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# RADIOACTIVE ENVIRONMENTAL SURVEY AT SANDIA CORPORATION

## ABSTRACT

This report describes the collection, analyses, and evaluation of soil, vegetation, and water samples from the local environment surrounding Sandia Corporation (Area V), the City of Albuquerque, and Bernalillo and Sandoval Counties, New Mexico.

## INTRODUCTION

The planned startup in 1961 of Sandia Corporation's SPRF (Sandia Pulsed Reactor Facility) and SERF (Sandia Engineering Reactor Facility) necessitated a preoperational survey to establish background radiation levels. SPRF is an unreflected, enriched uranium assembly similar to the Los Alamos Scientific Laboratory's Godiva II. SERF is a normal-water moderated reactor using 93 percent enriched U-235 fuel and operating at a peak power level of 5 megawatts.

To accomplish this mission, soil, water, and vegetation were analyzed for strontium-90 - yttrium-90, cesium 137 ($Sr^{90}$-$Y^{90}$, Cs-137), and gross beta activities. The size of the program is limited to an annual labor expenditure of one to one and one-half man years. Because the program is a relatively small one, the sampling rate is quarterly. $Sr^{90}$-$Y^{90}$ and Cs-137 were chosen for study because they are longlived fission products and are likely to collect in the environment. Other isotopes such as barium-140 and uranium-238 have been occasionally examined.

## DISCLAIMER

## TOPOGRAPHY, CLIMATOLOGY, HYDROLOGY

SLIDE #1

Located on a mesa, the SPRF-SERF site (Technical Area V) is bounded on the west by the Rio Grande, on the north by Tijeras Arroya-Canyon, on the south by Hell's Canyon Wash, and on the east by the Manzano Mountains.

The climate of the area is termed Arid Continental. Half the 8-inch average annual rainfall occurs between July and September, with the winter months being very dry. Temperature ranges are large, but extreme temperatures such as 0°F or 100°F are infrequent. Wind activity occurs mostly during the late winter and early spring months. On less than 13 percent of the days during the year does the maximum wind velocity reach 30 miles per hour.

The water table at the reactor site is about 450 feet below the surface. Indications are that ground water beneath the site moves from east to west toward the Rio Grande.

## PHILOSOPHY

For Sandia Corporation's Environmental Health responsibility incidental to the operation of SPRF and SERF, the following apply as primary missions.

1. Determine population exposure levels to radioactive environmental contaminants that can be traced to (a) normal background radiation, or (b) Sandia reactors.
2. Check effectiveness of established control measures at the reactors.
3. Have established records of normal population radiation levels that would be of use to Corporation management in litigation proceedings. Complaints from the general populace alleging unusual radioactive levels in the environment can then be verified or rejected. The degree of long

term increase in environmental radioactive levels above normal values traceable to any cause can also be assessed.

## SAMPLING SITES (OLD AND NEW)

### OLD SITES

The original program was initiated in December 1958. At that time, the location of environmental survey sites was based on the idea that those areas should be sampled where possible radioactive releases from the reactors are likely to be concentrated. It was thought that such a program would offer the most rapid detection of an abnormal change in the environmental radioactive levels. Accordingly, the majority of sampling sites were located on a relatively unpopulated Southwest-Northeast line along or in Tijeras Arroyo-Canyon, through which surface air flow from Technical Area V is predominant, so seen in Slide #2.

### NEW SITES

A re-evaluation of the survey program in the fall of 1960, indicated that more emphasis should be given to a direct check on the radioactive levels of the population areas of metropolitan Albuquerque. Accordingly, additional sampling sites were proposed, as seen in slide #3. If levels of radioactivity higher than normal are found to increase as one progresses from Line I to Lines II and III, the sources of the radioactive release will be traceable to Technical Area V, either SERF, SPRF, or perhaps one of the non-Sandia facilities in that general area which utilize radioactive isotopes. A general overall increase for all sites will indicate either general-area fallout or a release from the reactor area.

On March 1963 six additional sites for soil and vegetation samples and five sites for water were added, as seen in slide #4.

## COLLECTION OF SAMPLES

### Water

A 1-liter sample is taken. Use is made of a plastic or glass jug which has been cleaned with detergent and concentrated hydrochloric acid, then rinsed thoroughly with tap water and finally rinsed with distilled water.

1. Samples from water systems:

   When samples are collected from water systems, the water is collected from taps that are in frequent use. Well samples are taken before any treatment for human consumption and after rinsing the container with the water being sampled.

2. Samples from pools and rivers:

   Often in the Southwest, particularly around Albuquerque, ideal water sampling techniques cannot be accomplished. In this more usual case, the water sample is collected, but with appropriate remarks made about its conditions of collection, to include: stagnant or flowing water, shallow or deep, and approximate distance from the shore line for the Rio Grande water samples.

### Soil

Soil is collected from an area one foot square by one inch deep in a vegetation-free area and placed in a labeled plastic bag until analysis.

### Vegetation

Available grass which is characteristic of the sampling site is collected in such a manner that no roots or soil contaminate the sample. The amount taken is approximately 500 grams, and it is stored in plastic bags with air holes to prevent decomposition before analysis. Slide #5 shows the type and number of samples collected.

## CHEMICAL ANALYSES

Radiochemical techniques have been instituted that give the best possible determination, consistent with time and personnel allotted. The techniques were standardized by adding known amounts of radioactive isotopes to soil, vegetation, and water samples. The possibility that trace amounts of radioactivity are present in reagents is also considered.

The chemical recovery on each isotope on each analysis is determined by weighing the amount of carrier recovered. All samples are mounted in a standard manner and counted against a standard spike sample mounted in the same way. To expedite the strontium analysis, the precipitate is allowed to set for two weeks to allow for yttrium growth. The sample is then counted against a standard $Sr^{90}$-$Y^{90}$ sample prepared in the same manner.

## PREPARATION OF SAMPLES

### Soil

a. Dry the soil on a hot plate or oven at 90°C for one hour, then mix approximately one pound on a roller mill for 15 to 20 minutes. Screen through a 10 mesh sieve.

b. Weigh 5 to 10 grams into a suitable beaker.

c. Proceed with appropriate procedure.

### Vegetation

a. Pulverize in a Waring blender about 50 grams of vegetation. Weigh 10 gm. into a porcelain crucible. Heat in a muffle furnace at 450°C until only a white ash remains.

b. Cool and weigh 1 gram into a 250 ml beaker and proceed with the appropriate determination.

Water

a. Evaporate 1 liter of water with about 10 ml of $HNO_3$ on a hot plate.

b. Proceed with the appropriate determination.

## CURRENT DATA

### Results

Analyses on soil, water and vegetation have been conducted since February 1959. The following average values have been obtained, as shown in slide #6.

### Correlation with Published Data

Considering that every part of the country has unique meteorological conditions and background radioactive isotope levels, our data has been found to correlate satisfactorily with published environmental data. Vegetation correlation is difficult since the literature activity values are stated as "activity per gram dried weights" or sometimes stated on a "per gram wet weight" basis. Our values are on a "per gram ash" basis where the ash is obtained at 450°C. Recent samples, for example, have had a ratio of wet weight to ash weight equal to about 12.

Water data is divided into that coming from surface waters, and that originating from deep wells. Even though the number of samples contributing to a particular average may be statistically small, this classification is felt to demonstrate that surface water activities are generally higher than deep well water activities.

Since SPRF did not begin operation until the spring of 1961, and SERF in the spring of 1963, all the data collected through January 1961 is characteristic of background radioisotope levels.

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