PROGRESS TOWARD CLOSURE OF THREE CONTAMINATED GROUNDWATER SITES AT SANDIA NATIONAL LABORATORIES, NEW MEXICO

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ABSTRACT

Sandia National Laboratories/New Mexico (SNL/NM) is the site of three low-concentration contaminated groundwater sites. Site investigation and remediation work at SNL/NM had been voluntarily conducted for over a decade before the New Mexico Environment Department (NMED) issued a Compliance Order on Consent (COOC) (1) in 2004, which meant implementation of the Corrective Measures Evaluations (CMEs) for the contaminated groundwater sites. Sandia National Laboratories is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy (DOE) under contract DE-AC04-94AL85000. The contaminants found in concentrations exceeding drinking water standards at the three sites include trichloroethene (TCE), tetrachloroethene (PCE), and nitrate at Technical Area V; nitrate at the Canyons area; and TCE and nitrate at the Tijeras Arroyo Groundwater area.

The history of progress toward closure includes the transition from the voluntary groundwater program to a Corrective Action Process that requires an evaluation be completed by September 30, 2005 and implemented by September 30, 2006. The evaluation end dates were specified by the regulatory authority in a COOC in April 2004. Implementation end dates were specified by DOE to support Environmental Restoration closure by September 30, 2006. Post-closure activities and ownership are undefined but are anticipated to include groundwater monitoring to be performed by the landlord (National Nuclear Security Administration) organizations at Sandia National Laboratories.

Sandia National Laboratories is finding it possible to define and implement a process where regulations, requirements, and guidance have shared a history of change. Schedule uncertainties could not be totally resolved by the process developed to meet COOC deadlines. However, these uncertainties have been the exception rather than the rule and overall the process shows progress toward closure on both the Technical Area V and the Tijeras Arroyo Groundwater sites and all three CMEs are currently on schedule for completion by September 2005.

INTRODUCTION

Sandia National Laboratories/New Mexico lies within the boundaries of Kirtland Air Force Base southeast of Albuquerque, NM (Figure 1) and is the location of three low-concentration contaminated groundwater sites. Site investigation and remediation work at SNL/NM had been voluntarily conducted for over a decade before the NMED issued a COOC (1) in 2004, which meant implementation of the CMEs for the contaminated groundwater sites. Sandia National Laboratories is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the DOE under contract DE-AC04-94AL85000. The contaminants found in concentrations exceeding drinking water standards at the three sites include TCE, PCE, and nitrate at Technical Area V; nitrate at the Canyons area; and TCE and nitrate at the Tijeras Arroyo Groundwater area. The history of progress toward closure includes site characterization, transition from the voluntary groundwater program with no defined endpoint to a Corrective Actions Process, and planning for long-term stewardship.

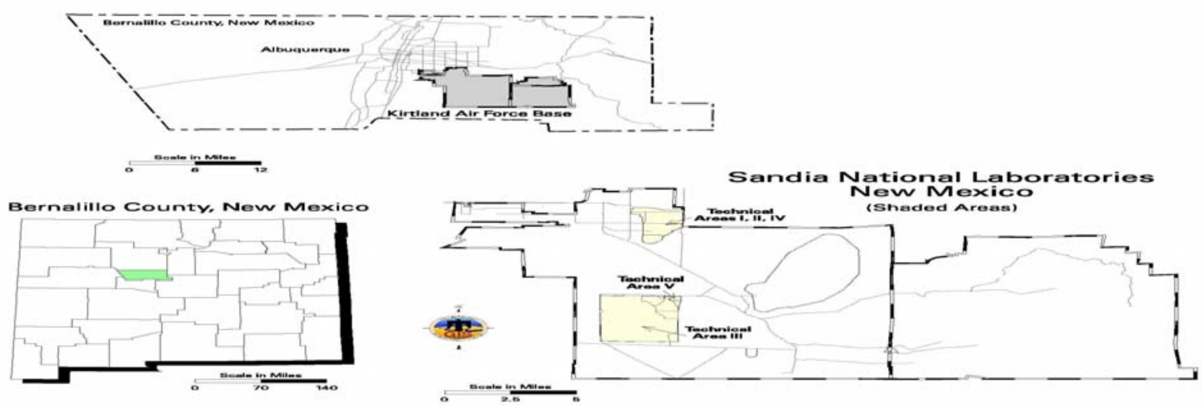

Fig. 1. Site Location

A discussion of the general geology and hydrology are provided below followed by more specific discussions of the three sites. A course of action was developed for the Corrective Action Process that included steps such as problem definition, remedy evaluation, and long-term corrective measures planning. Problem definition was supported by the previous decade's investigation and allowed some process acceleration opportunity. A strategy for progress monitoring was developed for the 16-month remedy evaluation step. This step culminates with CME Reports mandated for completion on September 30, 2005 by NMED in the COOC. Implementation by September 30, 2006 was encouraged by DOE to support site closures on that date. At that time, implementation will be conducted for the landlord organizations at Sandia National Laboratories.

GENERAL GEOLOGY AND HYDROLOGY

Surface and subsurface geologic features play an important role in the occurrence and movement of groundwater, as well as influencing potential pathways for contaminant migration. Therefore, SNL/NM completed an extensive characterization of the hydrogeologic system. Sandia National Laboratories lies within the Albuquerque basin, one of a series of north-south trending basins that was formed during the extension of the Rio Grande rift between 30 and 5 million years ago. The vertical displacement between the rock units exposed at the top of Sandia Crest and the equivalent units located at the bottom of the basin is over 3 miles. The basin is approximately 3,000 square miles and has received deposits from the ancestral Rio Grande, as well as eolian deposits and alluvial material shed from surrounding uplifts. These deposits belong to the Santa Fe Group, which are up to 14,500 ft thick at the center of the basin. The entire sequence consists of unconsolidated sediments, which thin toward the edge of the basin and are truncated by normal faults at the bounding uplifts.

The upper portion of the Santa Fe Group contains the most productive portion of the regional aquifer that supplies groundwater to the City of Albuquerque and Kirtland Air Force Base. In general, the high degree of heterogeneity and anisotropy within the upper unit results in a wide variety of hydraulic properties on a local scale.

Faults east of Sandia National Laboratories bound the Albuquerque basin and have created three different hydrogeologic regions: 1) the Albuquerque basin, 2) Tijeras fault complex, and 3) foothills and canyons. The Tijeras Arroyo Groundwater and Technical Area V sites are located within the Albuquerque basin hydrogeologic region, and the Canyons site lies within the foothills/canyons hydrogeologic region. A deep aquifer is present within the Albuquerque basin where the regional water table lies at approximately 500 ft below ground surface (bgs). There are also multiple perched aquifers above the regional aquifer in the vicinity of Tijeras Arroyo Groundwater site. The perched aquifer is approximately 220 to 330 ft bgs and is possibly formed by inter-arroyo recharge, irrigation of the golf course and other vegetated areas, water leakage from utility distribution lines, and infiltration from an unlined sewage lagoon system.

In the Canyons study area, a thin layer of alluvium covers the bedrock. The hydrogeology in this area is poorly understood due to the complicated geology created by the fault systems. The depth to groundwater ranges from about 50 to 200 ft. Most of the water supply and monitoring wells are completed in fractured bedrock and produce modest yields of groundwater. Groundwater in the bedrock aquifer generally flows west out of the canyons toward the Albuquerque basin.

The historic direction of regional groundwater flow within the Albuquerque basin was southwestward from the mountains toward the Rio Grande. However, due to groundwater pumping by Kirtland Air Force Base and the City of Albuquerque, a depression in the water table has created a broad trough directing flow towards the well fields northwest of Sandia National Laboratories. Groundwater recharge in the vicinity of Sandia National Laboratories is primarily derived from the eastern mountain front and within the major arroyos.

Tijeras Arroyo Groundwater Area

The principal contaminants of concern for the Tijeras Arroyo Groundwater Area are TCE and nitrate. The monitoring network consists of 27 wells screened within the regional aquifer or perched groundwater system. The Tijeras Arroyo Groundwater Investigation collectively includes sites located in Technical Areas I, II, and IV, and along Tijeras Arroyo, including neighboring property owned by Kirtland Air Force Base and the City of Albuquerque. The site history of the Tijeras Arroyo Groundwater Investigation area is complex. Since the late 1920s, there have been multiple tenants and facilities located in the area that have conducted a wide variety of activities. Many had the potential to contribute to groundwater contamination, which makes determining the sources of contaminants in the groundwater difficult. Source determination is further complicated by past operations at Kirtland Air Force Base and the City of Albuquerque, as well as City of Albuquerque sewer lines currently in use. Numerous Sandia National Laboratories facilities may have potentially released hazardous materials to the soil and groundwater; however, the research-oriented mission of most laboratories has resulted in an inventory of numerous chemicals, which are generally stored and used indoors in small quantities.

Of the 27 active wells, 14 wells are completed in the perched groundwater system and 13 wells are completed in the regional aquifer. In 1992, the first monitoring wells were installed as part of the groundwater quality investigations initiated in Technical Area II. In 1994, analytical results from a perched aquifer well identified TCE at a concentration of 1.0 µg/L, as compared to the maximum contaminant level (MCL) of 5.0 µg/L. Subsequently, a groundwater sample from a well located west of Technical Area II produced a TCE concentration of 8.1 µg/L. Additional investigations were prompted to identify the source of the TCE. In 2003, TCE continued to be detected in one of the perched aquifer wells at a level slightly above the MCL of 5.0 µg/L (6.57 µg/L). Nitrate is also a contaminant of concern in the Tijeras Arroyo Groundwater Investigation area and samples from five wells (four perched aquifer wells and one regional aquifer well) showed nitrate concentrations exceeding the MCL of 10 mg/L, with a maximum nitrate concentration of 26 mg/L.

Technical Area V

The principal constituents of concern for Technical Area V are TCE and nitrate. The monitoring network consists of 13 wells. The two primary areas of investigation are the Technical Area V Seepage Pits and the Liquid Waste Disposal System. The Technical Area V Seepage Pits (Solid Waste Management Unit [SWMU] 275) consist of two septic tanks that are connected to six seepage pits. In the past, at least six buildings at the south end of Technical Area V had sewer lines connected to the seepage pits. The system operated from the early 1960s through 1992, at which time the sewer lines were connected to the City of Albuquerque sewer system. It is estimated that 30 to 50 million gallons of wastewater were disposed to the pits during this timeframe. The Technical Area V Seepage Pits have been proposed and accepted by NMED for No Further Action.

The Liquid Waste Disposal System was designed to receive, monitor, and discharge effluent from Technical Area V facilities. The system consists of three individual SWMUs: Liquid Waste Disposal System Holding Tanks (SWMU 52); Liquid Waste Disposal System Drainfield (SWMU 5); and Liquid Waste Disposal System Surface Impoundments, including the discharge lines connecting to the impoundments (SWMU 4). The Liquid Waste Disposal System Surface Impoundments consist of two unlined impoundments that received approximately 12 million gallons of wastewater discharge from 1963 through 1971 and intermittent unmonitored discharge of local runoff and disposals to sink and floor drains until 1992. Approximately 6.5 million gallons of wastewater went to the drainfield from 1963 through 1967. The Liquid Waste Disposal System Drainfield (SWMU 5) and the Liquid Waste Disposal System Surface Impoundments (SWMU 4) have been proposed for No Further Action and are pending approval by NMED. The Liquid Waste Disposal System Holding Tanks (SWMU 52) are still in use and are on the active site list.

Groundwater monitoring at Technical Area V began in October 1992 with TCE first detected in October 1993. TCE has consistently been detected in one well in excess of the MCL of 5 µg/L, with a maximum value of 26 µg/L in 2000. The most likely sources of TCE are the drainfield for the Liquid Waste Disposal System and the Tech Area V Seepage Pits. TCE was also detected in a recently installed well at levels that exceed the MCL, with a maximum value of 8.18 µg/L in 2003. In 2003, nitrate levels were elevated above the MCL of 10 mg/L in one well, with a maximum concentration of 13.4 mg/L.

Canyons Area

The principal contaminant of concern for the Canyons Area is nitrate. The monitoring network consists of three monitoring wells, one production well, and two alluvial piezometers. The Canyons Area centers around the active Burn Site Facility and the former Explosives Test Site in Lurance Canyon. These facilities were/are used to conduct general explosives tests and thermal testing using JP-4 fuel. There are three groundwater-monitoring wells completed in a bedrock aquifer, one non-potable production well completed in a bedrock aquifer, and two alluvial piezometers in the monitoring network for the Canyons Area.

In 1996, elevated nitrate readings of 27 mg/L were first encountered in the monitoring wells. More wells were installed in 1997 to determine the extent of the potential contamination. Subsequent results revealed nitrate levels up to 27 mg/L. Two shallow piezometers were installed in 1997 to determine if any ephemeral flow was occurring at the alluvium-bedrock interface; both piezometers have been dry since they were installed.

THE CORRECTIVE MEASURE EVALUATION PROCESS

The Corrective Action Evaluation and Implementation Process requires an evaluation be completed by September 30, 2005 and implemented by September 30, 2006. A process was developed for the Corrective Action Process that included steps such as problem definition, remedy evaluation, and long-term corrective measures planning. Problem definition was supported by the investigations summarized above. Figure 2 charts the main steps in the process, which include (1) Defining the Problem, (2) Remedy Evaluation, (3) Long-Term Corrective Measures Planning, and (4) Corrective Measures Implementation.

Closure by September 30, 2006 is defined as completing the “Agency Decision Point” for Long-Term Corrective Measures Planning. After September 30, 2006, long-term stewardship operations conducted by the landlord organizations at Sandia National Laboratories will include Corrective Measures Implementation and eventually Corrective Measures Close-Out and a Corrective Measures Implementation Report.

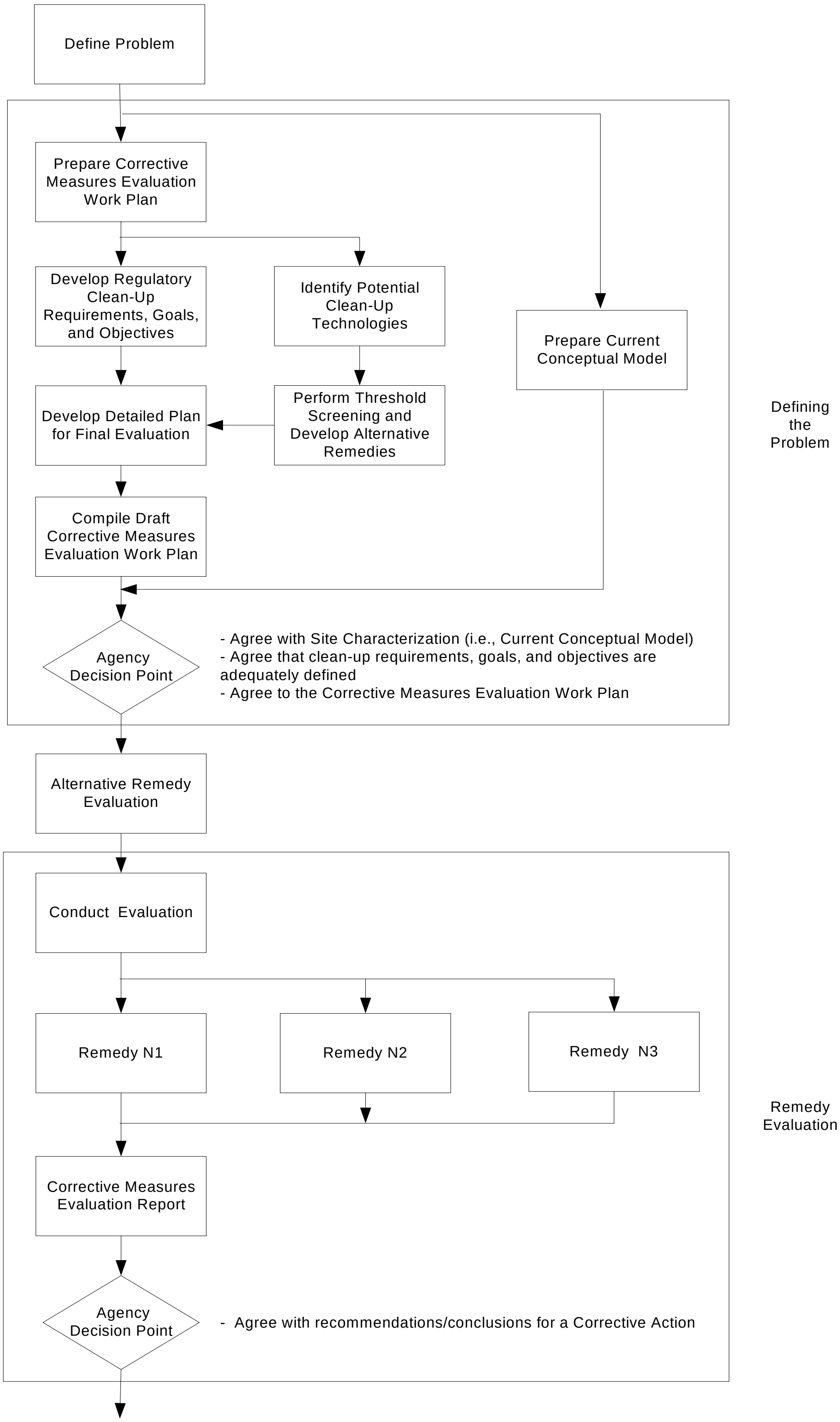

Fig. 2. Corrective Action Process

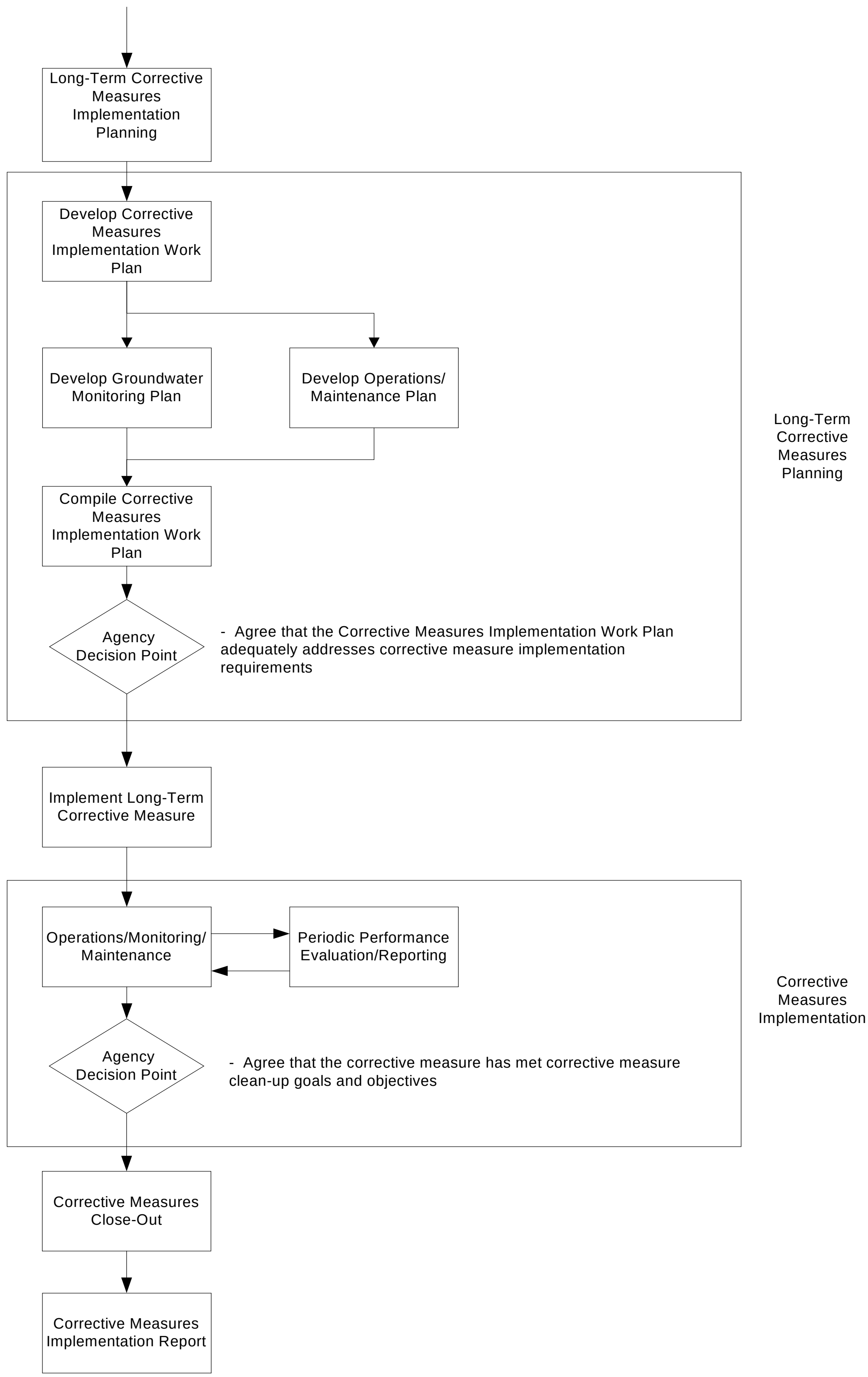

Fig. 2. Corrective Action Process (Continued)

Conceptual Model Reports and CME Work Plans (2, 3, 4, 5, 6) were produced to support the implementation of the CME for each site. The Conceptual Model Reports were produced to illustrate and communicate the current understanding of the contaminated groundwater sites. The Work Plans contained the requirements, objectives, and evaluation process to be used during the remedy component evaluations.

Conceptual Model Reports

Typically, Conceptual Model Reports (4, 5) were completed and delivered along with delivery of the CME Work Plans. Conceptual Model Reports were formatted to include the nine requirements identified in the COOC for satisfactory characterization of contaminant fate and transport in the subsurface (Section IV.C) (1). These requirements are stated in Table I.

Table I. Characterization requirements required prior to performing a CME under the COOC (1) at Sandia National Laboratories

Nine Characterization Requirements
1. Nature, rate of transport, and extent of contamination
2. Regional and perched aquifer boundaries
3. Depth to water, water levels, water table, potentiometric surface, and any seasonal variations
4. Flow directions and velocities
5. Geologic, hydrostratigraphic, and structural relationships
6. Water supply well pumping influences, seasonal pumping rates, and annual amounts of water withdrawn
7. Saturated hydraulic conductivity, porosity, effective porosity, permeability, transmissivity, particle size, storage coefficients, and estimated fracture/secondary porosity
8. Contaminant concentrations in soil, rock, sediment, vapor, and water (as appropriate)
9. General water chemistry

Corrective Measures Evaluation Work Plans

COOC Section VI, "Corrective Action Process," directed that CME Work Plans be submitted within 90 days of notification and that a schedule be included. Guidance from the Resource Conservation and Recovery Act (RCRA) Corrective Action Plan (7) was used to supplement COOC guidance. The typical CME Work Plan format, with comparison to the RCRA Corrective Action Plan guidance, is shown in Table II.

Table II. CME Work Plan format

RCRA Corrective Action Plan (7) Guidance Section	CME Work Plan (Section)
1.0 Purpose	1.0 Introduction
2.0 Cleanup Goals, Objectives and Requirements	2.0 Cleanup Goals, Objectives and Requirements
3.0 Technology Identification and Development	3.0 Technology Identification and Screening
4.0 Technology Evaluation Approach	4.0 Remedial Alternative Evaluation Approach
5.0 Technology Evaluation Plan	5.0 Remedial Alternative Evaluation Plan
6.0 Corrective Measures Study Report	6.0 Corrective Measures Evaluation Report
7.0 Project Management Plan	7.0 Project Management Plan

These Work Plans include a schedule for implementation of the CME and present a summary of the current conceptual model, state the contaminants of concern, identify cleanup goals and objectives, present potential remediation technologies, perform a technology screening, and identify possible remedial alternatives and the approach to evaluate these alternatives.

The NMED identified threshold criteria to use for evaluating remedial alternatives. These threshold criteria are reflective of cleanup standards identified in the RCRA Corrective Action Plan for evaluation of a final corrective measure alternative (7). Technologies potentially used as part of a remedy and other remedy components also need to be evaluated against these threshold criteria. The four threshold criteria listed in the COOC are:

1. Protective of human health and the environment.
2. Attain media cleanup standard or alternative, approved risk-based cleanup goals.
3. Control the source or sources of releases so as to reduce or eliminate, to the extent practicable, further releases of contaminants that may pose a threat to human health and the environment.
4. Comply with standards for management of wastes.

The site-specific conditions that impacted threshold criteria by bounding the problem are listed in each CME Work Plan and summarized in Tables III and IV. These conditions are being used to determine if the proposed remedy would be effective for an aquifer with these hydrogeologic conditions.

Table III. Summary of site-specific hydrogeologic conditions

Contaminated Groundwater Site	Technical Area V	Tijeras Arroyo Groundwater	Canyons Area Groundwater
Contamination Depth	Deep Aquifer: 500 ft bgs	Perched Aquifer: 220 - 330 ft bgs Deep Aquifer: 500 ft bgs	Deep Aquifer: 68 to 320 ft bgs
Groundwater Velocity	Slow velocities: The center of TCE mass has migrated approximately 300 ft in 36 years, which equates to a transport velocity of approximately 8 ft/year (assuming no retardation).	Slow velocities: Groundwater velocities are estimated to be 4 to 10 ft/year.	Small groundwater flux: Fracture flow is characterized by an apparent groundwater velocity of approximately 160 ft/year and by limited volumes of water.
Heterogeneous Subsurface	Alluvial fan lithofacies interfingers to the west with coarser fluvial sediments of the ancestral Rio Grande.	Deep heterogeneous perched system with low-permeability lenses.	Underlain by a structurally complex sequence of Precambrian metamorphic and Paleozoic sedimentary rocks cut by a system of north-trending faults.
Small Effective Porosity	25%		10^{-2} to 10^{-5}
Arid Environment	Recharge from annual precipitation is considered to be insignificant as a mechanism for transporting contaminants through the vadose zone.		
Water Levels	Water levels have declined steadily as a result of pumping from municipal wells to the north. These declines average 0.7 ft/year.	Variable trends in water levels in the perched system and saturated thickness ranges from 10 to 30 ft	

Table IV. Summary of site-specific peak historic contaminant concentrations

Contaminant	Technical Area V	Tijeras Arroyo Groundwater	Canyons Area Groundwater
TCE	26 µg/L	9.6 µg/L	N/A
PCE	7.5 µg/L	N/A	N/A
Nitrate	19 µg/L	44 µg/L	25 µg/L
N/A = Not Applicable			

ACCELERATE PROGRESS

One of the primary purposes of the CME Work Plans was to document agreement among the project team, stakeholders, and the regulatory agencies regarding the remedy selection process. According to guidance from the RCRA Corrective Action Plan (7), a Corrective Measures Study Work Plan will typically include a section on technology identification and development. Sandia National Laboratories, however, had sufficient data to include a technology screening in the Work Plans since extensive characterization of the three contaminated groundwater sites had been conducted. The commonalties of the three sites allowed for a technology survey on generic issues (8). This technology survey was supplemented and evaluated using the threshold criteria. The CME Work Plans took a step further by presenting a preliminary evaluation of these technologies that was performed based on information stated in the respective current conceptual models. The technologies that passed this preliminary evaluation were used to create remedial alternatives.

MONITORING PROGRESS

The only mandated regulatory date following the CME Work Plan is delivery of the CME Reports on September 30, 2005. Interim stages were defined to monitor progress toward that goal. An example for Technical Area V is shown in Figure 3.

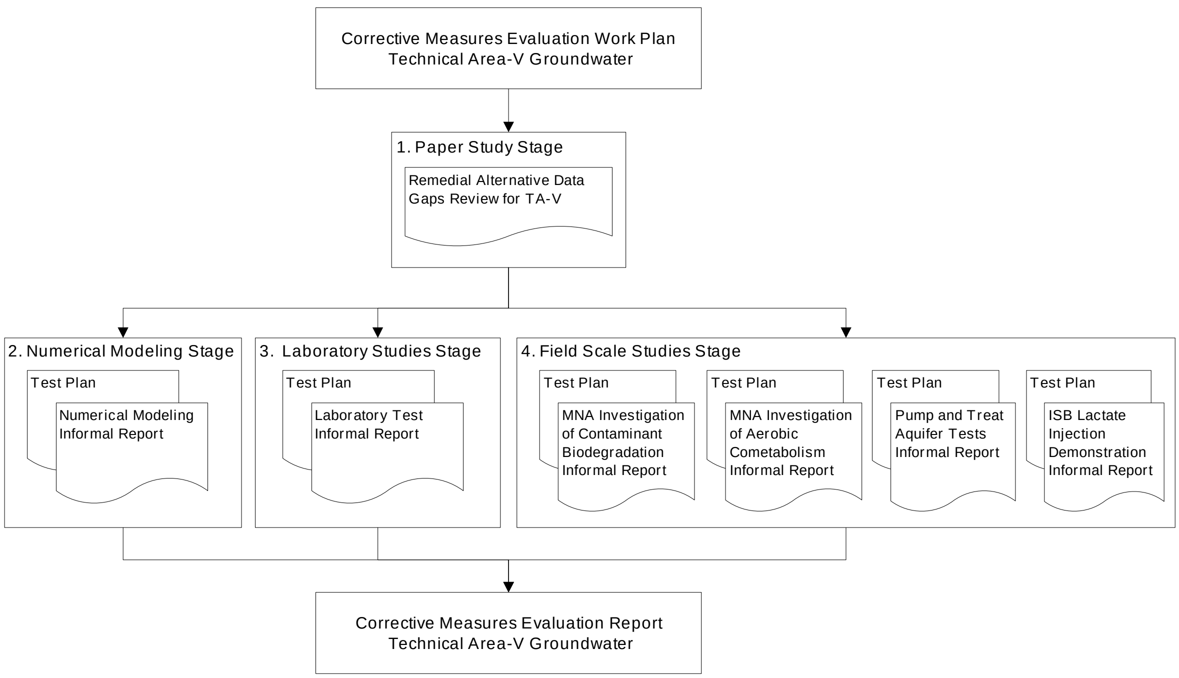

Fig. 3. Stages between CME Work Plan and CME Report for Technical Area V

As the four stages of data gathering activities are carried out, individual informal reports are created to document the results (9, 10, 11). The purpose of the informal reports includes:

- Reporting results and interpretation of results,
- Documenting decisions made during the CME process and documenting the results of the stages of data gathering,
- Providing supporting information for the CME Report, and
- Monitoring progress toward closure.

Several milestones were selected for inclusion in the Sandia National Laboratories Environmental Restoration Baseline in order to monitor progress and communicate progress to the customer. Following completion of all applicable stages for each site, the informal reports are presented to the NMED for informal discussion. Pertinent data will be compiled in a CME report where a final remedial alternative will be proposed. Upon NMED selection of a final remedy, a Corrective Measures Implementation Plan will be produced.

TRANSITION TO LONG-TERM STEWARDSHIP

Post-closure activities will be defined in the Corrective Measures Implementation Plan. They are anticipated to include, at a minimum, groundwater monitoring to be performed by the landlord organizations at Sandia National Laboratories. Groundwater team members are working with landlord and stakeholder organizations to produce draft long-term environmental stewardship planning documents, transition plans, and transition cost estimates. Stage 1 Paper Studies (9, 10, 11) included process information that is the basis for planning and estimating. An example for monitored natural attenuation at Technical Area V is shown in Table V.

Table V. Technical Area V monitored natural attenuation long-term monitoring

Parameter	Requirement
Duration of monitoring	To be determined
Frequency of monitoring	Annual
Analytes	All constituents of concern, water levels, and other parameters necessary to monitor attenuation mechanisms.
Analyses	The groundwater monitoring data would be analyzed and interpreted. This data would be used to monitor attenuation mechanisms and track contaminant of concern concentration changes.
Reporting	Annual reporting for the first 5 years, followed by reporting every 5 years until the end of long-term operations. Reports would include analysis of concentration trends and comparison to predicted trends of attenuation.
New monitoring wells	If water levels continue to decline, the following wells would need to be replaced between 2020 and 2041: TAV-MW3, TAV-MW4, TAV-MW2, LWDS-MW1, TAV-MW8, and TAV-MW5.
Depths of new monitoring wells (if installed)	Monitoring wells would be drilled at a depth sufficient to penetrate the contaminated zone. This would be determined using water level data for the past year.
Equipment	All equipment necessary for monitoring, including pumps, sample bottles, power (generator or utilities), shipping supplies, purge water tanks, personal protection equipment, and any other necessary equipment.
Equipment storage	Storage for field sampling and waste containing equipment.
Waste storage	Storage of purge water until authorized to dispose.
Institutional controls	Institutional controls would consist of engineering and administrative controls to protect current and future users from health risks associated with contaminated groundwater. Engineering controls would consist of methods to restrict access to contaminated water, including locking devices on wellheads. Administrative controls would include postings on wellheads identifying potential hazards and placing written notification of this corrective measure in the facility land-use master plan.

PROGRESS AND RESULTS

As noted above the only mandated deliverables under the COOC were the CME Work Plans and the CME Report. In order to maximize the possibility that the NMED would concur with the results of the CME reports, the Project Team proposed in the Work Plans several interim documents to provide informal progress reports of the results. These results were documented following key stages of the evaluation and show the progress made on the three contaminated groundwater sites at Sandia National Laboratories. The following is a list of progress milestones:

- All CME Work Plans were submitted before the COOC-required 90-day due date.
- Sandia National Laboratories continued work on the Stage 1 Paper Studies at risk.
- In October 2004, NMED gave approval for both the Technical Area V and the Tijeras Arroyo Groundwater CME Work Plans. The approval required small modifications to the Work Plans.
- In December 2004, both the Technical Area V and the Tijeras Arroyo Groundwater CME Work Plans were resubmitted to NMED with the requested modifications.
- Progress, as of January 21, 2005, for stages 1 through 4 is stated in Table VI.
- In November 2004, informal review of Stage 1 Paper Study began with NMED.
- Planning and estimating information has been provided to landlord organizations responsible for long-term stewardship operations.

Table VI. Progress of stages 1 through 4 (as of January 21, 2005)

Contaminated Groundwater Site	Progress
Technical Area-V	
Stage 1 Paper Study	Completed and submitted to NMED for informal review.
Stage 2 Numerical Modeling	Completed.
Stage 3 Laboratory Studies	Will not be conducted based on results of paper study.
Stage 4 Field Scale Studies	MNA field studies completed, awaiting results. ISB field studies pending results of MNA field studies. Pump and treat field studies will not be conducted based on results of paper study.
Canyons Area Groundwater	
Stage 1 Paper Study	Completed and submitted to NMED for informal review.
Stage 2 Numerical Modeling	In progress.
Stage 3 Laboratory Studies	Will not be conducted based on results of paper study.
Stage 4 Field Scale Studies	Nitrate source evaluation field studies completed. ISB and pump and treat field studies will not be conducted based on results of paper study.
Tijeras Arroyo Groundwater	
Stage 1 Paper Study	Completed and submitted to NMED for informal review.
Stage 2 Numerical Modeling	In progress.
Stage 3 Laboratory Studies	Will not be conducted based on results of paper study.
Stage 4 Field Scale Studies	Characterization and MNA field studies in progress. ISB and pump and treat field studies will not be conducted based on results of paper study.

CONCLUSIONS

Although the COOC provided a closure deadline for each of the three groundwater sites, it did not provide sufficient detail for all stages of the process. These details were resolved by consulting the Environmental Protection Agency guidance and by relying upon past experience with similar evaluation processes. Implementation of this staged process has resulted in demonstration of significant progress toward closure on both the Technical Area V and the Tijeras Arroyo Groundwater sites. As a part of this process, Sandia National Laboratories is finding it possible to define and implement a process where regulations, requirements, and guidance have shared a history of change. In addition, Sandia National Laboratories continues resolving technical issues on schedule but as yet, there is no formal regulatory input on that progress.

Despite these successes, schedule uncertainties have not been totally resolved by the staged process developed to meet COOC deadlines. For example, it is unclear if progress toward closure is being made on the Canyons site. In this case specifically, and in other situations that have arisen where NMED's slow response has had the potential to adversely impact the project schedule, Sandia National Laboratories has proceeded with work at risk. However, these situations have been the exception rather than the rule. Overall, NMED's ability to respond quickly to both formal and informal decision points has allowed for progress for each of the three groundwater projects. Because of this, all three CMEs are currently on schedule for completion by September 2005.

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