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**LOS ALAMOS SCIENTIFIC LABORATORY**  
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Plutonium and Strontium in  
Soil in the Los Alamos, Espanola, and  
Santa Fe, New Mexico, Areas

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UNIVERSITY OF CALIFORNIA  
LOS ALAMOS SCIENTIFIC LABORATORY  
(CONTRACT W-7405-ENG-36)  
P. O. Box 1663  
Los Alamos, New Mexico 87544

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On page 3, Table I, third column, change column  
heading from "<sup>239</sup>Pu" to "<sup>238</sup>Pu."

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**Plutonium and Strontium in**  
**Soil in the Los Alamos, Espanola, and**  
**Santa Fe, New Mexico, Areas**

by

**William R. Kennedy**  
**William D. Purtymun**

Work done by Patricio E. Trujillo, Pablo O. Romero, Jack W. Aeby, and William D. Purtymun.

## CONTENTS

ABSTRACT.....	1
I. INTRODUCTION.....	1
II. PLUTONIUM-238.....	1
III. PLUTONIUM-239.....	1
IV. STRONTIUM-90.....	1
V. ACTIVITY RATIO $^{239}\text{Pu}/^{90}\text{Sr}$ .....	1
VI. SUMMARY.....	2
REFERENCES.....	4

## FIGURES

Fig. 1. Location of regional soil survey.....	2
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## TABLES

I. Analytical Results of Soils from the Los Alamos, Espanola, and Santa Fe Areas.....	3
II. Analytical Results of Referenced Soils from New York, Ohio, and Colorado.....	3

PLUTONIUM AND STRONTIUM IN SOIL  
IN THE LOS ALAMOS, ESPANOLA AND SANTA FE, NEW MEXICO, AREAS

by

William R. Kennedy  
William D. Purtymun

ABSTRACT

Analyses for plutonium isotopes  $^{238}\text{Pu}$  and  $^{239}\text{Pu}$  and strontium isotope  $^{90}\text{Sr}$  were made of soil samples collected from the Los Alamos, Espanola, and Santa Fe areas to determine concentration levels considered as originating from world-wide fallout from atmospheric tests. On the basis of the limited number of samples it was concluded that the concentrations in soils from the area of study were similar to but no greater than those reported by others for soil samples from Colorado, Ohio, and New York.

I. INTRODUCTION

Soil samples were collected and analyzed for plutonium isotopes  $^{238}\text{Pu}$  and  $^{239}\text{Pu}$  and strontium isotope  $^{90}\text{Sr}$  from the Los Alamos, Espanola, and Santa Fe areas. The analyses were made to determine isotope levels possibly originating from world-wide fallout from atmospheric nuclear tests. The results of the analyses are compared to referenced soils collected in Colorado, Ohio, and New York and analyzed by organizations other than the Los Alamos Scientific Laboratory (LASL).

The soil samples were collected from 20 locations (Fig. 1) from flat undisturbed areas to avoid concentration or dilution by wash from storm runoff. Each sample was collected from a 4 by 4 in. area to a depth of 2 in. The samples were prepared and analyzed by methods outlined by Trujillo (1970).<sup>1</sup>

II. PLUTONIUM-238

The concentration of  $^{238}\text{Pu}$  in soil sample E, 0.074 dpm/g, (disintegration per

minute per gram) is probably due to local activity. The concentrations of  $^{238}\text{Pu}$  (excluding sample E) ranged from 0.001 to 0.008 dpm/g with an average of 0.003 dpm/g. The average concentration is about the same as found in referenced soils collected in Ohio and New York in late 1969 and early 1970 (Table II).<sup>2</sup>

III. PLUTONIUM-239

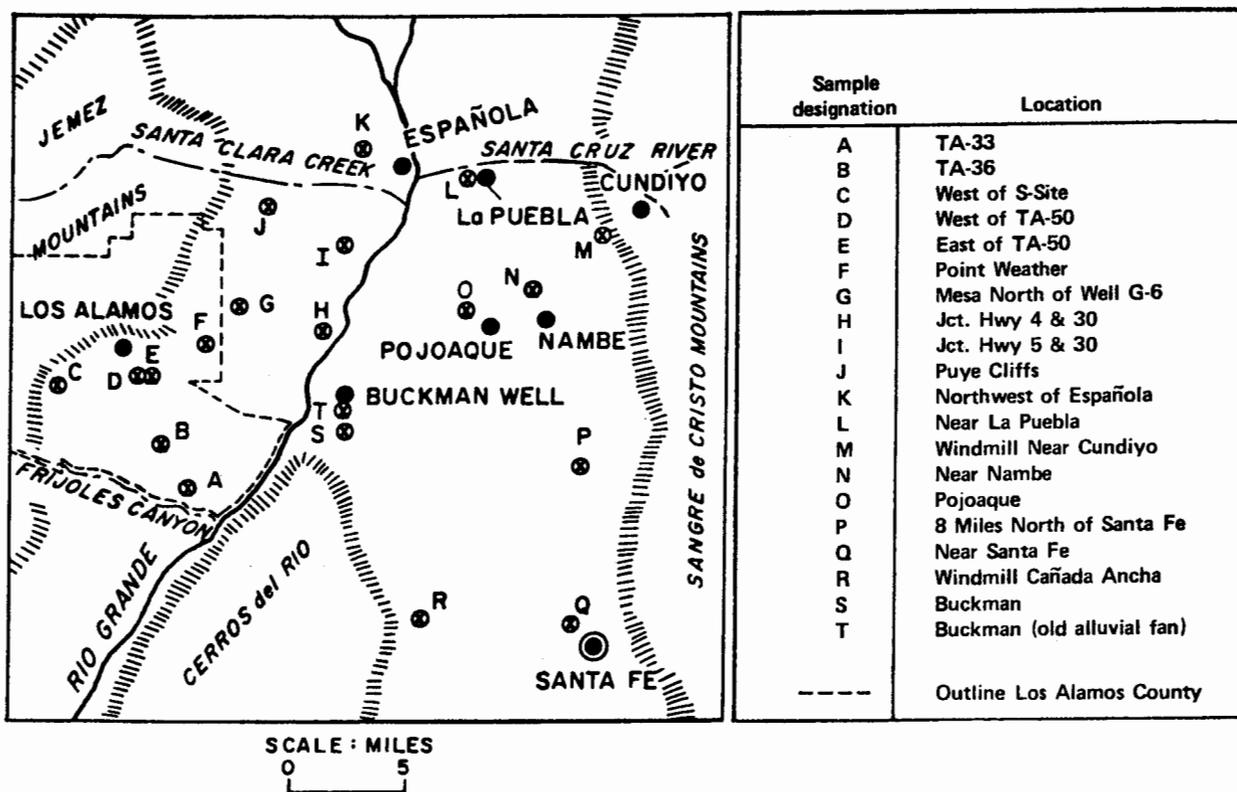
The concentrations of  $^{239}\text{Pu}$  ranged from 0.001 to 0.051 dpm/g with an average of 0.021 dpm/g. The concentrations are slightly lower than those concentrations in referenced soils (Table II).<sup>2,3</sup>

IV. STRONTIUM-90

The concentration of  $^{90}\text{Sr}$  ranged from 0.152 to 1.921 dpm/g with an average of 0.711 dpm/g. The concentrations were generally lower than those concentrations found in referenced soils from Colorado (Table II).<sup>3</sup>

V. ACTIVITY RATIO  $^{239}\text{Pu}/^{90}\text{Sr}$

The activity ratio  $^{239}\text{Pu}/^{90}\text{Sr}$  can be used to distinguish local stack emissions



- A SAMPLING STATION  
 ● TOWN OR VILLAGE

SKETCH SHOWING LOCATION OF REGIONAL SOIL SURVEY

Fig. 1. Location of regional soil survey.

from world-wide fallout. Care should be exercised in areas where there may be a local source of  $^{90}\text{Sr}$  in the soils.

The activity ratios for world-wide fallout in the area range from 0.003 to 0.138 dpm/g with an average of 0.038 dpm/g. The average is slightly lower, but not significantly different, than the average in referenced soils in Colorado (Table II).<sup>3</sup>

#### VI. SUMMARY

The following table presents the range and average concentration of  $^{238}\text{Pu}$ ,  $^{239}\text{Pu}$ ,  $^{90}\text{Sr}$ , and activity ratio in soils from the Los Alamos, Espanola, and Santa Fe areas that could be attributed to world-wide fallout from atmospheric nuclear tests. On the basis of a limited number of samples, it is concluded that the soil content for these isotopes is no greater in this area than was observed in soils reported from

Colorado, Ohio, and New York.

Isotope or Activity Ratio	Number of Samples	Concentrations dpm/g (Top 2 in.)	
		Range	Av
$^{238}\text{Pu}$	19	0.001-0.008	0.003
$^{239}\text{Pu}$	20	0.001-0.051	0.021
$^{90}\text{Sr}$	20	0.152-1.921	0.711
$^{239}\text{Pu}/^{90}\text{Sr}$	20	0.003-0.138	0.038

**TABLE I**  
**ANALYTICAL RESULTS OF SOILS FROM THE LOS ALAMOS, ESPANOLA, AND SANTA FE AREAS**

Sample Designation	Date Collected	dpm/g (Top 2 in.)			Activity Ratio $^{239}\text{Pu}/^{90}\text{Sr}$
		Plutonium $^{238}\text{Pu}$	Plutonium $^{239}\text{Pu}$	Strontium $^{90}\text{Sr}$	
A	1-27-70	0.005 ± 0.001	0.017 ± 0.003	0.686 ± 0.088	0.025
B	2-24-70	0.003 ± 0.003	0.005 ± 0.003	0.439 ± 0.077	0.010
C	1-27-70	0.003 ± 0.001	0.019 ± 0.004	0.403 ± 0.086	0.047
D	1-27-70	0.002 ± 0.001	0.013 ± 0.002	1.155 ± 0.119	0.011
E	1-27-70	0.074 ± 0.005	0.028 ± 0.003	0.660 ± 0.090	0.043
F	1-27-70	0.004 ± 0.001	0.040 ± 0.006	0.663 ± 0.101	0.061
G	2-25-70	0.008 ± 0.003	0.045 ± 0.008	1.115 ± 0.103	0.040
H	2-25-70	0.008 ± 0.003	0.001 ± 0.003	0.290 ± 0.059	0.003
I	2-25-70	0.001 ± 0.003	0.015 ± 0.005	0.361 ± 0.066	0.041
J	2-25-70	0.002 ± 0.003	0.018 ± 0.003	1.921 ± 0.134	0.009
K	2-25-70	0.001 ± 0.003	0.012 ± 0.004	0.948 ± 0.097	0.013
L	2-25-70	0.001 ± 0.003	0.012 ± 0.004	0.510 ± 0.079	0.024
M	2-25-70	0.008 ± 0.002	0.027 ± 0.005	0.893 ± 0.099	0.030
N	2-25-70	0.001 ± 0.003	0.014 ± 0.003	0.352 ± 0.068	0.040
O	2-25-70	0.001 ± 0.002	0.031 ± 0.004	0.473 ± 0.073	0.066
P	2-25-70	0.001 ± 0.002	0.007 ± 0.004	1.014 ± 0.092	0.007
Q	2-25-70	0.001 ± 0.002	0.028 ± 0.005	0.152 ± 0.057	0.184
R	2-25-70	0.001 ± 0.002	0.012 ± 0.003	0.561 ± 0.077	0.021
S	2-25-70	0.006 ± 0.002	0.021 ± 0.003	0.895 ± 0.094	0.023
T	2-25-70	0.001 ± 0.002	0.051 ± 0.005	0.724 ± 0.088	0.070

**TABLE II**  
**ANALYTICAL RESULTS OF REFERENCED SOILS FROM NEW YORK, OHIO, AND COLORADO**

Location	New York <sup>a</sup>	Ohio <sup>a</sup>	Colorado <sup>a</sup>
Date Collected	Dec. 1969	April 1970	1969
Number of Samples	4	2	5
Concentrations (dpm/g)			
$^{238}\text{Pu}$			
Range	0.0006-0.0078	0.0020-0.0064	--
Average	0.0038	0.0042	--
$^{239}\text{Pu}$			
Range	0.090-0.096	0.0420-0.0440	0.026-0.056
Average	0.092	0.0430	0.043
$^{90}\text{Sr}$			
Range	--	--	1.01-1.23
Average	--	--	1.10
Activity Ratio $^{239}\text{Pu}/^{90}\text{Sr}$			
Range	--	--	0.022-0.056
Average	--	--	0.041

2. Krey et al. (1970).  
3. Martell et al (1970).

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1. Patricio Trujillo, Jr., "Standard Analytical Procedures for Soil," LASL Group H-6, Los Alamos Scientific Laboratory, in preparation (1970).
2. P. W. Krey, and E. P. Hardy, "Plutonium in Soil Around the Rocky Flats Plant: Health and Safety Laboratory," USAEC, HASL-235 (1970).
3. E. A. Martell, P. D. Goldan, J. J. Kraushaar, D. W. Shea, and R. H. Williams Letter to Dr. Glen T. Seaborg from Colorado Committee for Environmental Information, January 13, 1970.