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Mr. James Bearzi, Chief
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2044 Galisteo Street
P.O. Box 26110
Santa Fe, NM 87502-2100

Dear Mr. Bearzi:

Enclosed is one of two NMED copies of the sampling and analysis plan (SAP) for characterizing and assessing potential releases to the environment from septic and other miscellaneous drain systems at Sandia National Laboratories/New Mexico. This negotiated SAP was prepared in consultation with the New Mexico Environment Department (NMED) Hazardous and Radioactive Materials Bureau (HRMB) and the DOE Oversight Bureau (OB).

NMED/HRMB review of No Further Action (NFA) proposals written for the 23 original ER sites, and the SWMU Assessment Reports for the first four non-ER sites has resulted in an NMED request for additional sampling. The SAP reflects a comprehensive sampling strategy for the investigation of the 101 non-ER sites, and to fill remaining data gaps in the investigation of the original 23 ER sites. The focal point of this strategy is based on the Septic Systems "Site Decision Tree", and the negotiated SAP has been produced based on this Decision Tree.

The SAP describes a stepped investigation approach that will be utilized to determine if significant impacts have resulted from septic and other miscellaneous drain system releases at SNL/NM. At the conclusion of each investigation phase, data that have been generated at a particular site will be reviewed and analyzed to determine:

- 1) if investigations are sufficient to complete the NFA process for a listed ER site,

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- 2) if investigations are sufficient to eliminate a non-ER site from further investigation , as documented in a SWMU Assessment Report,
- 3) if additional deeper soil investigations, and perhaps groundwater monitoring are required to assess the potential risk that a particular site may pose to human health and the environment or,
- 4) if investigations at a non-ER site clearly show a threat to human health and the environment, resulting in a permit modification to include the site on Table 2 of the Hazardous and Solid Waste Amendments Module of the SNL/NM Resource Conservation and Recovery Act Permit.

If you have any questions, please contact John Gould at (505) 845-6089.

Sincerely,



Michael J. Zamorski
Area Manager

Enclosure

cc w/enclosure:

D. Bourne, ERD

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J. Parker, NMED-OB

R. Kennett, NMED-OB

D. Neleigh, EPA, Region 6 (2 copies via Certified Mail)

cc w/o enclosure:

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**Sampling and Analysis Plan (SAP) for Characterizing and Assessing Potential
Releases to the Environment from Septic and Other Miscellaneous Drain Systems
At Sandia National Laboratories/New Mexico**

1.0 Introduction

This sampling and analysis plan (SAP) describes in detail the methodology and procedures that will be utilized to complete assessment and characterization of small septic and drain systems at Sandia National Laboratories/New Mexico (SNL/NM). This SAP has been developed and is based on negotiations and discussions between SNL/NM Environmental Restoration (ER) project personnel, and New Mexico Environment Department/Oversight Bureau (NMED/OB) and NMED/Hazardous and Radioactive Materials Bureau (NMED/HRMB) personnel conducted in late 1998 and early 1999. This document also expands on site characterization procedures and rationale described in a "Site Decision Tree" document that has been developed jointly by NMED/OB, NMED/HRMB and SNL/NM ER project personnel (Attachment A). This SAP is also based on, and is a follow-up to a position paper that describes the sampling and analysis procedures that were utilized to perform initial characterization activities at the first 16 non-ER septic and drain system sites. This position paper was formally submitted as a letter dated May 27, 1998, from Mr. George Lasker with the US Department of Energy (DOE), Albuquerque Operations Office, Kirtland Area Office (DOE/KAO) to Mr. Benito Garcia, Bureau Chief, NMED/HRMB. It is provided as Attachment B of this SAP. Field sampling work at the first 16 non-ER sites was completed in June and July 1998. Results of the field investigations at four of the 16 sites (includes the Bldg. 6631, 6730, 6750, and 6922 septic systems) were summarized in four Solid Waste Management Unit (SWMU) Assessment Reports, which were submitted to the NMED/HRMB on September 29, 1998.

The strategy presented below is a stepped investigation approach that will be utilized to determine if significant environmental impacts have resulted from septic and other miscellaneous drain system releases at SNL/NM. The approach includes various "trigger levels" that will be used to determine the amount of investigation that is required to adequately characterize the multitude of septic and other miscellaneous drain systems sites that are present at SNL/NM. At the conclusion of each investigation phase, data that has been generated at a particular site will be compared to the appropriate trigger level(s) to determine (1) if investigations are sufficient to propose the site for No Further Action (NFA), or (2) if additional deeper soil investigations, and perhaps groundwater monitoring are required to assess the potential risk that a particular site may pose to human health and the environment.

2.0 Phase I Field and Sampling Activities

2.1 Non-ER Septic and Drain Systems

As many as 101 non-ER septic and other miscellaneous drain systems (typically drywells, french drains, and surface outfalls not connected to a septic tank) are thought to exist at SNL/NM based on currently-available information. These systems are listed in an internal SNL/NM memo dated July 8, 1996, which is provided as Attachment C. Associated large-scale maps showing the approximate locations of these 101 systems are provided as Attachment D. The non-ER septic and drain systems are identified on these maps by a "map I.D. number", which corresponds to the "Map ID No." column in the Attachment C document spreadsheets. In addition, a map showing

the locations of the 23 ER septic and drain system sites within Kirtland Air Force Base (KAFB) is also provided as part of Attachment D.

2.2 Site Inspections

Visual site inspections will be conducted at the estimated 85 remaining non-ER septic and drain system sites at which no sampling has been done. These inspections will be completed to confirm the existence and nature of the systems, and to determine the locations of above-grade components (septic tanks and seepage pits, mainly), and estimated locations of buried components (primarily drainfields). SNL/NM facilities engineering maps will also be obtained when available, as an aid to system location. Finally, digging permits will be obtained, and a backhoe will be used to physically locate and confirm the size, depth, and configuration of buried components. This backhoe procedure has been previously utilized to locate buried units at numerous SNL/NM septic and drain systems. Recently gathered information indicates that some of the sites listed in Attachment C consist of nothing more than, for example, a drywell that was constructed to receive condensate water from an air conditioning unit, and would therefore not be expected to require an environmental investigation. SNL/NM and NMED personnel will jointly review all information available for each of the sites to identify sites that will, or will not, require environmental characterization and assessment. Once the systems are located, New Mexico State Plane coordinates will be determined for individual system components using Global Positioning System (GPS) survey equipment provided by the Sandia ER project, Geographic Information Systems (GIS) group. A general location map, and a detailed site map showing the location and configuration of system components, and soil-gas and soil sampling locations relative to those components will be generated. These maps will be included in the summary report that will be written for each site where characterization activities have taken place.

2.3 Goresorber™ Passive Soil Vapor Surveys

As shown in Step 1 of the Site Decision Tree (Attachment A), Goresorber™ (GS) passive soil vapor (SV) surveys will be conducted at all non-ER sites where such surveys are deemed necessary by NMED personnel. The Goresorber™ samplers will be obtained from, and will be analyzed for VOCs by the manufacturer, W.L. Gore, Inc. The number of samplers, and sample pattern required at each site will be determined on a case-by-case basis in consultation with NMED personnel. The average number of samplers is not expected to exceed five per site, although additional samplers may be required to adequately cover some of the largest units. Passive SV survey data will be used solely to help identify soil sampling locations, and as an additional data set for helping to select potential deep groundwater sites where subsurface active soil vapor samples will be collected.

GS sample locations will be surveyed using SNL/NM GPS equipment. GPS survey data, and pertinent SNL/NM electronic map files will be provided to W.L. Gore Inc., and they will produce GS sampling location and contaminant concentration maps. The maps, and GS sampler analytical results will be reviewed by NMED and SNL/NM ER personnel. NMED and SNL/ER personnel will then agree on shallow soil sampling locations at each site based primarily on the configuration or type of unit (e.g. drainfield, seepage pit, etc.), and also to some degree on the Goresorber™ analytical results.

2.4 Shallow Soil Sampling

As shown in Step 1 of the Site Decision Tree, shallow soil sampling investigations will be conducted at the non-ER septic and drain system sites that have not yet been sampled, and that are deemed by NMED personnel to require such investigations. Soil samples will be collected using Geoprobe™ sampling equipment, in the same manner as has been previously utilized at numerous other SNL/NM septic and drain system sites. A total of 101 non-ER sites are estimated to be present at SNL/NM, and shallow soil sampling was conducted at the first 16 of these non-ER sites in mid-1998. Therefore, as many as 85 sites remain to be sampled. Some of the remaining 85 sites may have multiple drain systems, based on past experience at the ER septic and drain system sites. Of the 85 sites, 5 are potential shallow groundwater sites, and the remaining 80 are potential deep groundwater sites, as discussed in Section 3.0 below.

The "standard suite" of analyses to be performed for shallow soil samples collected at each of the sites that remain to be sampled includes:

- Volatile organic compounds (VOCs) by EPA method 8260
- Semi-volatile organic compounds (SVOCs) by EPA method 8270
- Polychlorinated biphenyls (PCBs) by EPA method 8082
- Total Cyanide by EPA method 9010A
- High explosives (HE) compounds by EPA method 8330
- RCRA metals by EPA methods 6010 and 7471
- Hexavalent chromium by EPA method 7196A
- Gamma spectroscopy radionuclides by HASL 300
- Gross Alpha/Beta by EPA method 900.0

Additional samples for PCBs, cyanide, and hexavalent chromium will also be collected at the first 16 non-ER sites that were initially sampled in June and July 1998. These additional analytes were not specified or required when samples were first collected at these sites in 1998. (Attachment B).

Field duplicate soil samples, and aqueous equipment rinsate blanks will be collected at the frequency of 5% (or 1 in 20) of the environmental samples. Field duplicate and equipment blank samples will be analyzed for the same constituents as the environmental samples. Also, aqueous trip blanks will be included with all VOC sample shipments, and will be analyzed for VOCs only.

Once all shallow soil samples have been collected and analyzed, the analytical data will be compiled into data summary tables for each site, and will then be reviewed by SNL/NM and NMED personnel. The shallow soil sample results will be used as a basis for identifying potential shallow groundwater sites where additional soil sampling (if needed) will be completed, as discussed in Section 3.2 below. These data will also be used as a basis for determining which of the potential deep groundwater sites will be selected for deep soil vapor sampling, as discussed in Section 3.3 below.

3.0 Phase II Sampling Activities

3.1 Highly Contaminated Sites

Highly contaminated sites are defined as sites at which total VOCs are found at a concentration of greater than 100 parts per million (ppm) in any shallow soil sample. This value is thought to represent a soil concentration value at which measurable groundwater contamination may occur at depth. As shown in Steps 2 and 4 of the Site Decision Tree, if total VOC concentrations in excess of 100 ppm are detected in any of the shallow soil samples collected at a site, then deep soil vapor sampling (described in section 3.3 below) will be conducted to determine if significant VOC concentrations in soil vapor are present beneath the site, and if the potential for groundwater contamination exists.

3.2 Potential Shallow Groundwater Sites

Potential shallow groundwater sites are defined as those sites lying on or east of Sandia or Tijeras Faults, as shown on Plate IV ("Potentiometric Surface for the Regional Groundwater System at SNL/KAFB, Fall, 1995") of the Site Wide Hydrogeologic Characterization Project, Calendar Year 1995 Annual Report. The Plate IV faults have been transposed to the large-scale ER and non-ER site locations maps provided as Attachment D in order to show sites that are located either east or west of the Sandia or Tijeras Faults. As shown on the ER site location map in Attachment D, a total of 13 ER sites (Sites 49, 116, 140, 141, 142, 143, 144, 145, 147, 149, 150, 154, and 160) qualify as potential shallow groundwater sites. As shown on the non-ER site map in Attachment D, there are also an estimated five non-ER sites that qualify as potential shallow groundwater sites. The latter sites include the Solar detox facility septic system (map I.D. numbers 1018 and 1019), the live fire range septic system (map I.D. number 1094), the Bldg. 9938 seepage pit (map I.D. number 1095), and the SFER/127/128/130 septic system (map I.D. number 1097).

PETREX™ passive SV surveys and shallow soil sampling investigations were completed at the 13 potential shallow groundwater ER sites between 1994 and 1997. The results of these investigations have been compiled and presented in NFA proposals for these sites. No SV or soil sampling activities have been completed at the five potential shallow groundwater non-ER sites.

When the shallow soil and passive soil gas sampling has been completed at all of the sites, the data will be compiled and summarized. All soil sampling analytical data generated from all potential shallow groundwater ER and non-ER sites will be reviewed to determine if contaminant of concern (COC) concentrations in soil samples exceed any of the soil "trigger level" concentrations or radionuclide activities listed below. These trigger levels have been developed jointly by NMED and SNL/NM personnel, and are thought to be indicative of possibly significant contamination at depth, at potential shallow groundwater sites. The "trigger levels for the various COCs are as follows:

- VOCs: greater than 10 parts per billion (ppb) for any individual VOC
- SVOCs: greater than 1 ppm for any individual SVOC
- PCBs: greater than 1 ppm for any individual PCB compound
- Cyanide: greater than 1 ppm total cyanide
- HE compounds: greater than 1 ppm for any individual HE compound
- RCRA metals: greater than 5 times of the most appropriate background upper tolerance limit (UTL) or 95th percentile concentration that has been established and approved by the NMED for each metal in SNL/NM soils
- Hexavalent chromium: greater than the SNL/NM soil background UTL concentration of 1 ppm
- Gamma spectroscopy radionuclides: greater than 30% above the background UTL or 95th percentile activity level for any gamma spectroscopy radionuclide for which a background activity level that has been established and approved by the NMED for SNL/NM soils
- Tritium: 20,000 picocuries per liter (pCi/L) in soil moisture (for sites where tritium samples are collected)
- Gross alpha/beta activity levels will be used to qualitatively screen for high-level radionuclide contamination only, and will not be compared to any trigger level. If gross beta activity is considered "high", then additional samples for tritium analyses will be collected from the site. "High" gross beta is defined herein as greater than an order of magnitude (10 times) above 35.4 picocuries per gram (pCi/g), or 354 pCi/g. 35.4 pCi/g is the 95th percentile beta activity level for 40 gross beta soil samples collected from throughout New Mexico by NMED in 1990.

As shown in Step 5 of the Site Decision Tree, if the COC concentrations in any Phase I soil sample collected at any potential shallow groundwater site location exceeds one or more of the trigger level(s) listed above, additional soil samples will be collected at 5 foot intervals at that location. The additional samples from each interval will be analyzed for all of the COCs for which trigger levels were exceeded. Soil sampling at each location will continue until two consecutive sampling intervals are "clean" (i.e. no trigger level exceedances), or until bedrock or groundwater is encountered. If bedrock (or groundwater) is encountered before "clean" conditions are achieved, groundwater monitoring will be required at the site. If groundwater monitoring is required, the initial well will be installed at a location agreeable to both NMED and SNL/NM personnel. To the extent possible, only one well will be completed at each site to check for potential groundwater contamination. The need for additional wells at the particular site will depend on groundwater sampling results from the initial well, and will be determined based on discussions between SNL/NM and NMED personnel.

3.3 Potential Deep Groundwater Sites

Potential deep groundwater sites are defined as those lying west of the Sandia or the Tijeras Faults (Attachment D). Of the total of 123 ER and non-ER sites, 18 are shallow groundwater sites, and the remaining 106 sites are considered potential deep groundwater sites.

Soil sampling trigger levels discussed above will apply only to potential shallow groundwater sites, and will not be used to determine the need for additional shallow soil sampling at potential deep groundwater sites. Instead, analytical results of all shallow soil and passive soil vapor sampling completed at potential deep groundwater ER and non-ER sites will be reviewed and evaluated by SNL/NM and NMED personnel. SNL/NM and NMED personnel will then select a subset consisting of 10% of the total number of potential deep groundwater sites at which sampling has taken place, and that appear to have the highest potential for significant

contamination. The following activities will then be completed at each of the sites included in the first 10% subset:

- As shown in Step 8 of the Site Decision Tree, a single borehole will be drilled at each site, and active SV samples will be collected at 5, 20, 70, 100, and 150 feet below ground surface (bgs) in each borehole. The borehole location will be determined by SNL/NM and NMED personnel. Most likely, boreholes will be drilled using an auger rig, an air rotary/casing hammer (ARCH) rig, a core drilling rig, or other appropriate drilling technique. Upon completion of each borehole, a soil vapor monitoring probe will be installed at each of the pre-determined sampling depths in the borehole. Soil vapor sampling will be conducted after a minimum of 3 months have passed since installation of the probes, to allow for the dissipation of short-term, near-borehole disequilibrium conditions that may have been introduced during drilling.
- As shown in Step 10 of the Site Decision Tree, if the total VOC concentration exceeds 10 parts per million by volume (ppmv) in the 150-foot depth SV sample at any site in the initial 10% subset of sites, then a second 10% subset (of the initial total number of deep groundwater sites) will be selected for deep SV sampling. This second group of sites will again be selected based on shallow soil sampling analytical results, and Goresorber™ passive SV results, suspected discharge history, or other relevant information. Active SV samples will then be collected at 5, 20, 70, 100, and 150 feet bgs in a single boring drilled at each of the second group of sites. As before, if the total VOC concentration is greater than 10 ppmv in the 150-foot depth SV sample at one or more of the second group of sites, then a third 10% subset (of the initial total number of deep groundwater sites) will be selected for deep soil vapor sampling. This iteration will continue until none of the sites within the last 10% subset exhibits more than 10 ppmv total VOCs in soil vapor at the 150-foot depth. When an entire subset of sites passes the 10 ppmv total VOC test, active soil vapor sampling at potential deep groundwater sites will be terminated. For those sites that contain less than or equal to 10 ppmv total VOCs in the initial 150-foot soil vapor sample, no additional soil vapor sampling will be required, and the soil vapor monitoring borehole at the site will be abandoned. The site will then be proposed for NFA.
- The active SV sample analytical results will be evaluated in the following manner. Contaminant concentration trends in samples from an individual borehole will not be considered. Any site for which the total VOC concentration in the 150-foot depth SV sample is less than or equal to 10 ppmv will be proposed for NFA. On the other hand, if the SV concentration exceeds 10 ppmv total VOCs in the 150-foot depth SV sample, groundwater monitoring will be required at that site. If groundwater monitoring is required, the initial well will be installed at a location agreeable to both NMED and SNL/NM personnel. To the extent possible, only one well will be completed at each site to check for potential groundwater contamination. The need for possible additional wells at the particular site will depend on groundwater sampling results from the initial well, and will be determined based on discussions between SNL/NM and NMED personnel.

3.4 Risk Assessment, Data Evaluation, and Reporting

Results of all investigations completed at individual non-ER sites where no work has to date taken place will be evaluated, summarized, and reported. COC concentrations that are detected above maximum background concentrations at these sites will be evaluating using established risk assessment procedures. This evaluation will be performed to demonstrate either that the

individual site poses no significant risk to human health or the environment, or to determine if additional sampling, or remediation should be completed at the site.

Additional investigations that may be completed at ER septic and drain system sites will be summarized and submitted as addendum reports to the NFA proposals that have been written for those sites. Additional investigations that may be completed at the four non-ER sites for which SWMU Assessment Reports have already been completed and submitted to NMED/HRMB will be summarized and submitted as addenda to those reports. Reports that are written for each individual site will contain all information necessary to describe and evaluate the results of characterization and assessment activities that have taken place at the site. These reports will also contain sufficient information to determine or demonstrate the threat or degree of risk (if any) that the site poses to human health or the environment.

4.0 Groundwater Monitoring

As shown in Step 11 of the Site Decision Tree, groundwater samples will be collected from newly-installed wells for a minimum of eight quarters (2 years). Sample analytes will be determined on a case-by-case basis in consultation with NMED personnel. If COC concentrations exceeding pertinent drinking water standards, Maximum Contaminant Levels (MCLs), risk-based action levels, or other applicable standards are detected in groundwater samples from a particular well, then additional monitoring, and potentially remediation will be considered and possibly required at that site (Site Decision Tree Step 14).

ATTACHMENT A

**Sandia ER Program Septic Systems
Site Decision Tree Document**

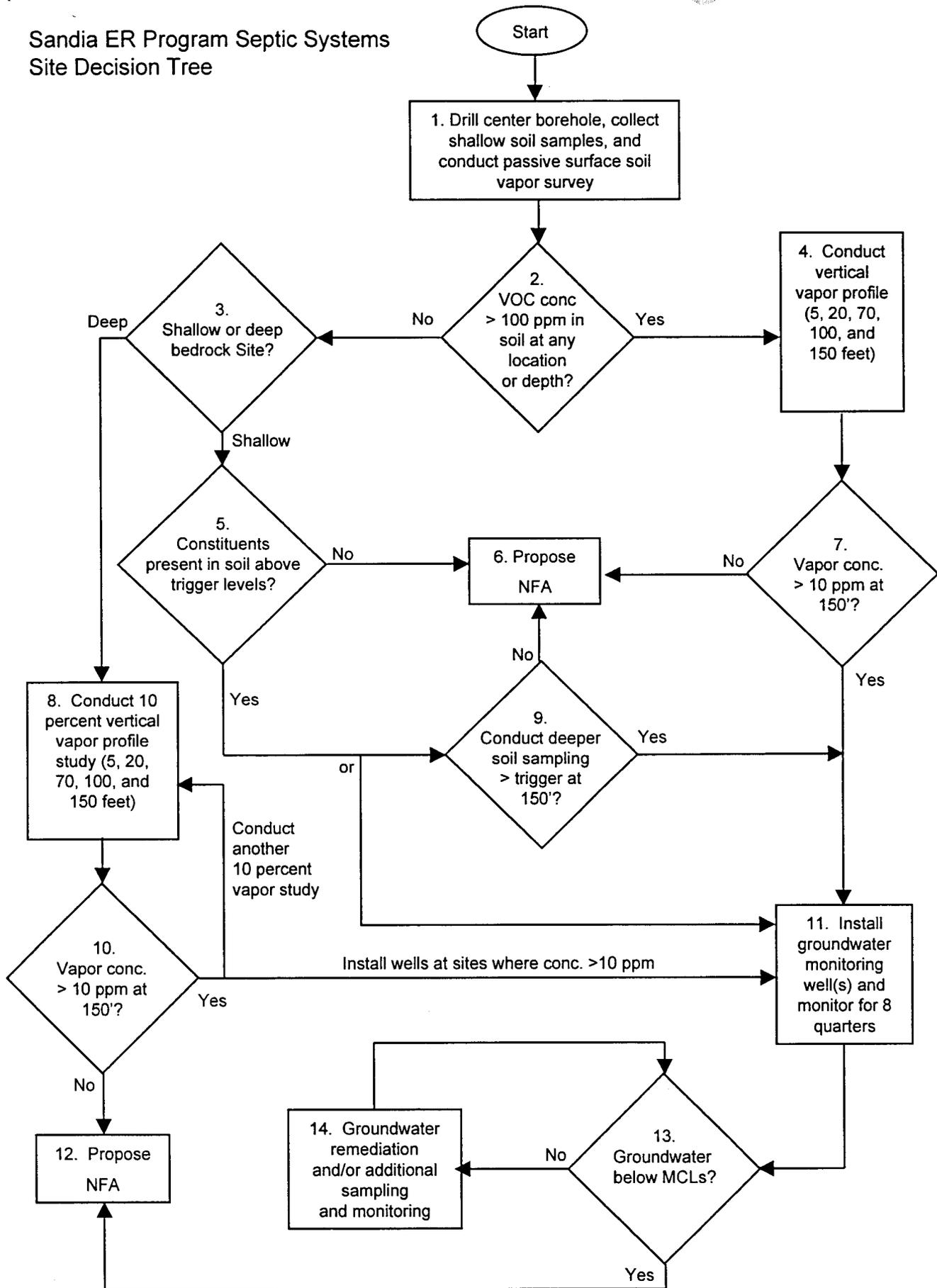
Sandia ER Program Septic Systems Site Decision Tree

Former septic systems at Sandia may pose a threat to groundwater or may have already resulted in measurable vadose zone and/or groundwater contamination. Little or no information is available regarding these liquid releases in terms of duration, quantity, or nature of the chemicals released in solution. Because these were liquid releases, it is crucial that the formal site investigation program is designed to identify specific sites that may pose significant risk to groundwater. Presented below is the step-by-step narration that describes the process illustrated in the attached Septic Systems Site Decision Tree. The decision tree is presented as a tool that will be used to manage the septic system program, as agreed by the U.S. Department of Energy, Sandia, and NMED, and assumes normal site conditions. The NMED reserves the right to require additional information or deviate from the decision tree if abnormal or unusual conditions are encountered.

Step	Description
1	A center borehole and passive surface soil vapor survey is required at all septic system sites to allow sites to be ranked according to 10 percent groups where the first 10 percent is the site group most likely to pose risk to the environment. The number and location of soil vapor and soil sampling locations will be determined on a site-by-site basis.
2	100 ppm VOC concentration in soil is used to make decisions regarding future activities at the site. This value is thought to represent a soil concentration value at which measurable groundwater contamination may occur at depth.
3	Shallow bedrock septic sites are east of Sandia and Tijeras Fault, deep are west of these faults.
4	If soil VOC concentration is measured above 100 ppm, conduct a vapor profile to 150-foot depth.
5	At shallow sites, are soil concentration results above trigger levels? VOCs – 10 ppb for any VOC cyanide – 1 ppm metals – 5 times background PCBs/SVOCs - 1ppm radionuclides - > 30 percent background Cr ⁺⁶ - background HE - 1 ppm H ₃ - 20,000 pCi/l
6	If the answer to question 5 is no, propose no further action (NFA).
7	Determine which sites have vapor concentrations greater than 10 ppm at 150 foot depth.
8	A vertical vapor profile will be conducted at the first 10 percent deep septic system sites (See item 1 above). This list of sites is the site group most likely to pose risk to the environment.
9	At shallow sites, if contamination is found above trigger levels in soil and/or vapor, a deeper soil study will be conducted to a depth of 150 feet, or a groundwater monitoring well will be installed. Soil samples will be collected at 5-foot intervals. If results for at least two consecutive soil samples are negative, NFA will be proposed (see Box 6).

10	At sites where vapor concentration is greater than 10 ppm at 150 feet, groundwater monitoring will be required. If any sites in a given 10 percent group are measured positive, the next 10 percent group will be studied. This iteration will continue until none of the sites included in any group exhibits contamination at 150 feet.
11	If vapor concentration is greater than 10 ppm at 150-foot depth (item 7), groundwater monitoring will be required for 8 consecutive quarters. Groundwater samples will be analyzed for all target level suites – VOCs, cyanide, PCBs/VOCs, radionuclides, Cr ⁺⁶ , HE, and tritium.
12	If vapor concentrations are measured below 10 ppm at 150 feet, propose NFA.
13	Are constituents measured in groundwater below drinking water or other applicable standards?
14	If groundwater is above drinking water or other applicable standards, remediation and/or additional monitoring will be required.

Sandia ER Program Septic Systems
Site Decision Tree



ATTACHMENT B

**Letter from DOE/KAO to NMED Describing Sampling and Analysis Procedures
Used at the First 16 Non-ER Septic and Drain System Sites**