
VI. Community Health Concerns

Responding to community health concerns is an essential part of ATSDR's overall mission and commitment to public health. ATSDR has actively gathered comments and other information from the people who live and work near the ORR; ATSDR is particularly interested in hearing from residents of the area, civic leaders, health professionals, and community groups. ATSDR addresses these community health concerns in the ORR public health assessments that are related to those concerns.

To improve the documentation and organization of community health concerns at the ORR, ATSDR developed a **Community Health Concerns Database** specifically designed to compile and track community health concerns related to the site. The database allows ATSDR to record, track, and respond appropriately to all community concerns and to document its responses to these concerns.

From 2001 to 2005, ATSDR compiled more than 3,000 community health concerns obtained from the ATSDR/ORRHES community health concerns comment sheets, written correspondence, phone calls, newspapers, comments made at public meetings (ORRHES and work group meetings), and surveys conducted by other agencies and organizations. These concerns were organized in a consistent and uniform format and imported into the database.

The community health concerns addressed in this section of the public health assessment include those in the ATSDR Community Health Concerns Database that are related to current and future chemical releases from the ORR. These concerns and ATSDR's responses are sorted and organized by category. Additional community concerns are addressed in the appropriate public health assessments.

VI.A. Chemical Mixtures

There were 17 individual comments specifically related to chemical mixtures and potential interactive effects in the Community Health Concerns Database. In this public health assessment on screening off-site current and future chemical exposure, ATSDR has considered interactive effects (cumulative, additive, synergistic, and antagonistic) of chemicals following exposure to multiple chemicals to the extent of the scientific knowledge in this area (please see the "Multiple Chemical Exposure" section on page 60). ATSDR does not expect interactive health effects of multiple chemicals because for each chemical evaluated the conservatively estimated exposure doses are below health effect levels reported in the scientific literature. The scientific literature surrounding chemical interactions indicates that if the estimated exposure doses for individual contaminants are below doses shown to cause adverse effects, then the combined effects of multiple chemicals are not expected to result in adverse health effects.

VI.B. Future Land Use

There was one concern that exposure to environmental contamination is causing adverse health effects, which will negatively impact future land use. ATSDR has concluded that current (1990 to 2003) and future exposures to site-related chemicals in soil, sediment, surface water, biota (other than fish), and air pose no apparent public health hazard. "No apparent public health

hazard” means that people may be exposed to contaminated media, but that exposure to contamination is not expected to result in adverse health effects. Dioxins pose an indeterminate public health hazard in an unknown fish species, but ATSDR does not expect adverse health effects to occur. Exposure to mercury, PCBs, uranium, fluoride, iodine 131, off-site groundwater, releases from the TSCA Incinerator, and radiological releases from White Oak Creek are evaluated in other public health assessments. The documents released to date are available at <http://www.atsdr.cdc.gov/HAC/oakridge/phact/index.html> and can also be ordered through a toll-free ATSDR telephone number, 1-800-232-4636.

VI.C. General Concerns

One comment was concerned whether it would be difficult to account for people tending to fish from more than one location. ATSDR accounted for this type of activity by using a conservative (protective) approach when calculating exposure doses—including using the species with the highest average concentration, using the sampling location with the highest average concentration, and assuming an adequate fish species population for recreational and subsistence behavior.

Another comment was related to exposure routes, including animal migration and deer hunting. ATSDR considered multiple exposure routes (current and future exposures to site-related chemicals in soil, sediment, surface water, groundwater, biota [game, fish, and vegetables], and air) based on environmental data from 1990 to 2003. In 1993, ATSDR released a health consultation that evaluated whether it was safe to eat fish from EFPC. ATSDR concluded that there was not an acute health hazard for people eating fish, but there was a hypothetical increased risk of adverse effects for people who frequently ingested fish over many years from EFPC at the levels reported in the health consultation. However, ATSDR currently believes this exposure scenario is unlikely because EFPC is not a productive fishing location. Copies of this health consultation, entitled *Y-12 Weapons Plant Chemical Releases into East Fork Poplar Creek* (ATSDR 1993b), are available from http://www.atsdr.cdc.gov/HAC/PHA/efork1/y12_toc.html.

VI.D. Odor/Stench/Public Nuisance

One commenter indicated that drinking water changes color and is sometimes cloudy. Oak Ridge receives and distributes public water from a treatment plant that collects surface water from Melton Hill Lake. The public water intake is approximately 1 mile upstream from the ORR.

Under the Safe Drinking Water Act, EPA sets standards for many substances in public drinking water and specifies treatments for providing safe drinking water. The public water supplies for Oak Ridge and throughout the State of Tennessee are continually monitored for these regulated substances. To ask specific questions related to your drinking water, contact TDEC’s Environmental Assistance Center in Knoxville, Tennessee at 865-594-6035. To find additional information related to your water supply or other water supplies in the area, please call EPA’s Safe Drinking Water Hotline at 1-800-426-4791 or visit EPA’s Safe Drinking Water Web site at <http://www.epa.gov/safewater>.

VI.E. Ongoing Activities of Health Concern

Five comments asked whether ATSDR would be screening chemicals from other currently operating plants/facilities and/or continuing releases from the ORR. During the public health assessment process, ATSDR evaluates environmental data (i.e., levels of chemicals in specific media), regardless of source. As such, any releases to soil, sediment, surface water, groundwater, biota, and air were evaluated with respect to public health.

VI.F. Screening Issues

One commenter asked about thorium levels detected at or near the site. ATSDR has reviewed available environmental data and determined that thorium levels are below screening values, and thus not a public health hazard for current and/or future exposures.

One comment stated that “the screening is done only for a finite period of time.” In this public health assessment, the chemical screening process evaluated environmental data from 1990 to 2003, to assess current and future exposures.

Several comments were related to availability/existence of biological testing for specific chemicals. Testing methods are available for certain compounds. The most common is for blood lead levels. Mercury can also be tested for in blood and urine. A 24-hour urine collection is used for chronic mercury exposures typically seen with environmental scenarios. Blood testing for mercury is used to assess more acute exposures associated with industrial uses and poisoning. For additional information regarding biological testing, please contact your local physician or poison control center.

VI.G. Soil, Sediment, and Surface Water Concerns

Several comments expressed concern over the “background soil sample” locations, with respect to which counties were included. Background soil samples were collected from Morgan, Loudon, and Knox Counties, but not from Roane, Anderson, and Blount Counties. ATSDR believes that the background soil samples are representative of the area and are appropriate to use in this public health assessment.

Several concerns were expressed regarding the robustness of the soil, sediment, and surface water data used to assess exposures. ATSDR believes the data set is adequate to evaluate current and future exposures to soil, sediment, and surface water. Appendix D contains maps that depict the number of samples collected from and the number of chemicals sampled at each location in each medium.

- The OREIS environmental database contains almost 10,000 records of chemicals sampled in off-site soil from November 5, 1990, to September 1, 2001. A total of 286 different chemicals were analyzed.
- OREIS contains about 56,000 records of chemicals sampled in off-site sediment from January 15, 1990, to September 1, 2001. A total of 319 different chemicals were analyzed.

- OREIS contains more than 93,000 records of chemicals sampled in off-site surface water from January 8, 1990, to September 10, 2002. A total of 310 different chemicals were analyzed.

VI.H. Scarboro Concerns

Scarboro residents have expressed concern that their community might be contaminated with chemicals currently being released from the ORR. To address this concern, ATSDR screened and evaluated the environmental data collected by the Florida Agriculture and Mechanical University (FAMU) and EPA. ATSDR's Scarboro-specific public health evaluation follows.²⁴

Scarboro Environmental Sampling

In 1998, FAMU sampled soil, sediment, and surface water in the Scarboro community to address community concerns about environmental monitoring in the neighborhood. All samples were analyzed for mercury, gross alpha/beta, uranium, and gamma-emitting radionuclides. About 10 percent of the samples were also analyzed for target compound list organics, target analyte list inorganics, strontium 90, thorium, and plutonium (FAMU 1998).

In 2001, EPA collected soil, sediment, and surface water samples from the Scarboro community to respond to community concerns, identify data gaps, and validate the sampling performed by FAMU in 1998. All samples were subjected to a full analytical scan, including inorganic metals, volatile organic compounds, semi-volatile organic compounds, radiochemicals, organochlorine pesticides, and PCBs (EPA 2003).

Methodology

The same methodology that was used to screen and evaluate current (1990 to 2003) environmental data was applied to the Scarboro-specific health evaluation (see Section III.B). ATSDR selected contaminants for further evaluation by comparing the maximum detected concentrations in Scarboro against health-based comparison values. Comparison values are derived using conservative exposure assumptions and reflect concentrations much lower than those that have been observed to cause adverse health effects. This means they are protective of public health in essentially all exposure situations; concentrations detected at or below ATSDR's comparison values are not a public health hazard and are not evaluated further.

ATSDR derived exposure doses for those contaminants that were detected above comparison values. When estimating exposure doses, health assessors evaluate chemical concentrations to which people could be exposed, together with the length of time and the frequency of exposure. ATSDR applied several protective assumptions to estimate exposures for Scarboro residents. ATSDR then compared the exposure doses to protective screening guideline values, including ATSDR's MRLs and EPA's RfDs. Estimated exposure doses that are below screening guideline values are not a public health hazard and are not evaluated further.

²⁴ Radionuclides are evaluated separately.

Scarboro Results

Soil

- 207 chemicals were analyzed.
- 40 chemicals were detected.
- 4 chemicals were detected above comparison values (arsenic, iron, gamma-chlordane, and heptachlor epoxide; see Table 34).
- 2 chemicals were detected above noncancer screening guidelines (heptachlor epoxide and iron; see Table 37).
- 0 chemicals were detected above cancer screening guidelines (see Table 38).

Sediment

- 206 chemicals were analyzed.
- 32 chemicals were detected.
- 2 chemicals were detected above comparison values (arsenic and iron; see Table 35).
- 0 chemicals were detected above noncancer and cancer screening guidelines (see Table 37 and Table 38).

Surface Water

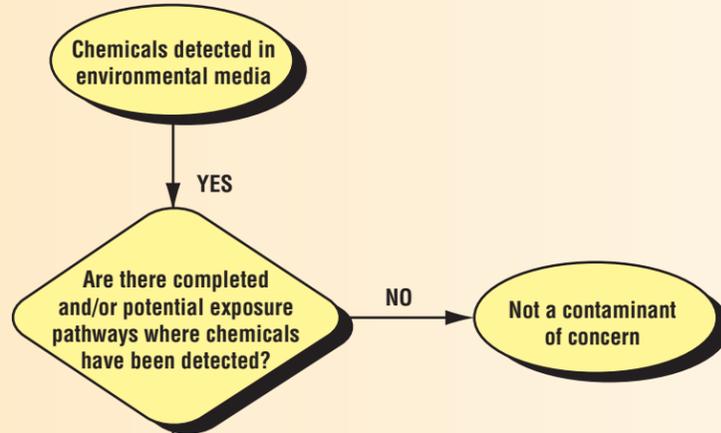
- 201 chemicals were analyzed.
- 23 chemicals were detected.
- 2 chemicals were detected above comparison values (arsenic and lead; see Table 36).
- 0 chemicals were detected above noncancer and cancer screening guidelines (see Table 37 and Table 38).

Figure 8 shows ATSDR's chemical screening process for the Scarboro public health evaluation. Chemicals without screening guidelines are discussed in Appendix B.

Figure 8. ATSDR Chemical Screening Process for Scarborough

Pathway Evaluation

Decision Diagram



Results

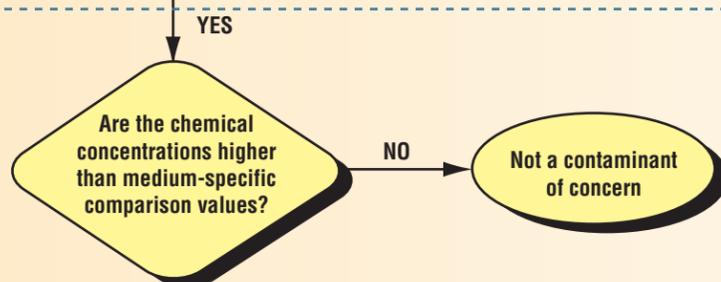
Chemicals Detected in Soil, Sediment, and/or Surface Water

Acetic acid	cis-Chlordane	Manganese
Acetone	Cobalt	Mercury
alpha-Pinene	Copper	Nickel
Aluminum	Cyclotetrasiloxane	Potassium
Antimony	DDE p,p'-	Pyrene
Arsenic	DDT p,p'-	Selenium
Barium	Di-n-butyl phthalate	Silver
Benzene ethanamine	Dodacane	Sodium
Benzoic acid	Fluoranthene	Thallium
Beryllium	gamma-Chlordane	Toluene
Bromoform	Heptachlor	Uranium-235
Butyl benzyl phthalate	Heptachlor epoxide	Uranium-238
Cadmium	Iron	Vanadium
Calcium	Lead	Zinc
Chromium	Magnesium	

Criteria

- Based on the results of environmental investigations
- Can or are exposures occurring?
- Identify potential or completed exposure pathways

Preliminary Screening

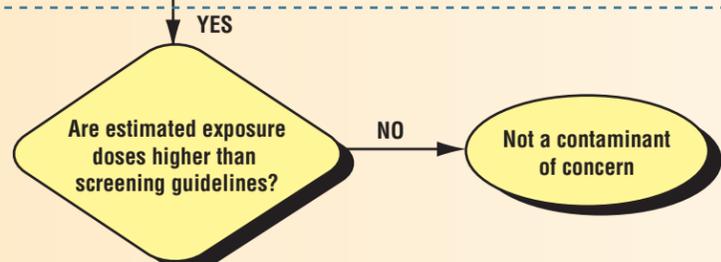


Chemicals Detected Above Comparison Values

Soil	Sediment	Surface Water
Arsenic	Arsenic	Arsenic
gamma-Chlordane	Iron	Lead
Heptachlor epoxide		
Iron		

- Based on maximum exposure conditions
 - maximum concentration detected
 - maximum exposure duration
 - maximum exposure frequency
 - maximum exposure bioavailability

Exposure Dose Comparison

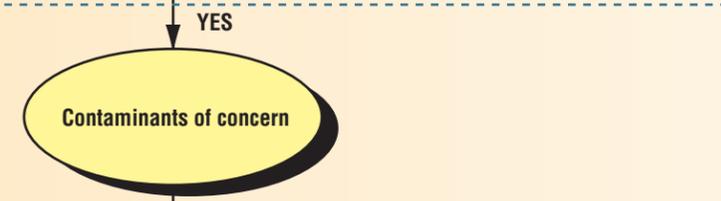


Chemicals With Completed and/or Potential Exposure Pathways

Soil	Sediment	Surface Water
Arsenic	Arsenic	Arsenic
gamma-Chlordane	Iron	Lead
Heptachlor epoxide		
Iron		

- Estimate doses based on site-specific exposure conditions
- Use more realistic exposure assumptions
 - realistic concentrations
 - realistic exposure duration
 - realistic exposure frequency
 - realistic exposure bioavailability

Contaminants of Concern

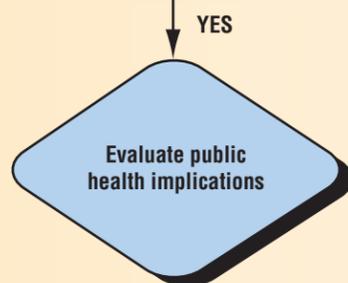


Chemicals Higher Than Screening Guidelines

Soil	Sediment	Surface Water
Heptachlor epoxide	None	None
Iron		

- Evaluate the public health implications of contaminants of concern in greater detail

Public Health Implications



Public Health Implications Evaluation—
Weight of Evidence

- Review toxicologic, medical, epidemiologic, and other scientific data on the contaminants of concern
- Evaluate whether contaminants of concern can affect public health in the vicinity of the site

Public Health Implications—Scarboro

A release of a chemical does not always result in human exposure, and human exposure does not always result in adverse health effects. Because screening guideline values were exceeded for two chemicals detected in soil (heptachlor epoxide and iron), ATSDR examined the health effect levels discussed in the scientific literature and more fully reviewed exposure potential for these chemicals. This information is used to describe the disease-causing potential of a particular chemical and to compare site-specific dose estimates with doses shown in applicable studies to result in illness. This process enables ATSDR to weigh the available evidence in light of uncertainties and offer perspective on the plausibility of harmful health outcomes under site-specific conditions.

Heptachlor Epoxide

The calculated dose for adults is below the noncancer and cancer screening guidelines for heptachlor epoxide; therefore, adults are not being exposed to heptachlor epoxide at levels constituting a health hazard. The calculated dose for pica children is below the acute screening guideline; therefore, pica children are not being exposed to heptachlor epoxide at levels constituting a health hazard. Because the calculated doses estimated for a non-pica child is above the noncancer screening guideline, ATSDR further examined the harmful effect levels reported in the scientific literature and more fully reviewed exposure potential for non-pica children.

Heptachlor epoxide is a breakdown product of heptachlor, a synthetic chemical used before 1988 for killing insects in homes, in buildings, and on food crops. Heptachlor epoxide was not manufactured—bacteria in the environment form heptachlor epoxide from heptachlor. Ingestion of soil containing heptachlor epoxide is one way the chemical can enter the body. The toxicokinetics (i.e., absorption, distribution, metabolism, and excretion) of heptachlor epoxide are not well studied in humans. Animal studies suggest that heptachlor epoxide is primarily stored in adipose tissue (i.e., fat). One animal study reported that the levels of heptachlor epoxide decreased to below detection limits 6 to 8 weeks after exposure (ATSDR 1993a).

ATSDR estimated that a non-pica child is expected to receive a dose of 0.000015 mg/kg/day from exposure to the soil in Scarboro. The oral screening guideline for heptachlor epoxide is based on a study in which liver-to-body weight ratios were significantly increased in animals fed heptachlor epoxide at doses of 0.0125 mg/kg/day for 60 weeks (Dow Chemical Company 1958). Supporting animal studies report no adverse health effects for doses ranging from 0.025 to 0.25 mg/kg/day (EPA 2004a). The estimated dose for non-pica children in Scarboro is well below these health effect levels.

Therefore, ATSDR does not expect that children who incidentally ingest soil from Scarboro would experience adverse health effects from exposure to heptachlor epoxide.

Iron

The calculated dose for adults is below the noncancer screening guideline for iron; therefore, adults are not being exposed to iron at levels constituting a health hazard. The estimated doses for both a pica child and non-pica child were above the acute and chronic noncancer screening

guidelines, respectively. Therefore, ATSDR further examined the harmful effect levels reported in the scientific literature and more fully reviewed exposure potential.

Iron is a naturally occurring element in the environment. In fact, it is the fourth most abundant element in the Earth's crust by weight (LANL 2001). The most common iron ore is hematite, which frequently can be seen as black sand along beaches and stream banks. It is hard and brittle, and is usually combined with other metals to form alloys, including steel.

Iron is also an important mineral that assists in the maintenance of basic life functions. It combines with protein and copper to make hemoglobin, which transports oxygen in the blood from the lungs to other parts of the body, including the heart. It also aids in the formation of myoglobin, which supplies oxygen to muscle tissues (ANR 2003). Without sufficient iron, the body cannot produce enough hemoglobin or myoglobin to sustain life. Iron deficiency (anemia) is a condition that occurs when the body does not receive enough iron. NAS's DRI for children 1 to 3 years old is 7 mg/day and for children 4 to 8 years old is 10 mg/day (NAS 2001).

According to the FDA, doses greater than 200 mg per event could poison or kill a child (FDA 1997). Doses of this magnitude are generally the result of children accidentally ingesting iron pills and are not from ingesting iron in soil. Acute iron poisoning has been reported in children less than 6 years of age who have accidentally overdosed on iron-containing supplements for adults. Because iron is not considered to cause harmful health effects in general, toxicological and epidemiological literature is limited.

For comparison, ATSDR calculated a daily consumption from exposure to the iron in soil using a modification of the dose equation (dose = concentration × intake rate). Exposure to iron in the soil would increase a pica child's daily consumption of iron by 149 mg/day and a non-pica child's daily consumption of iron by 5.1 mg/day. The median daily intake of dietary iron is roughly 11 to 13 mg/day for children 1 to 8 years old and 13 to 20 mg/day for adolescents 9 to 18 years old (NAS 2001). The daily increase in consumption of iron (from ingesting soil) by a non-pica child is within the NAS- and FDA-recommended intake guidelines, and well below the dose known to induce poisoning (e.g., greater than 200 mg/event). While the daily consumption of iron for a pica child exceeds the NAS and FDA recommended intake guidelines, the daily increase in consumption is not likely to cause a pica child's daily dose to exceed levels known to induce poisoning. Further, to the ATSDR health assessors' knowledge, no case of acute iron toxicity has ever occurred as a direct result of soil consumption. The absence of such cases probably reflects the large amount of soil that would have to be ingested combined with the much lower intestinal absorption of iron from soil than from food, and the fact that the human body regulates its own iron level. Therefore, ATSDR does not expect that children who incidentally ingest the soil or who exhibit pica behavior would experience adverse health effects from exposure to iron in Scarboro soil.

Conclusions

None of the soil, sediment, or surface water samples collected from the Scarboro community contained chemicals at levels posing a public health hazard.

VI.I. Cancer Concerns

Area residents have voiced concerns about cancer. Citizens living in the communities surrounding the ORR expressed many concerns to the ORRHES about a perceived increase in cancer in areas surrounding the ORR. A 1993 TDOH survey of eight counties surrounding the ORR indicated that cancer was mentioned as a health problem more than twice as much as any other health problem. The survey also showed that 83 percent of the surveyed population in the surrounding counties believed it was very important to examine the actual occurrence of disease among residents in the Oak Ridge area.

To address these concerns, ORRHES requested that ATSDR conduct an assessment of health outcome data (cancer incidence) in the eight counties surrounding the ORR (see Figure 6). Therefore, ATSDR conducted an assessment of cancer incidence using data already collected by the

“Cancer incidence” refers to newly diagnosed cases of cancer that are reported to the Tennessee Cancer Registry.

Tennessee Cancer Registry. This assessment is a descriptive epidemiologic analysis that provides a general picture of the occurrence of cancer in each of the eight counties. The purpose of this evaluation was to provide citizens living in the ORR area with information regarding cancer rates in their county compared to the State of Tennessee. The evaluation only examines cancer rates at the population level, not at the individual level. It is not designed to evaluate specific associations between adverse health outcomes and documented human exposures, and it does not—and cannot—establish cause and effect.

The results of the assessment of cancer incidence, released in 2006, indicated both higher and lower rates of certain cancers in some of the counties examined when compared to cancer incidence rates for the State of Tennessee. Most of the cancers in the eight-county area occurred at expected levels, and no consistent pattern of cancer occurrence was identified. The reasons for the increases and decreases of certain cancers are unknown. ATSDR’s ORR Assessment of Cancer Incidence is available online at http://www.atsdr.cdc.gov/HAC/oakridge/phact/cancer_oakridge/index.html.

In addition, over the last 20 years, local, state, and federal health agencies have conducted public health activities to address and evaluate public health issues and concerns related to chemical and radioactive substances released from the ORR. For more information, please see the Compendium of Public Health Activities at http://www.atsdr.cdc.gov/HAC/oakridge/phact/c_toc.html. The documents ATSDR has released to date are available from <http://www.atsdr.cdc.gov/HAC/oakridge/phact/index.html>.

VI.J. Private Vegetable Gardens

Because some people may only eat vegetables from their own garden, ATSDR specifically looked at exposures from eating the edible portion of vegetables sampled from each garden. Using the same assumptions and methodologies described in Section III.B, “Methodology,” ATSDR determined that none of the chemicals were detected at levels constituting a health hazard. If people are concerned, they should consider building raised-bed gardens and filling them with “clean” topsoil and compost, or increasing the organic matter in the soil by adding compost or manure from outside sources such as commercial garden centers.

VII. Conclusions

Based on ATSDR's evaluation of current (1990–2003) and future chemical exposures in the vicinity of the Oak Ridge Reservation, ATSDR concludes the following:

- Current and future exposures to site-related chemicals in soil, sediment, surface water, biota (other than fish), and air pose no apparent public health hazard. “No apparent public health hazard” means that people may be exposed to contaminated media, but that exposure to contamination is not expected to result in adverse health effects.
- Dioxins pose an indeterminate public health hazard in an unknown fish species due to limited sampling data.

VIII. Recommendations

Because dioxin data for fish are very limited, ATSDR recommends following the current State of Tennessee fish advisories to reduce exposure to contaminants in fish.

IX. Public Health Action Plan

The public health action plan for the Oak Ridge Reservation (ORR) contains a description of actions taken at the site and those to be taken at the site following the completion of this public health assessment. The purpose of the public health action plan is to ensure that this document not only identifies potential and ongoing public health hazards, but also provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to harmful substances in the environment. The following public health actions at the ORR are completed or ongoing:

Completed Actions

- In 1991, the Tennessee Department of Health (TDOH) began a two-phase research project to determine whether environmental releases from the ORR harmed people who lived nearby. Phase I focused on assessing the feasibility of doing historical dose reconstruction and identifying contaminants that were most likely to have effects on public health. Phase II efforts included full dose reconstruction analyses of iodine 131, mercury, polychlorinated biphenyls (PCBs), and radionuclides, as well as a more detailed health effects screening analysis for releases of uranium and other toxic substances (a summary can be found in the *Oak Ridge Dose Reconstruction Project Summary Report, Volume 7*). Phase II was completed in January 2000.
- In 1992, the U.S. Department of Energy (DOE) conducted a *Background Soil Characterization Project* in the area around Oak Ridge.
- In 2004, the Agency for Toxic Substances and Disease Registry (ATSDR) released the final ORR Public Health Assessment for Y-12 Uranium Releases. The document is available from <http://www.atsdr.cdc.gov/HAC/oakridge/phact/y12/index.html>.
- In 2005, ATSDR released the final ORR Public Health Assessment for the TSCA Incinerator. The document is available from <http://www.atsdr.cdc.gov/HAC/oakridge/phact/tsca/index.html>.
- In 2006, ATSDR released the final ORR Public Health Assessment for Contaminated Off-site Groundwater Exposures. The document is available from <http://www.atsdr.cdc.gov/HAC/oakridge/phact/groundwater/index.html>.
- In 2006, ATSDR released the final ORR Public Health Assessment for White Oak Creek Radionuclide Releases. The document is available from http://www.atsdr.cdc.gov/HAC/oakridge/phact/white_oak/index.html.

Ongoing Actions

- ATSDR is conducting public health assessments on the releases of uranium and fluorides from the K-25 site; iodine 131 from the X-10 site; mercury from the Y-12 plant; and PCBs from the X-10 site, the Y-12 plant, and the K-25 site.

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