JE/EM-52

Sampling Approach for Characterization of the Scarboro Community, Oak Ridge, Tennessee

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Sampling Approach for Characterization of the Scarboro Community, Oak Ridge, Tennessee

Date Issued—January 1998

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under contract DE-AC05-93OR22028

Prepared for
U.S. Department of Energy
Office of Environmental Management

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ACRONYMS AND ABBREVIATIONS

DOE	U.S. Department of Energy
ft	foot
GM	Geiger-Müller
ha	hectare
m	meter
ORR	Oak Ridge Reservation
QC	quality control
Tc	technetium

1. SITE LOCATION

The Scarboro Community, Oak Ridge, Tennessee, is located northwest of the Oak Ridge Y-12 Plant along the U.S. Department of Energy (DOE) Oak Ridge Reservation (ORR) boundary. The community is located in east Oak Ridge and is bounded to the west by East Fork Ridge and to the east by Pine Ridge (Fig. 1).

2. SITE DESCRIPTION

The Scarboro Community is a small urban community in the city of Oak Ridge, Tennessee. It is located approximately 457 m (1,500 ft) northwest of the Oak Ridge Y-12 Plant along the DOE ORR boundary. Pine Ridge separates the Scarboro Community from the Y-12 Plant area. The community occupies an area of approximately 101 ha (250 acres).

Note: This community is not on DOE-owned property.

3. PHYSICAL SETTING

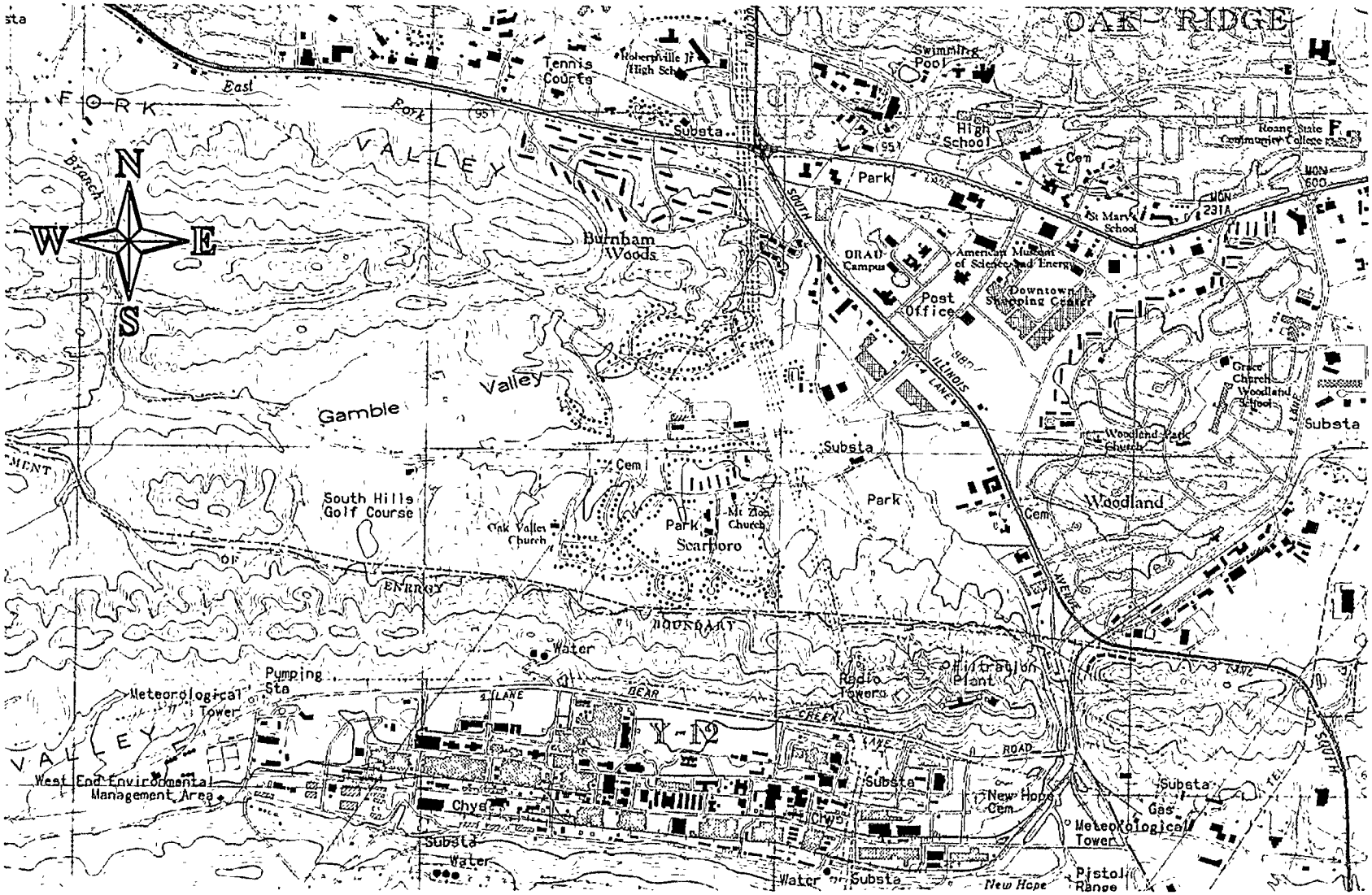
Topography of the Scarboro Community consists of gently rolling hills that have been cleared for residential use. The Scarboro saddle consists of a number of depressions in the ridge that may act as a conduit for air movement within the community. Pine Ridge rises sharply to the south. It is unknown whether the sampling area is in a floodplain and whether wetlands are present.

3.1 DEMOGRAPHY AND LAND USE

Land in the Scarboro Community was cleared and divided into lots ranging in size from approximately 0.1 to 0.2 ha (0.25 to 0.5 acre). The Scarboro Community Center Park, and various churches and small businesses are located in this area.

3.2 GEOLOGY

The Scarboro Community is underlain by the upper Rome Formation and the Chickamauga Group. According to P. J. Leminski (*Geologic Mapping of the Oak Ridge K-25 Site, Oak Ridge, Tennessee*, 1994), the Rome Formation is the oldest rock unit exposed in the Oak Ridge area. The upper Rome Formation is composed primarily of sandstone, siltstone, and



Source: TVA map - S16A Oak Ridge Area

JE	Fig. 1	Site location map Scarboro Community - Oak Ridge, Tennessee	DOCUMENT ID: 35H830 0015-99 / SSA	DRAWING ID: 97-15547.CDR	DRAWING DATE: January 26, 1998 WaM

shale. The sandstone is silica and hematite cemented and mostly fine- to medium-grained. The erosional resistance of the sandstone is responsible for the development of Pine Ridge which forms the southern boundary of the Scarboro Community. The northern part of the Scarboro Community is underlain by the Chickamauga Group of East Fork Valley (Oak Ridge Valley). According to R. D. Hatcher, Leminski, et al. (*Report on the Geology of the Oak Ridge Reservation*, ESD Pub. No. 3860, 1992), this younger geologic unit was placed adjacent to the older Rome Formation by a thrust fault. The Chickamauga Group consists almost entirely of limestone-dominated lithologies. This section of the Chickamauga Group consists predominantly of fossiliferous, thin to thick-bedded, fine-grained limestone interbedded with thin-to-massive beds of micrite and shale. In the lower and upper portions of the section, the limestone is predominantly argillaceous (high clay content). Near the upper part of the section a predominantly dark-gray to black chert bed underlies a metabentonite.

3.3 SOIL

The Scarboro Community is underlain by a silty loam commonly found on foot slopes below hills and ridges. Soils and subsoils extend to more than 1.52 m (5 ft) deep and consist of three distinct regions. The upper region is strong brown silt loam; the middle region is red, silty clay with mottled shades of brown; the lower region is red, shaly, silty clay loam. Soils are strong-to-medium in acidity except in some areas where surface soils have been limed. Soils of this type are typically low in fertility but high in water capacity. Overall, soil has a fair-to-good potential for urban use.

3.4 GROUNDWATER

No groundwater monitoring wells have been installed by DOE in the Scarboro Community; however, city water is available as drinking water to the community. Shallow groundwater is expected to follow the topography which runs north toward East Fork Poplar Creek.

3.5 SURFACE WATER

Three small intermittent drainage areas intersect the Scarboro Community. These small drains flow north, converge, and ultimately join East Fork Poplar Creek approximately 609 m (2,000 ft) north of the community.

3.6 DRAINAGE PATTERNS

Drainage patterns generally follow the topography which run predominantly north toward East Fork Poplar Creek.

3.7 CONTAMINANTS OF CONCERN

Based on the ongoing remedial investigation for the Y-12 Plant, mercury and radionuclides are two primary contaminants of concern, and therefore, are the target contaminants of concern for this investigation. Table 1 of this sampling approach presents the samples, analytes, and target constituents used in this investigation.

4. SITE ACCESS

The city of Oak Ridge will be contacted before initiation of any sampling activities at this site. All underground utilities located near the proposed sampling locations will be clearly marked and identified. In cases where proposed sampling locations fall on private property, consent of the property owner will be obtained before sampling activities begin. Utility maps are available, but are not included in this document. A. B. Perkins, DOE, is the Jacobs Environmental Management Team point-of-contact.

5. SAMPLING AND ANALYSIS

5.1 RATIONALE FOR SAMPLING

The purpose of this investigation is to validate measurements taken at the perimeter air monitor 46 (located in the Scarboro Community) and external gamma data collected during past flyover surveys. Five sampling tasks will be performed to validate these measurements. These tasks include biased sampling of residential properties, random sampling of residential properties, ORR boundary sampling, focused soil sampling in the Scarboro saddle, and surface water and sediment sampling in the Scarboro tributaries (Fig. 2). Additionally, a radiological walkover of representative areas of the Scarboro Community will be performed.

Biased soil sampling from residential properties will be performed and will include resident input. One soil sample will be collected from each selected property using a hand auger.

Table 1. Samples, analytes, and target constituents, Scarboro Community, Oak Ridge, Tennessee

Analyte/ matrix	Number of samples	Applicable Jacobs EM Team SOP	Analytical method	Container	Preservative	Detection limits[a]	No. and type of QA/QC
Total Hg in soil/ sediment	Sediment: 3 Soil: 46	FS-8.1.1, FS-8.1.2, or FS-8.1.4	7471	4-oz amber glass	Cool to 4°C ± 2°C	23 mg/kg	1/20 samples
Gross alpha/ beta in surface water	3	FS-6.1.1	900	1-gal[3]	HNO_3 to pH < 2.0	Based on laboratory selected	1/20 samples
Gross alpha/ beta in soil/ sediment	Sediment: 3 Soil: 46	FS-8.1.1, FS-8.1.2, or FS-8.1.4	9310	500-g polyethylene	Cool to 4°C ± 2°C	Based on laboratory selected	1/20 samples
Isotopic uranium in water[b]	3	FS-6.1.1	901.1 908[b]	1-gal[3]	HNO_3 to pH < 2.0	0.59 pCi/L	1/20 samples
Isotopic uranium in soil/ sediment[b]	Sediment: 3 Soil: 46	FS-8.1.1, FS-8.1.2, or FS-8.1.4	Gama spec 908[b]	500-g polyethylene	Cool to 4°C ± 2°C	0.16 pCi/g	1/20 samples

[a]Note: Detection limits listed are based on the preliminary remediation goals for the listed analytes.
[b]Isotopic analysis will be run only if the gama spec indicates the presence of uranium above background.

°C = degrees Celsius
g = gram
gal = gallon
EM = environmental management
Hg = mercury
HNO_3 = nitric acid
kg = kilogram
L = liter
mg = milligram
No. = number
oz = ounce
pCi = picocurie
QA = quality assurance
QC = quality control
SOP = standard operating procedure

LEGEND

- ● Proposed soil sample locations
- ▲ Proposed surface water/sediment sample locations

0 400 800

SCALE IN FEET

Tennessee State Plane NAD 83

N

NOTE: The 15 random residential sample locations and bias locations are not represented on this map.

JE	Fig. 2	
Proposed sample locations		
Scarboro Community - Oak Ridge, Tennessee		
DOCUMENT ID: 35H830 0015/99	DRAWING ID: MAPINFO 97-15601.WOR	DRAWING DATE: January 26, 1998 CC

Random soil sampling will be performed at 15 residential properties (roughly 10 percent of the residential properties in the community). One soil sample will be collected from each of these properties using a hand auger.

Soil samples will be collected in the Scarboro Community near the ORR property boundary along a transect parallel to the boundary line. The transect will connect the southwestern corner and the southeastern corner of the community. Soil samples will be collected at 50 m (164 ft) intervals for approximately 1,000 m (3,281 ft) (approximately 20 samples) using a hand auger.

Focused soil sampling will be conducted in a saddle which is located in the western part of the Scarboro Community. Three transects will divide the saddle. Two soil samples will be collected from each transect. The samples will be collected on either side of the creek that flows through the low point in the saddle. Transects will be located south of Spellman Avenue, south of the intersection of South Dillard Avenue and South Fisk Avenue, and south of Wilberforce Avenue. Soil samples will be collected using a hand auger.

Surface water and sediment samples will be collected from three tributaries flowing through the community. One surface water and sediment sample set will be collected downstream of a spring located east of South Hills Golf Club. A second set of samples will be collected at the confluence of two streams located west of Hampton Lane in the northern part of the community. A third set of samples will be collected in a stream south of Wilberforce Avenue and east of the community cemetery. Surface water samples will be collected using direct-fill methods to the extent practical and may be collected using a stainless steel dipper, if conditions warrant. Sediment samples may be collected using a stainless steel spade or scoop, to the extent practical, or the hand auger method may be used.

All samples collected will be analyzed for the target constituents (see Table 1). Sample results will be evaluated against the *Final Report on the Background Soil Characterization Project at the Oak Ridge Reservation, Oak Ridge, Tennessee*, DOE/OR/01-1175-V1, issued October 1993, to determine if elevated concentrations of target constituents are present in the Scarboro Community. All sampling activities, decontamination of sampling equipment, and quality control will be conducted in accordance with standard operating procedures written in accordance with the U.S. Environmental Protection Agency, Region 4 *Quality Assurance Manual*. If soil samples are collected in vegetated areas, the vegetation will be removed before augering. On completion of sampling activities at each sample location, the borehole will be backfilled with soil and seeded, if necessary.

A radiological walkover survey will be performed at the Scarboro Community Center Park and selected residences. The lack of buildings, trees and large vegetation in this area provides a higher probability of potential airborne deposition. This survey will be performed using a sodium iodide gamma scintillation detector and a Geiger-Müller (GM) detector. A data collection system will be used, such that radiological readings correspond to known geographical data points (e.g., Global Positioning System or equivalent).

The sodium iodide detector will be used qualitatively to note any increases in background activity and to help determine radiological isopleths that may exist as a result of the community's geography. The target constituent is uranium and its associated decay products. The uranium decay products emit one or more beta particles or gamma rays per decay. These daughter products are always present with the uranium parent. GM detectors respond to the more penetrating beta and gamma radiation as well as alpha radiation, thus reliably detecting uranium and providing a conservative upper estimate of any uranium present. Additionally, efficiencies for the GM detectors will be determined using a ^{99}Tc source that gives off a beta particle consistent in energy levels with the uranium daughters.

6. LABORATORY DELIVERABLES/DATA VALIDATION

6.1 EVALUATION LEVEL

Screening: Yes

(Analytical samples will be screened for radionuclides before shipment to laboratory.)

Definitive: Yes

(Laboratory analytical results and radiological walkover data from the Scarboro Community Center park.)

Percent validation:

100 percent for definitive data.

Electronic data deliverable: Yes

For definitive data.

Estimated number of samples:

3 (soil and sediment).

Sample delivery groups:

1 [water and quality control (QC)].

7. QC SAMPLE FREQUENCY

A QC sample will be taken for field duplicates, field rinsates, matrix spikes, and laboratory duplicates at a frequency of 1 per 20 samples.