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M. Alexander, ESH-18, w/ enc., MS K497  
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CRM-4, w/enc., MS A150



**BURNS SWALE REMEDIAL ACTION AND SAMPLING PLAN  
FENTON HILL HOT DRY ROCK GEOTHERMAL FACILITY  
LOS ALAMOS NATIONAL LABORATORY**

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**OVERVIEW**

**Introduction**

Since 1972 Los Alamos National Laboratory (LANL) has operated the Fenton Hill Hot Dry Rock Geothermal Facility (facility) for the purpose of researching the feasibility of extracting heat from hot dry rocks deep within the earth. The Fenton Hill site is operated in cooperation with the U.S. Department of Agriculture, Santa Fe National Forest, Jemez Ranger District.

**Problem Definition**

On November 22, 1996, approximately 5,000 gallons of a cement/mud slurry were accidentally discharged from the facility's EE-3 wellbore to Burns Swale, an ephemeral tributary of Lake Fork Canyon, when a retainer failed during plugging and abandonment operations. The spill traveled approximately 1500 feet down Burns Swale, less than one-half the distance to Lake Fork Canyon (See Map 1.0). A sample of the spill material collected from Burns Swale on November 22, 1996, and analyzed using EPA SW 846 methods (TCLP analysis) determined that the solids deposited in the watercourse do not meet the definition of a RCRA hazardous waste. Two water samples collected from Burns Swale on November 22, 1996, and analyzed for total metals using EPA SW 846 methods, produced conflicting results; one sample showed detectable quantities (0.0018 mg/L) of total mercury while the other sample was non-detect (>0.0002 mg/L) for total mercury. Further characterization of the spill material and surface runoff from Burns Swale has been requested by the New Mexico Oil Conservation Division (OCD).

**Site Description**

The majority of the Fenton Hill site slopes gently south towards Burns Swale, a small, intermittent, tributary of Lake Fork Canyon (See Map 1.0). Lake Fork Canyon is a tributary to the Rio Cebolla, a perennial stream below Fenton Lake. Stream flow in Burns Swale is generated by spring snowmelt and by brief, intense, thunderstorms which occur during the summer months (July through September). Approximately 1000 feet below the Fenton Hill site the natural stream channel is interrupted by a small earthen berm and detention basin (See Map 1.0). This berm and basin were constructed by the Fenton Hill Geothermal Facility in the early 1980's for the purpose of spill control.

Alluvium deposits in Burns Swale are 2-6 feet deep in the upper reaches and more than 40 feet deep at the confluence with Lake Fork Canyon. The depth to groundwater (perched on the Abo Formation) at this location is approximately 450 feet.

**Historical Data**

In 1996 the Laboratory's Environmental Restoration Project issued a RCRA Facility Investigation Report (RFI) for the Fenton Hill site. This report identified a Potential Release Sites (PRS) in the upper reach of Burns Swale: PRS 57-001(b). Phase I sampling showed elevated levels of arsenic and manganese in the surface soils. This contamination probably resulted from the discharge of fluids from a drilling mud settling pond (Pond GTP-3W). The proposed action for the Burns Swale portion of PRS 57-001(b) is for Phase II sampling. This will determine the extent of the arsenic and manganese contamination in the surface soils and will calculate the human health risk under the recreational land-use scenario. Phase II sampling has been scheduled for FY1997.

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**REMEDIAL ACTION AND SAMPLING PLAN FOR BURNS SWALE**

**Phase I: Burns Swale Monitoring**

Burns Swale will be visually monitored by LANL twice weekly during the months of March, April, and early May to evaluate snow pack and spring runoff conditions. There are three (3) objectives to this monitoring:

- 1) Verify that the existing silt fences installed in Burns Swale are continuing to function as barriers to the migration of the spill material. Silt fences will be repaired as needed;
- 2) Determine when runoff conditions will permit the collection of representative surface water samples (snow melt): and
- 3) Determine when snow pack depths have been sufficiently reduced to permit the collection of representative samples of the spill material.

**Phase II: Burns Swale Sampling**

Once site conditions permit, three (3) samples of the cement/mud slurry deposited in Burns Swale will be collected from three (3) different locations (See Map 1.0). Three (3) grab samples of runoff from snow melt will be collected from three (3) different locations in Burns Swale (See Map 1.0). The sampling locations identified on Map 1.0 are only estimated since field conditions will determine the exact sample collection point. Map 1.0 will be updated following sample collection to reflect actual sampling locations. Sampling points will be marked with pin flags. Samples will be submitted to LANL's contract analytical laboratory for analysis using EPA SW-846 methods. The pH of all water samples will be field measured using a Beckman pH meter. Table 1.0 presents a sampling plan summary.

**Table 1.0. Sampling Plan for Fenton Hill Spill Site.**

Sample Location	Sample Matrix	Analytes
57-BS-001	solid	Total Metals (2,3)
57-BS-002	solid	"
57-BS-003	solid	"
57-BS-004	water	Dissolved metals (1,2,3); Total Hg; Total Recoverable Se; pH (4)
57-BS-005	water	"
57-BS-006	water	"

Notes:

- (1) Filtered samples are prepared using a 0.45 micrometer pore-size membrane filter.
- (2) WQCC Section 3101.(K)&(L) parameters: Al, As, Bo, Cd, Cr, Co, Cu, Pb, Hg, Se, V, Zn.
- (3) Manganese.
- (4) pH will be field measured.

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**Sampling Schedule**

Currently, Burns Swale is covered by a heavy snow pack. Sample collection cannot be scheduled until spring snow melt occurs and the solids deposited in channel become accessible. The OCD, NMED, and Forest Service will be notified in advance of sample collection so that representatives from their respective agencies can accompany LANL personnel during sample collection.

**Report to Regulators**

Analytical data generated from this sampling plan will be submitted to OCD, NMED, and the Forest Service in a summary report within 60 days of sample collection.

**Phase III: Burns Swale Cleanup**

1. Burns Swale will be visually monitored by LANL twice weekly during the months of April, May and June to evaluate snow pack, spring runoff, and site mud conditions. The objective of this monitoring will be to determine when site conditions will safely permit the cleanup of the spilled material.
2. Pursuant to Section 404 of the Clean Water Act, LANL will submit an application for a Nationwide Section 404 Permit with the NMED, Surface Water Quality Bureau, and the U.S. Army Corps of Engineers at least 30 days prior to the beginning of work. A copy of the permit application and approval letters will be forwarded to the OCD and the Forest Service.
3. As soon as conditions allow safe access to Burns Swale, LANL will deploy personnel to pick-up and collect as much of the spill material as is possible using manual methods. Machinery, such as a small "Bobcat" type loader, may be used to transport material from Burns Swale to centralized collection site. Under no circumstances will mechanized equipment be used to excavate spill material from the stream channel. All clean-up activities by LANL will be carefully planned to minimize the risk to personnel and to prevent further erosion and damage to the vegetation and terrain.

The OCD, NMED, and Forest Service will be notified in advance of cleanup activities so that representatives from their respective agencies can be present.

The total volume of spill material collected will be documented prior to off-site disposal.

4. Once cleanup activities are complete, LANL will request that OCD, NMED, and Forest Service personnel conduct a visual inspection of the spill site. If the cleanup is satisfactory, LANL will request verification from OCD, NMED, and the Forest Service that remediation of the spill site is administratively complete.
5. The silt fences installed in Burns Swale will be maintained through October, 1997, At that time they will be removed and any spill material that has been collected by the fences will be disposed of off-site.

# MAP 1.0. Fenton Hill (TA-57) Hot Dry Rock Geothermal Facility Sampling Plan

-  Drainage
-  Earth Berm
-  Fence, Industrial
-  Road, Dirt
-  Road, Paved
-  Silt Fence
-  Spill Location
-  Structure
-  Sample Location

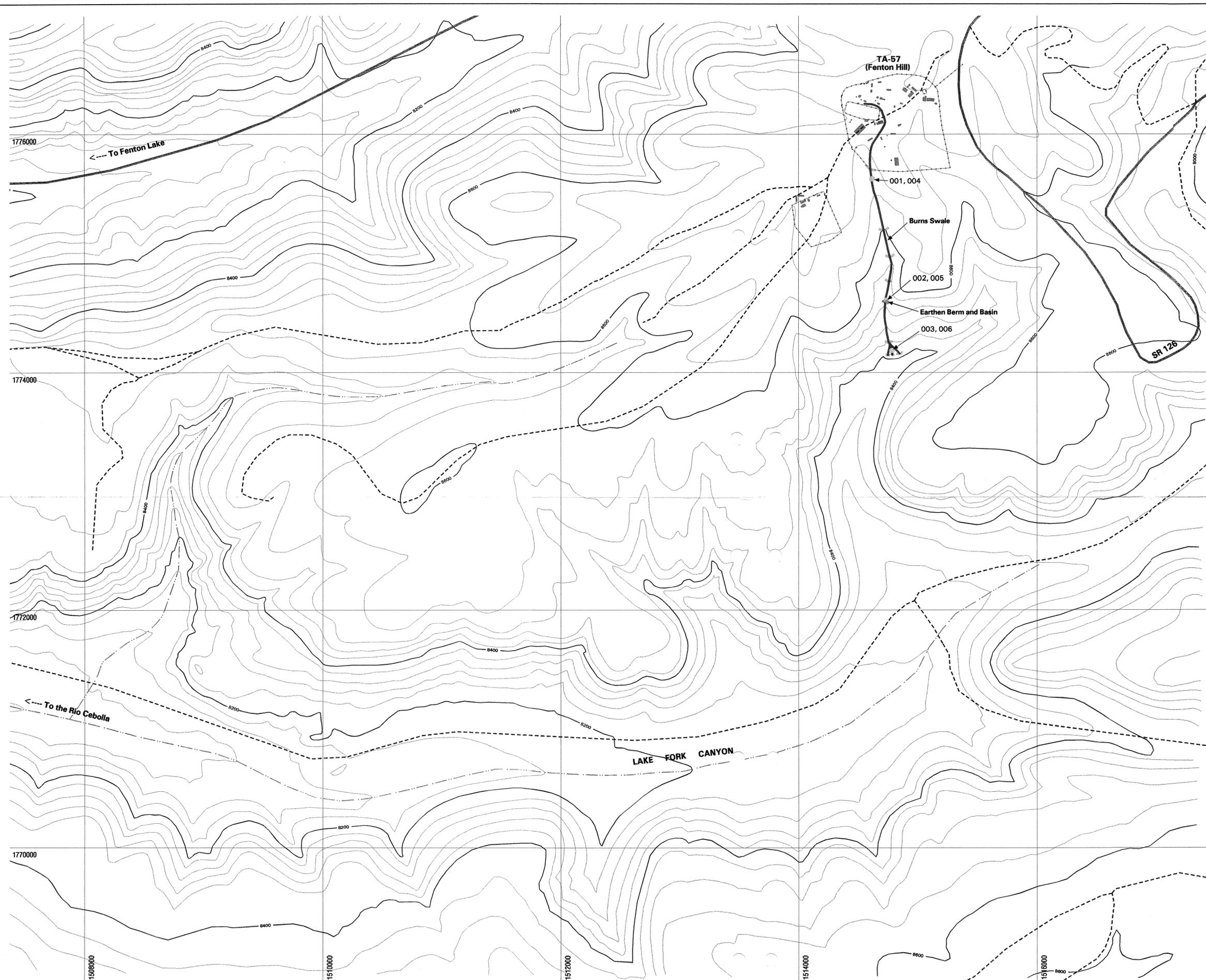


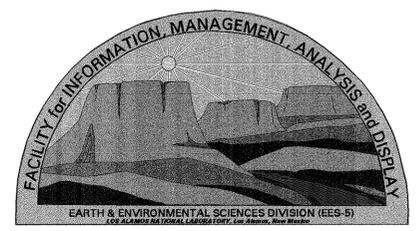
Table 1.0: Sampling Plan for Fenton Hill Spill Site

Sample Location	Sample Matrix	Analytes
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57-BS-002	solid	Total Metals (2,3)
57-BS-003	solid	Total Metals (2,3)
57-BS-004	water	Dissolved metals (1,2,3); Total Hg; Total Recoverable Se; pH (4)
57-BS-005	water	Dissolved metals (1,2,3); Total Hg; Total Recoverable Se; pH (4)
57-BS-006	water	Dissolved metals (1,2,3); Total Hg; Total Recoverable Se; pH (4)

Notes:  
 (1) Filtered samples are prepared using a 0.45 micrometer pore-size membrane filter.  
 (2) WQCC Section 3101.(K)&(L) parameters: Al, As, Co, Cd, Cr, Co, Cu, Pb, Hg, Se, V, Zn.  
 (3) Manganese  
 (4) pH will be field measured.

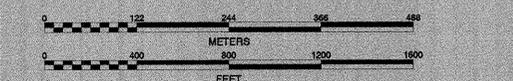
3704-A

Contour Interval: 40 ft



Produced by: Marcia Jones  
 Date: March 11, 1997  
 FIMAD Plot ID: 105440

State Plane Coordinate System, New Mexico Central Zone,  
 1983 North American Datum  
 Grid provides NM State Plane coordinates in feet.  
 Grid interval, in feet: 2000



NOTICE: The information on this map is provisional. Feature locations are dependent on scale and symbology and their accuracy may not have been confirmed. Los Alamos National Laboratory boundary is based on legal description established in 1995. Contour data are from a September 1991 aerial survey. All other data are from various sources and are part of the FIMAD repository.