

Evaluation of Uranium Releases Y-12 Plant—Oak Ridge Reservation

Public Comment Release April 22, 2003

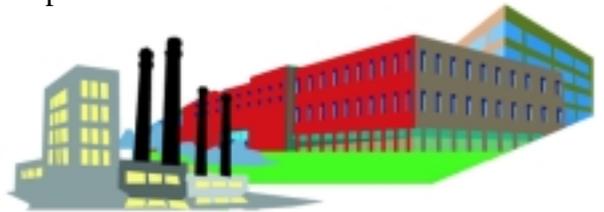
What did ATSDR find out about the uranium releases?

ATSDR health scientists concluded that the uranium releases from the Y-12 plant operation pose no past or current harmful health effects to the residents living near the Oak Ridge Reservation. Please see Table 1 for a summary of ATSDR's evaluation of past and current uranium exposure.

Key Issues and Concerns Evaluated

(see Figure 1 for the exposure pathways evaluated)

- ❖ Playing in the East Fork Poplar Creek (EFPC) floodplain soil and water
- ❖ Contacting the soil and water in Scarboro
- ❖ Inhaling dust or particles containing uranium
- ❖ Eating vegetables grown in the area
- ❖ Eating fish from EFPC
- ❖ Consuming meat or milk from cows raised in the EFPC floodplain



Evaluation of Past Uranium Releases (1944–1995)

Did past Y-12 plant releases of uranium cause harmful health effects from radiation exposure? No

To evaluate potential harmful effects from radiation exposure in the past, ATSDR calculated the total radiation doses to residents living near the Y-12 plant using the modeling results from the Uranium Releases Report of the Oak Ridge Dose Reconstruction conducted by the Tennessee Department of Health (TDOH). Using air dispersion modeling, the TDOH report identified the Scarboro community, located within the city of Oak Ridge, as a reference location. The TDOH stated that Scarboro residents would have received the highest exposure from past Y-12 uranium releases and were most suitable for screening both a maximally and typically exposed individual. ATSDR estimated a committed effective dose equivalent (total radiation dose) of 155 millirem (mrem) over 70 years based on exposure to uranium from all the exposure pathways evaluated (see Figure 1 for key issues). This total radiation dose is 32 times less than ATSDR's radiogenic cancer comparison value of 5,000 mrem over 70 years, which ATSDR believes to be protective of human health. Therefore, ATSDR does not expect harmful health effects to have occurred from radiation exposure to uranium in the past (see Figure 2 for a comparison of radiation doses).

ATSDR health scientists concluded that the levels of uranium to which people were exposed in the past are too low to cause health effects from either radiation or chemical exposures.

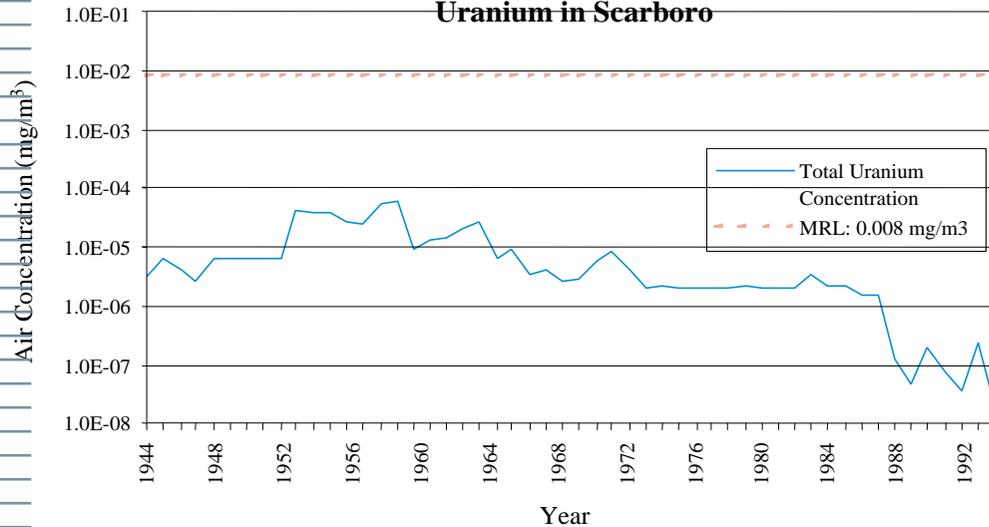
Did past Y-12 plant releases of uranium cause harmful health effects from chemical exposure? No

To evaluate potential harmful effects from chemical exposure in the past, ATSDR used the modeling results from the TDOH's Uranium Releases Report of the Oak Ridge Dose Reconstruction to calculate the average uranium air concentration in Scarboro for each year from 1944 to 1995. These esti-

Y-12 Uranium Releases

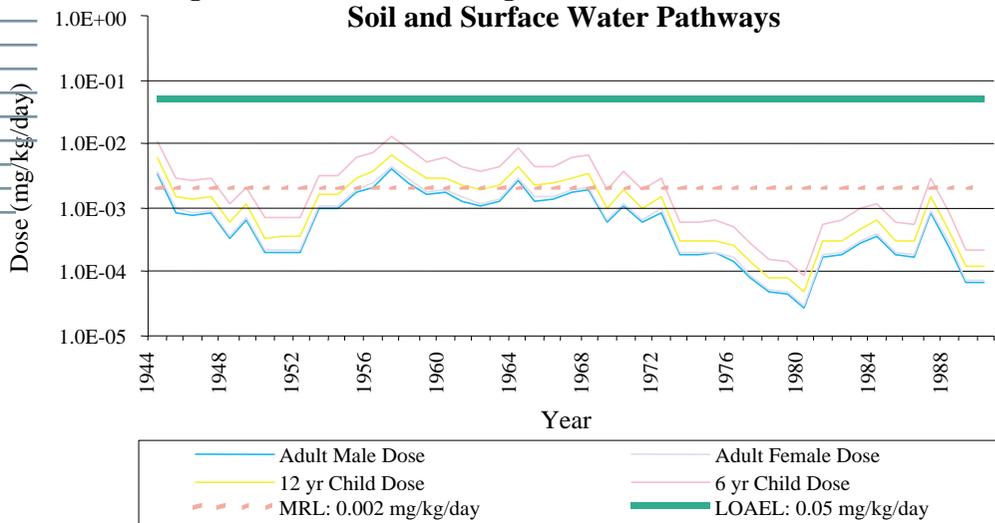
Estimated uranium air concentrations are less than 1% of ATSDR's minimal risk level (MRL—an estimate of exposure that is unlikely to result in harmful noncancer health effects) for chronic exposure to insoluble forms of uranium in air (see Figure 3).

Figure 3. Estimated Average Annual Air Concentrations of Total Uranium in Scarboro



ATSDR also calculated average uranium doses from the EFPC floodplain soil and surface water exposure pathways for each year from 1944 to 1990. The uranium doses include exposure from playing in the floodplain, eating fish, eating vegetables, and consuming meat and milk from cows (see Figure 1 for key issues and concerns evaluated). All the estimated uranium doses are well below the lowest uranium dose at which health effects (kidney toxicity) have been observed (see Figure 4). Therefore, past exposure to uranium from all surface water and soil exposure pathways is not a health concern.

Figure 4. Estimated Average Annual Doses of Uranium via the Soil and Surface Water Pathways



It should be noted that several levels of conservatism were built into the evaluation of past exposures to uranium. For example, the majority of the total uranium dose in the past is attributed to frequently eating EFPC fish and homegrown vegetables. If a person did not regularly eat fish from EFPC or vegetables grown near the Y-12 plant, then that person's radiation and chemical doses would likely have been substantially lower.

Y-12 Uranium Releases

Evaluation of Current Uranium Releases (since 1990)

To determine whether residents living near the Y-12 plant are currently being exposed to harmful levels of uranium, ATSDR evaluated recent

- ❖ Soil and surface water data collected in Scarboro by Florida Agricultural and Mechanical University (FAMU) and the U.S. Environmental Protection Agency (EPA)
- ❖ Air monitoring data collected from Station 46 in Scarboro by the U.S. Department of Energy (DOE)
- ❖ Surface water samples collected from EFPC by DOE
- ❖ Vegetable data collected by DOE from Scarboro gardens

Based on our review of the environmental sampling data collected in and around the Scarboro community, ATSDR has determined that the presence of uranium in air, soil, vegetables, and surface water is not a public health concern to people living near the Y-12 plant.

Would the current levels of uranium in the Scarboro community result in harmful health effects from radiation exposure? No

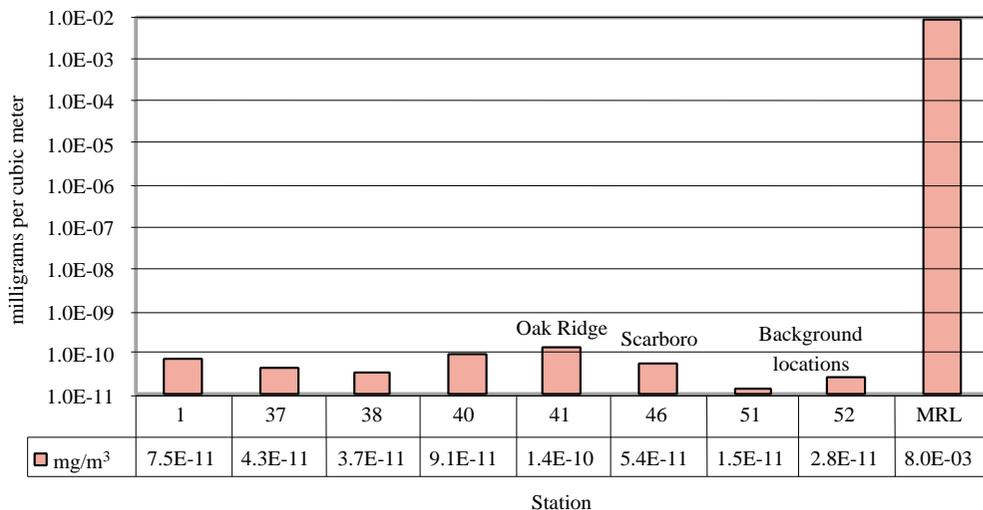
To evaluate the potential for harmful effects from radiation exposure to occur from uranium currently being released from the Y-12 plant, ATSDR calculated a committed effective dose equivalent of 0.216 mrem over 70 years from exposure to uranium in the air, soil, and vegetables in Scarboro (see Figure 1 for the exposure pathways evaluated). This radiation dose of 0.216 mrem is 23,000 times less than the ATSDR radiogenic cancer comparison value of 5,000 mrem over 70 years (see comparison of radiation doses in Figure 2). Therefore, ATSDR does not expect health effects to occur from radiation doses received from current uranium exposures in Scarboro.

Are harmful health effects from chemical exposure likely to occur from exposure to current levels of uranium in Scarboro? No

To evaluate the potential for harmful effects from chemical exposure to uranium, ATSDR evaluated exposures through inhalation of air in Scarboro and ingestion of Scarboro soils, homegrown vegetables, and surface water.

- ❖ The average current uranium air concentrations (5.4×10^{-11} mg/m³ in Scarboro and 1.4×10^{-10} mg/m³ in the city of Oak Ridge) are over a million times less than ATSDR's chronic MRL of 8×10^{-3} mg/m³ for insoluble uranium (see Figure 5).

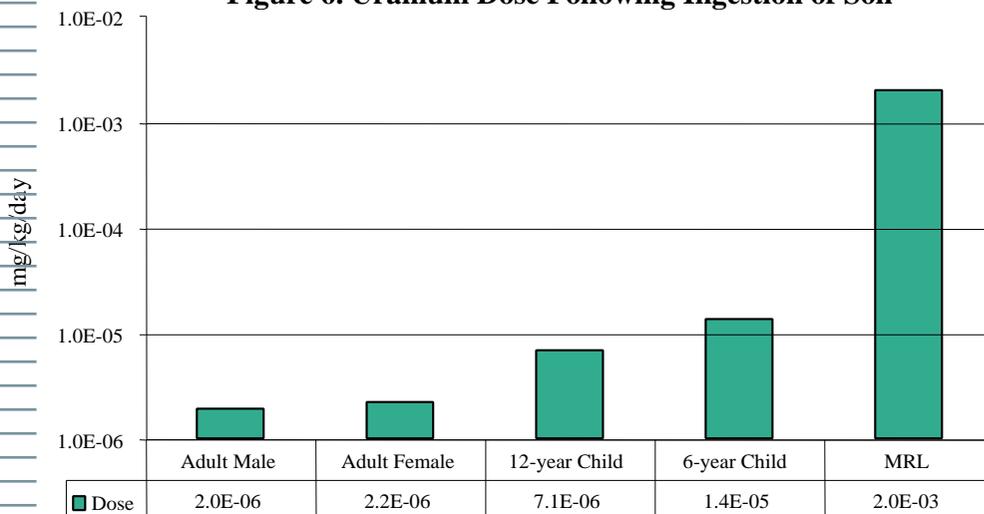
Figure 5. Average Uranium Air Concentrations Compared to the MRL



Y-12 Uranium Releases

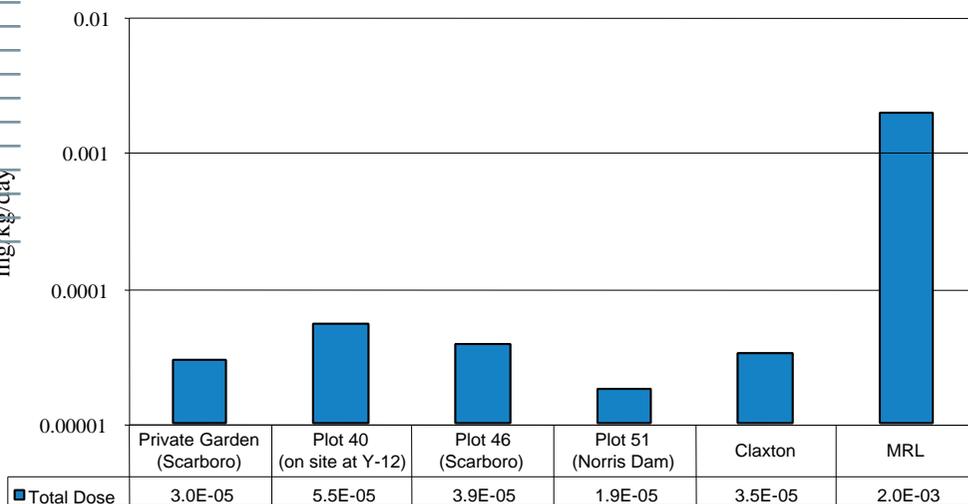
- ❖ ATSDR calculated a uranium dose of 1.4×10^{-5} mg/kg/day from ingestion of Scarboro soil by a 6-year old child. This dose is 140 times less than ATSDR's MRL of 2×10^{-3} mg/kg/day for chronic exposure to uranium through ingestion (see Figure 6).

Figure 6. Uranium Dose Following Ingestion of Soil



- ❖ ATSDR calculated uranium doses of 3.0×10^{-5} and 3.9×10^{-5} mg/kg/day from ingestion of vegetables grown in Scarboro. These doses are at least 50 times less than ATSDR's MRL of 2×10^{-3} mg/kg/day for chronic exposure to uranium through ingestion (see Figure 7).

Figure 7. Total Uranium Dose Following Ingestion of Vegetables



- ❖ The mean uranium concentrations (0.197 mg/L) in surface water from ditches in Scarboro are 100 times less than ATSDR's environmental media evaluation guide of 20 mg/L for highly soluble uranium salts.

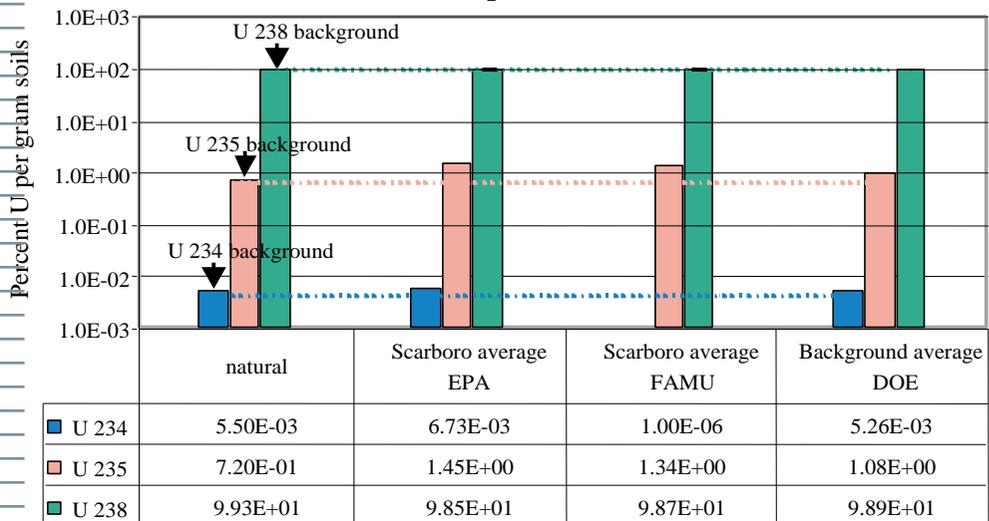
Therefore, ATSDR does not expect that residents of Scarboro are currently being exposed to levels of uranium that would cause harmful chemical effects.

Y-12 Uranium Releases

Does soil in Scarboro contain elevated levels of uranium or enriched uranium produced during various activities at the Y-12 plant? No

To evaluate the soil data collected in Scarboro, ATSDR compared the isotopic composition of uranium in Scarboro soil to natural background values as well as to soil samples collected in uncontaminated areas on and off the Oak Ridge Reservation (see Figure 8). Overall, this evaluation indicates that the concentrations of uranium detected in Scarboro by FAMU and EPA are indistinguishable from the background concentrations of uranium in uncontaminated areas around the reservation. Furthermore, the percentages of uranium in the Scarboro community are essentially identical to the amount of uranium found in nature.

Figure 8. Comparison of the Average Uranium Isotopic Concentrations



Are the residents in other areas in Oak Ridge being exposed to harmful levels of uranium? No

The Scarboro community, located in the city of Oak Ridge, was identified as a reference location because it represents an established community surrounding the Oak Ridge Reservation where residents resided during the years of uranium releases. Air dispersion modeling by the TDOH indicated that Scarboro residents were most likely to have received the highest exposure to uranium released from the Y-12 plant. All of the exposure pathways evaluated by ATSDR in the reference location, Scarboro, for both radiation and chemical health effects resulted in uranium exposures that were too low to be of health concern. Consequently, if the Scarboro community—the population likely to have received the highest uranium exposures from the Y-12 plant—was not in the past and is not currently being exposed to harmful levels of uranium from the Y-12 plant, then other residents living near the Y-12 plant, including those within the city of Oak Ridge, are also not being exposed to harmful levels of uranium.

Why is ATSDR at the DOE Oak Ridge Reservation?

ATSDR is the principal federal public health agency charged with evaluating the human health effects of exposure to hazardous substances in the environment. Congress created ATSDR to implement the health-related sections of the 1980 Superfund law and other laws that protect the public from hazardous waste and environmental spills of hazardous substances. The Oak Ridge Reservation is on EPA's National Priorities List of sites and facilities that have been found to pose a sufficient threat to human health or the environment to warrant cleanup.

What is ATSDR doing at the Oak Ridge Reservation?

As a part of ATSDR's congressional mandate, ATSDR is evaluating previous studies and environmental data to determine whether releases of hazardous substances from the site could have affected the health of the people in nearby communities. The public health assessment is the primary public health process ATSDR uses to:

- ❖ Identify populations off the site who could have been exposed to hazardous substances
- ❖ Determine the public health implications of exposure
- ❖ Address the health concerns of people in the community
- ❖ Recommend any needed follow-up public health actions to address exposure.

ATSDR health scientists conducted a review and analysis of TDOH's Screening-Level Evaluation Report (1944-1990) of the Oak Ridge Dose Reconstruction to identify contaminants of concern for further evaluation. Based on this review, ATSDR scientists are conducting public health assessments on:

- ❖ Iodine 131
- ❖ Mercury
- ❖ Polychlorinated biphenyls
- ❖ TSCA incinerator
- ❖ Radionuclides from White Oak Creek
- ❖ Uranium releases from Y-12 and K-25
- ❖ Fluorine
- ❖ Off-site groundwater

Where can I get more information?

For more information on ATSDR's public health activities at the Oak Ridge Reservation, including the public health assessment on the Y-12 Uranium Releases, please visit the Oak Ridge Reservation Health Effects Subcommittee (ORRHES) Web site at:

<http://www.atsdr.cdc.gov/HAC/oakridge/index.html> or contact Jack Hanley or William Taylor.

Jack Hanley, M.P.H.
Environmental Health Scientist
ATSDR
1600 Clifton Rd., NE (E-32)
Atlanta, GA 30333
Phone: 1-888-422-8737
404-498-0358
Email: jah8@cdc.gov



CDR William Taylor, Ph.D., DABT
ATSDR Oak Ridge Field Office
197 South Tulane Avenue
Oak Ridge, TN 37830
Phone: 865-220-0295
Fax: 865-220-0457
Mailing address: P.O. Box 5088
Oak Ridge, TN 37831-5088

Y-12 Uranium Releases

Table I. Summary of Public Health Implications from ATSDR's Evaluation of Past and Current Uranium Exposure to Off-Site Populations

Exposure	Effects	Media	Route	Notes	Is there a public health concern?
	Radiation	<ul style="list-style-type: none"> Air Soil Surface water 	Ingestion & Inhalation 	The total radiation dose from exposure to uranium via all exposure pathways was estimated to be 32 times less than ATSDR's radiogenic cancer comparison value.	No
Past	Chemical	<ul style="list-style-type: none"> Air 	Inhalation 	All yearly estimated uranium air concentrations were less than 1% of the intermediate-duration inhalation MRL for insoluble forms of uranium.	No
		<ul style="list-style-type: none"> Soil Surface water 	Ingestion 	Yearly estimated uranium doses via all soil and surface water exposure pathways are less than the dose at which health effects have been observed.	No
	Radiation	<ul style="list-style-type: none"> Soil Vegetables Air 	Ingestion & Inhalation 	The uranium radiation dose from exposure via ingestion of soil and vegetables and inhalation of air is 23,000 times less than the radiogenic cancer comparison value.	No
Current	Chemical	<ul style="list-style-type: none"> Air 	Inhalation 	Average uranium air concentrations are over a million times less than the MRL for insoluble uranium.	No
		<ul style="list-style-type: none"> Soil 	Ingestion 	The estimated uranium dose from ingestion of Scarboro soil was more than 140 times less than ATSDR's oral MRL.	No
		<ul style="list-style-type: none"> Vegetables 	Ingestion 	The estimated uranium dose from ingestion of vegetables grown in private garden in Scarboro is more than 50 times less than the oral MRL.	No
		<ul style="list-style-type: none"> Surface water 	Ingestion 	The mean uranium concentration in surface water from ditches in Scarboro are 100 times less than ATSDR's environmental media evaluation guide for highly soluble uranium salts.	No

Figure 1. Exposure Pathways Evaluated



Figure 2. Comparison of Radiation Doses

Screening and Regulatory Dose Limits



Radiogenic cancer comparison value, lifetime exposure—5,000 mrem over 70 years
NRC regulation, worker exposure—5,000 mrem/year

mrem

10,000



ATSDR acute MRL for noncancer endpoints—400 mrem/event above background

1,000



NRC regulation, public exposure—100 mrem/year above background
NCRP guidance, public exposure—100 mrem/year above background

ATSDR chronic MRL, for noncancer endpoints, annual—100 mrem/year above background



EPA CERCLA cleanup level, annual—15 mrem/year above background

Typical Doses from Ionizing Radiation Sources



2,500 mrem/test above background—Nuclear medicine stress test



1,000 mrem/scan above background—CT scan



600 mrem/year—Average background in Denver, Colorado, annual



155 mrem over 70 years above background—Total past radiation dose for Scarboro

360 mrem/year—Average US background, including artificial sources², annual

<1 mrem over 70 years above background—Current radiation dose for Scarboro
300 mrem/year—Average US background from natural sources¹, annual

ACRONYMS

ATSDR: Agency for Toxic Substances and Disease Registry
EPA: U.S. Environmental Protection Agency
NCRP: National Council on Radiation Protection and Measurement
NRC: Nuclear Regulatory Commission
MRL: minimal risk level
mrem: millirem (1,000 mrem = 1 rem)

¹NATURAL SOURCES

200 mrem/year Radon
40 mrem/year Natural internal
30 mrem/year Terrestrial (from the earth)
30 mrem/year Cosmic (from space)

²ARTIFICIAL SOURCES

50 mrem/year Medical
10 mrem/year Consumer products
<1 mrem/year Nuclear power

