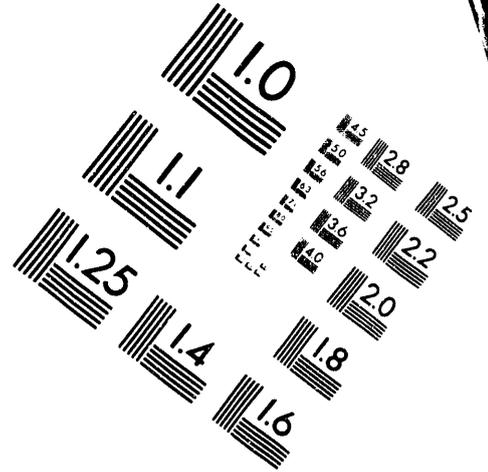
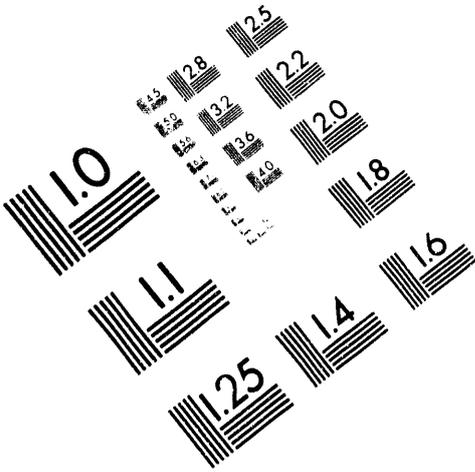




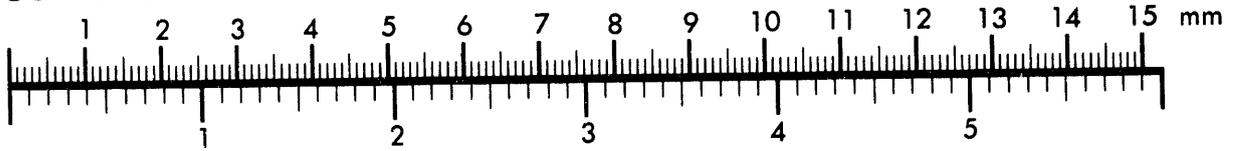
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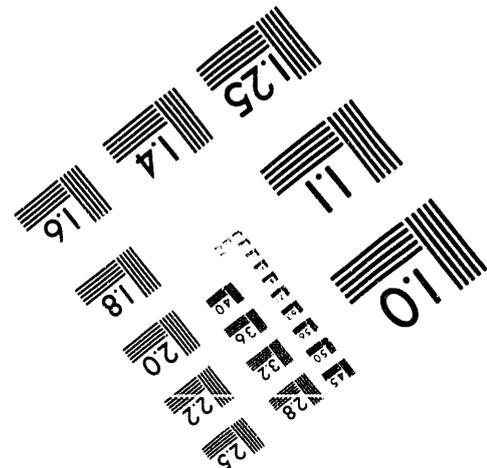
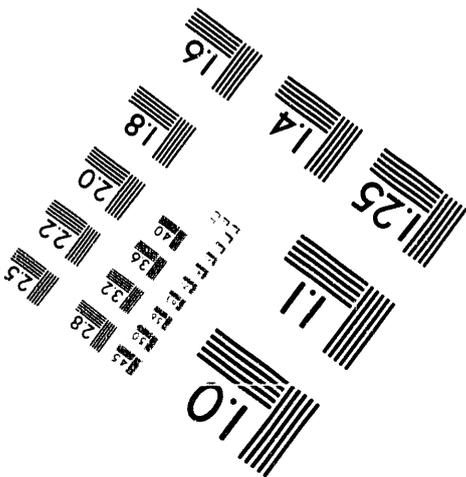
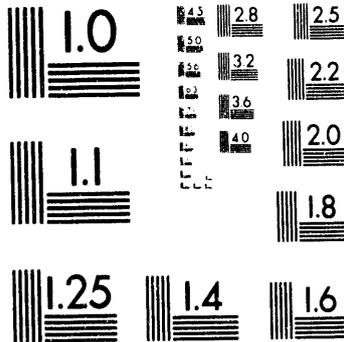
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HEALTH AND SAFETY RESEARCH DIVISION

Environmental Restoration and Waste Management Non-Defense Programs
(Activity No. EX 20 20 01 0; ADS1310)

**RESULTS OF THE RADIOLOGICAL SURVEY AT
77 SINNINGER STREET, MAYWOOD, NEW JERSEY
(MJ052)**

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Date Published - June 1993

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ABSTRACT

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the U.S. Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th , derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 77 Sinninger Street, Maywood, New Jersey (MJ052), was conducted on December 17, 1992.

Results of the survey demonstrated no radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. The radionuclide distributions were not significantly different from normal background levels in the northern New Jersey area.

RESULTS OF THE RADIOLOGICAL SURVEY AT 77 SINNINGER STREET, MAYWOOD, NEW JERSEY (MJ052)*

INTRODUCTION

From 1916 to 1956, process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores were generated by the Maywood Chemical Works (MCW), Maywood, New Jersey. During the latter part of this period, MCW supplied rare earth metals and thorium compounds to various government agencies. In the 1940s and 1950s, MCW produced thorium and lithium, under contract, for the Atomic Energy Commission (AEC). These activities ceased in 1956, and, approximately three years later, the 30-acre real estate was purchased by the Stepan Company. The property is located at 100 Hunter Avenue in a highly developed area in Maywood and Rochelle Park, Bergen County, New Jersey.

During the early years of operation, MCW stored wastes and residues in low-lying areas west of the processing facilities. In the early 1930s, these areas were separated from the rest of the property by the construction of New Jersey State Highway 17. The Stepan property, the interim storage facility, and several vicinity properties have been designated for remedial action by the Department of Energy (DOE).

The waste produced by the thorium extraction process was a sandlike material containing residual amounts of thorium and its decay products, with smaller quantities of uranium and its decay products. During the years 1928 and 1944 to 1946, area residents used these process wastes mixed with tea and cocoa leaves as mulch in their lawns and gardens. In addition, some of the contaminated wastes were apparently eroded from the site into Lodi Brook and carried downstream.

Lodi Brook is a small stream flowing south from Maywood with its headwaters near the Stepan waste storage site. Approximately 150 ft after passing under State Route 17, the stream has been diverted underground through concrete or steel culverts until it merges with the Saddle River in Lodi, New Jersey. Only a small section near Interstate 80 remains uncovered. From the 1940s to the 1970s when the stream was being diverted underground, its course was altered several times. Some of these changes resulted in the movement of contaminated soil to the surface of a few properties, where it is still in evidence. In other instances, the contaminated soil was covered over or mixed with clean fill, leaving no immediate evidence on the surface. Therefore, properties in question may be drilled in search of former streambed material, even in the absence of surface contamination.

As a result of the Energy and Water Appropriations Act of Fiscal Year 1984, the property discussed in this report and properties in its vicinity contaminated with residues from

*The survey was performed by members of the Measurement Applications and Development Group of the Health and Safety Research Division at Oak Ridge National Laboratory under DOE contract DE-AC05-84OR21400.

the former MCW were included as a decontamination research and development project under the DOE Formerly Utilized Sites Remedial Action Program. As part of this project, DOE is conducting radiological surveys in the vicinity of the site to identify properties contaminated with residues derived from the MCW. The principal radionuclide of concern is thorium-232. The radiological survey discussed in this report is part of that effort and was conducted, at the request of DOE and the property owner, by members of the Measurement Applications and Development Group of the Oak Ridge National Laboratory.

A radiological survey of the private, residential property at 77 Sinninger Street, Maywood, New Jersey, was conducted on December 17, 1992 and is summarized in this report.

SURVEY METHODS

The radiological survey of the property included: (1) a gamma scan of the entire property surface outdoors at the surface, and (2) collection of surface and subsurface soil samples. No indoor survey measurements were performed. The survey methods followed the basic plan outlined in a correspondence from W. D. Cottrell to A. J. Whitman.¹ A comprehensive description of the survey methods and instrumentation has been presented in another report.²

Using a portable gamma scintillation meter, ranges of gamma exposure rates were recorded for areas of the property surface. Systematic soil samples were then obtained at randomly selected locations irrespective of the gamma exposure rates. Measurements were usually made and soil samples collected from depths of 0 to 30 cm. The samples were analyzed for ²²⁶Ra, ²³²Th, and ²³⁸U content.

SURVEY RESULTS

Applicable DOE guidelines are summarized in Table 1.³ The normal background radiation levels for the northern New Jersey area are presented in Table 2.^{4,5} These data are provided for comparison with survey results presented in this report. All direct measurement results presented in this report are gross readings; background radiation levels have not been subtracted. Similarly, background concentrations have not been subtracted from radionuclide concentrations measured in soil samples.

Current photographs of the site are shown in Figs. 1 and 2.

Surface Gamma Radiation Levels

Gamma radiation levels measured during a gamma scan of the property surface are given in Fig. 3. Gamma exposure rates over the major portion of the property ranged from 4 to 9 μ R/h. The highest gamma levels at the surface ranged from 7-11 μ R/h near the foundation of the house. This slight elevation in gamma levels is typical of the naturally occurring radioactive substances present in bricks, concrete, granite, and other such materials used in paving and building construction. Otherwise, none of the measurements were elevated.

Systematic Soil Samples

Systematic soil samples were taken from various locations on the property for radionuclide analyses. Locations of the systematic samples (S) are shown in Fig. 3, with results of laboratory analyses provided in Table 3. Concentrations of ^{226}Ra , ^{232}Th , and ^{238}U in these samples ranged from 0.72 to 0.94 pCi/g, 0.88 to 1.04 pCi/g, and 1.1 to 2.3 pCi/g, respectively. All samples were below DOE criteria (Table 1), and near or below the normal background level for ^{238}U for the northern New Jersey area (Table 2).

SIGNIFICANCE OF FINDINGS

Measurements and results of soil sample analyses taken at 77 Sinniger Street indicate that the property contains no significant radioactive contamination above normal background levels for this area. The slight elevation in the gamma level near the foundation is typical of the naturally occurring radioactive substances present in bricks, granite, concrete cinder blocks and other such materials used in paving and building construction. Assessments of soil samples and direct measurements at the site demonstrate no radiological contamination in excess of DOE guidelines.

REFERENCES

1. W. D. Cottrell, ORNL, to A. J. Whitman, DOE/HQ, correspondence, "Radiological Survey of Private Properties in Lodi, New Jersey" (August 15, 1984).
2. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, *Procedures Manual for the ORNL Radiological Survey Activities (RASA) Program*, Oak Ridge National Laboratory, ORNL/TM-8600 (April 1987).
3. U.S. Department of Energy, *Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites* (Rev. 2, March 1987).
4. U.S. Department of Energy, *Radiological Survey of the Middlesex Municipal Landfill, Middlesex, New Jersey*, DOE/EV-00005/20 (April 1980).
5. T. E. Myrick, B. A. Berven, and F. F. Haywood, *State Background Radiation Levels: Results of Measurements Taken During 1975-1979*, Oak Ridge National Laboratory, ORNL/TM-7343 (November 1981).



Fig. 1. View looking northeast at 77 Sinniger Street, Maywood, New Jersey (MJ052).

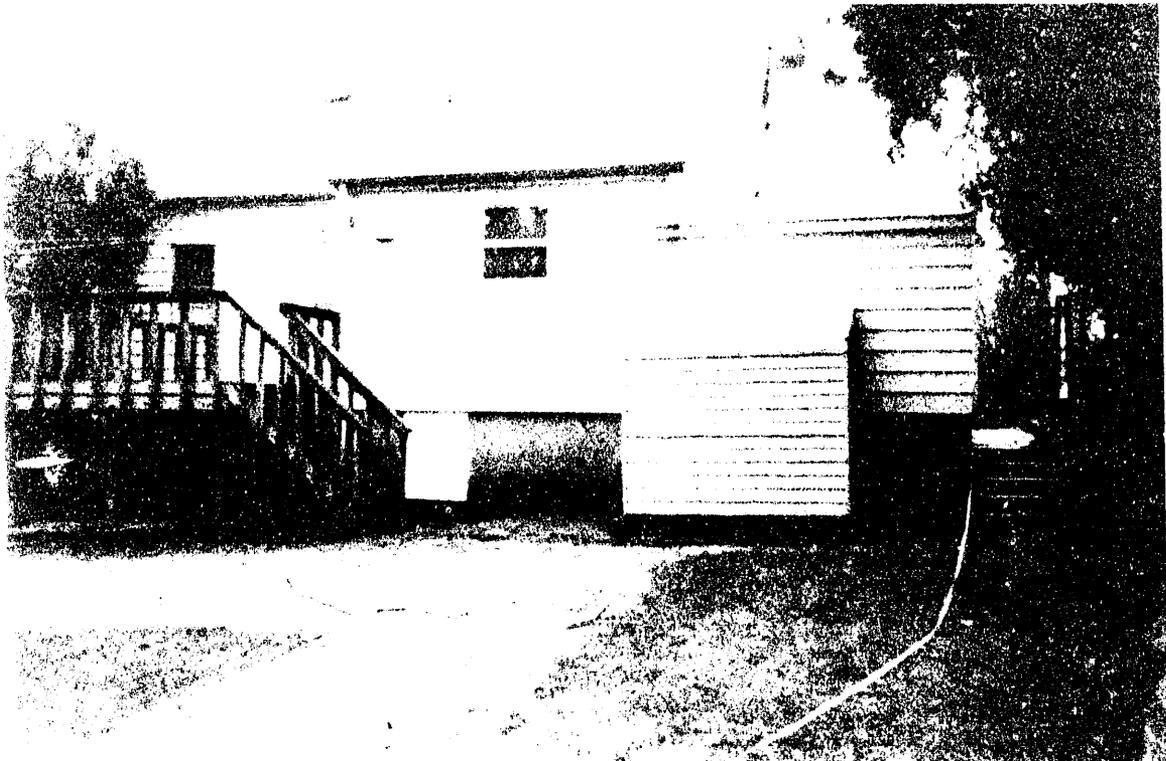


Fig. 2. View looking southwest at 77 Sinniger Street, Maywood, New Jersey (MJ052).

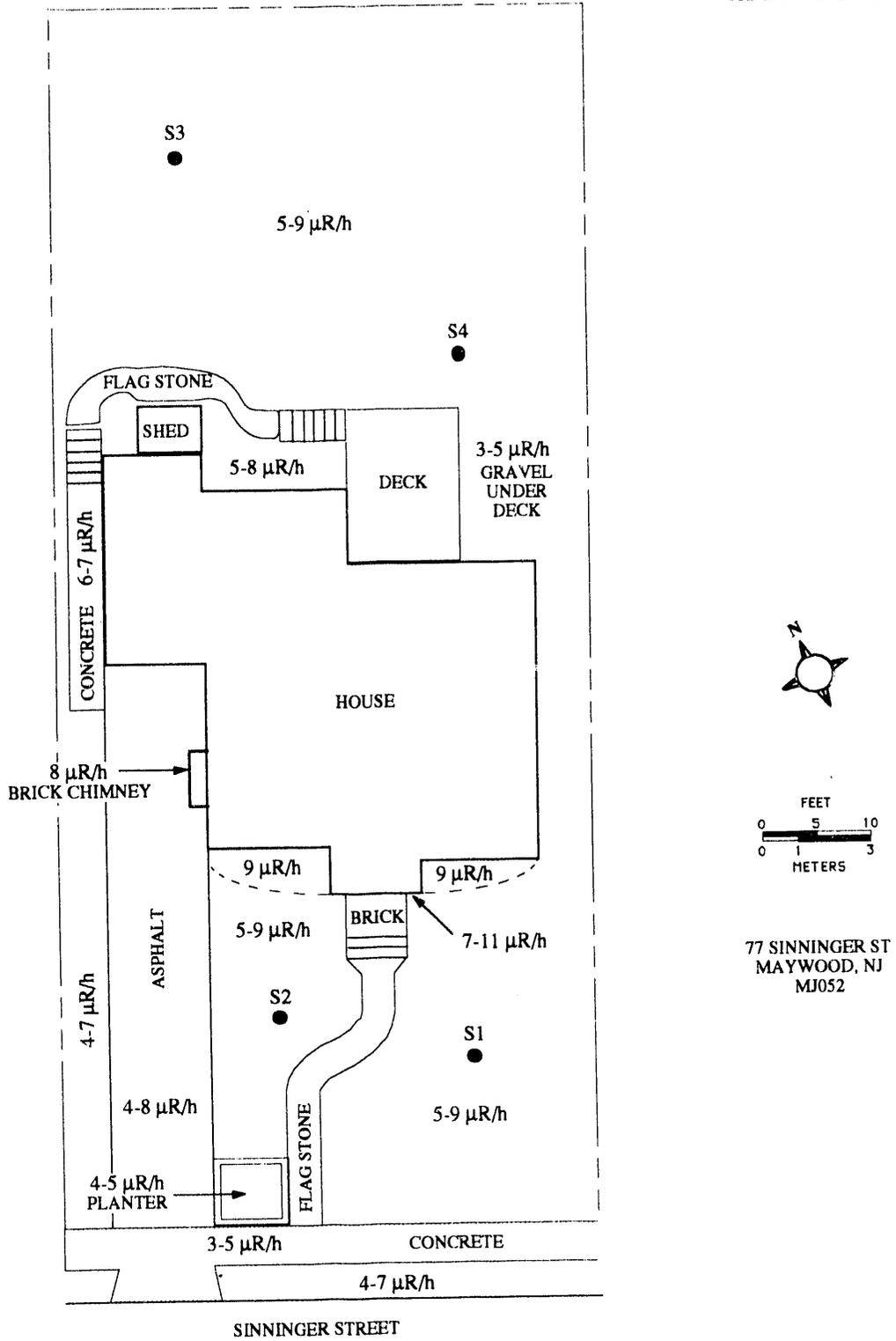


Fig. 3. Surface gamma radiation levels ($\mu\text{R/h}$) and soil sampling locations at 77 Sinninger Street, Mayood, New Jersey (MJ052).

Table 1. Applicable guidelines for protection against radiation
(Limits for uncontrolled areas)

Mode of exposure	Exposure conditions	Guideline value
Total residual surface contamination ^a	²³⁸ U, ²³⁵ U, U-natural (alpha emitters)	
	or	
	Beta-gamma emitters ^b	
	Maximum	15,000 dpm/100 cm ²
	Average	5,000 dpm/100 cm ²
	Removable	1,000 dpm/100 cm ²
	²³² Th, Th-natural (alpha emitters)	
	or	
	⁹⁰ Sr (beta-gamma emitter)	
	Maximum	3,000 dpm/100 cm ²
Average	1,000 dpm/100 cm ²	
Removable	200 dpm/100 cm ²	
	²²⁶ Ra, ²³⁰ Th, transuranics	
	Maximum	300 dpm/100 cm ²
	Average	100 dpm/100 cm ²
	Removable	20 dpm/100 cm ²
Beta-gamma dose rates	Surface dose rate averaged over not more than 1 m ²	0.20 mrad/h
	Maximum dose rate in any 100-cm ² area	1.0 mrad/h
Radionuclide concentrations in soil (generic)	Maximum permissible concentration of the following radionuclides in soil above background levels, averaged over a 100-m ² area ²²⁶ Ra ²³² Th ²³⁰ Th	5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over 15-cm-thick soil layers more than 15 cm below the surface

Table 1 (continued)

Mode of Exposure	Exposure conditions	Guideline value
Derived concentrations	^{238}U	Site specific ^c
	Concentration limit in surface soil above background levels based on dose estimates from major exposure pathways	

^aDOE surface contamination guidelines are consistent with *NRC Guidelines for Decontamination at Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-Product, Source, or Special Nuclear Material*, NUREG 1.86, May 1987.

^bBeta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except ^{90}Sr , ^{228}Ra , ^{223}Ra , ^{227}Ac , ^{133}I , ^{129}I , ^{126}I , ^{125}I .

^cDOE guidelines for uranium are derived on a site-specific basis. Guidelines of 35–40 pCi/g have been applied at other FUSRAP sites. *Source*: J. L. Marley and R. F. Carrier, *Results of the Radiological Survey at 4 Elmhurst Avenue, Colonie, New York (AL219)*, ORNL/RASA-87/117, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., February 1988; B. A. Berven et al., *Radiological Survey of the Former Kellex Research Facility, Jersey City, New Jersey*, DOE/EV-0005/29, ORNL-5734, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., February 1982.

Sources: Adapted from U.S. Department of Energy, *Radiological Control Manual*, DOE/EH-0256T (DOE N 5480.6), June 1992, U.S. Department of Energy, DOE Order 5400.5, April 1990, and U.S. Department of Energy, *Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites*, Rev. 2, March 1987.

Table 2. Background radiation levels for the northern New Jersey area

Type of radiation measurement or sample	Radiation level or radionuclide concentration ^a
Gamma exposure at 1 m above ground surface ($\mu\text{R/h}$)	8 ^b
Concentration of radionuclides in soil (pCi/g)	
^{226}Ra	0.9 ^c
^{232}Th	0.9 ^c
^{238}U	0.9 ^c

^aThese values represent an average of normal radionuclide concentrations in this part of the state. Actual values may fluctuate.

^bReference 4.

^cReference 5.

Table 3. Concentrations of radionuclides in soil at 77 Sinninger Street, Maywood, New Jersey (MJ052)

Sample ^a	Depth (cm)	Radionuclide concentration (pCi/g)		
		²²⁶ Ra ^b	²³² Th ^b	²³⁸ U ^c
<i>Systematic samples^d</i>				
S1A	0-15	0.83±0.07	1.00±0.12	2.3±0.35
S1B	15-30	0.94±0.07	0.97±0.11	1.2±0.27
S2A	0-15	0.91±0.02	0.91±0.03	1.4±0.6
S2B	15-30	0.86±0.11	0.94±0.14	1.1±0.47
S3A	0-15	0.93±0.10	0.96±0.15	2.2±0.50
S3B	15-30	0.75±0.07	1.04±0.13	1.3±0.29
S4A	0-15	0.87±0.02	0.88±0.04	1.7±0.55
S4B	15-30	0.72±0.06	0.88±0.09	1.2±0.41

^aLocations of soil samples are shown on Fig. 3.

^bIndicated counting error is at the 95% confidence level ($\pm 2\sigma$).

^cTotal analytical error of measurement results is less than $\pm 5\%$ (95% confidence level).

^dSystematic samples are taken at locations irrespective of gamma exposure rates.

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