulfide	Wersin *et al.*, 1991
ferrihydrite, lepidocrocite, goethite, magnetite, hematite	Abiotic reaction with dissolved sulfide	Fe(II) sorbed to iron oxide surface, FeS	Poulton *et al.*, 2004

Table 3. Listing of water-leachable chemical constituents present in drilling fluids employed during implementation of the hydrogeologic characterization program at LANL.

Analyte *	Concentration Unit	Bentonite	EZ-MUD	Quik-FOAM	TORKEASE	LIQUI-TROL	PAC-L	Soda Ash	Quick-gel	magma-fiber	n-seal	Regional Aquifer**	Intermediate Perched Zones**
Ag	ppm	<0.009					<0.2		<0.01		<0.01		
Al	ppm	0.229					3.860		1.006		5.971		
Alk(Lab)	ppm CaCO3	—					85657.377	1062213.067	17596.519		75253.562	150.000	65.000
As	ppm	1.374					<0.2		0.091		<0.01	<0.007	<0.007
B	ppm	1.008					<2		0.302		0.379		
Ba	ppm	0.018					1.103		0.101		0.209		
Be	ppm	<0.009					<0.2		<0.01		<0.01		
Br	ppm	0.275					<4		6.336		<0.2		
C DIC	ppm	—					295.915		156.886		25.779		
C DOC	ppm	—					195663.745		94.232		30.423	<12	<12
C TIC	ppm	—					—		—		—		
C TOC	ppm	—					—		—		—		
Ca	ppm	9.984					115.783		137.778		583.288	38.000	16.000
Cd	ppm	<0.009					<0.2		<0.01		<0.01		
Cl	ppm	116.332					20769.162		65.067		3.981	9.100	71.000
ClO3	ppm	<0.09					<4		<0.2		<0.2		
ClO4	ppm	1.191					—		—		—		
Co	ppm	<0.009					<0.2		<0.01		<0.01		
CO3	ppm	—					0.000	602459.000	556.000		910.000		
Cond.(F)	µS/cm	—					—		—		—		
Cond.(L)	µS/cm	—					—		—		—		
Cr	ppm	0.062					2.941		0.070		0.009		
Cs	ppm	<0.009					<0.2		0.020		<0.01		
Cu	ppm	0.062					3.492		0.131		0.171		
F	ppm	7.236					1630.287		10.560		16.017		
Fe	ppm	<0.09					6.514		0.503		<0.1		
Hardness	CaCO3 ppm	—					—		—		—		
HCO3	ppm	—					104380.000	58700.000	19665.000		89959.000		
Hg	ppm	0.002					<0.02		<0.001		<0.001		
I	ppm	—					—		—		—		
K	ppm	6.046					33.084		15.387		80.084	5.100	7.500
Li	ppm	0.247					<0.2		0.704		0.266		
Mg	ppm	1.282					16.542		13.778		0.863		
Mn	ppm	0.016					0.368		0.080		<0.01		
Mo	ppm	2.473					<0.2		0.825		<0.01		
Na	ppm	1346.520					93553.127		5390.440		64.162	31.000	36.000
NH4	ppm	—					—		—		—		
Ni	ppm	0.016					0.368		0.040		0.019		
NO2	ppm	0.183					<4		<0.2		<0.2		
NO3	ppm	196.940					<4		237.340		<0.2	0.910	0.600
OH	ppm	—					—		—		—		
Oxalate	ppm	4.855					<4		<0.2		<0.2		
Pb	ppm	<0.0009					0.368		<0.01		<0.01		
pH	Lab	—					7.970	11.380	9.090		9.470		
PO4	ppm	6.504					10586.759		<0.5		<0.5		
Rb	ppm	0.011					<0.2		0.040		0.171		
Sb	ppm	0.056					<0.2		<0.01		0.020		
Se	ppm	0.092					<0.2		0.191		0.066		
Si	ppm	204.268					110.279		159.903		211.347		
SiO2	ppm calc	437.134					235.996		342.192		452.283		
SO4	ppm	1007.600					<4		9483.553		95.722	17.200	11.300
S2O3	ppm	—					—		—		—		
Sn	ppm	<0.009					<0.2		<0.01		<0.01		
Sr	ppm	0.030					0.551		2.011		1.137		
Th	ppm	<0.009					<0.2		<0.01		0.023		
Tl	ppm	<0.009					<0.4		<0.02		<0.02		
Tl	ppm	<0.009					<0.2		<0.01		0.023		
U	ppm	0.070					<0.2		0.040		0.023		
V	ppm	0.128					<0.4		<0.02		0.152		
Zn	ppm	<0.009					<0.4		<0.02		<0.02		
TDS	ppm	—					231339.313		36259.586		92184.026		
Acetate	ppm	++					+		-		-		
Formate	ppm	++					+		-		-		

No data reported for these analytes.

Indicates analyte with elevated concentration that may serve as a useful indicator for water quality in impacted well screens.

* Data were copied from Excel file (Drilling_Additives.xls) provided by Patrick Longmire/LANL to Richard Mayer/R6 via e-mail on April 19, 2005.

** Maximum background concentration; data were derived from Table 4.3-1 (LANL, 2005b) and/or LANL (2005a), Appendix C.

Appendix A

Screening Tables Template
(LANL, 2005b)

The following tables were provided by LANL via electronic mail and dated September 6, 2005.

Table 4.3-1

Background Values for Key Indicator Species Used in this Assessment

Analyte	Units	Regional Aquifer			Intermediate Perched Zones			Tier criteria
		Minimum	Maximum	Mean	Minimum	Maximum	Mean	
Field parameters								
Field alkalinity (as HCO_3)	mg/L	65	150	103	34	65	54	2.2-3, 2.2-5
Field pH	SU	6.5	8.3	7.6	6.7	8.0	7.4	2.2-3, 2.2-5
Turbidity (nonfiltered)	NTU	0	5.4	2.0	0	27	7.3	2.1-1, 2.1-6
General Inorganics								
Calcium	mg/L	9.1	38	16	5.8	16	9.4	*not used*
Chloride	mg/L	1.7	9.1	3.2	0.53	71	6.9	*not used*
Magnesium	mg/L	0.23	8.4	2.7	1.2	6.1	2.8	*not used*
Nitrate and Nitrite (NO_3+NO_2-N)	mg/L	0.025	0.91	0.32	0.001	0.5	0.3	2.2-4, 2.2-5
Potassium	mg/L	1.4	5.1	2.4	1.5	7.5	3.5	*not used*
Sodium	mg/L	9.4	31	18	4.4	36	9.2	2.1-1, 2.1-6
Sulfate	mg/L	1.8	17.2	4.7	0.95	11.3	4.4	2.1-1, 2.1-6 2.2-2, 2.2-5
Metals								
Barium	µg/L	1.9	110	36	5	110	29	*not used*
Boron	µg/L	4.6	51	23	1	13	7.4	2.1-1, 2.1-6
Iron	µg/L	3.65	131	27	3.65	1560	170	2.2-3, 2.2-5
Manganese	µg/L	0.025	57	4.7	0.05	9	2.4	2.2-3, 2.2-5
Strontium	µg/L	42	510	192	42	164	76	2.1-2, 2.1-6
Uranium	µg/L	0.195	2.8	0.88	0.11	0.84	0.31	2.1-1, 2.1-2, 2.1-6
Zinc	µg/L	0.26	80	13	0.26	33	5.3	2.1-2

SU=standard units, pH=-log[H+]

Table 4.4-1

Tier 1 Questions and Criteria for Effects of Residual Drilling Materials

Tier 1 Issue:	**Does the screen interval produce groundwater samples that are free of any residual effects from drilling fluids or muds, and that are reliable and representative of the groundwater*?**		
	Note: The assessment criteria in this table are applicable to the three most recent characterization and/or surveillance samples for the screen. If less than three samples are available for this purpose, then the outcome is considered "Preliminary."		
Tier	**Screening Question**	**Assessment Criteria**	**Consequence of "NO" response**
1-1	Is residual bentonite mud known to be absent from the screen interval?	• If the well was not drilled using bentonite mud, answer YES. • If the well was drilled using bentonite mud, answer NO.	If NO, then tier 2.1 questions are applicable to identify the extent to which analytes or PCOCs may be affected by residual bentonite.
1-2	Is residual organic drilling fluid known to be absent from the screen interval?	• If the well was not drilled using organic drilling fluids, answer YES. • If the well was drilled using organic drilling fluids, answer NO.	If NO, then tier 2.2 questions are applicable to identify the extent to which analytes or PCOCs may be affected by residual organic drilling fluids or reducing conditions.
If the answer is YES for both questions, then it is concluded that the screen interval produces groundwater samples that are representative of predrilling conditions for all analytes and PCOCs. **It is not necessary to proceed to either of the Tier 2 sets of questions.**			

* In this report, "groundwater" refers only to water from perched intermediate zones or the regional aquifer. The methodology used in this report is not applicable to water from alluvial zones.

Table 4.5-1

Tier 2.1 Questions and Criteria for Residual Bentonite

Tier 2.1 Issue: Has residual bentonite been sufficiently removed such that it does not interfere with transport of contaminants into the screen interval[a]?

Note: The assessment criteria in this table are applicable to the three most recent characterization and/or surveillance samples for the screen. If less than three samples are available for this purpose, then the outcome is considered "Preliminary."

Tier	Screening Question	Assessment Criteria[b]	Consequence of "NO" response
2.1-1	Evaluation of bentonite as a potential source term: Have all indicators of bentonite mud been removed from the screen interval?	2.1-1a Are concentrations of the following species all within the upper range of background concentrations in groundwater? For well screens in the regional aquifer: – Is B < 0.051 mg/L? – Is SO_4 < 17 mg/L? – Is Na < 31 mg/L? – Is U < 0.0028 mg/L? For well screens in intermediate perched zones: – Is B < 0.013 mg/L? – Is SO_4 < 11 mg/L? – Is Na < 36 mg/L? – Is U < 0.0008 mg/L?	If NO for any analyte, then flag any detections of the following analytes as possibly elevated above predrilling concentrations due to desorption from residual bentonite: General inorganic analytical suite: Alkalinity, K, Mg, Na, Br, Cl, F, NO_3, Total P, SO_4 Metals analytical suite: As, Ba, B, Cr, Cu, Hg, Mn, Mo, Ni, Sb, Se, U, V Radionuclide analytical suite: U-234, U-235, U-238
2.1-2	Evaluation of bentonite as a potential sink: Are water-quality data reliable and representative for general inorganics, metals, and radionuclides that would adsorb onto residual bentonite if present?	2.1-2a. Is the concentration of dissolved Sr > 0.042 mg/L (the minimum background concentration for groundwater)?	If NO, then flag the following analytes as possibly less than predrilling concentrations due to adsorption onto residual bentonite: Ca, Mo, Sr, V Sr-90
		2.1.2b. Is the concentration of dissolved U above the minimum background concentration for groundwater? For screens in the regional aquifer: – Is U > 0.0002 mg/L? For screens in intermediate perched zones: – Is U > 0.0001 mg/L?	If NO, then flag the following analytes as possibly less than predrilling concentrations due to adsorption onto residual bentonite: U, U-234, 235, 236, 238

Tier 2.1 Issue: Has residual bentonite been sufficiently removed such that it does not interfere with transport of contaminants into the screen interval[a]?

Note: The assessment criteria in this table are applicable to the three most recent characterization and/or surveillance samples for the screen. If less than three samples are available for this purpose, then the outcome is considered "Preliminary."

Tier	Screening Question	Assessment Criteria[b]	Consequence of "NO" response
		2.1.2c. Is the concentration of dissolved Zn above the instrument detection limit? Note: Zn is considered here to be an appropriate indicator species for the adsorption behavior of metal cations and Cs-137, Co-60, Eu isotopes, and Nd-147.	If NO, then flag any nondetects of the following analytes as possibly less than predrilling concentrations due to adsorption onto residual bentonite: Metals: Ag, Be, Cd, Cr, Cs, Co, Cu, Fe, Pb, Hg, Mn, Mo, Ni, Sb, Tl, Zn Radionuclides: Cs-137, Co-60, Eu-152, Eu-154, Eu-155, La-140, Nd-147
		2.1.2d. Some radionuclides adsorb so strongly to clays, including bentonite, that they are rarely detected in groundwater. As a result, we are not aware of any suitable indicator species that are routinely measured and that can be used to evaluate whether or not the nondetects are representative of groundwater concentrations.	Flag any nondetects of the following analytes as possibly less than predrilling concentrations due to adsorption onto residual bentonite: Am-241, Ce-139, Ce-141, Ce-144, Pu-238,239,240, Ra-226, Ra-228
2.1-3	Are water-quality data reliable and representative for HE and HE degradation products?	NO for HE and HE degradation products with an adsorption coefficient (Kd) greater than 1 mL/g. YES for all other relevant HE and HE degradation products because these do not adsorb or partition onto bentonite.	Flag the following HE and HE degradation products: *{to be determined following literature review}*
2.1-4	Are water-quality data reliable and representative for Herbicides, Pesticides, PCBs, Dioxins, and Furans?	NO for herbicides, pesticides, PCBs, and dioxins. These species are assumed to partition or adsorb strongly onto bentonite, with Kd values much greater than 1 mL/g. YES for furans. These species adsorb poorly onto bentonite, with Kd values less than 1 mL/g.	Flag all herbicides, pesticides, PCBs, and dioxins.
2.1-5	Are water-quality data reliable and representative for SVOAs/VOAs (LANL Specific)?	NO for SVOAs/VOAs that have an adsorption coefficient (Kd) greater than 1 mL/g. YES for all other SVOAs/VOAs because these adsorb poorly onto bentonite, with Kd values less than 1 mL/g.	Flag the following SVOAs/VOAs: – Xylene[1,3-] [meta] – Trichlorobenzene[1,2,4-] – Trichlorobenzene[1,2,3-] – Dioxins, PCBs, and pesticides – Polynuclear aromatic hydrocarbons (PAHs)
2.1-6	Are water-quality data reliable and representative for Diesel Range Organics (DROs)?	NO for DRO species. These long-chain aliphatic hydrocarbons are assumed to adsorb or partition strongly onto bentonite, with Kd values greater than 1 mL/g.	Flag all DRO analytes.

[a] In this report, "groundwater" refers only to water from perched intermediate zones or the regional aquifer. The methodology used in this report is not applicable to water from alluvial perched zones.

[b] Responses should be based on analytical results obtained for filtered samples.

Table 4.5-2

Tier 2.2 Questions and Criteria for Residual Organic Drilling Fluids

Tier 2.2 Issue: Have the effects of residual organic drilling fluids been sufficiently removed such that groundwater samples are reliable and representative of the groundwater[a]?

Note: The assessment criteria in this table are applicable to the three most recent characterization and/or surveillance samples for the screen. If less than three samples are available for this purpose, then the outcome is considered "Preliminary."

Tier	Screening Question	Assessment Criteria[b]	Consequence of "NO" response
2.2-1	Have residual organic drilling fluids been removed from the screen interval?	Are all of the following conditions met the last 3 times that these analytes were measured? – Are DOC/TOC < 2 mg/L? – Is TKN < 0.4 mg/L? – Is Ammonium (as N) < 0.07 mg/L? – Are concentrations of acetone and/or isopropyl alcohol below the detection limit?	If NO, flag any detected concentrations of the following analytes as possibly greater than predrilling concentrations due to the presence of residual organic fluids: – DOC, TOC, TKN, Ammonia (as N), acetone, isopropyl alcohol Note: This flag is not applicable to any non-detects for these analytes.
2.2-2	Is sulfur present in its oxidized (SO_4) form?	Is SO_4 detected?	If NO, then flag the following analytes as possibly less than predrilling concentrations due to chemical transformation, desorption from Fe/Mn (oxy)hydroxides, or mineral precipitation under sulfate-reducing conditions. General inorganic analytical suite: Alkalinity, Ca, NO_2+NO_2-N, SO_4, ClO_4 Metals analytical suite: Ag, As, Ba, B, Be, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn Radionuclide analytical suite: Am-241, Ce-139, Ce-141, Ce-144, Cs-137, Co-60, Eu-152, Eu-154, Eu-155, La-140, Nd-147, Pu-238,239,240, Ra-226, Ra-228, Sr-90, U-234,235,236,238 All HE and HE degradation products All herbicides, pesticides, PCBs, dioxins, and furans All Diesel Range Organics All SVOAs and VOAs
If YES for question 2.2-2, then continue to the next question. If NO, there is no need to proceed further.			

Tier 2.2 Issue: Have the effects of residual organic drilling fluids been sufficiently removed such that groundwater samples are reliable and representative of the groundwater[a]?

Note: The assessment criteria in this table are applicable to the three most recent characterization and/or surveillance samples for the screen. If less than three samples are available for this purpose, then the outcome is considered "Preliminary."

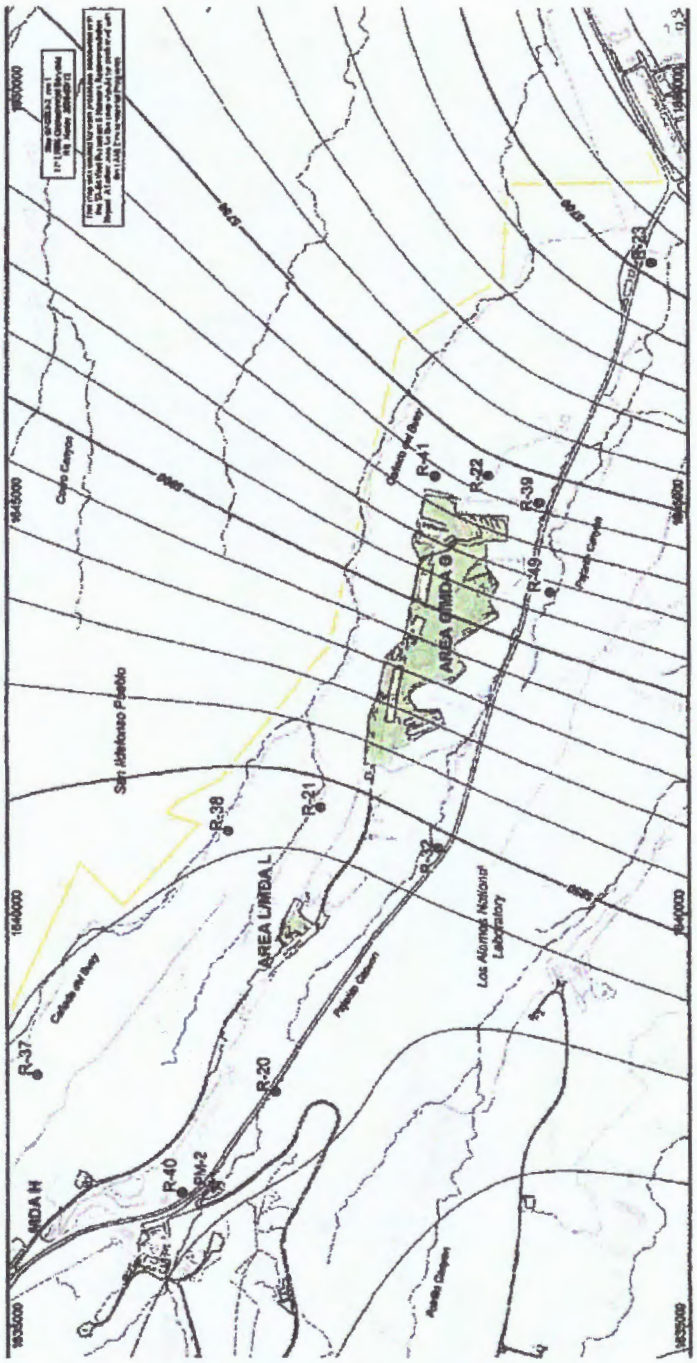
Tier	Screening Question	Assessment Criteria[b]	Consequence of "NO" response
2.2-3	Have redox conditions been restored to oxidizing conditions with respect to SO_4, Fe and Mn?	**If YES for 2.2-2 (above), then** are all of the following conditions also met? – Is field pH between 6.5 and 8.3? – Is dissolved Fe < 130 µg/L? – Is dissolved Mn < 60 µg/L? – Is field alkalinity (as HCO_3) < 150 mg/L (for well screens in the regional aquifer) or < 65 mg/L (for well screens in intermediate perched zones)?	If NO, then flag the following analytes as possibly not reliable or representative of predrilling concentrations due to chemical transformation, desorption from Fe/Mn (oxy)hydroxides, or mineral precipitation under reducing conditions. General inorganic analytical suite: Alkalinity, Ca, NO_3+NO_2-N Metals analytical suite: Ag, As, Ba, B, Be, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn Radionuclide analytical suite: Am-241, Ce-139, Ce-141, Ce-144, Cs-137, Co-60, Eu-152, Eu-154, Eu-155, La-140, Nd-147, Pu-238,239,240, Ra-226, Ra-228, Sr-90, U-234,235,236,238 All SVOAs and VOAs
If YES for question 2.2-3, then continue to the next question. If NO, there is no need to proceed further.			
2.2.4	Have redox conditions been restored to oxidizing conditions with respect to NO_3 and dissolved oxygen (DO)?	**If YES for 2.2-2 and 2.2-3 above, then** are both of the following conditions also met? – Is NO_3+NO_2-N detected? – Is field DO > 0.1 mg/L?	If NO, then flag the following analytes as possibly not reliable or representative of predrilling concentrations: General inorganic analytical suite: Alkalinity, Ca, NO_3+NO_2-N All SVOAs and VOAs
If YES for all of the above criteria, then it is concluded that residual organic drilling fluids have been sufficiently removed, and that redox conditions have been restored, such that there are no residual impacts of these products on analytes in this screen interval.			

Figure 3. RCRA regulated units MDA G, MDA L and MDA H at LANL TA-54

- The distance from the northern boundary of MDA L to well R-38 is ~ 1/4 mile

- The contour lines are the elevation of the water table of the regional aquifer

- The R-wells are the monitoring wells installed in the regional aquifer.



Source: Figure 2.3-13 *"Regional monitoring wells, water supply wells, and groundwater gradient" in* LANL Report *MDA G CME Report – Rev 1* (LA-UR-09- 5509 September 2009).

EXHIBIT
12

Permit

Permit

GROUND WATER MONITORING EXEMPTION REQUEST

Pursuant to: 40 CFR 264.90 (b) (4) and

40 CFR 265.90 (c)

November 1, 1984

14832

"NOT FOR PUBLIC DISSEMINATION.
THIS DOCUMENT CONTAINS INFORMATION
THAT MAY BE SUBJECT TO SECTION 148
OF THE ATOMIC ENERGY ACT, AS AMENDED."

Filed Nov 1, 1984
Enforcement File

UCNI

0390
Permit

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

RECEIVED
EPA REGION VI
FEB 03 1986
Hazardous Waste Management Div.

RECEIVED
JUL 14 1986
HAZARDOUS WASTE COMPLIANCE BRANCH

January 31, 1986

MEMORANDUM

SUBJECT: Compliance Status and Issues at Los Alamos National Laboratory, New Mexico

FROM: William N. Rhea, Chief
Hazardous Waste Compliance Branch

TO: Allyn M. Davis, Director
Hazardous Waste Management Division

Attached is a briefing sheet regarding the current compliance status and other issues at Los Alamos National Lab. Also attached is a map of the facility with hazardous waste unit areas highlighted. The known RCRA units are as follows:

TA-54	Area G and Area L landfill container storage area
TA-16	Area P landfill HE burn pads recently discovered surface impoundment
TA-3	LiH storage area
TA-50	Incinerator 5000 gal. treatment tank

14870

CA Exhibit 13

Briefing Sheet

Los Alamos National Laboratory (LANL) is a federal facility in Los Alamos, New Mexico. EPA I.D. Number NM0890010515. There are many issues regarding permitting and compliance at LANL.

(1) LANL has requested a waiver from groundwater monitoring at TA-54, which includes the Area G and Area L landfills. The waiver was inadequate and NMEID issued a C.O. May 7, 1985, with a schedule which allowed LANL until March 1987 to submit the information required to substantiate the waiver. On November 5, 1985, Peter Pache of NMEID sent a letter to Tony Drypolcher at LANL approving the waiver. The Compliance Order has not been withdrawn and in the letter NMEID states that LANL is still required to submit the information required to substantiate a § 265 waiver. LANL cannot demonstrate for a § 264 groundwater monitoring waiver. As a result LANL has indicated they wish to close Area G and Area L. However, no closure plans have been submitted and only Area L has been included in the Part B. (Technical Section has a copy of the waiver and is reviewing it).

ISSUES:

- Does EPA accept NMEID's approval of the waiver? Does Peter Pache have the authority to approve such a waiver?

- Regardless of the waiver, Area G has lost interim status because it was not included in the Part B. However, it is most likely still receiving solid waste and possibly RCRA waste.

- Area L is still receiving waste and has a Part B. Is the waiver valid?

(2) LANL was in violation of the inspection plan requirements in the May 7, 1985 Compliance Order for 100 days. NMEID proposed a civil penalty of $100,000. LANL and NMEID are coming to some sort of an agreement whereby LANL will purchase safety equipment, provide training, and perform some environmental studies for NMEID.

ISSUES:

- If this is not yet settled, can EPA issue enforcement actions?

- Does this type of settlement involve conflict-of-interest?

(3) It is suspected by EPA and NMEID that all units which should be regulated by RCRA have not been brought to our attention and have not been inspected. This is due to LANL's interpretation of the regulations and their reluctance to show inspectors areas which may be secured. There is a possibility that LANL has constructed a surface impoundment in the past year which should be RCRA regulated.

(4) Los Alamos responded to EPA's request for information on SWMU's and releases by submitting a document which discussed locations where possible releases of radioactive elements may have occurred with one exception. LANL sent a copy of a two-page memo which discussed evidence of a release of organics in the Area L landfill.

(5) Some radioactive-mixed hazardous waste is regulated under RCRA. When the definition of byproduct, source, and special nuclear material is published in the Federal Register, the number of units regulated at LANL may increase substantially.

(6) The PCB-approved incinerator has been burning radioactive-mixed hazardous waste. It was constructed prior to 1980, but it was not included on the original Part A. A Part B has been submitted to permit the unit. NMEID is considering granting interim status for the incinerator. This will provide for disposal of the laboratory waste so that the landfills can be closed.

(7) During the inspection on July 10-11, 1985, NMEID inspected a landfill at Area P. This landfill receives possibly reactive, Barium EP Toxic waste. This landfill has been receiving waste since 1980 and was never included in either the Part A or B. NMEID required LANL to submit a closure plan and cease receiving waste at the landfill. LANL has submitted the closure plan and NMEID is waiting for formal correspondance from LANL requesting closure before further action is taken on the closure plan. LANL has also "lost" a 250 gallon tank. The tank was on the original Part A, never went through closure, and LANL doesn't know where the tank is now.

(8) The Part B is currently under review by NMEID after LANL responded to an NOD in November 1985.

are rather rare.

5. Population Distribution. Los Alamos County has an estimated 1983 population of 18 500 (based on the 1980 census adjusted for 1983). Two residential and related commercial areas exist in the county (see Fig. 7 area (including the residential areas of White Rock, La Senda, and Pajarito Acres) has about 6896 residents. About one-third of those employed in Los Alamos commute from other counties. Population estimates for 1983 place about 162 000 people within an 80 km (50 mi) radius of Los Alamos.

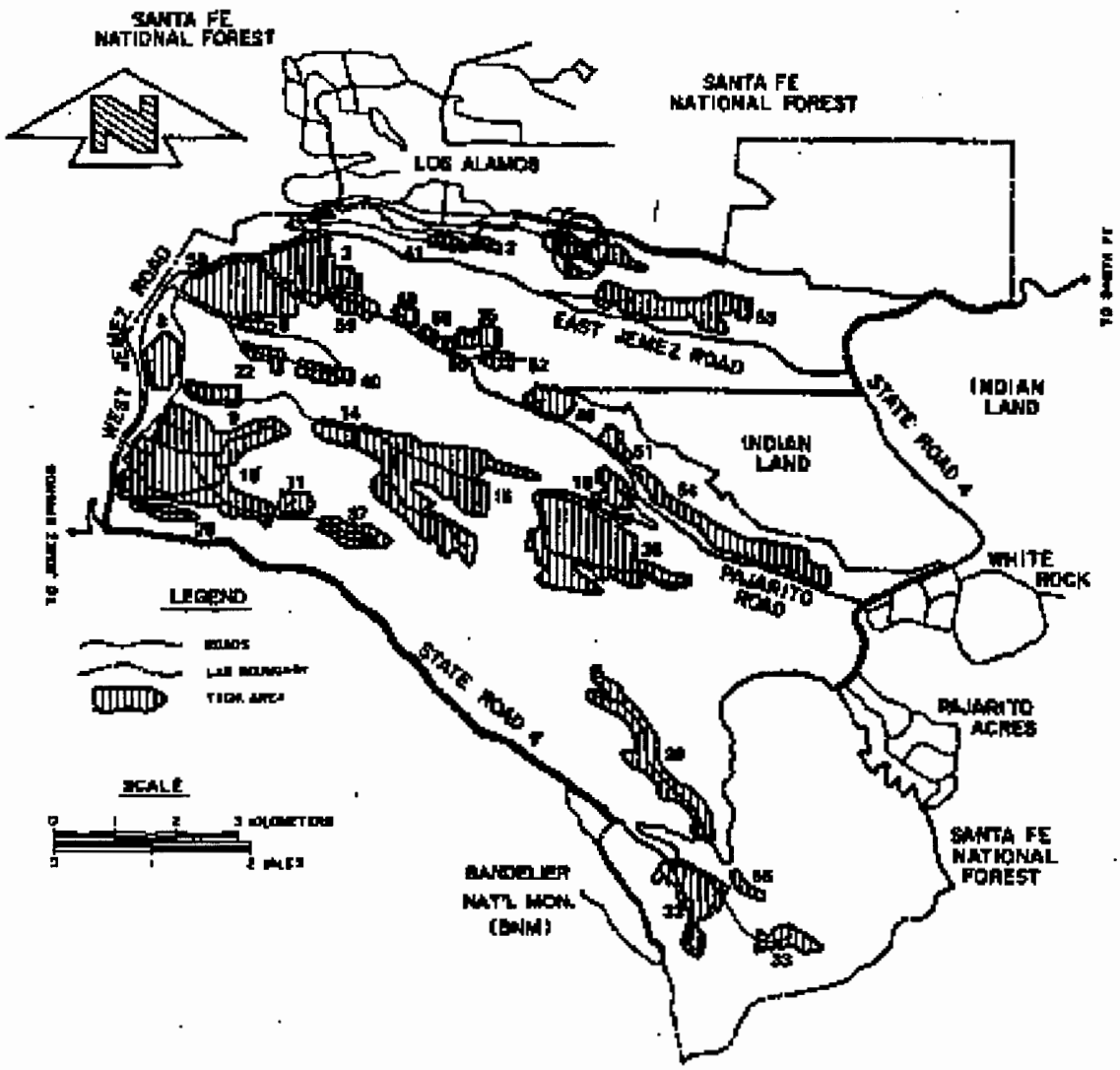
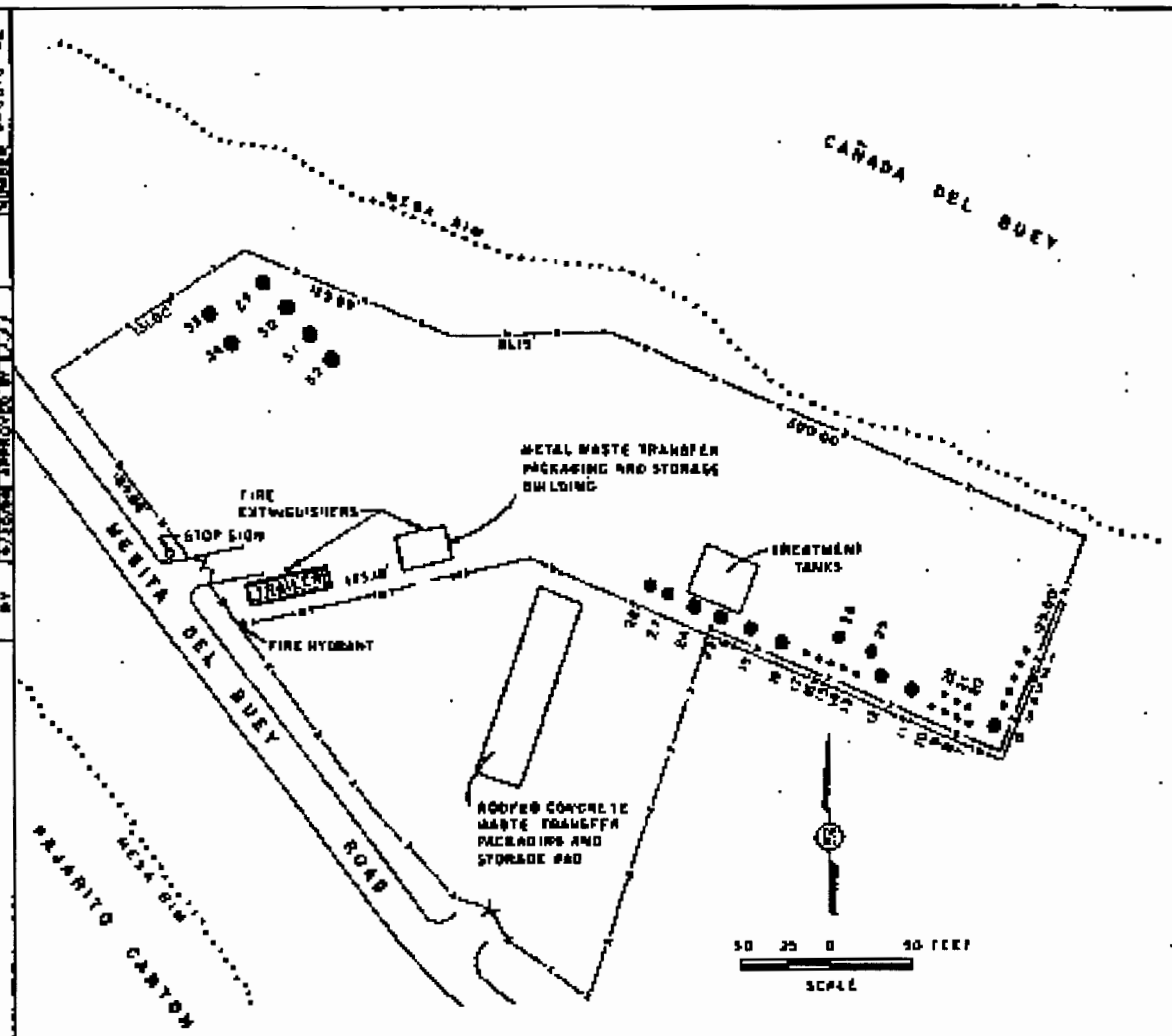


Fig. 7. Los Alamos National Laboratory's technical areas and adjacent communities.

Hazardous waste units located in these areas



SHEET NO.	[illegible]	DATE BUILTIN	DATE CAPPED	CONTENTS
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22	1	[illegible]	[illegible]	[illegible]
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39	1	[illegible]	[illegible]	[illegible]
40	1	[illegible]	[illegible]	[illegible]

NOTES:
(1) [illegible]
(2) [illegible]
(3) [illegible]
(4) [illegible]
(5) [illegible]

FIGURE 2-5

TA-54 AREA L
WASTE MANAGEMENT FACILITIES

PREPARED FOR

LOS ALAMOS NATIONAL LABORATORY
LOS ALAMOS, NEW MEXICO

IT CORPORATION

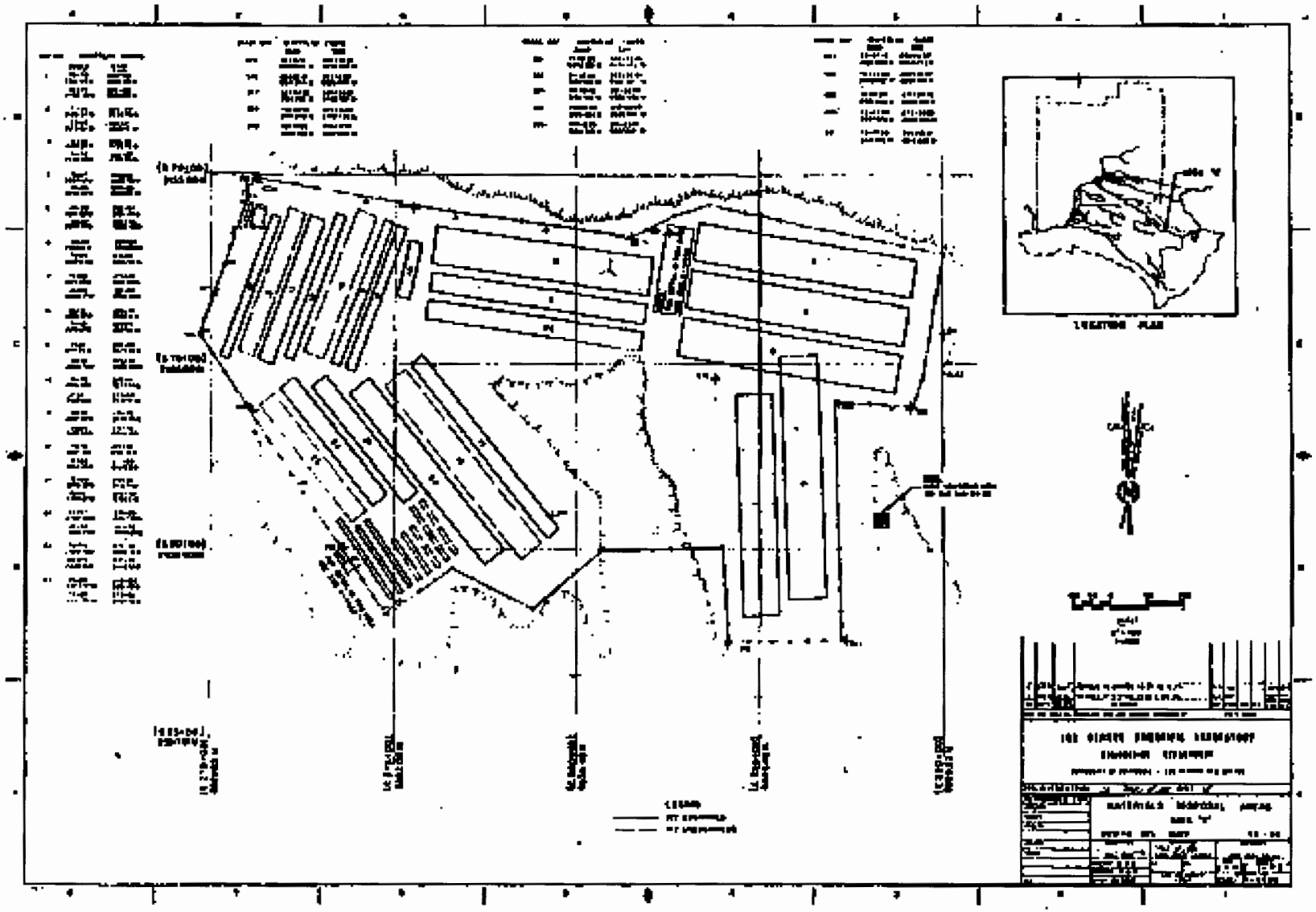

Fig. G-1.
Materials Disposal Area G, Mesita del Buey, TA-54.

0390
Permit

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

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Hazardous Waste Management Div.

January 31, 1986

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HAZARDOUS WASTE COMPLIANCE BRANCH

MEMORANDUM

SUBJECT: Compliance Status and Issues at Los Alamos National Laboratory, New Mexico

FROM: William N. Rhea, Chief
Hazardous Waste Compliance Branch

TO: Allyn M. Davis, Director
Hazardous Waste Management Division

Attached is a briefing sheet regarding the current compliance status and other issues at Los Alamos National Lab. Also attached is a map of the facility with hazardous waste unit areas highlighted. The known RCRA units are as follows:

TA-54	Area G and Area L landfill container storage area
TA-16	Area P landfill HE burn pads recently discovered surface impoundment
TA-3	LiH storage area
TA-50	Incinerator 5000 gal. treatment tank

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Briefing Sheet

Los Alamos National Laboratory (LANL) is a federal facility in Los Alamos, New Mexico. EPA I.D. Number NM0890010515. There are many issues regarding permitting and compliance at LANL.

(1) LANL has requested a waiver from groundwater monitoring at TA-54, which includes the Area G and Area L landfills. The waiver was inadequate and NMEID issued a C.O. May 7, 1985, with a schedule which allowed LANL until March 1987 to submit the information required to substantiate the waiver. On November 5, 1985, Peter Pache of NMEID sent a letter to Tony Drypolcher at LANL approving the waiver. The Compliance Order has not been withdrawn and in the letter NMEID states that LANL is still required to submit the information required to substantiate a § 265 waiver. LANL cannot demonstrate for a § 264 groundwater monitoring waiver. As a result LANL has indicated they wish to close Area G and Area L. However, no closure plans have been submitted and only Area L has been included in the Part B. (Technical Section has a copy of the waiver and is reviewing it).

ISSUES:

- Does EPA accept NMEID's approval of the waiver? Does Peter Pache have the authority to approve such a waiver?

- Regardless of the waiver, Area G has lost interim status because it was not included in the Part B. However, it is most likely still receiving solid waste and possibly RCRA waste.

- Area L is still receiving waste and has a Part B. Is the waiver valid?

(2) LANL was in violation of the inspection plan requirements in the May 7, 1985 Compliance Order for 100 days. NMEID proposed a civil penalty of $100,000. LANL and NMEID are coming to some sort of an agreement whereby LANL will purchase safety equipment, provide training, and perform some environmental studies for NMEID.

ISSUES:

- If this is not yet settled, can EPA issue enforcement actions?

- Does this type of settlement involve conflict-of-interest?

(3) It is suspected by EPA and NMEID that all units which should be regulated by RCRA have not been brought to our attention and have not been inspected. This is due to LANL's interpretation of the regulations and their reluctance to show inspectors areas which may be secured. There is a possibility that LANL has constructed a surface impoundment in the past year which should be RCRA regulated.

(4) Los Alamos responded to EPA's request for information on SWMU's and releases by submitting a document which discussed locations where possible releases of radioactive elements may have occurred with one exception. LANL sent a copy of a two-page memo which discussed evidence of a release of organics in the Area L landfill.

(5) Some radioactive-mixed hazardous waste is regulated under RCRA. When the definition of byproduct, source, and special nuclear material is published in the Federal Register, the number of units regulated at LANL may increase substantially.

(6) The PCB-approved incinerator has been burning radioactive-mixed hazardous waste. It was constructed prior to 1980, but it was not included on the original Part A. A Part B has been submitted to permit the unit. NMEID is considering granting interim status for the incinerator. This will provide for disposal of the laboratory waste so that the landfills can be closed.

(7) During the inspection on July 10-11, 1985, NMEID inspected a landfill at Area P. This landfill receives possibly reactive, Barium EP Toxic waste. This landfill has been receiving waste since 1980 and was never included in either the Part A or B. NMEID required LANL to submit a closure plan and cease receiving waste at the landfill. LANL has submitted the closure plan and NMEID is waiting for formal correspondance from LANL requesting closure before further action is taken on the closure plan. LANL has also "lost" a 250 gallon tank. The tank was on the original Part A, never went through closure, and LANL doesn't know where the tank is now.

(8) The Part B is currently under review by NMEID after LANL responded to an NOD in November 1985.

are rather rare.

5. Population Distribution. Los Alamos County has an estimated 1983 population of 18 500 (based on the 1980 census adjusted for 1983). Two residential and related commercial areas exist in the county (see Fig. 7 area (including the residential areas of White Rock, La Senda, and Pajarito Acres) has about 6896 residents. About one-third of those employed in Los Alamos commute from other counties. Population estimates for 1983 place about 162 000 people within an 80 km (50 mi) radius of Los Alamos.

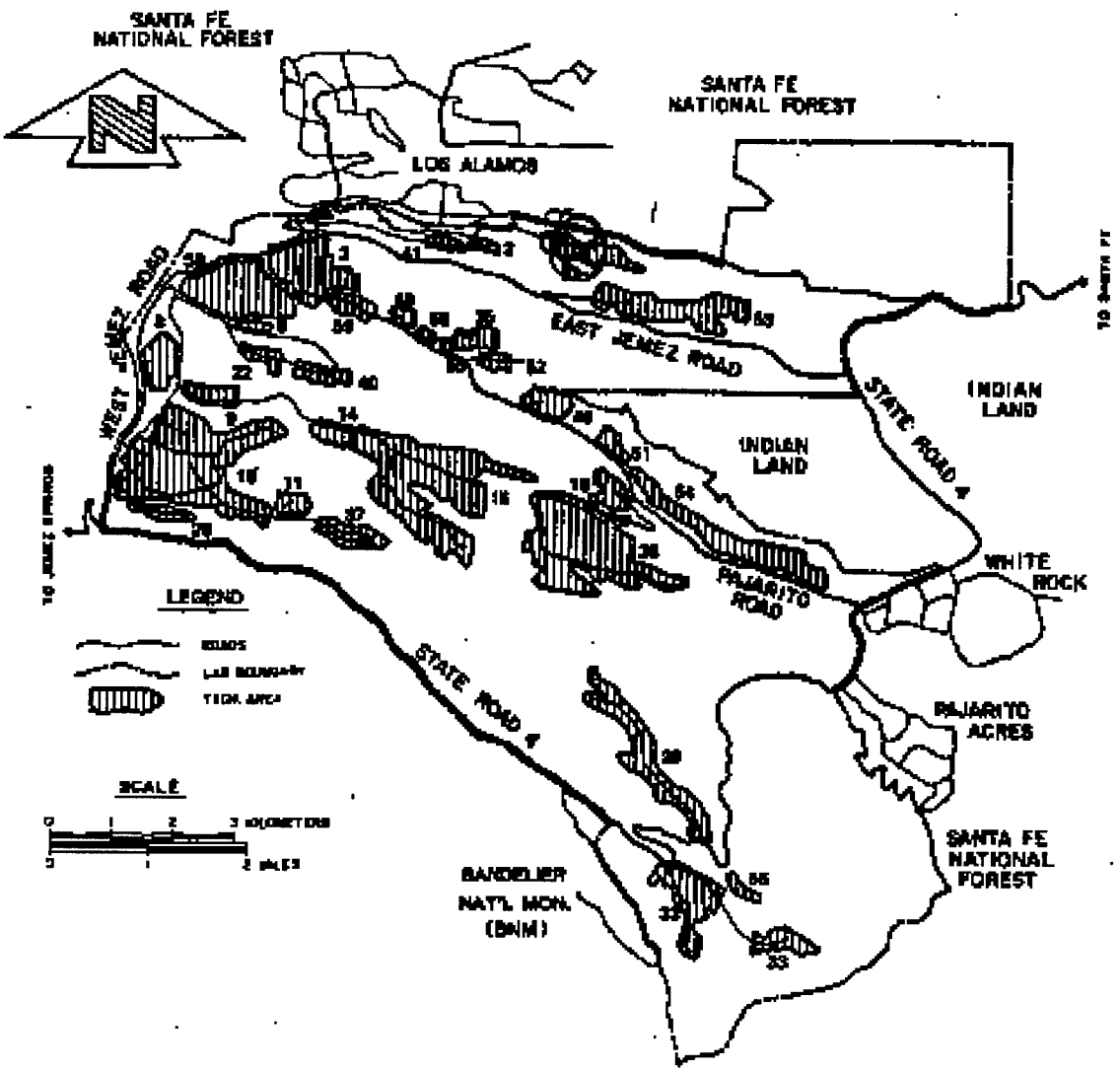

Fig. 7. Los Alamos National Laboratory's technical areas and adjacent communities.

Hazardous waste units located in these areas

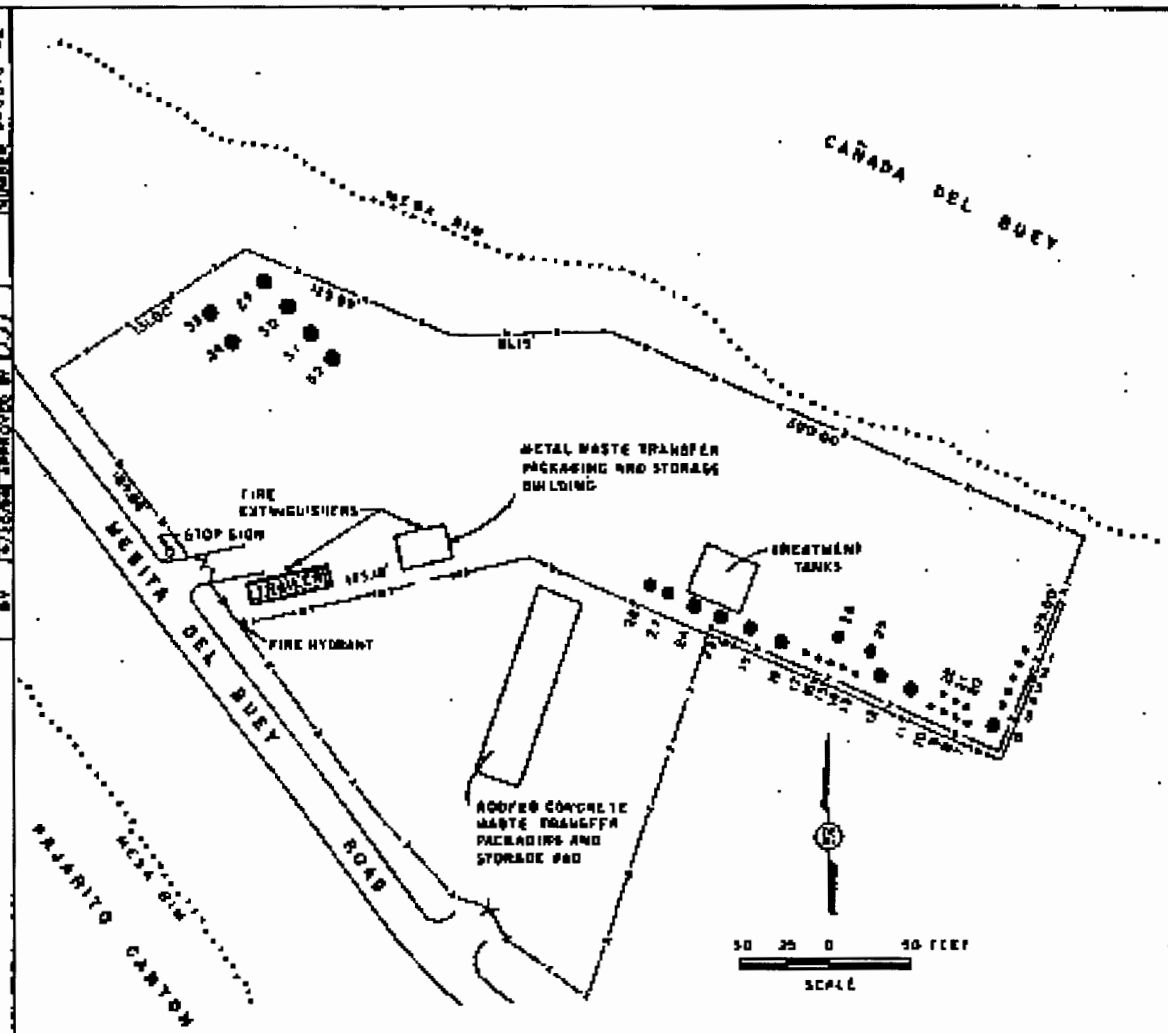

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FIGURE 2-9

TA-54 AREA L
WASTE MANAGEMENT FACILITIES

PREPARED FOR

LOS ALAMOS NATIONAL LABORATORY
LOS ALAMOS, NEW MEXICO

IT CORPORATION

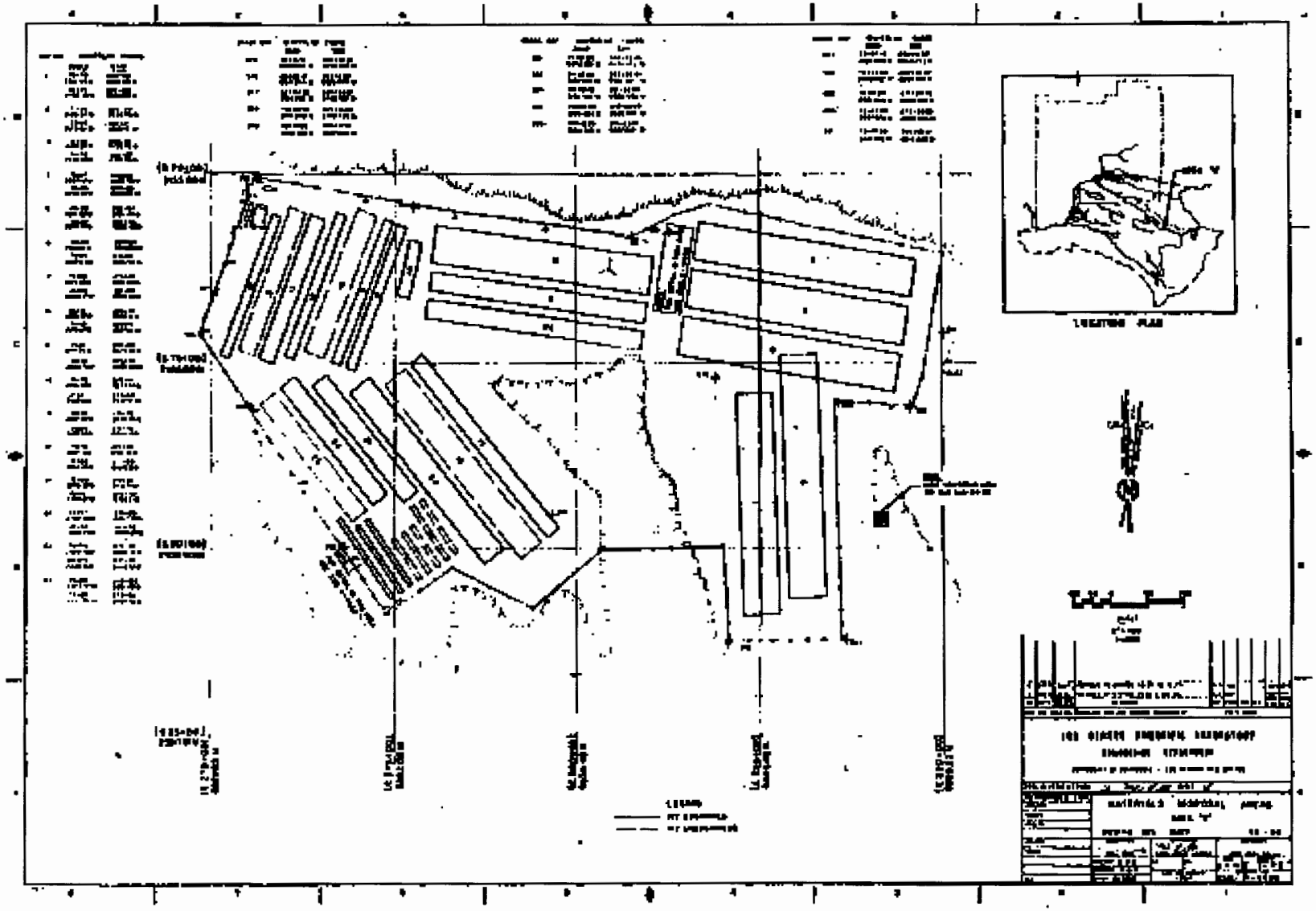

Fig. G-1.
Materials Disposal Area G, Mesita del Buey, TA-54.

LA-UR-07-6436
EP2007-0591

Technical Area 54 Well Evaluation and Network Recommendations, Revision 1

October 2007

Responsible project leader:

Responsible project leader:

Printed Name	Signature	Title	Organization	Date
Danny Katzman		Project Leader	Environmental Programs	10.4.07

Responsible LANS representative:

Printed Name	Signature	Title	Organization	Date
Susan G. Stiger		Associate Director	Environmental Programs	10/4/07

Responsible DOE representative:

Printed Name	Signature	Title	Organization	Date
for David R. Gregory		Project Director	DOE-LASO	10/5/07

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AR 30479

This objective is focused on an evaluation of the network from the perspective of whether there is some unknown aspect of nature and extent related to the physical, geochemical, or hydrologic status of wells that is sufficient to change or affect the remedy selection for MDAs H, L, and G. This objective is based in large part on the conceptual model and the nature of known releases from each of the MDAs.

2. Establish a groundwater-monitoring network that meets the requirements for "detection monitoring" and subsequent "compliance monitoring" at permitted units at TA-54.

   The following requirements from 40 CFR 264.90-.99, Subpart F apply to permitted units or regulated units that received waste after July 26, 1982. The regulations apply throughout the active life of the units and the closure and post-closure period if the units are not "clean-closed" under RCRA. The groundwater-monitoring network and facility process must be able to detect, evaluate, and respond to releases of hazardous waste or hazardous waste constituents into the uppermost aquifer. Detection monitoring is required to establish that a release has occurred. It is assumed that because of the significant depth to groundwater beneath TA-54, vadose-zone monitoring will be a key component of the overall monitoring program in support of both CMEs and the RCRA Part B permit.

   An integrated groundwater-monitoring system must consist of a sufficient number of near-field wells and downgradient monitoring wells installed at appropriate locations and depths to obtain representative groundwater samples from the uppermost aquifer. These samples must represent both the quality of background water not affected by the regulated unit and the quality of groundwater passing beneath the regulated unit to allow for detection of contamination in the uppermost aquifer.

3. Evaluate the configuration of the monitoring network to confidently protect water-supply wells and detect contaminants that may migrate off-site.

   This objective integrates water-supply protection with the above objectives to ensure that contaminants, if present, can be detected before reaching water-supply wells or the Laboratory boundary. The objective is met using sampling data and a groundwater-transport model that traces the path of hypothetical mobile contaminants from locations where contaminants might break through to the regional groundwater system. The model is used to assess the ability of the current well network to detect at least 95% of potential contaminants from TA-54 that might migrate toward a production well or pass beneath the Laboratory boundary. The current network configuration was found to be inadequate to detect for potential offsite releases. Therefore, this evaluation includes newly proposed well locations that are discussed below.

4.0 MONITORING NETWORK ASSESSMENT

The following table summarizes the evaluation of the physical and geochemical performance of the group of wells considered for TA-54 in the context of the monitoring objectives described in Section 3.0. The physical criteria include the effectiveness of sampling systems to provide representative groundwater data, well construction, and isolation of sampling zones. Also included are reviews of factors such as screen positions and screen length evaluated in the context of the conceptual model and monitoring objectives. Geochemical criteria include the consideration of conditions within the aquifer related to drilling operations that may result in sample data that do not meet monitoring objectives.

The GWPMPP serves as a Laboratory precursor and driver for the development of this Hydrogeologic Workplan. The GWPMPP issue of "hydrogeologic characterization" is addressed by this Workplan. The GWPMPP describes this issue with the following language:

> An ..."issue concerning the regional aquifer is the lack of hydrogeologic data. Not enough wells are completed to the regional aquifer to understand local and regional hydrogeologic properties. The depth and continuity of the regional aquifer is not well understood. Also, information is not available on the vertical stratification of the aquifer materials. Studies of the storage and transmissivity of the aquifer, as well as the physical characteristics of aquifer materials, need to be performed."

In addition to the GWPMPP, the Laboratory has received letters from the NMED which provide further impetus to create this Workplan. Specifically, DOE/Los Alamos Area Office (LAAO) received a letter dated May 30, 1995 from NMED denying the Laboratory's groundwater monitoring waiver requests. A second letter received by DOE/LAAO August 17, 1995 contained NMED comments and concerns regarding groundwater contamination and protection at the Laboratory, and required development of this Workplan. The two NMED letters are described in further detail in the following sections. Copies of these two key letters are provided in Appendix 1 and Appendix 2.

1.5.2 NMED Correspondence: May 30, 1995

NMED's letter of May 30, 1995 responds to correspondence during the late 1980's and early 1990's in which the Laboratory submitted documentation to support requests for waivers of groundwater monitoring requirements under RCRA. In response, NMED opined that the information provided did not fulfill the groundwater monitoring standards at 40 CFR 265. This was the basis for denial of the requests. The letter stated:

> "Los Alamos National Laboratory (LANL) has provided inadequate and incomplete information pertaining to the unsaturated and saturated conditions across the Pajarito Plateau in support of ground-water monitoring waivers for the various RCRA-regulated units (TA-54 Area G & L, TA-16 Surface Impoundment & Area P Landfill, TA-35-125 & 85 Surface Impoundments, and TA-53 Surface Impoundments). Basic geology, hydrogeology, and pathways for contaminant transport have not been adequately addressed to date."

The letter stated further:

> "Because these demonstrations, have not met the technical standards necessary for approval of ground-water monitoring waivers at the sites listed above, ground-water monitoring program plans will be required for LANL to be in compliance with 20 NMAC Subpart VI, 40 CFR 265 Subpart F regulations."
>
> "Although NMED does not relinquish any of New Mexico's regulatory or statutory authorities, these denials do not require immediate submittal of ground-water monitoring program plans for each closure. Instead, in light of DOE/LANL's budgetary constraints, a comprehensive ground-water monitoring program plan should be developed which addresses both site-specific and site-wide ground-water monitoring objectives. This may be achieved by modifying the existing site-wide Groundwater Protection Management Program Plan, Revision 1.0, March 6, 1995 to include regulatory site-specific considerations. NMED intends to coordinate with DOE/LANL in this site-wide approach."

The revisions to the GWPMPP were submitted as Revision 2.0 in October, 1995 (LANL, 1995c).

1.5.3 NMED Correspondence: August 17, 1995

NMED's letter dated August 17, 1995 expressed concerns over groundwater contamination and protection at the Laboratory as a result of an assessment of the Laboratory's groundwater protection program by the

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1.5.5 Other Requirements

In addition to the HSWA Module VIII requirements, numerous federal and state requirements are relevant to groundwater protection, groundwater monitoring, and hydrogeologic characterization. For example, DOE Order 5400.1 Environmental Protection, and the New Mexico Water Quality Control Commission Regulations (WQCC) both address groundwater characterization, monitoring, and protection. These two examples, as well as other relevant federal and state requirements have been technically considered in the preparation of this Workplan.

The structured groundwater monitoring requirements applied to regulated units under RCRA are prescriptive[2]. The New Mexico Annotated Code, Title 20, Chapter 4, Part 1 (20 NMAC 4.1) Subpart VI, Sections 264.91-100 establish three progressive monitoring programs that, unless a demonstration can be made that no potential for migration of liquid from the regulated unit to the uppermost aquifer exists, may be necessary to implement for detecting and addressing releases to groundwater. To adequately establish a monitoring network under any of these programs, it is necessary to characterize the subsurface (including groundwater) in a comprehensive manner.

It is the DOE and UC's intention to perform characterization activities set forth in this Workplan to ensure that information is gathered sufficient either to demonstrate an adequate groundwater monitoring waiver or to provide for the installation of a detection monitoring network (or both, as appropriate). If it is determined to be necessary, repetitive monitoring described in any of the three progressive monitoring programs will be performed outside the scope of this plan.

1.6 Groundwater Protection Strategy

The Laboratory has developed a Groundwater Protection Strategy (Strategy) [Appendix 3] to provide a basis and direction for groundwater protection, and to serve as a guide for the development of this Workplan. The goal of the Strategy is to describe a dynamic approach to protecting the groundwater resource from unacceptable impacts resulting from past, present, and future Laboratory operations. Fundamental to the Strategy 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 is the ER Project's characterization and assessment of Potential Release Sites (PRSs) on a site-specific basis, including investigations of the canyons which will provide information regarding the Laboratory's vadose zone and evaluations of saturated systems associated with PRSs. A third source will be the proposed installation of wells that will be used to characterize and define the Laboratory's basic hydrogeologic setting by providing geologic, 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

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[2] Following examination of relevant regulations, DOE and UC have determined that, depending on the status of the units in question, different groundwater monitoring requirements could apply. Specifically, in New mexico Annotated Code, Title 20, chapter 4, Part 1 (20 NMAC 4.1) Subpart VI, 264.90, a distinction is made between regulated units (those surface impoundments, landfills, land treatment units, and waste piles that have received hazardous waste after July 26, 1982), and other solid waste management units (SWMUs). Regulated units are subject to 264.91 - 100 requiring, in many cases, groundwater monitoring. (However, a Subpart X unit, while it does not meet the definition of a surface impoundmant, landfill, land treatment unit, or waste pile, can also be subject to 264.91 - 100 if it potentially impacts groundwater -- otherwise 264.101 applies). In contrast, no formal monitoring requirements are established in 264.101 for SWMUs that are not regulated units. Although monitoring may be a component of remediation, no automatic monitoring requirements are triggered by 264.101. Instead, actions pursuant to 264.101 are driven by the occurrence of an actual release for which a threat to human health and the environment has been established and corrective action is necessary.

RCRA GROUND-WATER MONITORING:

DRAFT TECHNICAL GUIDANCE

OFFICE OF SOLID WASTE
U.S. ENVIRONMENTAL PROTECTION AGENCY
401 M STREET, S.W.
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NOVEMBER 1992

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- §270.21(b)(1) - Hydrogeologic report for owners and operators of landfills seeking a variance from the design and operating requirements under §264.301(b); and

- §270.23(b) - Hydrogeologic and/or geologic assessments for owners and operators of miscellaneous units that are providing information to address and ensure compliance with the environmental performance standards of §264.601.

The Regional Administrator can, however, extend the Subpart F requirements to any corrective actions specified in the permit, including those initiated under §264.101(c).

1.1 Overview of Ground-Water Monitoring Programs Under Subpart F

Subpart F outlines a three-phase ground-water monitoring program for regulated units. "Detection monitoring," the first phase, involves at least semi-annual monitoring of parameters and/or constituents that provide a reliable indication of the presence of hazardous constituents in ground water. Detection monitoring is performed at permitted land based disposal units not believed to be releasing hazardous wastes or constituents into the ground water. If monitoring indicates a release, analysis of all Appendix IX constituents is required, and the facility enters "compliance monitoring."

Compliance monitoring, the second phase, requires at least semi-annual monitoring for those constituents detected in ground water during detection monitoring. A facility performing compliance monitoring also monitors ground water for all constituents on Appendix IX at least annually, and reports the concentration of any new compound detected to the Regional Administrator. Detected compounds are then added to the list of analytes monitored semi-annually. The concentrations of all compliance monitoring constituents are compared to their permitted concentration levels, one of the elements of the facility's ground-water protection standard, to determine whether or not corrective action is required.

If a unit in compliance monitoring contaminates the ground water above the allowable concentration set forth in the facility's permit, the unit enters "corrective action," the third phase of ground-water monitoring. In corrective action, a facility is required to "remove or treat in place" (§264.100(e)) all hazardous constituents that are detected in ground water at concentrations greater than their respective ground-water concentration limits specified in the facility's permit. The monitoring associated with corrective action tracks the progress of the clean-up and detects any other constituents entering the ground water at concentrations greater than the allowable concentration limits.

CHAPTER FIVE

DETECTION MONITORING SYSTEM DESIGN

This chapter discusses the design of detection monitoring systems. Section 5.1 addresses the design of detection monitoring systems in environments where ground-water flow occurs through porous media. As discussed in Section 4.3.1, the term "porous media" generally encompasses both unconsolidated granular deposits and rock (Freeze and Cherry, 1979). In some areas underlain by fractured rock or karst terrane, ground-water flow does not conform to the principles that describe ground-water flow through porous media. In these settings, ground-water flow may occur predominantly through conduits and fractures. Appropriate supplemental monitoring strategies for these settings are discussed in detail in Section 5.2.

5.1 Ground-Water Monitoring in Aquifers Dominated by Ground-Water Flow Through Porous Media

This section provides guidance for determining the number and location of detection monitoring wells in aquifers dominated by ground-water flow through porous media. The correct placement of monitoring wells relative to hazardous waste management units is an obvious goal of a detection monitoring program.

5.1.1 Introduction

The location of both background and point of compliance (i.e., downgradient) monitoring wells at permitted facilities must comply with the requirements of §264.97. Point of compliance monitoring wells should be located so that they intercept potential pathways of contaminant migration. Background wells should be located so that they provide ground-water samples that are representative of the quality of ground water that has not been affected by leakage from the waste management unit. The number and location of monitoring wells must allow for the detection of contamination when hazardous waste or hazardous constituents have migrated from the waste management area to the uppermost aquifer (§264.97(a)(3)).

There is no required minimum number of wells at permitted facilities; the owner/operator is simply required to install a "sufficient" number of wells to allow for determination of background water quality and the water quality at the point of compliance. Typically, the minimum number of wells specified for interim status facilities in 40 CFR §265.91(a) will not be sufficient for achieving the performance objectives of a detection monitoring system because site hydrogeology is too complex or the hazardous waste unit is too large. Supplemental monitoring wells may be required in conjunction with point of compliance wells to ensure early detection of contamination. In addition, unsaturated zone

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areas, such as the karst terrane described in a study by Shuster and White (1971). Quinlan (1990) discusses the differences between conduit and diffuse flow and provides a relatively simple method for distinguishing between a conduit flow spring and a diffuse flow spring.

Karst ground-water systems developed in both younger limestones, such as those in Puerto Rico and Florida, and in older limestones, such as those in the Appalachians, the Ozarks, and the Kentucky-Indiana karst region, may be either conduit-flow or diffuse flow. Younger limestones, however, may have significant primary porosity, so that they can be likened to a gigantic sponge in which flow occurs throughout the entire aquifer through huge pores rather than being constrained in conduits. Consequently, the type of flow found in some younger, highly porous limestones may be rapid and turbulent -- not the slow, linear flow described by Darcy's law.

In the United States, lava tubes and caves occur in areas of great thicknesses of basaltic lava flows (Hawaii and the Columbia Plateau and Snake River Plain of the Pacific Northwest), but conduit flow rarely is present.

4.3.2 Definition of the "Uppermost Aquifer"

The owner/operator is required under 40 CFR §264.97 to install a ground-water monitoring system that yields representative samples from the uppermost aquifer beneath the facility. The ground-water monitoring system should allow for the detection of contamination when hazardous waste or hazardous constituents have migrated from the waste management area to the uppermost aquifer. Owners and operators should properly identify the uppermost aquifer when establishing a ground-water monitoring system that meets the requirements of §264.97. EPA has defined the uppermost aquifer as the geologic formation nearest the ground surface that is an aquifer, as well as lower aquifers that are hydraulically connected within the facility's property boundary. "Aquifer" is defined as the geologic formation, group of formations, or part of a formation that is capable of yielding a significant amount of ground water to wells or springs (40 CFR §260.10). The identification of the confining layer or lower boundary is an essential facet of the definition of uppermost aquifer. Interconnected zones of saturation below an aquifer that are capable of yielding significant amounts of water also comprise the uppermost aquifer. Quality and use of ground water are not factors in the definition. Even though a saturated zone may not be presently in use, or may contain water not suitable for human consumption, it should be monitored if it is part of the uppermost aquifer to ensure that the performance standard of §264.97(a)(3) is met. Identification of formations capable of "significant yield" is made on a case-by-case basis.

There are saturated zones, such as low permeability clays, that do not yield a significant amount of water, yet act as pathways for contamination that can migrate horizontally for some distance before reaching a zone that yields a significant amount of water. If there are hydrogeologic data supporting the belief that potential exists for contamination to migrate along such pathways, the Regional Administrator may invoke the

authorities of §264.97 to require such zones to be monitored. In addition, the Regional Administrator may require the use of supplemental monitoring wells in conjunction with point of compliance wells to monitor sites where hydrogeologic conditions or contaminant characteristics allow contaminants to move past or away from the point of compliance without being detected (§264.97(a)(3)). The Agency recommends the use of unsaturated zone monitoring where it would aid in detecting early migration of contaminants into ground water. In determining the necessity for and scope of unsaturated zone monitoring, the Regional Administrator will consider site specific factors that include geologic and hydrogeologic characteristics.

Other authorities that can be used to require monitoring include §3004(u) for corrective action for permitting; the "omnibus" permitting authority under §3005(c)(3) of RCRA and 40 CFR §270.32(b) that mandates permit conditions to protect human health and the environment; and §3013 authority that authorizes the Agency to require monitoring, testing, analyses, and reporting in certain circumstances upon a finding of a substantial hazard. If a release to ground water is detected, the release should be characterized in all saturated zones regardless of yield.

The owner/operator should assess hydraulic connection between zones of saturation yielding significant amounts of water, and properly define potential zones of contaminant migration. The owner/operator also should be able to demonstrate to the satisfaction of the EPA Regional Administrator (e.g., through the use of aquifer testing and/or modeling) that the units identified as the confining units below the uppermost aquifer are of sufficiently low permeability to minimize the passage of contaminants to saturated, stratigraphically lower units. Owners and operators should be aware that true confining layers rarely exist. Facies changes are the rule, and not the exception at most sites, and may preclude the existence of a confining layer. Furthermore, particularly with regard to DNAPLs, a confining layer may not inhibit flow laterally downdip of the layer. Solvents also have been shown to interact with clays, causing dessication and the formation of fractures. Consequently, even if the confining layer is continuous (it usually is not), the confining layer may not prevent contaminant migration.

4.3.3 Determining Ground-Water Flow Direction and Hydraulic Gradient

Installing monitoring wells that will provide representative background and downgradient water samples requires a thorough understanding of how ground water flows beneath a site. Developing such an understanding requires obtaining information regarding both ground-water flow direction(s) and hydraulic gradient. Ground-water flow direction can be thought of as the idealized path that particles of ground water follow as they pass through the subsurface. Hydraulic gradient (i) is the change in static head per unit of distance in a given direction. The static head is defined as the height above a standard datum of the surface of a column of water (or other liquid) that can be supported by the static pressure at a given point (i.e., the sum of the elevation head and pressure head).

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AR 9580

areas, such as the karst terrane described in a study by Shuster and White (1971). Quinlan (1990) discusses the differences between conduit and diffuse flow and provides a relatively simple method for distinguishing between a conduit flow spring and a diffuse flow spring.

Karst ground-water systems developed in both younger limestones, such as those in Puerto Rico and Florida, and in older limestones, such as those in the Appalachians, the Ozarks, and the Kentucky-Indiana karst region, may be either conduit-flow or diffuse flow. Younger limestones, however, may have significant primary porosity, so that they can be likened to a gigantic sponge in which flow occurs throughout the entire aquifer through huge pores rather than being constrained in conduits. Consequently, the type of flow found in some younger, highly porous limestones may be rapid and turbulent -- not the slow, linear flow described by Darcy's law.

In the United States, lava tubes and caves occur in areas of great thicknesses of basaltic lava flows (Hawaii and the Columbia Plateau and Snake River Plain of the Pacific Northwest), but conduit flow rarely is present.

4.3.2 Definition of the "Uppermost Aquifer"

The owner/operator is required under 40 CFR §264.97 to install a ground-water monitoring system that yields representative samples from the uppermost aquifer beneath the facility. The ground-water monitoring system should allow for the detection of contamination when hazardous waste or hazardous constituents have migrated from the waste management area to the uppermost aquifer. Owners and operators should properly identify the uppermost aquifer when establishing a ground-water monitoring system that meets the requirements of §264.97. EPA has defined the uppermost aquifer as the geologic formation nearest the ground surface that is an aquifer, as well as lower aquifers that are hydraulically connected within the facility's property boundary. "Aquifer" is defined as the geologic formation, group of formations, or part of a formation that is capable of yielding a significant amount of ground water to wells or springs (40 CFR §260.10). The identification of the confining layer or lower boundary is an essential facet of the definition of uppermost aquifer. Interconnected zones of saturation below an aquifer that are capable of yielding significant amounts of water also comprise the uppermost aquifer. Quality and use of ground water are not factors in the definition. Even though a saturated zone may not be presently in use, or may contain water not suitable for human consumption, it should be monitored if it is part of the uppermost aquifer to ensure that the performance standard of §264.97(a)(3) is met. Identification of formations capable of "significant yield" is made on a case-by-case basis.

There are saturated zones, such as low permeability clays, that do not yield a significant amount of water, yet act as pathways for contamination that can migrate horizontally for some distance before reaching a zone that yields a significant amount of water. If there are hydrogeologic data supporting the belief that potential exists for contamination to migrate along such pathways, the Regional Administrator may invoke the

authorities of §264.97 to require such zones to be monitored. In addition, the Regional Administrator may require the use of supplemental monitoring wells in conjunction with point of compliance wells to monitor sites where hydrogeologic conditions or contaminant characteristics allow contaminants to move past or away from the point of compliance without being detected (§264.97(a)(3)). The Agency recommends the use of unsaturated zone monitoring where it would aid in detecting early migration of contaminants into ground water. In determining the necessity for and scope of unsaturated zone monitoring, the Regional Administrator will consider site specific factors that include geologic and hydrogeologic characteristics.

Other authorities that can be used to require monitoring include §3004(u) for corrective action for permitting; the "omnibus" permitting authority under §3005(c)(3) of RCRA and 40 CFR §270.32(b) that mandates permit conditions to protect human health and the environment; and §3013 authority that authorizes the Agency to require monitoring, testing, analyses, and reporting in certain circumstances upon a finding of a substantial hazard. If a release to ground water is detected, the release should be characterized in all saturated zones regardless of yield.

The owner/operator should assess hydraulic connection between zones of saturation yielding significant amounts of water, and properly define potential zones of contaminant migration. The owner/operator also should be able to demonstrate to the satisfaction of the EPA Regional Administrator (e.g., through the use of aquifer testing and/or modeling) that the units identified as the confining units below the uppermost aquifer are of sufficiently low permeability to minimize the passage of contaminants to saturated, stratigraphically lower units. Owners and operators should be aware that true confining layers rarely exist. Facies changes are the rule, and not the exception at most sites, and may preclude the existence of a confining layer. Furthermore, particularly with regard to DNAPLs, a confining layer may not inhibit flow laterally downdip of the layer. Solvents also have been shown to interact with clays, causing dessication and the formation of fractures. Consequently, even if the confining layer is continuous (it usually is not), the confining layer may not prevent contaminant migration.

4.3.3 Determining Ground-Water Flow Direction and Hydraulic Gradient

Installing monitoring wells that will provide representative background and downgradient water samples requires a thorough understanding of how ground water flows beneath a site. Developing such an understanding requires obtaining information regarding both ground-water flow direction(s) and hydraulic gradient. Ground-water flow direction can be thought of as the idealized path that particles of ground water follow as they pass through the subsurface. Hydraulic gradient (i) is the change in static head per unit of distance in a given direction. The static head is defined as the height above a standard datum of the surface of a column of water (or other liquid) that can be supported by the static pressure at a given point (i.e., the sum of the elevation head and pressure head).

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL RISK MANAGEMENT RESEARCH LABORATORY
GROUND WATER AND ECOSYSTEMS RESTORATION DIVISION
P.O. Box 1198 Ada,OK 74820

OFFICE OF
RESEARCH AND DEVELOPMENT

March 30, 2009

MEMORANDUM

SUBJECT: Los Alamos National Laboratory (LANL), Los Alamos, NM (09RC06-001)
Well Screen Analysis Report (WSAR), Rev. 2 (LA-UR-07-2852)
Groundwater Background Investigation Report (GBIR), Rev. 3 (LA-UR-07-2853)

FROM: Steven D. Acree, Hydrologist
Applied Research & Technical Support Branch

Richard T. Wilkin, Ph.D., Environmental Scientist
Subsurface Remediation Branch

TO: Richard Mayer
U.S. EPA, Region 6

As requested, the referenced documents have been reviewed by the above named staff of the National Risk Management Research Laboratory (NRMRL) – Ground Water and Ecosystems Restoration Division. Additional review was provided by Dr. Bruce Pivetz of Shaw Environmental, Inc. Shaw is an on-site contractor providing technical support services to this laboratory. The review focused on the methods and conclusions of the WSAR. The GBIR was reviewed in the context of its use in the WSAR. The review and recommendations contained in this memorandum represent a technical evaluation of site-specific conditions based on the current state of the science and are neither policy nor prescriptive guidance.

As in the review of previous versions of these documents (Ford and Acree to Mayer, 2/16/06), this review is focused on the evaluation of the effects of drilling additives on the collection of representative samples from wells installed under the hydrogeologic characterization program. It is noted that factors other than the effects of drilling additives (*e.g.*, screen length, position within the hydrostratigraphic section, location with respect to potential contaminant source areas, groundwater sampling methods) may have a greater impact on whether groundwater samples are suitable for the purpose of early detection of contaminant releases or migration. Such location-specific issues are beyond the scope of this review.

Although the current versions of the documents attempt to address several of the issues raised during the previous reviews, there is still a relatively high degree of uncertainty in the results reported in the WSAR. For example, additional species indicative of a range of contaminant reactivity have been incorporated into the evaluations. However, several potential indicators are

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not routinely measured or available. The uncertainty related to this issue is illustrated by the following example. At locations where bentonite additives were used, the WSAR (Section 4.11) concludes that indicators suitable for directly evaluating the reliability of non-detects of highly adsorbing radionuclides are not available. Consequently, this section of the document concludes that it was not possible to evaluate the affected well screen intervals for detections of strongly adsorbing radionuclides. The document appears to modify this conclusion in later sections and indicates that these non-detect results would be accepted as representative of actual conditions if the well passed all other applicable criteria. Regardless of the conclusion stated in Section 4.11, the WSAR ultimately determines that some well screens drilled using bentonite, such as well R-32, screen 1 (Table 4-5) produce reliable samples for highly sorbing constituents such as plutonium (Table 6-4). Such assessments appear to be contradictory and are, at best, confusing. Given the lack of appropriate indicators, a more conservative and defensible approach would appear to be the one advocated in Section 4.11 rather than the approach ultimately used. Many similar issues contribute to the uncertainty inherent in the screening results.

In general, the criteria used to evaluate wells in the WSAR are complex and may ultimately prove to be unreliable. The most significant concerns noted in review of the current versions of the WSAR and GBIR are related to three areas:

- The results of the WSAR and related assessments have not been fully validated using site-specific data from laboratory and field studies.

- The criteria rely heavily on "background" data obtained from long-screened production wells and springs that do not necessarily represent water quality upgradient of the hydrogeologic characterization monitoring wells.

- The reliability of criteria used to evaluate the representativeness of groundwater samples from well screens following transformations of residual organic drilling additives and the return of groundwater samples to oxidized conditions is uncertain due to a lack of direct assessments of the site-specific mineralogical transformations and the reliance on groundwater sampling data.

Each of these issues increases the uncertainty in the conclusions of the WSAR and is discussed in detail below.

Validation of the Screening Results

As noted by the National Research Council (2007: National Research Council, Plans and Practices for Groundwater Protection at the Los Alamos National Laboratory, Final Report), evidence regarding the conditions surrounding the monitoring well screens is indirect. Additional laboratory and field investigations to better determine the nature and evolution of the interactions between the drilling, well construction, and aquifer materials; quantify sorption parameters; and to demonstrate the accuracy of the screening results presented in the WSAR are

recommended to validate the results. Without such validation, assessments of the impacts on the representativeness of groundwater samples should be considered to be of uncertain quality.

Uncertain Background Conditions

The WSAR criteria rely heavily on comparisons between data obtained from the impacted well screens and data reported in the GBIR. The data used to characterize "background" conditions is sparse, derived mainly from sources representing mixtures of water that are significantly different from the samples obtained from the hydrogeologic characterization wells, and are representative of significantly different flow paths and residence times within the aquifer. Actual background values at the locations of the individual characterization well screens may be significantly different from the proposed values.

As noted many times in the GBIR, water chemistry is determined by the lithologies of aquifer materials through which the water migrates and the residence time. Data from springs near the Rio Grande and the long-screened production wells does not necessarily represent the flowpaths monitored by the individual short-screened characterization wells. The GBIR recognizes this limitation. However, it indicates that the appropriate data (*i.e*, data from similarly screened wells immediately upgradient of the regulated units) may never be available. This approach introduces unavoidable uncertainty in evaluations of screens with residual effects because it does not allow for spatially distinctive geochemical zones or variability in groundwater chemistry in different aquifer lithologies.

It is quite possible that constituent concentrations observed in unimpacted monitoring wells may be significantly different from the data provided in the GBIR. For example, it appears the well R-35B was recently installed near the top of the regional aquifer without the use of harmful drilling additives within the screened interval. Concentrations of zinc measured in filtered groundwater samples have varied from approximately 40 ug/l to 60 ug/l. This range is above the maximum value of approximately 32 ug/l reported in Table 4.2-3 of the GBIR and is at or above the maximum value reported in Table 4-3a of the WSAR. This example illustrates the uncertainty inherent in using "background" data obtained from sources that are not constructed to monitor the same flowpaths as the monitoring wells in question.

It is also noted that the current evaluation methods may not fully identify conditions representative of the unimpacted regional aquifer. Footnote K in Table E2 indicates that although screens 6, 7, and 8 of well R-25 had a perfect score in the evaluation, the screens may still be impacted by water from perched zones above the regional water table.

Continuing Impacts to Aquifer Materials after Return to Oxidizing Conditions

The geochemical analysis appears to rely heavily on a determination of the overall redox status of groundwater as inferred from water quality parameters, such as dissolved oxygen, oxidized forms of nitrogen (nitrate) and sulfur (sulfate), low dissolved concentrations of iron and manganese, and detection of contaminants in oxidized forms. Part of the analysis includes an

evaluation of potential solid-phase processes (modification of surface-active minerals, changes to carbonate mineral stability) based upon the groundwater chemistry. Modification of in situ redox conditions is clearly an important aspect of the problem being dealt with here. As pointed out, the organic drilling fluids provide a source of carbon for native microbial populations in the aquifer. These organisms can have long-term impacts on water chemistry and aquifer mineralogy in the vicinity of the well screen. In general, anaerobic conditions resulting from the respiration of microbes shift the types of minerals and contaminant-reactivity of mineral surfaces that may be in equilibrium or near equilibrium with the specific water chemistry.

Using criteria established in this report, an undesirable component of uncertainty will persist regarding screen impacts because it is not possible to understand all possible mineral-contaminant interactions solely by evaluating water chemistry. As an example, consider a well that shows redox-status evolution from iron-reducing conditions, linked to residual drilling fluids, to oxidizing conditions comparable to the targeted background conditions. In this case, the geochemical criteria would suggest that water chemistry has achieved or is approaching pre-drilling conditions and, furthermore, that contaminant species can be monitored accordingly for their presence or absence. During the evolution of this system, when native microbes supported mobilization of ferrous iron, it is possible that reactive Fe(II)-bearing minerals formed in the available pore spaces adjacent to the well screen. As portrayed in the conceptual model presented in the WSAR (*e.g.*, Figure 4-9), possible phases include ferrous carbonate, ferrous sulfide (in sulfate-reducing compartments or micro-environments), but also could include green rust minerals, ferrous hydroxycarbonate, and magnetite. These Fe(II)-bearing phases are all known to interact with and possibly sequester potential contaminants of concern (*i.e.*, nickel, cadmium, cobalt, arsenic, zinc, americium, technetium, chromium, uranium). In this scenario, as organic carbon is consumed and levels of dissolved oxygen begin to increase, these previously formed Fe(II)-bearing minerals would be anticipated to undergo oxidative transformation to hydrous ferric oxide or iron oxyhydroxides. It might be further anticipated that these newly formed Fe(III)-bearing phases would be very fine-grained and highly sorbent, again with the ability to sequester contaminant species of concern. So along with the shift to oxidizing conditions, as indicated in water chemistry parameters, comes an anticipated shift in reactive iron mineralogy. Based on the criteria proposed, it is not possible to clearly assess: i) how long reduced, Fe(II)-bearing minerals might persist, and ii) what type of mineral phase or assemblage would result as a consequence of the return to more oxidizing conditions.

The critical point is that the nature of the reactive iron mineralogy cannot be assessed by examining water chemistry alone. In order to have a sense of the reactive nature of the aquifer solids, other testing would be required. At some point, it would be expected that any reactive minerals present in the system may become saturated or modified to the extent that they would no longer influence water chemistry in regions adjacent to the well screen. However, there are no compelling lines of evidence provided in the report that would indicate when this desired point is ultimately reached.

Recommendations to Reduce Uncertainty

Due to uncertainties in the mineralogical alterations induced by the drilling additives, uncertainty in the utility of aqueous chemistry assessments for the determination of whether samples are fully representative of aquifer conditions, and the lack of appropriate data for the assessment of water quality immediately upgradient of the impacted characterization wells, it is recommended that additional laboratory/field studies be designed to reduce uncertainty and validate the results of the WSAR. In this regard, the following studies may significantly improve the understanding of the site-specific impacts of the drilling additives and the potential time frames over which the impacts may be expected to continue.

1. **Upgradient Well Installations.** Install wells immediately upgradient of the regulated units of most concern, screening intervals equivalent to those of monitoring wells located downgradient of the regulated units. If such wells were installed without the use of harmful drilling additives in the screened zone, the data should be useful in better defining pre-drilling conditions within the particular hydrostratigraphic units of interest. The data would also provide insight into the representativeness of the "background" ranges used in the WSAR.

2. **Laboratory Investigations.** Laboratory studies could be performed to more fully understand impacts of the drilling additives on the evolution of redox conditions and secondary mineral formation. Subsequently, impacted materials from the studies could be subjected to redox conditions representative of the unimpacted aquifer allowing investigation of the evolution of mineral phases. Aquifer materials obtained during these studies could be used to quantify interactions with contaminants of concern. The results could be used as a baseline to understand the geochemical behavior of subsurface materials and validate conceptual models for the transformations that are occurring as well as aid in the validation of the criteria proposed in the WSAR. It is noted that similar studies were recommended by the National Research Council (2007: National Research Council, Plans and Practices for Groundwater Protection at the Los Alamos National Laboratory, Final Report). Laboratory studies could also be performed to quantify sorption of the inorganic constituents of concern onto the materials used during well construction at LANL.

3. **Field Studies**. Ultimately, lines of evidence from field studies will be needed to reduce uncertainty in the validation of criteria used in the WSAR. Useful lines of evidence would include: characterization of aquifer solids obtained from impacted wells, evaluation of the effects of well purging prior to sampling of impacted wells, and push-pull tests to directly examine sorption properties at impacted wells. A primary line of evidence would also be the installation of new well(s) drilled without the use of additives in the screened zone near impacted well(s). A comparison of water quality data from the two wells would provide direct evidence of the degree of impact and the effects on water quality. Such installations could be performed near regulatory units of greatest concern to maximize the benefits of the data.

If you have any questions concerning this review, please do not hesitate to call us (Acree: 580-436-8609; Wilkin: 580-436-8874) at your convenience. We look forward to future interactions with you concerning this and other sites.

cc: Mike Fitzpatrick (5303W)
Vince Malott, Region 6
Terry Burton, Region 6

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CERTIFIED MAIL
RETURN RECEIPT REQUESTED

TA-16

May 30, 1995

Mr. Larry Kirkman,
Acting Area Manager
Department of Energy
Los Alamos Area Office
528 35 Street
Los Alamos, New Mexico 87545

RE: Denial of the Los Alamos National Laboratory's Ground-Water Monitoring Waiver Requests

Dear Mr. Kirkman:

As stated in the New Mexico Environment Department's (NMED's) May 5, 1994 letter regarding ground-water monitoring waiver documentation, NMED deferred a decision regarding ground-water monitoring waivers pending reevaluation of the hydrogeologic conditions beneath the facility and consideration of new ground-water data. Closure plans for the below named units have been submitted to NMED for closure under 20 NMAC 4.1, Subpart VI, 40 CFR 265 Subpart G:

TA-54 Areas G & L (March, 1987)
TA-16 Surface Impoundment & Area P Landfill (December, 1987)
TA-35-125 & 85 Surface Impoundments (March, 1989)
TA-53 Surface Impoundments (1992)

Through evaluation of the submitted supporting documentation, NMED has determined that the information provided does not fulfill Part 265 standards. This letter serves to document the bases for regulatory denial of ground-water monitoring waiver proposals [20 NMAC 4.1 Subpart VI, 40 CFR 265.90] as submitted by Los Alamos National Laboratory (LANL) to NMED. General technical rationale, specific waiver requests, and reasons for denial of the ground-water monitoring waivers are provided in the enclosed Attachment.

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Because these demonstrations, have not met the technical standards necessary for approval of ground-water monitoring waivers at the sites listed above, ground-water monitoring program plans will be required for LANL to be in compliance with 20 NMAC Subpart VI, 40 CFR 265 Subpart F regulations.

Although NMED does not relinquish any of New Mexico's regulatory or statutory authorities, these denials do not require immediate submittal of ground-water monitoring program plans for each closure. Instead, in light of DOE/LANLs budgetary constraints, a comprehensive ground-water monitoring program plan should be developed which addresses both site-specific and site-wide ground-water monitoring objectives. This may be achieved by modifying the existing site-wide Groundwater Protection Management Program Plan, Revision 1.0, March 6, 1995 to include regulatory site-specific considerations. NMED intends to coordinate with DOE/LANL in this site-wide approach. If DOE or LANL staff wish to discuss this issue, please contact Ronald Kern, manager of the RCRA Technical Compliance Program, to arrange a meeting. If you have any questions regarding this matter, please contact Ms. Lee Winn or Ms. Teri Davis of my staff at (505) 827-4308.

Sincerely,

Benito J. Garcia, Chief
Hazardous & Radioactive Materials Bureau

CC: Ron Kern, Manager, RCRA Technical Compliance Program
LANL 1995 Red File
Barbara Hoditscheck, Manager, RCRA Permitting Program
Neil Weber, DOE Oversight Bureau
Marcy Leavitt, Ground Water Protection & Remediation Bureau

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RCRA regulated units

ATTACHMENT

GENERAL TECHNICAL RATIONALE FOR DENIAL OF GROUND-WATER MONITORING WAIVERS

Los Alamos National Laboratory (LANL) has provided inadequate and incomplete information pertaining to the unsaturated and saturated conditions across the Parajito Plateau in support of ground-water monitoring waivers for the various RCRA-regulated units (TA-54 Area G & L, TA-16 Surface Impoundment & Area P Landfill, TA-35-125 & 85 Surface Impoundments, and TA-53 Surface Impoundments). Basic geology, hydrogeology, and pathways for contaminant transport have not been adequately addressed to date. Listed below are the general technical concerns of LANL, U.S. Environmental Protection Agency (EPA), and the New Mexico Environment Department (NMED) regarding the lack of understanding of the hydrogeologic system at this facility. These technical concerns and data gaps support denial of LANL's ground-water monitoring waiver requests.

1. LANL's Installation Work Plan Revision 3, November 1993

Within LANL's Installation Work Plan Revision 3, November 1993, specific data gaps were listed and data needs were identified explicitly throughout the environmental setting section of this document. These data gaps are relevant to the ground-water monitoring waiver issue. These are specifically:

- Absence of facility-wide geologic mapping . The lack of geologic mapping in the intervening areas causes the validity of the correlations to be uncertain. [section 2.6.1.2.9]

  "Stratigraphic features in the tuff, such as volcanic surge deposits, ***may locally provide a preferential migration pathway for moisture and contaminants in the subsurface*** [emphasis added] (Purtymun 1973, 0710; Crowe et al. 1978, 0041). Purtymun (1973, 0710) noted increased rates of vapor phase migration of tritium away from storage shafts at TA-54 along a stratigraphic boundary that includes surge layers. Individual flow units in the Tshirege Member contain vertical cooling joints that may or may not cross flow unit boundaries. In ash flow tuffs, cooling joints spacing varies primarily with the thickness of the unit, emplacement temperature, substrate temperature, and topography. Joint density tends to be greatest in welded tuff and least in non welded tuff. Hydraulic conductivities are generally greatest in the fractured, welded parts of ash flow tuffs and least in the non-welded parts (Crowe et al. 1978, 0041)."(Section 2.6.1.2.9, page 2-17).

- "Dransfield and Gardner (1985, 0082) integrated a variety of data to produce structure contour and paleogeologic maps of the pre Bandelier Tuff surface beneath the Pajarito Plateau. Their maps reveal that subsurface rock units are cut by a series of down-to-the-west normal faults; the overlying Bandelier Tuff is not obviously displaced by these buried faults. However, where detailed fracture studies have been done on the

plateau, they have shown that fracture abundances and apertures increase in the Bandelier Tuff over fault projections, which indicates tectonic fracturing mentioned above (Vaniman and Wohletz 1990, 0541). In addition, small-scale offsets along fractures have been observed in various parts of the Laboratory, including ***Area G at TA-54*** [emphasis added] (Rogers 1977, 0216), that suggest additional unmapped fault zones. Unfortunately, detailed fracture studies on the Pajarito Plateau are few." (Section 2.6.1.4, page 2-19).

- "Perched water bodies occur in the conglomerates and basalts beneath the alluvium in the mid and lower reaches of Pueblo and Los Alamos canyons and in the lower reach of Sandia Canyon. Depth to perched water ranges from about 90 ft in the midreach of Pueblo Canyon to about 450 ft in lower Sandia. ***The vertical and lateral extent of the perched groundwaters, the nature and extent of perching units, and the potential for migration of perched water to the main aquifer is not fully understood by investigators to date.*** [emphasis added] " (Section 2.6.2.3.2, page 2-29).

2. LANL's Groundwater Protection Management Program Plan, 1995

Comments and Recommendations found in LANL's "Groundwater Protection Management Program Plan, Appendix I" - (March 6, 1995, Revision 1.0) identified numerous deficiencies in the conceptual hydrogeological understanding at LANL. Major concerns and recommendations are listed below:

Appendix I - Los Alamos National Laboratory E S & H Self-Assessment Report (August 91):

"Not enough is yet known about the fundamental processes controlling movement of water or contaminants through the unsaturated zone to completely understand whether contamination could ever reach the main aquifer." (3.2.4, par.2)

"Fundamental research is necessary in basic geology, unsaturated zone geology and hydrology, and saturated zone geology and hydrogeology." (3.2.4, par. 5)

"Basic Geology: Basic geology of the Laboratory area includes structural features, stratigraphy, fracture and fault zone (knowledge of both the Pajarito fault zone on the western margin of the plateau and the plateau itself where faults and fractures may control erosional patterns and potential infiltration zones are crucial to understanding ground water recharge), geomorphology, seismic history, and geochemistry. (3.2.4, 1st bullet)

"Saturated Zone Geology and Hydrology: Information on recharge of the main aquifer and lithology is incomplete; knowledge of the upper surface of the main aquifer, especially toward

the west, is incomplete; temporal variation of the ground water surface is not well described; information is lacking on vertical and horizontal permeability variation, horizontal and vertical pore-water velocities, pore-water flow gradients, extent of phreatic versus confined zones, geologic structure beneath the Bandelier tuff, spatial variations of natural ground water quality, and areal continuity of data." (3.2.4, 2nd bullet)

"Unsaturated or Vadose Zone Geology and Hydrology: Unsaturated hydrologic property measurements are lacking for the Otowi and Guaje Members of the Bandelier tuff, the Chino Mesa Basalts, the Puye conglomerate, and the unsaturated portions of the Santa Fe group sediments." (GW.2 Implementation of Ground Water Protection Programs)

Appendix 1 - Hydrogeologic Review for the Environmental Restoration Program at Los Alamos National Laboratory. LANL Hydrogeology Panel Final Report, Summary of Comments on Issues Identified by the Program:

"Issue 3: Do we know enough about the role of fractures?

"The panel is somewhat divided on this question. On one hand, some geologic evidence suggest that fractures lack connectivity over great depths and fractures may provide capillary barrier to unsaturated flow. On the other, roots and weathering patterns suggest that some fractures on the mesa tops may be preferential paths for infiltration. Our primary concern for liquid flow in fractures is in canyon bottoms where fractures in bedrock may intersect perched alluvial aquifers. There are few field data on the role of fractures, but there is also very little one can do to adequately and quantitatively characterize variably saturated fracture flow and transport coefficients. At small site scales, the role of fractures as transport pathways and their connections to regional pathway will likely have to be addressed for each site individually."

The above statement about the uncertainty of location and connection, and flow in fractures is important reasoning for requiring ground-water monitoring wells to detect releases.

"Issue 4: Can we defensibly model LANL hydrogeology using a porous continuum model?

"Much of the experimental and environmental monitoring data suggests that a porous media flow model would be appropriate. However, porous media models should be used to predict observed behavior in order to validate the model and to confirm the validity of the porous medial approach."

Because of fractures, cooling joints, faults, bedding planes, a porous media model seems flawed. The above statement, suggest the need for empirical data to confirm modeling information. The complexity of the vadose zone supports the rejection of porous media flow conceptual models presented in the ground-water monitoring waiver requests.

"Issue: 5: Are we sufficiently certain of ground water flow direction regionally that we can know ground water flow direction at a specific OU? Additionally, is there any reason to believe that there are local ground water gradients?

"Local effects undoubtedly occur near the well fields, and it is possible that small perturbations may occur in the main aquifer beneath perched aquifers or other potential recharge areas. Additional information is required to monitor horizontal and vertical pathways and to confirm sources of recharge. Mapping details of drawdown and "zones of capture" around the well fields would add to this knowledge base.

"Issue 6: Can we defensibly state there is no connection between any perched zones and the main aquifer?

"Existing data are insufficient to state that no perched water percolates to the main aquifer. In fact, recent work at Mortandad Canyon shows that vertical transport has occurred in the Bandelier Tuff to at least 150 ft (46m) beneath the perched alluvial aquifer. Little is known of vapor phase transport in these areas.

"Issue 8: Do we know enough that modeling as a homogeneous, steady state system adequately defines the system? Alternatively, do we know enough to model as a nonhomogeneous, transient system?

"Except for scoping calculations, field observations and model studies show that some degree of heterogeneity will need to be incorporated into the conceptual models of flow and transport in the vadose zone, in the perched aquifers, and in the main aquifer. Transient effects will need to be considered to simulate transport at least within perched alluvial aquifers, and in pumping scenarios for the main aquifer.

"Available data are scarce, and details of experimental procedures need to be published. A model study using existing sorption data underestimated observed radionuclide transport. Available data do not appear to be sufficient to defend ER objectives."

3. EPA Concerns

Major relevant EPA concerns, as documented in the March 16, 1994 Comprehensive Ground Water Monitoring Evaluation (CME), are expressed in the following questions:

1. "Has a ground water monitoring program (capable of determining the facility's impact on the quality of ground water in the uppermost aquifer underlying the facility) been implemented as per 40 CFR subparagraph 265.90? Uppermost aquifer means the geologic formation nearest the natural ground surface that is an aquifer as well as

lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary.

"No, the facility does not have a ground water monitoring program capable of determining all of the facility's impact on the uppermost aquifer. LANL has ground water monitoring waivers on file for each unit requiring ground water monitoring"

2. "Has the facility adequately identified the uppermost aquifer?

"No, based upon the reviewed documents, the uppermost aquifer has not been adequately characterized. Additional studies are required. Each ground water monitoring waiver needs to be evaluated to determine its appropriateness. If the ground water monitoring waiver does not meet the requirements of 40 CFR 265.90(c), LANL will be required to submit additional information or install ground water monitoring wells at each regulated unit."

4. State Concerns

In addition to the specific data gaps and needs described by LANL and EPA above, the state has additional concerns:

- Water-level contour maps presented in the submitted supporting ground-water monitoring waiver documentation are not adequate. The ground-water elevation data obtained from supply and test well data has been compiled together. It is generally not accepted practice to contour such data. The test wells are screened over short intervals (10 feet), presumably at the top of the aquifer, whereas the production wells are screened over much greater lengths (1500-2500 feet), starting typically hundreds of feet below the presumed top of the aquifer. Compiling such data may give a nonrepresentative picture of the hydraulic head distribution within the aquifer(s). Additionally, elementary contouring errors have apparently been reproduced from document to document, which have resulted in compounded errors in water-level contours.

- Individual zones of saturation beneath LANL have not been adequately delineated, and the "hydraulic interconnection" between these is not understood. Inadequate and incomplete knowledge concerning the geometries and boundary conditions of the zones of saturation beneath the facility exists. A facility-wide description of the hydrogeologic characteristics affecting ground-water flow beneath the facility can not 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 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 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 are unknown.

- Detection of low-level tritium in the main aquifer in Los Alamos, Pueblo, and Mortandad Canyons (all of which have monitoring wells in them) refutes fundamental assumptions supporting low or no potential of migration of constituents of concern to the uppermost aquifer.

SITE-SPECIFIC GROUND-WATER MONITORING WAIVER REQUESTS & DENIALS

1. March 1987, *"Hydrogeologic Assessment of Technical Area-54 Area G & L, Los Alamos National Laboratory"*

In addition to the general technical reasons listed in the previous section, denial is based on the following observations:

- The presence of an alluvial aquifer in lower Pajarito Canyon is of concern from a horizontal contaminant transport standpoint. The continuing degradation of water quality within Pajarito Canyon from PCO-1 to PCO-3 is of concern. No apparent principal release site other than Area G & L exist that may account for the observed change in water quality.

- Section 3.0 Hydrologic Characterization of the Vadose Zone, page 3-1, first paragraph which states, "No perched water has been detected above the main aquifer; therefore, studies of moisture movement have been concentrated on unsaturated flow processes." As noted by N.D. Rosenburg and H.J. Turin (1993), Summary of Area G Geology, Hydrogeology, and Seismicity for Radiological Performance Assessment, a seismic hole drilled by J. Gardner in 1993 recorded wet core approximately 125 to 145 feet below ground-level, suggesting the possible existence of a perched-intermediate aquifer. The seismic drill hole is located approximately 700 feet NW of production

well PM-2 which is located immediately downstream of the confluence of the Pajarito and Three Mile Canyons (TA-18).

- The potential for perched water below the base of the basaltic units beneath Areas G & L is of concern. Springs 4A discharge near the basalt - Santa Fe Group contact in Pajarito Canyon at an elevation hundreds of feet above the surface of the Rio Grande. The river is believed to represent the surface of the top of the main aquifer through this stretch of the Rio Grande (Cushman, 1965). As noted in LANL's May 1993 OU 1148 RFI Workplan: "Perched (intermediate) aquifers, recharged from the alluvial aquifer in Pajarito Canyon, may exist in the subsurface in the southern vicinity of OU 1148, although no drill holes are available to determine if they exist."

U.S. EPA's 1994 CME supports these reasons by relating the following:

> "The ground water monitoring waiver for TA 54 Area L & G states: 1) there is not a perched water table at these areas, and 2) there is not any hydraulic connection to the main aquifer. However, there are not any ground water monitoring wells in the vicinity of Area L & G which verify this statement. It is understood that LANL was preparing to install a monitoring well penetrating the main aquifer, just east of TA 54, which could have been used to provide this information. However, it is also understood that due to budget constraints, the proposed installation of this well has been halted. It is recommended that this well be installed as expeditiously as possible in order to verify the ground water conditions in this area."

2. **December 15, 1987, *"Supporting Documentation for the Ground-Water Monitoring Waiver at the TA-16 Surface Impoundment".***

The above referenced documentation for the ground-water monitoring waiver at TA-16 Surface Impoundment has been reviewed. In addition to the general technical reasons listed in the previous section, the following technical issues support denial of the ground-water monitoring wavier at this RCRA regulated unit:

- Contaminant transport through the tuff is probable, based on field observations in Mortandad Canyon and low-level detection of tritium in the main aquifer.
- Recharge to the main aquifer is likely from the Pajarito fault zone and associated fracture-fault zones across the Plateau.
- Canon de Valle surface water is perennial within this stretch of the canyon. In addition, the wetlands in Canon de Valle appear to bisect the toe of the landfill. The wetlands areas could be in direct communication with a potential migration pathway.
- The depth to the uppermost aquifer is unknown.

Furthermore, the site has a documented release which requires a corrective action program plan be implemented.

3. **March 1989, *"Supporting Documentation for the Ground-Water Monitoring Waivers at the TA-35 TSL-85 and TSL-125 Surface Impoundments".***

In addition to the general technical reasons listed in the previous section, denial of the ground-water monitoring waiver request is based on inadequate documentation. A general technical reason which is particularly relevant to this site is that in nearby Mortandad Canyon, low levels of tritium have been detected at a depth of 200 feet in the Bandelier Tuff. This finding indicates that there is vertical transport within the tuff and therefore a potential for migration which must be addressed.

4. **April 1992, *"Ground-Water Monitoring Waiver Demonstration for Surface Impoundments at Technical Area-53".***

LANL 's reasoning for demonstrating "low potential for migration of hazardous waste or hazardous waste constituents to the uppermost aquifer" is described as:

> "(1) the unsaturated characteristics of the vadose zone below the TA-53 surface impoundments on Mesita de Los Alamos demonstrate low gravimetric moisture content..., and
>
> "(2) the annual evaportranspiration equals or exceeds the annual mean precipitation, resulting in a negative annual infiltration at TA 53."

In addition to the general technical reasons listed in the previous section, denial of the waiver is based on the following:

(a) There has been no site characterization to determine the uppermost aquifer below the site. The two canyons adjacent to Mesita de Los Alamos, Los Alamos and Sandia, both have perched water beneath the canyon bottoms.

(b) In point (1) quoted above, saturated porous media flow is assumed as the only transport model. Vapor phase flow of contamination and fracture flow are not adequately characterized or addressed in the supporting documentation, and

(c) Regarding point (2) quoted above, using a mean annual precipitation to calculate evapotranspiration is not adequate to account for all possible water balance at the site. Recharge mechanisms are also inadequately understood.

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www.nmenv.state.nm.us

GARY E. JOHNSON
GOVERNOR

PETER MAGGIORE
SECRETARY

ENTERED

KED LANL 14 2410

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

December 21, 2001

Dr. John C. Browne
Director
Los Alamos National Laboratory
P. O. Box 1663, MS A100
Los Alamos, NM 87545

Mr. David A. Gurulé
Area Manager
Los Alamos Area Office
Department of Energy
528 35th Street, MS A316
Los Alamos, NM 87544

SUBJECT: DETERMINATION OF INCOMPLETENESS FOR:
1) "CLOSURE AND POST CLOSURE PLANS FOR TA 54-AREA G LANDFILL," SEPTEMBER 1985;
2) "TA-54 AREA H & AREA L LANDFILL CLOSURE AND POST-CLOSURE PLAN," NOVEMBER 1986;
3) "CLOSURE PLAN FOR TECHNICAL AREA 54, MATERIAL DISPOSAL AREA L" (REVISION 1.0), MARCH 1998;
4) "CLOSURE PLAN FOR TECHNICAL AREA 54, MATERIAL DISPOSAL AREA H" (REVISION 1.0), MARCH 1998.
LOS ALAMOS NATIONAL LABORATORY EPA ID# NM0890010515
HWB-LANL-99-050

Dear Dr. Browne and Mr. Gurulé:

The New Mexico Environment Department (NMED) has reviewed the above-referenced Closure Plans and Post-Closure Plans (Plans) submitted by Los Alamos National Laboratory and the U.S. Department of Energy (Permittees) and has determined that all four Plans are incomplete. This letter outlines the most glaring deficiencies of the Plans.

The Plans fail to demonstrate that the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§ 264.91 through 100 and Part 264, Subpart G) will be met. Individual shafts, pits, and trenches

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at Technical Area (TA) 54 Material Disposal Areas (MDA's) G, H, and L are unlined, and therefore the whole of each MDA is considered one hazardous waste disposal unit (i.e., a landfill), as defined at 20.4.1.100 NMAC (incorporating 40 CFR § 260.10). Hazardous waste was disposed of at MDA's G, H, and L after the effective date of regulation under the Resource Conservation and Recovery Act (RCRA), and therefore each MDA is subject to all groundwater monitoring, closure, and post-closure requirements of 20.4.1.500 NMAC (incorporating 40 CFR Part 264, Subparts F and G). Hazardous waste was disposed of at MDA's G, H, and L after July 26, 1982, and therefore each MDA is subject to the specific groundwater monitoring requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§ 264.91 through 100). 40 CFR Part 264, Subparts F and G, are therefore not adequately addressed in the Plans.

In order to comply with groundwater monitoring, closure, and post-closure requirements, including the closure performance standard of controlling, minimizing, or eliminating, to the extent necessary to protect human health and the environment, escape of hazardous waste or constituents to the groundwater or surface water (20.4.1.500 NMAC (incorporating 40 CFR § 264.111(b))), the nature and extent of releases from MDA G as a whole, MDA H as a whole, and MDA L as a whole must be determined and releases that result in an unacceptable risk must be remediated. The Permittees are required to include an assessment of risk from radionuclides in their assessment of total risk from each MDA.

The Permittees' Groundwater Monitoring Waiver Request was denied (see May 30, 1995, letter from NMED to Permittees) because it failed to demonstrate compliance with 20.4.1.500 NMAC (incorporating 40 CFR § 264.90(b)(4)). Therefore, post-closure plans for MDA's G, H, and L, which are regulated units as defined at 20.4.1.500 NMAC (incorporating 40 CFR § 264.90(a)(1)), must include groundwater monitoring meeting the requirements of 20.4.1.500 NMAC (incorporating 40 CFR §§ 264.91 through 100 and 264.117(a)(1)(i)). To comply with 20.4.1.500 NMAC (incorporating 40 CFR §§ 264.91 through 100), the Permittees may consider the whole of TA 54 a waste management area, as defined at 20.4.1.500 NMAC (incorporating 40 CFR § 264.95(b)(2)). Therefore, MDA's G, H, and L groundwater monitoring requirements may be met by groundwater monitoring for TA-54 as a whole.

For MDA H only, in accordance with terms outlined in previous NMED correspondence to the Permittees dated December 27, 2000, compliance with 40 CFR Part 264, Subparts F and G requirements may be demonstrated under 40 CFR § 264.101 corrective action procedures, such as RCRA Facility Investigation Reports and Corrective Measures Studies. However, the substantive requirements of Subparts F and G must be met at MDA H.

The Permittees must submit revised plans within 60 days of receipt of this letter. Failure to submit these plans in a timely manner could significantly delay processing of the TA 54 Permit Application.

I regret that NMED did not respond to the Permittees' plans until now. We are committed to much better customer service for our Permittees, and appreciate your patience and willingness to work with us as we improve our business practices.

If you have any questions or need additional information please contact me at 505-428-2512 or have your staff contact Carl Will of my staff at 505-428-2542.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

cc: J. Kieling, NMED HWB
D. Cobrain, NMED HWB
C. Will, NMED HWB
L. Winn, NMED HWB
P. Allen, NMED HWB
A. Ortiz, NMED OGC
D. Neleigh, EPA Region 6 (6PD-N)
J. Ellvinger, LANL ESH-19, MS K490
G. Bacigalupa, LANL ESH-19, MS K490
G. Turner, DOE LAAO, MS A316

file: Reading and LANL red 2001

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GARY E. JOHNSON
GOVERNOR

PETER MAGGIORE
SECRETARY

Permit

February 14, 2002

Greg Mello
Los Alamos Study Group
212 E. Marcy Street, Suite 10
Santa Fe, New Mexico 87501

Dear Mr. Mello:

Thank you for Los Alamos Study Group's (LASG's) recent January 15 letter in which you request that the New Mexico Environment Department (NMED) "formally close" the Los Alamos National Laboratory's (LANL's) Material Disposal Area (MDA) G.

As we have discussed on several occasions, the Department is in the midst of a major effort to issue a new RCRA permit for the LANL. Technical Area 54, including MDA G, will be included in the new permit. Moreover, the NMED expects to issue an administrative order in the near future addressing at least some of the issues you raise regarding MDA G. As you know, the permit renewal process requires public participation as described in 40 CFR §270.42 and 20.4.1.901 NMAC. Additionally, I have pledged to you and other groups that the NMED will not issue any order requiring closure or corrective action at Los Alamos without allowing the public an opportunity to provide comments on the proposed action. My commitment to honor that pledge has not wavered.

The Department sincerely values the input provided by your and others' organizations, and will strongly consider your positions regarding closure and disposal at TA-54 throughout the permitting process.

Finally, as Secretary, I am the party who would issue any permit for operations at LANL. Accordingly, please ensure that future discussions and correspondence about specific issues and requests similar to those you raise be directed to Greg Lewis, the Department's Water & Waste Management Division Director. I'm sure you can understand my desire not to have any *ex parte* discussions about substantive portions of the permit or potential orders I may issue. To reiterate, I am happy to continue to discuss process issues, in particular, public participation, with you or your colleagues at any time.

CA Ex. 23

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GARY E. JOHNSON
GOVERNOR

PETER MAGGIORE
SECRETARY

February 14, 2002

Marsha Mason
528 Don Gaspar
Santa Fe, New Mexico 87501

Dear Ms. Mason:

Governor Johnson has asked me to respond to your January 2, 2002, letter in which you request that I demand closure of Los Alamos National Laboratory's (LANL's) Material Disposal Area (MDA) G. I appreciate your concerns, and urge you to participate throughout the permitting process that will be ongoing in the months and years to come.

As you may know, the Department is in the midst of a major effort to issue LANL a new Resource Conservation and Recovery Act (RCRA) permit. This permit will set forth the requirements that must be met at LANL for managing hazardous waste, and hazardous waste that may contain radioactive contamination as well. The permit and associated administrative orders will also define how and how fast clean up will take place at LANL for at least the next decade. The permit renewal process requires public participation as described in 40 CFR §270.42 and 20.4.1.901 NMAC. Additionally, should the Department issue an order or other administrative action requiring closure or corrective action at LANL, it will only do so after having given the public an opportunity to provide comments on the proposed action.

The Department sincerely values the input provided by New Mexicans such as yourself, and will strongly consider your positions regarding closure and disposal at TA-54 throughout the permitting process. On behalf of the Department, I thank you for bringing your position on these important issues to my attention. Should you require further information, please contact James Bearzi, Chief of the Department's Hazardous Waste Bureau. He may be reached at (505) 428-2512.

Sincerely,

Peter Maggiore

Peter Maggiore
Cabinet Secretary

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GARY E. JOHNSON
GOVERNOR

PETER MAGGIORE
SECRETARY

Permit

February 14, 2002

Greg Mello
Los Alamos Study Group
212 E. Marcy Street, Suite 10
Santa Fe, New Mexico 87501

Dear Mr. Mello:

Thank you for Los Alamos Study Group's (LASG's) recent January 15 letter in which you request that the New Mexico Environment Department (NMED) "formally close" the Los Alamos National Laboratory's (LANL's) Material Disposal Area (MDA) G.

As we have discussed on several occasions, the Department is in the midst of a major effort to issue a new RCRA permit for the LANL. Technical Area 54, including MDA G, will be included in the new permit. Moreover, the NMED expects to issue an administrative order in the near future addressing at least some of the issues you raise regarding MDA G. As you know, the permit renewal process requires public participation as described in 40 CFR §270.42 and 20.4.1.901 NMAC. Additionally, I have pledged to you and other groups that the NMED will not issue any order requiring closure or corrective action at Los Alamos without allowing the public an opportunity to provide comments on the proposed action. My commitment to honor that pledge has not wavered.

The Department sincerely values the input provided by your, and others' organizations, and will strongly consider your positions regarding closure and disposal at TA-54 throughout the permitting process.

Finally, as Secretary, I am the party who would issue any permit for operations at LANL. Accordingly, please ensure that future discussions and correspondence about specific issues and requests similar to those you raise be directed to Greg Lewis, the Department's Water & Waste Management Division Director. I'm sure you can understand my desire not to have any *ex parte* discussions about substantive portions of the permit or potential orders I may issue. To reiterate, I am happy to continue to discuss process issues, in particular, public participation, with you or your colleagues at any time.

Again, thank you for bringing LASG's positions on these important issues to my attention. I look forward to continuing our constructive working relationship.

Sincerely,

Peter Maggiore

Peter Maggiore
Cabinet Secretary

Los Alamos
NATIONAL LABORATORY

Hazardous & Solid Waste, ESH-19
Mail Stop K490
Los Alamos, New Mexico 87545
667-0633 / Fax 667-5224

Date: February 15, 2002
Refer to: ESH-19:02-010

TA-54

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FEB 2002
NMED Hazardous Waste Bureau

Carl Will, Permitting
RCRA Permits Management Program
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Dear Mr. Will:

Subject: Determination of Incompleteness for:

1) **"Closure and Post Closure Plans for TA-54-Area G Landfill," September 1985;**
2) **"TA-54 Area H & Area L Landfill Closure and Post-closure Plan," November 1986;**
3) **"Closure Plan for Technical Area 54, Material Disposal Area L" (Revision 1.0), March 1998;**
4) ***"Closure Plan for Technical Area 54, Material Disposal Area H" (Revision 1.0), March 1998.***

- Los Alamos National Laboratory EPA ID# NM0890010515 -

The purpose of this letter is to request a sixty (60) day extension to the subject letter issued by the Hazardous Waste Bureau (HWB) regarding the Los Alamos National Laboratory's (LANL) Material Disposal Areas (MDA) located at Technical Area (TA) 54. In that letter, LANL is required to provide a response by February 26, 2002. As we discussed in our meeting with James Bearzi and John Kieling, our response to your concerns about our approach will require a substantial effort.

We are concerned about coordinating activities that are currently approved by the HWB and being implemented by the LANL Environmental Restoration Program for MDA-H. These involve the shift from closure and post closure care to corrective action through the endeavors of the High Performance Team. We are also collecting data from modeling being completed at TA-54, the storm water run-off program, the vadose zone monitoring, and the Hydrogeologic Work plan as it relates to the ground water monitoring requirements in the closure regulations. Addressing the issue of risk assessment for each of the individual MDAs is a substantial challenge. Also, the effort to develop the requested crosswalks that establish how the corrective action program is fulfilling the requirements for closure and post closure care is extensive.

We wish to comply with your request, and believe it is pivotal to the Laboratory's approach to closure, post closure, and corrective action for regulated disposal units. It is imperative that we spend the necessary time to address the issues presented by the three MDAs. Therefore, we request an additional sixty days to develop our response to your letter.

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Thank you for your consideration of this issue. If you should have any questions concerning this issue, please feel free to contact me at 667-0633.

Sincerely,

for JEE

Jack Ellvinger
ESH-19

JE/dts

Cy: James P. Bearzi
Hazardous and Radioactive Materials bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

John Kieling, Program Manager,
Permits Management Program
Hazardous and Radioactive Materials Bureau
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G. Turner, DOE/OLASO, MS A316
J. Stetson, DOE/OLASO/PWT, MS A316
D. McInroy, E-ER Proj. Office, MS M992
E. Louderbough, LANL, LC-OL, MS A187
G. Bacigalupa, LANL, ESH-19, MS K490
S. French, LANL, SWO/WFM, Ms F691
IM-5, MS A150
ESH-DO File, MS K491
ESH-19 File

TA 54

State of New Mexico
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GARY E. JOHNSON
GOVERNOR

PETER MAGGIORE
SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

March 20, 2002

Dr. John C. Browne, Director
Los Alamos National Laboratory
P.O. Box 1663, MS A100
Los Alamos, NM 87545

Mr. David A. Gurule
Los Alamos Area Office
Department of Energy
528 35th Street, MS A316
Los Alamos, NM 87544

SUBJECT: CLOSURE AND POST-CLOSURE PLAN REQUIREMENTS TECHNICAL AREA 54, MATERIAL DISPOSAL AREA H LOS ALAMOS NATIONAL LABORATORY EPA ID# NM0890010515 HWB-FACILITY-99-050

Dear Dr. Browne and Mr. Gurule:

The New Mexico Environment Department (NMED) is in receipt of a February 6, 2002, letter from Los Alamos National Laboratory and the U.S. Department of Energy (Permittees) in which clarification of groundwater monitoring, closure, and post-closure reporting requirements for Technical Area (TA) 54, Material Disposal Area (MDA) H, under the Federal Resource Conservation and Recovery Act (RCRA), the New Mexico Hazardous Waste Act, and pursuant regulations is requested. Specifically, the letter requests clarification regarding compliance with the 40 C.F.R. Part 264, Subparts F and G, groundwater monitoring, closure, and post-closure requirements under proposed Subpart S procedures *vis-à-vis* MDA H.

The Permittees have submitted applications for renewal of their RCRA Permit, which will incorporate closure plans and post-closure plans. NMED will issue the Permit in several phases or "chapters." One chapter will contain facility-wide requirements, and other subsequent chapters will be issued for specific TA's, containing TA-specific requirements. The TA-54 Application and Permit Chapter shall contain a closure plan and post-closure plan for TA-54,

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which must include MDA H. A separate closure plan and post-closure plan for MDA H is not required nor desired.

The MDA H section of the TA-54 closure plan and post-closure plan must include a short narrative summary of investigation and remediation activities at MDA H, a demonstration of compliance with groundwater monitoring, closure, and post-closure requirements, and references identifying where compliance with those requirements is documented. The plans must list applicable regulatory provisions under 40 C.F.R., Part 264, Subparts F and G, and indicate how compliance with each provision is achieved and where compliance is documented. Where the means of compliance is not yet determined indicate in the plans the proposed schedule for attaining compliance. This description of regulatory compliance can be in table crosswalk format.

The following is a list of the applicable sections of 40 C.F.R. Part 264 for which compliance at MDA H must be demonstrated: 264.91 through 100; 264.111; 264.112(b)(1), (3), (4), (5), and (6); 264.113(a), (b), and (c); 264.114; 264.115; 264.116; 264.117; 264.118(b); 264.119(a) and (b); and 264.310.

If you have any questions or need additional information please contact me at 505-428-2512 or have your staff contact Carl Will of my staff at 505-428-2542.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

cc: J. Kieling, NMED HWB
D. Cobrain, NMED HWB
C. Will, NMED HWB
J. Young, NMED HWB
E. Frank, NMED HWB
N. Dhawan, NMED HWB
A. Ortiz, NMED OGC
L. King, EPA Region 6
J. Ellvinger, LANL ESH-19, MS K490
G. Bacigalupa, LANL ESH-19, MS K490
G. Turner, DOE LAAO, MS A316
J. Canepa, LANL EM/ER, MS M992
M. Kirsch, LANL EM/ER, MS M992
D. McInroy, LANL EM/ER, MS M992
J. Vozella, DOE LAAO, MS A316

file: Reading and ~~LANL TA-54~~

FACT SHEET

Issuance of an Order
Under Sections 74-4-10.1 and 74-4-13 of the
New Mexico Hazardous Waste Act

The United States Department of Energy
The University of California
Los Alamos County, New Mexico

Facility Name: Los Alamos National Laboratory

EPA ID Number: NM0890010515

Type of Facility: The Los Alamos National Laboratory (Facility) is a hazardous waste treatment, storage, and disposal facility under the New Mexico Hazardous Waste Act (HWA) and the federal Resource Conservation and Recovery Act (RCRA).

Location: The Facility is comprised of approximately 43 square miles located on the Pajarito Plateau in Los Alamos County in north-central New Mexico, approximately 60 miles north-northeast of Albuquerque and 25 miles northwest of Santa Fe. The Facility is surrounded by the Pueblo of San Ildefonso, Los Alamos County, Bandelier National Monument, Santa Fe National Forest, and Bureau of Land Management lands. The Rio Grande River and the tribal lands of the Pueblo of San Ildefonso border the Facility down stream to the east.

Respondents: The Order is issued to the United States Department of Energy (DOE), the owner of the Facility, and the University of California which operates the Facility.

PUBLIC PARTICIPATION

Comment Period and Regulatory Contact:

The public comment period for this Order begins on May 2, 2002 and will end on July 1, 2002. Written comments and any requests should be submitted no later than 5:00 p.m., July 1, 2002 to:

James P. Bearzi, Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303
Ref: Los Alamos National Laboratory Facility Order

Availability of the Order and Other Documents:

The administrative record for the Order includes the Order, this Fact Sheet, a public notice, a finding of imminent and substantial endangerment, investigation and monitoring data,

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investigation reports, related correspondence and other documents. NMED has prepared an index to the administrative record to facilitate access to the administrative record by the public. The documents that comprise the administrative record may be reviewed during normal business hours (8:00 a.m. to 5:00 p.m.) at:

New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
(505) 428-2500

The text of the Order, Fact Sheet and Public Notice are also available at the Mesa Public Library located 2400 Central Avenue, Los Alamos, New Mexico [(505) 662-8253] and on the New Mexico Environment Department (NMED) Web Page at:

http://www.nmenv.state.nm.us/HWB/pubnotice.html

To obtain a copy of the administrative record or any part thereof, please contact the NMED Hazardous Waste Bureau at the address provided above. There will be a charge for reproduction of all or any portion of documents. Any person who wishes to comment on this proposed Order should submit written comments, along with the commentor's name and address, to Bureau Chief, Hazardous Waste Bureau at the above address. Only comments received by 5:00 p.m. on July 1, 2002 will be considered.

PROCEDURES FOR REACHING A FINAL DECISION

All comments received during the comment period will become part of the Administrative Record and will be considered by the NMED in formulating the final Order. The NMED will prepare a response to all written comments which will specify which provisions, if any, of the Order have been changed in the final Order, and the reasons for any changes. NMED will issue a final Order to the Respondents upon incorporation of any such changes. The NMED will make the final Order available to the public. All persons who presented written comments or who requested notification in writing will be notified of the issuance of the final Order by mail. The Secretary's issuance of the final Order constitutes a final agency action and may be appealed as provided by the Hazardous Waste Act.

INTRODUCTION

On May 2, 2002, NMED determined that the past or present storage, treatment or disposal of hazardous and solid waste at the Facility may result in an imminent and substantial endangerment to human health and the environment. NMED is issuing the Order to abate the endangerment and to protect human health and the environment. This fact sheet is intended to facilitate public review of the Order.

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GARY E. JOHNSON
GOVERNOR

PETER MAGGIORE
SECRETARY

For Immediate Release
May 2, 2002

Contact: James Bearzi, Chief, Hazardous Waste Bureau
Phone: (505) 428-2512
Contact: Cathy Tyson, Communications Director
Phone: (505) 827-2855

State Environment Department Schedules Public Informational Meetings Concerning Draft Order for Investigation and Cleanup of Contamination at Los Alamos National Laboratory

(Santa Fe, NM) –Today the New Mexico Environment Department (NMED) issued a draft order to Los Alamos National Laboratory (LANL) requiring a comprehensive investigation and cleanup of contaminated sites at LANL. The draft order addresses all significant environmental cleanup issues at LANL, including hundreds of contaminated sites, landfills, and surface and ground water. It marks the first time the state has set strict schedules for LANL's environmental cleanup work, and will help ensure appropriate prioritization of environmental activities by LANL and the Department of Energy (DOE).

In an effort to answer questions from and generally inform the public about the draft order, the NMED will be holding informational meetings in late May. The meetings will be held from **6 p.m. to 9 p.m.** The dates and locations are as follows:

- **Tuesday, May 21 – Española:** Northern New Mexico Community College Auditorium, 921 Paseo de Oñate
- **Thursday, May 23 – Jemez Springs:** Jemez Springs High School Auditorium, 8501 Highway 4

- More -

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- **Tuesday, May 28 – Los Alamos:** Smith Auditorium, Los Alamos High School, 1400 Diamond Drive
- **Thursday, May 30 – Santa Fe:** Harold Runnels Building, Auditorium, 1190 S. St. Francis Drive

At these meetings NMED personnel will provide information about the order and answer questions to clarify its content. These are informational meetings, and there will be no opportunities for presenting oral testimony; however, members of the public may submit to NMED written comments on the draft order at any time during the public comment period, including at the informational meetings. NMED will issue the final order after considering all written comments.

The NMED is inviting the public to submit written comment on the draft order during a sixty-day public-comment period that starts today. NMED will issue the final order after considering all written comments. Both the draft order and the administrative record may be reviewed at the NMED Hazardous Waste Bureau located at 2905 Rodeo Park Drive East, Building 1, Santa Fe, New Mexico 87505-6303. Procedures for submitting written comments and a copy of the draft order are also available at the NMED website:

http://www.nmenv.state.nm.us/HWB/pubnotice.html

Written comments will be accepted until **5 p.m., July 1, 2002.**

For additional information, please contact James Bearzi, Chief, NMED Hazardous Waste Bureau, at (505) 428-2512, or Cathy Tyson, NMED Communications Director, at (505) 827-0314.

###

August 1, 2002

By email to: James_Bearzi@nmenv.state.nm.us

James P. Bearzi, Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Re: Los Alamos National Laboratory Facility Order

Dear James:

Concerned Citizens for Nuclear Safety (CCNS) makes the following comments on the New Mexico Environment Department's (NMED's) May 2, 2002 draft order issued to the Los Alamos National Laboratory (LANL):

1. CCNS is pleased that the NMED Secretary has issued the determination and that the NMED has prepared the draft order and released it for public comment. However, the draft order does not state when, where and how the public may participate in and comment on investigation and cleanup processes that will be performed by the Facility and reviewed by the NMED. The NMED should prepare a public participation section for the draft order, based on Environmental Protection Agency guidance as referenced in the Attorney General of New Mexico's July 30, 2002 comments, and release it for a 30-day comment period. After receiving and incorporating the comments, the NMED then should release the final order.

2. Santa Fe County should be included as an entity surrounding LANL in all descriptions of the Facility. §§II.A.3, IV.B.1.a.

3. If the Respondents, U.S. Department of Energy (DOE) and the University of California (UC), fail to respond in any way to any of the requirements found in the order, the NMED Secretary should quickly commence civil litigation against the Respondents under NMSA §74-4.10.1.

4. The definition for a Material Disposal Area (MDA) should explain more fully why closure or post-closure care requirements may not apply to an MDA. §III.B.

5. The Respondents should be required to maintain paper copies of all "documents, data, and other information required to be prepared under this Order" for 100 years, a time period discussed in the context of long-term stewardship and long-term environmental stewardship. The NMED should require Respondents to keep electronic copies, with a properly maintained and operating electronic reader. For example, if

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Respondents recorded information on an 8-track, then Respondents should be required to maintain an 8-track player in order to provide access to the information.

6. CCNS supports a strong NMED enforcement program. However, over the years, the enforcement program has suffered because of inadequate funding. The NMED must charge the Respondents fees that will adequately fund a strong enforcement program. §III.M.

7. All information required to be posted on the Facility website should accessible and able to be downloaded by older computer systems without crashing the systems. §IV.A.2.

8. The NMED should be more specific about the requirements for the background groundwater concentration study required by the Order. Is the Respondent required to take background samples from each well, at each level in the alluvial aquifer, intermediate zone, and regional aquifer groundwater? The final order should state where and the frequency of sampling in order to establish an adequate background groundwater data set. §§IV.A.3.d.

The final order should include a requirement for a background surface water concentration study that includes the specifics stated above. The study should include the perennially-flowing surface water, snowmelt run-off, stormwater run-off, and artificial sources of stormwater, including outfalls.

9. All quarterly or periodic monitoring results should be posted on the Facility website when submitted to the NMED, with appropriate qualifiers. §IV.A.3.f. Respondents should be required to state the applicable cleanup standards or other regulatory criteria with their postings. §VII.D.2.9.

10. CCNS strongly supports the development of a "return of the lands used by the Facility to 1942 background levels," also known as a "pre-LANL," or "sustainable homesteader" or "sacred" scenario for the use in cleanup levels, screening levels, reporting level, migration pathways, and risk assessments. Public participation in the development of such a scenario should be provided for in the final order.

11. The NMED should define "technically infeasible." §VII.C.1. The NMED should provide "technically infeasible" criteria in the draft order and submit such language to the public for a 30-day comment period.

12. The reference to §VII.C.4.b is unclear. §§VII.D.2.12, VII.D.4.b.

13. The threshold criteria should cite regulations or standards or provide definitions. §VII.D.4.a.

14. After the "...this report is true, accurate, and complete" language in the remedy completion report certification, the NMED should insert the following: "... and that if

Facility classifiers have changed any information that forms the basis for the report, that that information would not change the final determination." §VII.E.6.a.

15. The final order should include a provision prohibiting the Facility from destroying any documents or samples, including drilling core, until receiving the approval to destroy from the NMED.

Thank you for your careful consideration of CCNS's comments. Should you have any questions or comments, please contact me.

Sincerely,

Joni Arends
Waste Programs Director

TA54

Los Alamos
NATIONAL LABORATORY
EST. 1943

ENTERED

Environmental Programs
P.O. Box 1663, MS M991
Los Alamos, New Mexico 87545
505-606-2337FAX 505-665-1812

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OCT 2007
NMED Hazardous Waste Bureau

National Nuclear Security Administration
Los Alamos Site Office, MS A316
Environmental Restoration Program
Los Alamos, New Mexico 87544
505-667-4255/FAX 505-606-2132

Date: October 5, 2007
Refer To: EP2007-0591

James P. Bearzi, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Submittal of Technical Area 54 Well Evaluation and Network Recommendations, Revision 1

Dear Mr. Bearzi:

Enclosed please find two hard copies with electronic files of the "Technical Area 54 Well Evaluation and Network Recommendations, Revision 1." The revision addresses specific requirements described in the New Mexico Environment Department's Approval with Direction letter dated August 31, 2007. In addition to supporting the corrective measures being conducted under the Consent Order, the groundwater monitoring-well network recommended in this evaluation is intended to meet detection monitoring requirements under 40 CFR 264.90-99, Subpart F.

If you have any questions, please contact Danny Katzman at (505) 667-6333 (katzman@lanl.gov) or Mat Johansen at (505) 665-5046 (mjohansen@doeal.gov).

Sincerely,

Susan G. Stiger, Associate Director
Environmental Programs
Los Alamos National Laboratory

Sincerely,

for David R. Gregory, Project Director
Environmental Operations
Los Alamos Site Office

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2.3 MDA G

MDA G is the largest of the MDAs at TA-54. It contains low-level radioactive waste and hazardous waste. It consists of 38 large pits and 4 trenches that were filled with Laboratory waste beginning in the 1950s, with low-level radioactive waste emplacement continuing into the present (Hollis et al. 1997, 063131; LANL 2005, 090513). Additionally, there are dozens of shafts at the site, some of which received large inventories of tritium, and high-activity tritium waste accounts for more than 90% of the total radionuclide inventory projected for the facility. Other radionuclides present in large quantities include isotopes of americium, plutonium, and uranium.

Currently, the only significant subsurface transport at MDA G has been of VOCs and tritium, both of which travel in the vapor phase. The VOC inventory at MDA G is much lower than at MDA L, and the maximum VOC concentrations in the subsurface are also approximately an order of magnitude lower than at MDA L. Transport of VOCs at MDA G should be quite similar to that at MDA L. With a thinner vadose zone to diffuse through, the VOC could potentially reach the regional aquifer more quickly than simulations at MDA L predict. However, concentrations would be lower because of the lower source-term concentrations. The footprint at the regional aquifer would be similarly localized beneath MDA G, following the shortest diffusive pathway. Also, concentrations measured in the regional aquifer would be expected to be quite low because of minimal fractionation from the vapor phase into liquid water at the water table.

Tritium at MDA G is the primary contaminant of concern because of its relatively high mobility in the vapor phase (water vapor) as well as the large inventory (>2 million Ci) disposed of at this site. The vapor-phase transport mechanisms are expected to be the same as described at MDAs H and L, but because of the thinner vadose zone, diffusive travel time to depth could be shorter at MDA G. Also, a water vapor tritium plume will equilibrate with clean porewater that it encounters. For example, if tritium in water vapor encounters elevated saturations in the Guaje Pumice Bed at the top of the Cerros del Rio basalt, exchange with the porewater could result in lateral transport of tritiated water along that steeper topographic gradient, leading to a more complicated footprint of tritium at the water table from MDA G than at the other sites. Tritiated porewater flowing south along the gradient of the basalt topography may then encounter recharge infiltration occurring beneath Pajarito Canyon, leading to enhanced downward migration to the regional aquifer to the south of MDA G than would be expected for transport through the mesa itself.

Liquid-phase migration is the dominant transport method for nonvolatile contaminants at MDA G. It is expected to be quite slow because of very dry conditions that limit migration. However, because of thinning Bandelier Tuff units, the fastest liquid-phase travel times are expected to occur at the eastern end of MDA G, which has the greatest inventory.

3.0 MONITORING OBJECTIVES

The monitoring objectives for TA-54 are based on both the regulatory status described in Section 1.0 and the conceptual model described in Section 2.0. They are described below. The recommendations provided in Section 5.0 are made in the context of these objectives.

1. Evaluate whether the existing groundwater-monitoring well network provides an understanding of nature and extent of contamination sufficient to support remedy selection for SWMUs and anticipated permit requirements for TA-54.

This objective is focused on an evaluation of the network from the perspective of whether there is some unknown aspect of nature and extent related to the physical, geochemical, or hydrologic status of wells that is sufficient to change or affect the remedy selection for MDAs H, L, and G. This objective is based in large part on the conceptual model and the nature of known releases from each of the MDAs.

2. Establish a groundwater-monitoring network that meets the requirements for "detection monitoring" and subsequent "compliance monitoring" at permitted units at TA-54.

   The following requirements from 40 CFR 264.90-.99, Subpart F apply to permitted units or regulated units that received waste after July 26, 1982. The regulations apply throughout the active life of the units and the closure and post-closure period if the units are not "clean-closed" under RCRA. The groundwater-monitoring network and facility process must be able to detect, evaluate, and respond to releases of hazardous waste or hazardous waste constituents into the uppermost aquifer. Detection monitoring is required to establish that a release has occurred. It is assumed that because of the significant depth to groundwater beneath TA-54, vadose-zone monitoring will be a key component of the overall monitoring program in support of both CMEs and the RCRA Part B permit.

   An integrated groundwater-monitoring system must consist of a sufficient number of near-field wells and downgradient monitoring wells installed at appropriate locations and depths to obtain representative groundwater samples from the uppermost aquifer. These samples must represent both the quality of background water not affected by the regulated unit and the quality of groundwater passing beneath the regulated unit to allow for detection of contamination in the uppermost aquifer.

3. Evaluate the configuration of the monitoring network to confidently protect water-supply wells and detect contaminants that may migrate off-site.

   This objective integrates water-supply protection with the above objectives to ensure that contaminants, if present, can be detected before reaching water-supply wells or the Laboratory boundary. The objective is met using sampling data and a groundwater-transport model that traces the path of hypothetical mobile contaminants from locations where contaminants might break through to the regional groundwater system. The model is used to assess the ability of the current well network to detect at least 95% of potential contaminants from TA-54 that might migrate toward a production well or pass beneath the Laboratory boundary. The current network configuration was found to be inadequate to detect for potential offsite releases. Therefore, this evaluation includes newly proposed well locations that are discussed below.

4.0 MONITORING NETWORK ASSESSMENT

The following table summarizes the evaluation of the physical and geochemical performance of the group of wells considered for TA-54 in the context of the monitoring objectives described in Section 3.0. The physical criteria include the effectiveness of sampling systems to provide representative groundwater data, well construction, and isolation of sampling zones. Also included are reviews of factors such as screen positions and screen length evaluated in the context of the conceptual model and monitoring objectives. Geochemical criteria include the consideration of conditions within the aquifer related to drilling operations that may result in sample data that do not meet monitoring objectives.

1.5.5 Other Requirements

In addition to the HSWA Module VIII requirements, numerous federal and state requirements are relevant to groundwater protection, groundwater monitoring, and hydrogeologic characterization. For example, DOE Order 5400.1 Environmental Protection, and the New Mexico Water Quality Control Commission Regulations (WQCC) both address groundwater characterization, monitoring, and protection. These two examples, as well as other relevant federal and state requirements have been technically considered in the preparation of this Workplan.

The structured groundwater monitoring requirements applied to regulated units under RCRA are prescriptive[2]. The New Mexico Annotated Code, Title 20, Chapter 4, Part 1 (20 NMAC 4.1) Subpart VI, Sections 264.91-100 establish three progressive monitoring programs that, unless a demonstration can be made that no potential for migration of liquid from the regulated unit to the uppermost aquifer exists, may be necessary to implement for detecting and addressing releases to groundwater. To adequately establish a monitoring network under any of these programs, it is necessary to characterize the subsurface (including groundwater) in a comprehensive manner.

It is the DOE and UC's intention to perform characterization activities set forth in this Workplan to ensure that information is gathered sufficient either to demonstrate an adequate groundwater monitoring waiver or to provide for the installation of a detection monitoring network (or both, as appropriate). If it is determined to be necessary, repetitive monitoring described in any of the three progressive monitoring programs will be performed outside the scope of this plan.

1.6 Groundwater Protection Strategy

The Laboratory has developed a Groundwater Protection Strategy (Strategy) [Appendix 3] to provide a basis and direction for groundwater protection, and to serve as a guide for the development of this Workplan. The goal of the Strategy is to describe a dynamic approach to protecting the groundwater resource from unacceptable impacts resulting from past, present, and future Laboratory operations. Fundamental to the Strategy 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 is the ER Project's characterization and assessment of Potential Release Sites (PRSs) on a site-specific basis, including investigations of the canyons which will provide information regarding the Laboratory's vadose zone and evaluations of saturated systems associated with PRSs. A third source will be the proposed installation of wells that will be used to characterize and define the Laboratory's basic hydrogeologic setting by providing geologic, 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

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[2] Following examination of relevant regulations, DOE and UC have determined that, depending on the status of the units in question, different groundwater monitoring requirements could apply. Specifically, in New mexico Annotated Code, Title 20, chapter 4, Part 1 (20 NMAC 4.1) Subpart VI, 264.90, a distinction is made between regulated units (those surface impoundments, landfills, land treatment units, and waste piles that have received hazardous waste after July 26, 1982), and other solid waste management units (SWMUs). Regulated units are subject to 264.91 - 100 requiring, in many cases, groundwater monitoring. (However, a Subpart X unit, while it does not meet the definition of a surface impoundmant, landfill, land treatment unit, or waste pile, can also be subject to 264.91 - 100 if it potentially impacts groundwater -- otherwise 264.101 applies). In contrast, no formal monitoring requirements are established in 264.101 for SWMUs that are not regulated units. Although monitoring may be a component of remediation, no automatic monitoring requirements are triggered by 264.101. Instead, actions pursuant to 264.101 are driven by the occurrence of an actual release for which a threat to human health and the environment has been established and corrective action is necessary.

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TA 54

NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

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Governor

DIANE DENISH
Lieutenant Governor

RON CURRY
Secretary

CINDY PADILLA
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

October 29, 2007

David Gregory
Federal Project Director
Los Alamos Site Office, Department of Energy
528 35th Street, Mail Stop A316
Los Alamos, NM 87544

David McInroy
Remediation Services Deputy Project Director
Los Alamos National Laboratory
P.O. Box 1663, Mail Stop A992
Los Alamos, NM 87545

RE: NOTICE OF APPROVAL
TECHNICAL AREA 54 WELL EVALUATION AND NETWORK RECOMMENDATIONS, REVISION 1
LOS ALAMOS NATIONAL LABORATORY
EPA ID #NM0890010515
HWB-LANL-GROUNDWATER MISC

Dear Messrs. Gregory and McInroy:

The New Mexico Environment Department (NMED) is in receipt of the United States Department of Energy and Los Alamos National Security, LLC (collectively, the Permittees) document entitled *Technical Area 54 Well Evaluation and Network Recommendations, Revision 1* (hereafter, the Report) dated October 2007 and referenced by LA-UR-07-6436/EP2007-0591. NMED has reviewed the Report and hereby issues this Notice of Approval with the following comment.

In Figure C-1of the Report, the Permittees identified five alternative locations (R-37, R-37a, R-37b, R-37c, and R-37d) to place a well for monitoring potential releases from Material Disposal Areas (MDAs) H and J. To eliminate any potential to contaminate regional groundwater during installation and operation of the proposed monitoring well, and to increase the probability of detecting potential releases at this monitoring location at the earliest possible time, the Permittees must place this well close to the proposed location of R-37c. If the site conditions allow, this well

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must be placed to the west of the service road in Cañada del Buey to minimize the distance between MDAs H and J and the monitoring well. To implement the recommendations that have been identified in Section 5.0 of the Report, the Permittees must submit a work plan to NMED for approval no later than November 12, 2007, as required in NMED's August 31, 2007 letter.

Should you have any questions or comments, please contact John Young at (505) 476-6038 or Hai Shen at (505) 476-6039.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

JPB:hs

cc: D. Cobrain, NMED HWB
J. Young, NMED HWB
K. Roberts, NMED HWB
H. Shen, NMED HWB
T. Skibitski, NMED DOE OB
S. Yanicak, NMED DOE OB, MS J993
B. Olson, NMED GWQB
L. King, EPA 6PD-N
M. Johansen, DOE LASO, MS A316
S. Stiger, LANL ENV, MS J591
C. Mangeng, LANL ENV, MS J591
T. Behr-Andres, LANL ENV, MS M992
D. Katzman, LANL ENV, MS M992

file: Reading and LANL TA-54 (MDAs G, H, L, Groundwater)

General

NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

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Secretary

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CERTIFIED MAIL - RETURN RECEIPT REQUESTED

February 11, 2010

George J. Rael
Environmental Operations Manager
Los Alamos Site Office
Department of Energy
3747 West Jemez Road, MS A316
Los Alamos, NM 87544

Michael Graham
Associate Director Environmental Programs
Los Alamos National Security, L.L.C.
P.O. Box 1663, MS 991
Los Alamos, NM 87545

RE: REQUIREMENT TO CONDUCT RELIABILITY ASSESSMENT OF MULTI-SCREENED WESTBAY WELLS
LOS ALAMOS NATIONAL LABORATORY (LANL)
EPA ID #NM0890010515
HWB-LANL-MISC-GW

Dear Messrs Rael and Graham:

The New Mexico Environment Department (NMED) reiterates its longstanding concern with the reliability of the data generated from multi-screened no-purge Westbay monitoring wells at LANL. Specifically, these wells may not be capable of producing representative samples for contaminant detection and monitoring. In 2007, the United States Department of Energy (DOE) and the Los Alamos National Security, L.L.C. (LANS) (collectively, the Permittees) submitted to NMED the *Well Screen Analysis Report, Revision 2* (Report), which was approved on May 25, 2007. The Report evaluated impacts from residual drilling fluids on the representativeness of groundwater samples in regional and intermediate aquifer wells. The Report concluded that the majority of screens associated with the Westbay installations may have been impacted by drilling fluids. Since then, several Westbay wells have been rehabilitated and converted to single or dual-screened wells that contain pumps and therefore are capable of being purged prior to sample collection.

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The March 1, 2005 Compliance Order on Consent (Order) requires wells to be designed and constructed in a manner which will yield high quality samples. In order to determine if the remaining Westbay wells are yielding high quality samples suitable for monitoring purposes, the Permittees must conduct a reliability assessment of Westbay wells by comparing water-quality data from groundwater samples collected from the same screen intervals in Westbay wells both prior to and after purging.

The Permittees must conduct the reliability assessment for at least seven screens from a minimum of four Westbay wells. The Permittees must submit a work plan that proposes the Westbay wells to be tested and describes the details of purging and collection of samples from the selected wells, proposed analytical tests, and the methodology to assess representativeness of samples collected by **March 12, 2010**.

Should you have any questions or comments, please contact Michael Dale at (505) 661-2673.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

cc: J. Kieling, NMED HWB
D. Cobrain, NMED HWB
J. Kulis, NMED HWB
K. Roberts, NMED HWB
S. Yanicak, NMED DOE OB, MS M894
T. Skibitski, NMED DOE OB
L. King, EPA 6PD-N
P. Huber, EP-LWSP, MS M992
H. Shen, DOE-LASO, MS A316

File: Reading and LANL '10, Groundwater Miscellaneous

Kieling, John, NMENV

From: Mayer.Richard@epamail.epa.gov
Sent: Friday, September 04, 2009 3:40 PM
To: Pullen, Steve, NMENV; david.cobrain@state.nm.us; Kieling, John, NMENV
Subject: Re: EPA's LANL Draft RCRA Permit Comments
Attachments: LAN Permit comments 72109.doc; LAN Permit comments 72109.pdf

See attachments below.

Rich Mayer, P.G.
Sr. Project Engineer
US EPA
Federal Facilities Section (6PD-F)
214-665-7442
Fax - 214-665-7263

This inbound email has been scanned by the MessageLabs Email Security System.

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Part 9: This part is inconsistent regarding there being a clean closure performance standard for regulated units. The section on regulated units, Section 9.1.1, references the closure performance standards.

Section 9.1, Page 93, Line 5: Are all of the disposal units at MDA's G, H, and L considered RCRA regulated units or are only certain disposal units considered RCRA units? This should be clarified in the permit and clearly depicted on a Figure.

Section 9.1.1, Page 93, Lines 22 & 23: It appears that Section 9.2 does not mention the "regulated units" as needing to meet the closure performance standards but does mention the indoor and outdoor units; therefore, the reference to the closure performance standard in Permit Section 9.2 can be deleted.

Section 9.3, Page 93, Line 7: EPA was under the impression that the Permit would address the closure and post-closure of all RCRA regulated units and that the Compliance Order on Consent would address the SWMUs and AOCs. However, the permit indicates in this section that the consent order is where the closure and post-closure care requirements for the Material Disposal Areas will be addressed. However, in Section 9.5 the permit requires a closure certification report for all permitted units. Please clarify. This section appears to be in conflict with Section 9.5.

If Closure and Post-Closure care of the MDAs are to be addressed under the Order on Consent, then NMED should assure the same requirements (Closure and Post-Closure) in the Order as would be required in the permit.

Section 9.4.7.1.ii.a, Page 102, line 13: EPA is not sure what is meant by "One sample at all secondary containment areas". Under line 9 in the same section, there is a requirement for "1 sample for every 900 square feet under the pad". Is the sample to be taken underneath the curb or wall of the storage unit? Please clarify in the permit.

Section 9.2.1, Page 94, Line 21: EPA does not see the difference between the standards of "Clean Closure" and the standard under line 27, "Inability to Achieve Clean Closure Performance Standards". They appear to be the same standards.

Section 9.4.7.1: This references 9.4.7.1.ii(c), which does not exist. Please revise.

Section 11.3.1., Groundwater Monitoring: EPA recommends that the Interim Facility Wide Groundwater Monitoring Plan be attached to the permit unless there is a public comment period under the Consent Order where the public can comment on this plan.

Section 11.11.2.3, Page 163, Water Rotary and Mud Rotary: EPA recommends that mud rotary methods not be used at LANL due to the well documented problems identified over the past 5 years. Additives may be used in intervals above the target zone if telescoping casing constructions are used and the hole is adequately cleaned before drilling the final footage within the interval to be screened.

TA-16 Closure Plan for the Open Burning Units, Attachment G: The closure soil sampling plan does not specifically indicate the types of samples to be taken; discrete or the multi-increment sampling (MIS) approach. EPA recommends that the MIS approach be used. However, if the MIS approach is not used, then **many** discrete samples (more than 4) are needed to adequately characterize the site for closure.

Attachment A, Page 32, line 18 and Page 33 line 5: These lines references figures (H-3, H-4, H-5) that do not exist. Please revise.

Attachment I (Compliance Schedule): The attachment incorrectly references Section 2.5 as including a requirement to submit particular figures.

Attachment I (Compliance Schedule): The incorrectly omits the Section 6.5.2 requirement to submit annual storm water sampling report.

Attachment A: Section A.5.2 references "Figure X" (page 24, line 27), which does not appear in the Permit.

Attachment G, Closure Plan: There were no closure plans included for MDA's H, L, and G.

Closure Cost Estimates for Financial Assurance, Attachment M: The total cost for closure should be $26,452, 303.00. This is number EPA got when totaling the closure costs for each hazardous waste unit in Attachment M. (Please note that the cents column was not added when totaling the costs). Please revise accordingly. Also, please note that t he closure costs for the MDA's were not included.

Attachment N: Some of the figures are not in numerical order.

Attachment O, Long-Term Maintenance and Monitoring Plans: When is this section to be completed and what hazardous waste units are to be included? Does the post-closure plan cover the same requirements as this attachment?

Time for NMED to protect groundwater from LANL
Joni Arends
Posted: Saturday, December 05, 2009 - 12/6/09

http://www.santafenewmexican.com/Opinion/My-View-Time-for-NMED-to-protect-groundwater-from-LANL

The recent action by the New Mexico Environment Department to fine Los Alamos National Laboratory nearly $1 million for groundwater contamination is important.

This is the seventh fine that taxpayers have had to pay since 2005 when the NMED/LANL consent order was signed, and so far, about $1.3 million has been paid to NMED. The consent order requires LANL to investigate some of its dumps located on the Pajarito Plateau and propose several different remedies to address pollution migration. Federal and state laws are very clear about what is required to protect groundwater, especially for the 21 million cubic feet of hazardous, toxic and radioactive waste buried in poorly monitored dump sites across the Pajarito Plateau.

But there is a dirty little secret: NMED is not requiring LANL to prevent legacy wastes from contaminating groundwater. NMED has not made LANL perform the necessary scientific studies nor provide accurate monitoring of the groundwater as required by law. NMED has approved well-monitoring networks that allow large-scale groundwater contamination to migrate uncontrolled beneath the 40-square-mile facility.

A little background information helps situate the issue. The Environmental Protection Agency has declared the Española Basin as a sole-source aquifer, meaning that it is the only groundwater source of drinking water. The Buckman well field is within this area, as well as LANL. Further, 60 percent of the water produced from the Buckman wells comes from the Pajarito Plateau. And approximately 40 percent of Santa Fe's drinking water comes from the Buckman wells.

The danger from LANL contaminants is real, but poorly understood, despite spending hundreds of millions of taxpayer dollars. In addition, federal law requires special protection for sole-source

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aquifers, but LANL has an exemption. This exemption should be removed by congressional action with support from NMED.

Federal and state laws require that pollution from LANL dumps be detected when it first reaches the groundwater underneath them. The existing well networks do not detect this contamination. For the past six years, Robert H. Gilkeson, a registered geologist and LANL whistleblower, has documented that LANL has not installed the required well networks in order to protect the precious groundwater as a drinking-water resource.

NMED is allowing LANL to use Monte Carlo computer models to conduct analyses that give a 95 percent confidence the well network will detect contamination before it reaches a drinking-water well or the site boundary. In other words, it's an assessment that allows large-scale contamination to migrate below the LANL property and pretends to protect the groundwater.

Yet, NMED recognizes that this scheme will not work. In an Aug. 15, 2007, letter to LANL, NMED acknowledged, "contaminant plumes that originate below (the large LANL dump sites) may not be detected by (the existing well networks) until the contaminants spread in groundwater as far as 3 to 5 miles downgradient from (where contamination first reaches the regional aquifer below the dumps)." But NMED eventually approved the deficient well network, even though it does not meet legal requirements and allows uncontrolled contaminant migration miles away from the dumps.

This is only one example. NMED has approved similar assessments for all the groundwater networks across the LANL site. The $1 million fine does not correct the mistakes made in the existing and planned groundwater monitoring networks at the large waste dumps.

The ongoing demolition of buildings will change the horizon at LANL. But the underground migration of contaminants will continue. NMED must stop approving bogus Monte Carlo computer models as a substitute for strict compliance with federal and state laws. NMED must stop gambling with protection of public health and require LANL to comply with the laws.

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