LOS ALAMOS SCIENTIFIC LABORATORY
UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO 87545

OFFICE MEMORANDUM

TO : Wayne R. Hansen

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FROM : Karin Budding, Margaret Anne Rogers

SUBJECT : ANNUAL REPORT FOR 1977

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MAIL STOP: --

1380 Report

LASL Radioactive Solid Waste Disposal Site Studies LS-15-1-8A

A number of projects are underway at the current LASL Waste Disposal Site Area G, TA-54.

Much work this past year involved efforts to detect moisture and radionuclide migration beneath Waste Disposal Pit 3, Area G. The tuff recovered from the horizontal drilling holes beneath the pit, performed during FY 75, has undergone various analyses. The core was sampled at one foot intervals and at each joint within 15 feet of the pit, while the remaining core was only sampled at five foot intervals and at joints. Screening with a NaI detector indicated radiation content of the samples was less than 10nCi/gm, low enough to allow storage in the low level storage facility. Samples were then submitted for gross-α and gross-β analyses. Results were uniformably low. Detection limits and background values for these and other tested radionuclides are given in Table I. Results greater than the defined detection limits indicate the presence of the constituent at the 95% confidence level; however, results less than the detection limit do not necessarily indicate its absence. In May, 45 core samples from the horizontal holes were submitted for ^{238}Pu, ^{239}Pu, and total U analysis. Samples were selected at 25 foot intervals, both below and outside of the pit, in addition to those indicating "relatively" high gross-alpha results. Samples on either side of the "relative highs" were also included. Results from the plutonium analyses were all below detection limits, which are about 0.06 times normal fallout levels. Total uranium results are in for three out of the five holes and results range from 1.8 to 8.0 ppm. Background for uranium, measured in a different locality but in the same part of the geologic section the holes are located in, is <4.3 ppm. Our results are comparable to background values measured for various units of the tuff scattered throughout the plateau. Part of next years work at Area G will involve ascertaining the background for uranium near the waste disposal pits. The core samples selected for the plutonium and uranium analysis have also been submitted for strontium and americium detection. All data received thus far indicates that radionuclide concentration in the core is within or below the normal range for the Bandelier Tuff. No radionuclide distribution patterns related to position beneath the pit are apparent. From the work described above, one can conclude that no radionuclides have migrated downward from the disposal pit.

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TABLE I

Radionuclide	Background	Detection Limit
Gross-alpha	<10.7 pCi/g	0.8 pCi/g
Gross-beta	< 8.4 pCi/g	0.003 pCi/g
^{238}Pu*	< 0.03 pCi/g†	0.003 pCi/g
^{239}Pu*	< 0.05 pCi/g†	0.002 pCi/g
Uranium (in unit horizontal holes lie in)	< 4.3 ppm	0.02 ppm
Uranium (throughout the plateau)	7.73 ppm	0.02 ppm

* Man-made radionuclides

† In disturbed tuff

A steel tower and adjoining instrumentation shelter have been constructed at Area G for collection of meteorological data. All three levels - one, three, and ten meters - on the tower have been wired to measure wind direction and velocity and temperature. This routine surveillance data will be useful in the event of accidental atmospheric releases at the disposal area. A humidity channel has been installed on the second level and a rain gauge set up on the ground nearby. Due to the tower's extreme exposure, an extensive lightning protection system was built. A CMOS microprocessor is in use for data acquisition and pre-processing. The microprocessor is a prototype for eventual field work, as both it and the sensors are solar powered. Meteorologic information obtained will be used to determine the varying saturation of the ground throughout the year and in ascertaining the turbulent exchange coefficient.

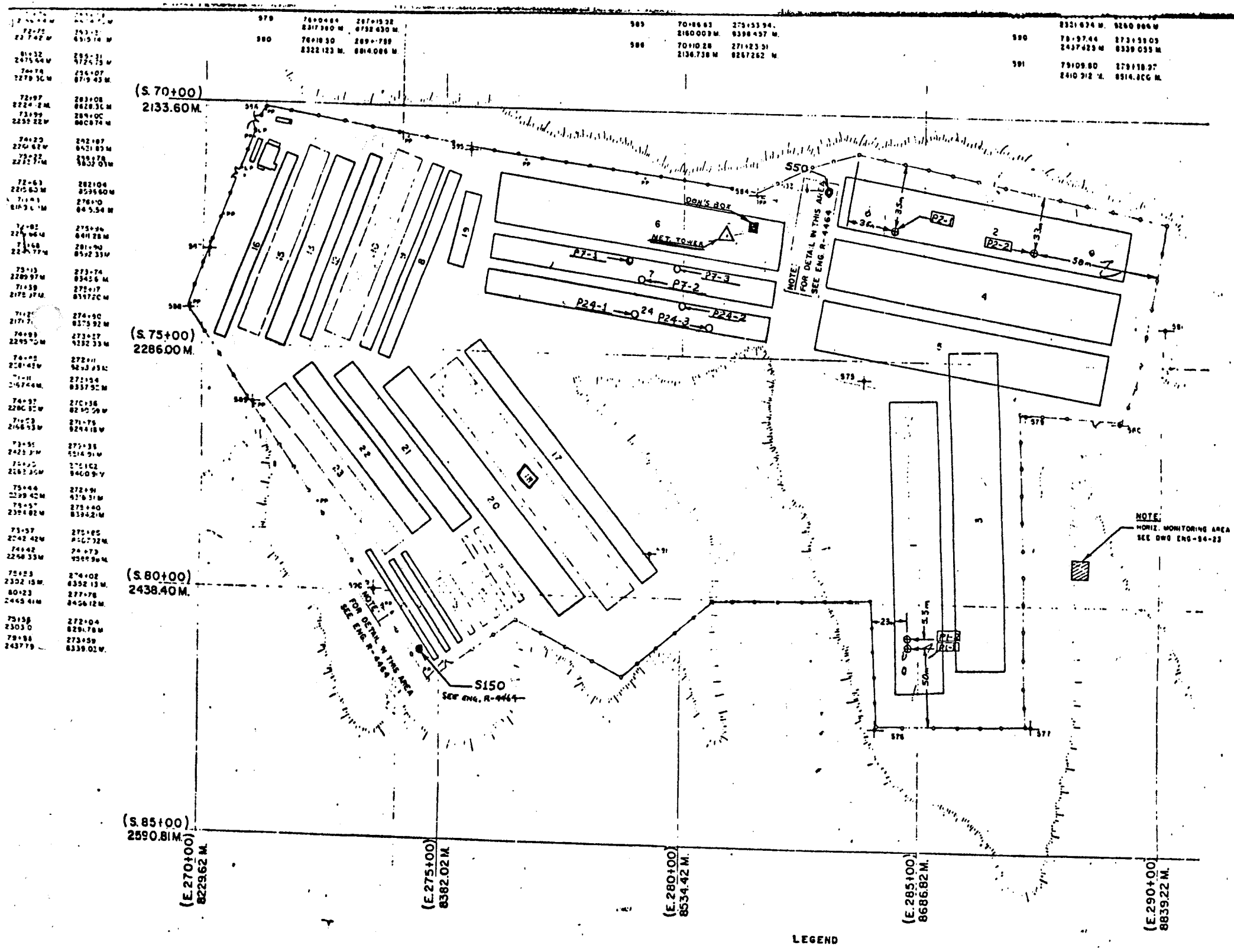
The most recent excavation at Area G has been Disposal Pit 18. Its location (along with that of the meteorologic tower) is shown on the following page. The pit was mapped, that is, the location and orientation (strike and dip) of major fractures--those that span the height of the walls--were measured and fractures described. Color photographs of the pit walls were taken and fractures numbered. All this information now lies in the permanent files of H-8. The part of the geologic section exposed in Pit 18 was divided into 4.5 foot intervals, through the use of a Jacob Staff, and described geologically.

Margaret Anne Roger's report--History and Environmental Setting of LASL Near-Surface Land Disposal Facilities for Radioactive Wastes (Areas A, B, C, D, E, F, G, and T)--has been assembled into notebooks and sent out to those on the preliminary distribution list.

Considerable progress on the geologic mapping project of the Bandelier Tuff on the Pajarito Plateau, in the immediate vicinity of DOE land, was made this year and it is hoped the map will be finished by this coming summer. A fair amount of time was spent reviewing the literature concerning volcanic ash-flow tuffs in general, and more specifically, the Pajarito Plateau. No geologic work previously pursued in this area has involved the detail essential to our waste management work. By doing extensive field work of the plateau, we will be able to produce a map which will fill our needs.

April 9-14 was spent participating in a symposium on ash flows. Most of the time was spent in field discussion with one day devoted to more "formal" presentation of information. During the more "formal" discussions Ms. Rogers presented an overview of past and present waste management practices, studies, and monitoring. The talk was slanted toward showing the development of our present geologic studies for waste management.

I arrived in June to assist Ms. Rogers with field work and other activities related to the mapping project. The following areas have been covered: Pueblo Canyon, Bayo Canyon, North Mesa, Barranca Mesa, Barrancas Canyon, and Rendida Canyon. Extensive field work has also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NOTE:
FOR DETAIL IN THIS AREA
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NOTE:
HORIZ. MONITORING AREA
SEE DWG ENG-94-23
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P24-3
P2-1
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LEGEND

been carried out in Sandia and Los Alamos Canyons, with particular attention given to TA-21 and TA-53 (see next page). Parts of Potrillo, Pajarito, and Water Canyon, and the upper part of Mortandad Canyon require some additional work.

We recently acquired a Bausch and Lomb Stereo Zoom Transfer Scope. It is a graphical data transfer instrument which enables an operator to view two materials, such as a photo and a map, in superimposition. The two materials need not be of equal scale. We will use this instrument, along with our aerial photographs, topographic maps, and field notes to produce a map and single out areas of question.

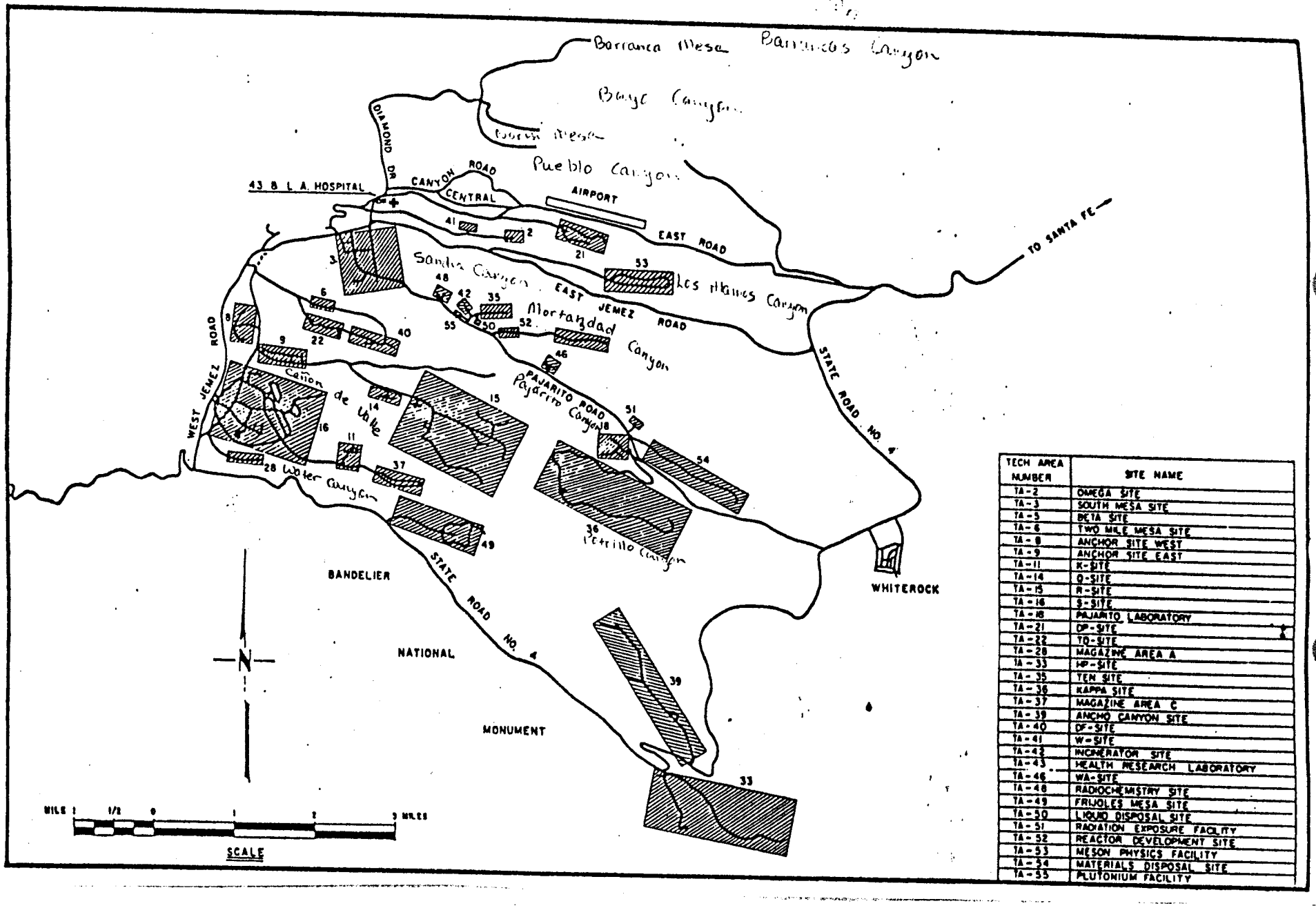
A joint study is being carried out to determine if fracturing in the tuff is due to cooling, tectonic movement, or a combination of the two. Localities are being chosen so that the entire plateau will be represented, including each of the radioactive waste disposal areas, past and present. To date, studies have been carried out on Horse Mesa, the end of 35th Street off of Orange Street, Mesita del Buey near the horizontal hole drilling platform, and Pit 18, Area G. A computer program has been developed which will generate a rose diagram from the data. All data must be collected and compared before a conclusion can be drawn.

A Carl Zeiss microscope was uncovered at TA-55, overhauled, and converted to a polarizing scope. It is being used in thin section analysis of samples from measured sections in the tuff. Sections are vertical segments of rock which are representative of the local stratigraphy. They are being prepared at strategic locations on the plateau and at the waste disposal areas.

Fracture fillings in the Bandelier Tuff were analyzed first by quantitative emission spectrometry and consequently by X-ray diffraction in order to determine their mineralogy. Table I lists the sample number and location. Results of the analyses are listed in Table II.

Emission spectroscopy, a method which determines an element by means of its emission spectrum, obtained from a suitably excited source, was used. The chemical composition of various substances can be determined from their spectra since the frequency of emitted or absorbed light is related to the energy of the electrons in an element. A qualitative analysis is based on the wavelengths of the lines characteristic of an element while a quantitative analysis is based on the ratios between the intensities of these lines--a function of the number of excited atoms involved. Our analyses were quantitative.

Analyses were requested for Na, K, Mg, Ca, Al, Si, Fe, plus any other cations equal to or greater than 0.5%; CO_3, SO_4, and combined H_2O. The results were reported in percentile of elemental constituents or in ppm if present in less than 1%. Some elemental concentrations were estimated for example, Si 30-60%.



TECH AREA NUMBER	SITE NAME
TA-2	OMEGA SITE
TA-3	SOUTH MESA SITE
TA-5	BETA SITE
TA-6	TWO MILE MESA SITE
TA-8	ANCHOR SITE WEST
TA-9	ANCHOR SITE EAST
TA-11	K-SITE
TA-14	Q-SITE
TA-15	R-SITE
TA-16	S-SITE
TA-18	PAJARITO LABORATORY
TA-21	DP-SITE
TA-22	TD-SITE
TA-28	MAGAZINE AREA A
TA-33	HP-SITE
TA-35	TEN SITE
TA-36	KAPPA SITE
TA-37	MAGAZINE AREA C
TA-39	ANCHO CANYON SITE
TA-40	DF-SITE
TA-41	W-SITE
TA-42	INCINERATOR SITE
TA-43	HEALTH RESEARCH LABORATORY
TA-46	WA-SITE
TA-48	RADIOCHEMISTRY SITE
TA-49	FRIJOLES MESA SITE
TA-50	LIQUID DISPOSAL SITE
TA-51	RADIATION EXPOSURE FACILITY
TA-52	REACTOR DEVELOPMENT SITE
TA-53	MESON PHYSICS FACILITY
TA-54	MATERIALS DISPOSAL SITE
TA-55	PLUTONIUM FACILITY

X-ray diffraction was used for mineral identification. In X-ray diffractions a polycrystalline phase (inorganic substance) diffracts a monochromatic beam of X-rays into a spectrum. Each "line" of this spectrum, in position and intensity, represents a particular family of crystal planes of the phase. Since the sequence of planes (in spacing and X-ray scattering power) of a crystal is unique to that crystal, the X-ray diffraction pattern is unique to that phase.

For our purposes, X-ray diffraction proved to be the speedier and more definitive method employed, and will be used initially in any further studies.

The diffraction data with the information from emission spectroscopy can be compared, but only on a qualitative basis as there are too many unknowns to attempt a quantitative correlation. For example, orthoclase and hematite only accounted for 45% of the elemental constituents of sample 4, with 4% Na, 8% Al, and 17% Si still remaining. Part of this remainder is composed of amorphous silica (volcanic glass or ash) and a minor amount of clay.

Table I

Sample Number	Description	Location*
A	white	Roadcut south of Pajarito Acres
B	white	East end of Barranca Mesa
3	yellow	Puye Drive
4	red	Puye Drive
5	red	Entrance to Rendija Canyon off of San Ildefonso Road
6	red	Cementary Road
18-A	black	Pit 18, Area G
18-B	tan	Pit 18, Area G
18-C	reddish	Pit 18, Area G

*As only one sample of a particular description was taken from each locality, variability was not accounted for.

Table II

Sample Number	Mineralogy
A	caliche
B	caliche
3	orthoclase
4	orthoclase, trace hematite
5	orthoclase, trace hematite
6	sanadine cristobalite hematite
18-A	orthoclase, hematite*
18-B	orthoclase, hematite*
18-C	orthoclase, hematite*

*From the shade of the background color of the films from samples 18-A, 18-B, 18-C, one observed the hematite content decreasing in this order - 18-A, 18-C, 18-B. This deduction was possible due to the fluorescence of iron.