

OAK RIDGE Reservation

Annual Site Environmental Report Summary



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Moving Forward Together



Message from the students...

Hello! We are students from Karns High School. As members of the Creative Writing class for fall 1999, we accepted the opportunity to help create the *Oak Ridge Reservation Annual Site Environmental Report Summary*. This document's purpose is to educate people about the environmental compliance programs at the Department of Energy's Oak Ridge facilities.

The idea of nuclear radiation is incredibly frightening. Thanks to movies about nuclear holocaust and news bulletins about horrific accidents, nuclear energy is largely considered to be bad and dangerous. However, while working on this project, we learned that although nuclear energy has negative effects, it also has positive uses, such as medicine, CAT scans, X-rays, and many other useful technologies.

Scientists and specialists from Oak Ridge were very helpful and insightful when they came to our school to answer our questions. Even the Oak Ridge Operations Manager, as well as several other Department of Energy personnel, took time from their busy schedules to be interviewed or answered questions.

It took hard work and dedication from everyone involved in this project to make this document. We hope that it is very informative and helps the reader better understand the Department of Energy's role in the Oak Ridge area.

We would like to thank everyone who devoted their time and energy to help produce this document. Without their encouragement and support, none of this would have been possible.

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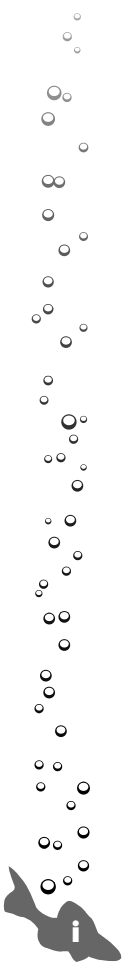
The Oak Ridge Reservation is a complex, distinctive, and valuable natural and industrial resource, with a vision of environmental stewardship, research, national defense, and industrial development for the benefit of all. By "Moving Forward Together," unified in approach and spirit, the public, industry, and government represent an invincible league that can, and will, have a most positive impact on tomorrow.

Cover artwork:

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Credits





The Fall 1999 Creative Writing Class, Karns High School, Knoxville, Tennessee.


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*Oak Ridge Reservation
Annual Site Environmental Report Summary for 1998*

December 1999

This report summarizes the information found in the *Oak Ridge Reservation Annual Site Environmental Report for 1998* (DOE/ORO/2091). Each year the Department of Energy publishes an Annual Site Environmental Report that presents the analysis, results, and interpretation of extensive, ongoing environmental monitoring and surveillance programs in which our contractors measure tens of thousands of data points in the water, air, soil, and animal life on and around the Oak Ridge Reservation. These programs exist for four crucial reasons. One, we know a legacy of contamination exists on and off the reservation that must be closely watched; two, existing operations produce pollutants that must be controlled; three, we wish to fully understand the fate, transport, and control of all these chemical and radiological contaminants; and four, we must keep the public fully informed of any real or potential environmental problems.

The *Annual Site Environmental Report* consists of three components of increasing length and complexity: 1) the *Annual Site Environmental Report Summary* (this document); 2) the *Annual Site Environmental Report*; and 3) the *Environmental Monitoring on the Oak Ridge Reservation: 1998 Results* (DOE/ORO/2092), which provides more comprehensive data. The results volume is in limited distribution but is available upon request. The *Annual Site Environmental Report* and this *Report Summary* are public documents and are distributed to government regulators, scientists, engineers, business people, special interest groups, and members of the public. They are available in public reading rooms and libraries, and can be easily accessed on the World Wide Web at http://www.ornl.gov/Env_Rpt/asr98/asr.htm.

I consider the *Annual Site Environmental Report* our most pivotal annual environmental document, for it is a crucial instrument through which we and our contractors maintain a continual vigilance on operations and the natural environment, and a watchful eye for any possible effect of present or past operation on the health of the environment or the public. The *Annual Site Environmental Report* is always extensive, technical, and complex; hence, it is somewhat difficult to understand. This concerns us, for all stakeholders should have a document that they can reference and utilize. Therefore, we have again teamed with an important stakeholder, high school students in a creative writing class. I asked these talented young people to participate in the creation of a Report Summary that is easily read, easily understood, and meaningful. The Department of Energy thanks this class for their hard work, creativity, and dedication in meeting this difficult challenge.










Printed reports are available upon request from the Annual Site Environmental Report Project Director, Ms. Laury Hamilton, at 865-576-4526. As the Department of Energy Program Director of the Annual Site Environmental Report, my foremost goal is to provide all stakeholders with documents of quality and value. Should you have any comments or suggestions on how to improve either this summary report or the *Annual Site Environmental Report*, I invite your input. 



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A Tale of Three Facilities

In the beginning...

In 1939, in a remote region of East Tennessee, a few small communities — often little more than a store and a church — were the social center for farmers who had lived in the area for generations. The small communities located near Black Oak Ridge had not yet been recognized as a city. Little did the people of this region know that their area would play a major role in the history of the country and the world.

During World War II, German scientists accomplished the task of splitting the atom. American scientists realized that with this technology, the Germans could create a weapon of mass destruction. Concerned scientists composed a letter to President Roosevelt warning of the new German capabilities. Knowing that the President would respect a letter from Albert Einstein, they persuaded him to send a signed letter to the President stating that the creation of an atomic bomb was possible. The President reacted by forming the Manhattan Project, and the Black Oak Ridge area was chosen as one of the project sites.

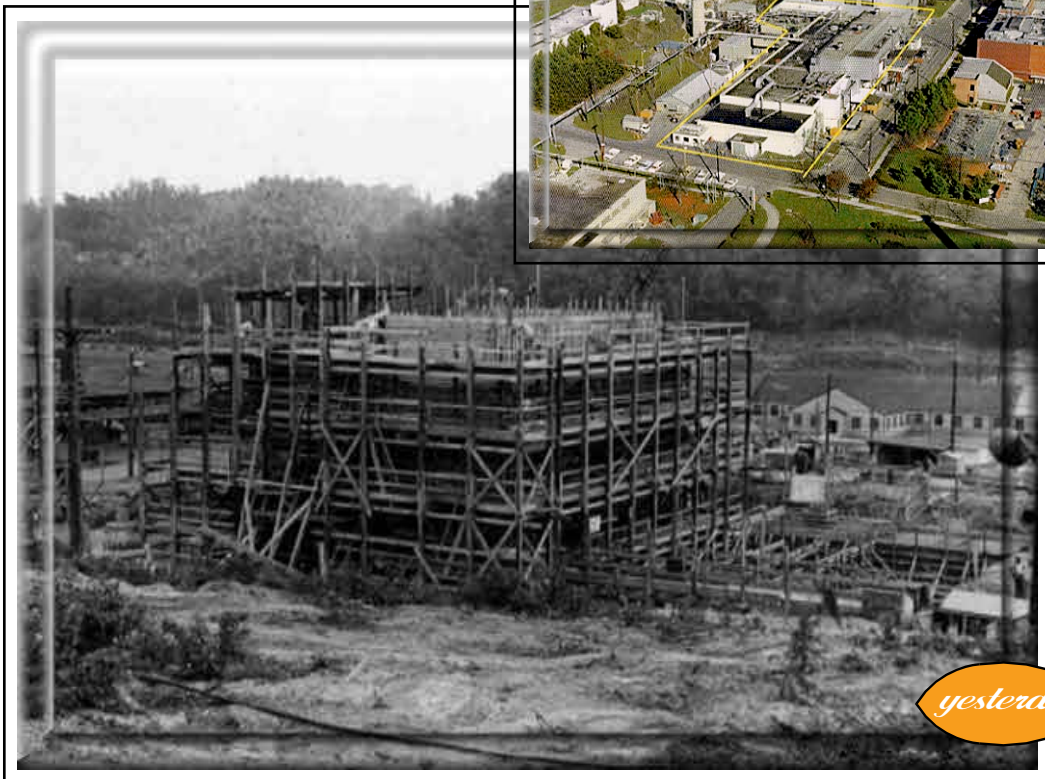
Ground was broken for the Manhattan Project on February 2, 1943. By summer, some 3,000 construction workers had erected about 150 buildings. The material list included 30,000 yards of concrete; 4 million board feet of lumber; 4,500 gallons of paint; and 1,716 kegs of nails.

Within the boomtown of Oak Ridge itself, a house was being completed every 30 minutes. The bus system in the secret city would be the nation's sixth largest; electricity consumption (largely because of the immense uranium enrichment plants called Y-12 and K-25) would be 20 percent greater than in New York City.

Aerial view of Graphite Reactor and Building 3019, 1998



today



yesterday

TNX building and stack 105, 3001 Graphite Reactor, and 2006 Building, July 14, 1943.



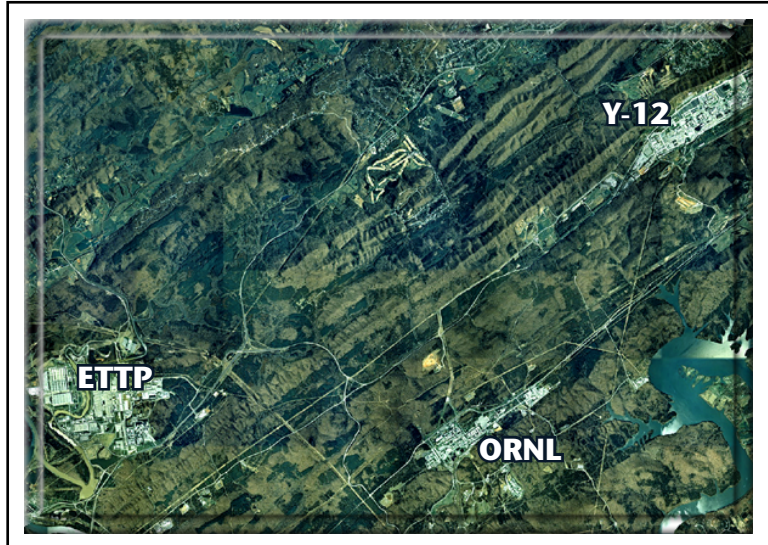
Over 50 years later...

The Oak Ridge Reservation contains three large plant sites:

Oak Ridge Y-12 Plant. Since World War II, the number of buildings at Y-12 has doubled. Its mission and capabilities have changed as well. The first site mission was the separation of uranium-235 from natural uranium by the electromagnetic separation process. The magnetic separators were taken out of commission at the end of 1946 when gaseous diffusion became the accepted process for enriching uranium. For more than 50 years, the plant has been a premier Department of Energy weapons manufacturing facility. Every weapon in the stockpile has some components manufactured at the Y-12 Plant.

The plant's work in the Manhattan Project helped produce the first nuclear weapons. Weapon components later produced at the plant helped win the Cold War. Nuclear weapons remain an integral part of national security today.

Today, the Department of Energy's Oak Ridge Y-12 Plant is a complex manufacturing facility that stretches over 811 acres. Its 250 buildings contain about 7 million square feet of floor space. (That's the square footage of 150 football fields!)



Aerial view of the East Tennessee Technology Park, Oak Ridge National Laboratory, and the Oak Ridge Y-12 Plant.

Oak Ridge National Laboratory

On first glance, there is little resemblance between the sprawling Oak Ridge National Laboratory of today and the single-mission radiochemical pilot plant of World War II. A closer inspection shows otherwise: An early scientific path led here, then branched this way and that; another converged from over yonder.

The Graphite Reactor showed many uses for nuclear energy, both as a scientific probe and as a pusher of submarines and spinner of turbines. And it led to other research reactors, beyond which awaits the Spallation Neutron Source. But the Graphite Reactor was the trailhead for other paths also, such as explorations of the problems — technological, environmental, and safety — that arose as a whole generation of nuclear reactors began showing their age and imperfection. And the wartime separation of plutonium led to the peacetime extraction of radiochemical exotica and the development of nuclear medicine. So it is with every path the Laboratory treads: It probably came from a patch of familiar scientific ground, and sooner or later it is likely to lead to some other place worth exploring. For the next 50 years, the journey begins with genetic research, protein engineering, advanced materials, environmental science, nuclear safety, fusion research. No one can say where it leads. Hard though it was to see at the time, Oak Ridge National Laboratory's half-century of exploration has positioned it to head toward precisely these kinds of urgent challenges.

The East Tennessee Technology Park (ETTP), formerly known as the K-25 Site, is the smallest of the three major sites on the Oak Ridge Reservation. In 1943 the plant was established to produce enriched uranium, using the gaseous diffusion process, for the first atomic bombs. Although the plant has many facilities, the main process was carried out in a giant U-shaped building, each side of which is a half mile long. The plant filtered the raw uranium hexafluoride gas through a series of barriers. The uranium-235 was separated (this is the enriched uranium) and shipped to one of the other labs designated to assist in building the atomic bomb. The remaining isotopes, mostly uranium-238, were stored in huge cylinders and kept in cylinder yards at the K-25 Site.

After the war, the K-25 Site continued to make enriched uranium for bombs, but it also began to make fuel for nuclear reactors. The plant also was the site of several experimental efforts to enrich uranium using other processes, such as laser enrichment or centrifuge enrichment.

In the 1980s, demand for enriched uranium decreased, so the process at the K-25 Site was shut down. During the 1990s, the K-25 Site was renamed East Tennessee Technology Park, and the priority for the plant shifted to cleaning up the environment and old buildings for potential industrial reuse.





Compliance Laws and Regulations

Environmental compliance through the decades...

The '40s — When the Oak Ridge Reservation first began operations in the forties, there were virtually no regulations or laws governing the protection of the environment or the generation and management of radioactive waste. In 1946, the Atomic Energy Act took authority and oversight for atomic energy programs away from the military and established the five-member Atomic Energy Commission.

The '50s — In the post-World War II era, America was booming. Industry was growing at a rapid rate, new frontiers were being explored in the area of nuclear materials. There was no national/public concern about impacting the environment through industrial growth, pollution, and waste control and handling.













The '60s — The dawn of environmental awareness began in this decade. In the 1960s, the book *Silent Spring* by Rachael Carson brought about the beginning of public environmental awareness. In 1965, the Solid Waste Disposal Act was passed by Congress to deal with the ever-increasing problem of solid waste.

The '70s — In 1970 a day was established, for the first time, to reflect upon and honor the environment. This was the beginning of Earth Day. As the 1970s progressed, laws were passed with the intention to protect and clean up the environment. The public's awareness of environmental issues and problems grew. Environmental special interest groups became a powerful force in our country's stride toward environmental protection. At the same time, the Environmental Protection Agency was formed to enforce the environmental laws in industry.

The '80s — In the 1980s, the government continued to enforce the cleanup and protection of the environment. The laws established in the seventies were vague and hard to follow, so many were reissued with more stringent controls and requirements. In addition, with agreement of the government, the environmental laws were extended to regulate governmental agencies as well (e.g., the Department of Defense, the Department of Energy)

The '90s — In the nineties, with strict policies in place, the government focuses on enforcement as well as cleanup and restoration of environmentally impacted areas throughout the country.

The U. S. Environmental Protection Agency and the Tennessee Department of Environment and Conservation are the principal regulators of Oak Ridge Reservation activities. These agencies issue permits, review compliance reports, participate in joint monitoring programs, inspect facilities and operations, and oversee compliance with applicable regulations. The following are a few of the many federal, state and local laws and regulations with which Department of Energy must comply:

- | | |
|---|--|
|  Clean Air Act |  Federal Insecticide, Fungicide, and Rodenticide Act |
|  Clean Water Act |  National Environmental Policy Act |
|  Safe Drinking Water Act |  National Historical Preservation Act |
|  National Pollution Discharge Elimination System |  Resource Conservation and Recovery Act |
|  Comprehensive Environmental Response, Compensation, and Liability Act |  Toxic Substances Control Act |
|  Federal Facility Compliance Act |  National Emission Standards for Hazardous Air Pollutants |




Environmental Occurrences in 1998:

- During the 1998 goose roundup, 38 geese at Oak Ridge National Laboratory were retained because the cesium-137 concentrations in the geese exceeded the release limit.
- Two incidents of oil sheens on East Fork Poplar Creek were reported by the Y-12 Plant.
- The reservation experienced a total of 19 National Pollution Discharge Elimination System and Clean Water Act noncompliances during 1998.

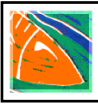
Environmental High Points in 1998:

- All but one of the 1998 milestones and commitments made under the Oak Ridge Reservation Site Treatment Plan for mixed wastes were met.
- The effective dose equivalent to the most-exposed member of the public from airborne radionuclide emissions was 0.73 mrem for 1998, far below the allowable compliance limit of 10 mrem per year.
- All three sites had better than a 99% compliance rate for National Pollution Discharge Elimination System permit requirements.
- Actual air emissions from the Toxic Substances Control Act Incinerator at the Oak Ridge East Tennessee Technology Park were between 0.06 and 7.0% of allowable air emissions as a result of extensive exhaust treatment systems.

Ongoing Environmental Issues:

- PCBs had been in service on the Oak Ridge Reservation throughout its 50-year history prior to being banned as environmental hazards. Most PCB uses have been phased out, although small amounts of PCBs remain in service, for example, in fluorescent light ballasts. Also, PCBs have been discovered in unusual media such as building materials, lubricants, paint coatings and sealants, and PCB-impregnated gaskets in the old K-25 ventilation systems. To address these issues, and the issue of PCB-contaminated radioactive waste, a PCB-specific Federal Facility Compliance Agreement is in place that contains records and reporting requirements, including the handling and disposal of PCB-contaminated materials.
- Groundwater contamination has been an ongoing issue at the Y-12 Plant. Known or potential sources of groundwater contamination involve four types of primary contaminants: nitrate, volatile organic compounds, metals, and radionuclides. Groundwater monitoring at the Y-12 Plant covers groundwater flow, direction, and velocity, as well as contaminant concentrations, depth, and movement. Volatile organics were first detected in 1993 in off-site wells in deep bedrock formations and were found to be moving toward the east into Union Valley. Data collected in 1998 showed no significant changes in the types and concentrations of contaminants forming the groundwater contaminant plume in Union Valley.
- Two high-priority remediation projects at the Oak Ridge National Laboratory have been the remediation of the Molten Salt Reactor Experiment and the Gunite and Associated Tanks. Although much work has been done, more is still forthcoming at the Molten Salt Reactor Experiment, to melt and remove the fuel salt. At the Gunite and Associated Tanks, radioactive liquids and sludge were removed from two tanks. The remediation on the remaining tanks continues. 





Environmental Monitoring

Information from the Oak Ridge Reservation environmental monitoring programs is used to show compliance with applicable environmental laws, regulations, and Department of Energy requirements, and to identify trends, inform the public, and contribute to general environmental awareness. Discharges into the air and water are measured at the point of discharge; this is called effluent monitoring. Concentrations of contaminants also are measured in environmental media (i.e., fish, water, air, vegetables, and wildlife); this is called surveillance monitoring. The data gathered help to determine the effect of operations at the Department of Energy facilities on the public and environment. This information also can be used to help reduce or eliminate future releases of radioactive and hazardous materials. A lot of the information gathered during specific monitoring programs is published in routine reports to local, state, and federal agencies and to the public. The surveillance data is a measure of what is found in the environment regardless of origin (natural, residential, industrial, or Oak Ridge Reservation operation).



Ambient air sampler

Air

One of the most important things monitored is the air. Ambient air — air that is natural in the environment — is sampled using filters at eight locations on the border of the reservation and one background location at Fort Loudoun Dam (this is a location that should not be affected by discharges from the Oak Ridge Reservation). The filters collect small particles from the air. These particles are analyzed to determine if radioactivity is present. The moisture in the air, known as humidity, is also collected and analyzed for tritium. Tritium is a radioactive form of hydrogen and can combine with oxygen to form radioactive moisture.

Air is also sampled at the point of discharge from stacks; this is called effluent sampling. There are more than 400 emission sources, covered by 69 active air permits, on the Oak Ridge Reservation that have the potential to discharge contaminants into the air. There are many more sources that are not required to be permitted. The 1998 air emissions were below the permit limits on all permitted sources. No noncompliances were written by the Tennessee Department of Environment and Conservation at any of the facilities during inspections of all permitted emission sources. Also, airborne radioactive releases from the reservation should not have caused anyone to receive a dose greater than 0.73 mrem, well below the 10 mrem limit.

Direct Radiation

Direct radiation exposure rates are measured at six locations on and off the Oak Ridge Reservation. The measurements are compared with normal background levels for Tennessee to determine whether radioactive releases from the Oak Ridge Reservation are significantly increasing area radiation levels. The average measured exposure rate at locations around the Oak Ridge Reservation during 1998 was about 36 mrem per year. This is within the range of background levels in Tennessee, which range from 19 to 72 mrem per year with an average of 42 mrem per year. This means that everyone living in Tennessee receives a dose of direct radiation from the natural environment that contributes about 40 mrem to their total background exposure of about 300 mrem per year.



Direct radiation measurements

Surface Water

Water is a vital part of our everyday lives. It is important to test the water to ensure that its quality is not being degraded. Water that is directly discharged into lakes and streams (effluent water) is regulated under the National Pollutant Discharge Elimination Program permitted by the State of Tennessee. Facilities are issued a permit from the state that identifies discharge limits for various contaminants (oil and grease, metals, chlorine, etc.) The Oak Ridge Reservation has three separate National Pollutant Discharge



Water sampling location

Elimination System permits (Y-12, East Tennessee Technology Park, and Oak Ridge National Laboratory.) During 1998, the permit requirements were met over 99% of the time for all three facilities.

Out in the environment, surface water samples were collected in streams, reservoirs, and public water intakes on and around the reservation. All locations in the Reservation Surface Water Monitoring Program were checked for dissolved oxygen, pH, and temperature. A radioactivity screening was performed on all samples in the laboratory. Radionuclides were detected at all locations where samples were collected. Three of the reservation locations were tested for metals, one upstream and two downstream of any discharges from the Oak Ridge Reservation. There were trace amounts of zinc and lead detected in some of the samples collected at the location prior to any influences from the Oak Ridge Reservation. In addition to the Reservation program, each site has a site specific surface water monitoring program.

Average annual concentrations of radionuclides in water samples at the East Tennessee Technology Park (Gallaher) Water Plant were used to calculate potential individual doses for drinking water. A worker who drank 370 liters (98 gallons, or half of the worker's total annual intake) of East Tennessee Technology Park water during 1998 could have received a dose of about 0.095 mrem; a person who drank a greater amount of water from the Kingston Municipal Water Plant (730 liters, or 193 gallons) could have received a dose of about 0.19 mrem.

The maximum annual dose associated with water exposure routes other than drinking water or eating fish was calculated to be 0.012mrem, which is attributed to boating, swimming, and shoreline use.

Groundwater

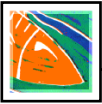
Most residents in the Oak Ridge area do not rely on groundwater for domestic uses such as drinking water. Local groundwater provides for some domestic, municipal, farm irrigation, and industrial uses, however, and must be viewed as a potential pathway for exposure to hazardous wastes and as a means of contaminant transport. Groundwater monitoring programs on the Oak Ridge Reservation are guided by and comply with Environmental Protection Agency and other federal regulations that target protection of groundwater from contamination by hazardous wastes. Groundwater is monitored for volatile organic compounds, trace metals, major ions (electrically charged atoms and molecules), specific radionuclides, and general levels of radioactivity.

To assess the extent to which the groundwater from the Oak Ridge Reservation is transporting contaminants, data on water quality of springs, seeps, and surface water are used, along with sampling results from numerous wells on the reservation. Together with sampling data from plant perimeter groundwater monitoring stations, this information is used to assess potential migration of contaminants beyond the boundary of the Oak Ridge Reservation.



Groundwater quality is monitored by testing springs, seeps, surface water, and samples from wells.

The primary groundwater contaminants on the Oak Ridge Reservation are nitrates, volatile organic compounds, trace metals, and radionuclides. Most of this contamination is from former waste disposal sites, which are the subject of ongoing remediation, or from past projects no longer in operation. Data collected during 1998 indicate that only a few perimeter locations at the Y-12 Plant show any evidence of

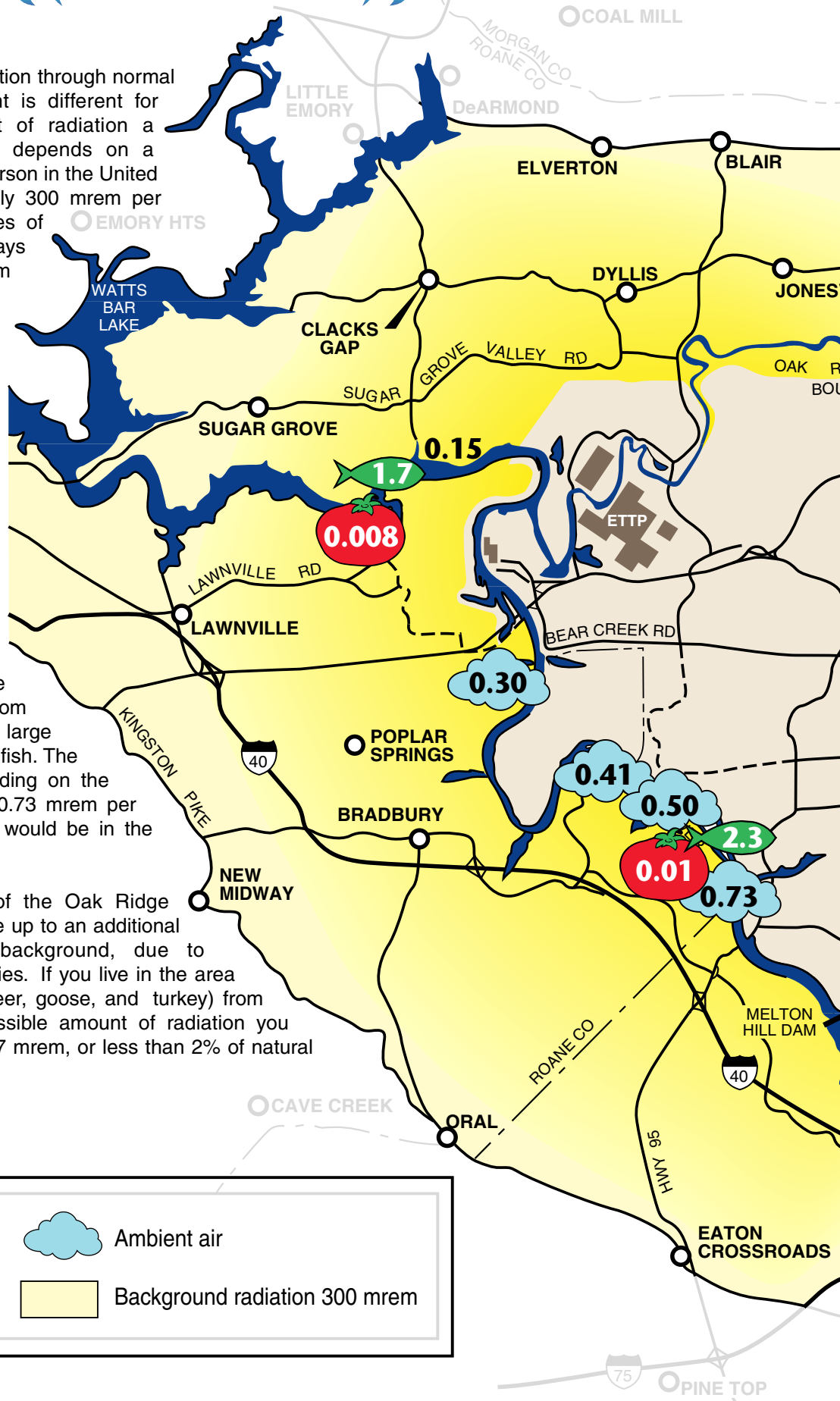


Dosage Map

Everyone is exposed to radiation through normal daily activities. The amount is different for each person. The amount of radiation a person receives in a year depends on a variety of factors. A typical person in the United States receives approximately 300 mrem per year from all natural sources of radiation such as cosmic rays from outer space, radon from the ground and natural radioactive elements found in soil, water and food. Approximately another 40 – 60 mrem per year come from man-made sources such as medical and dental exams (i.e., X-rays), air travel, and consumer products (i.e., wrist watches and smoke detectors).

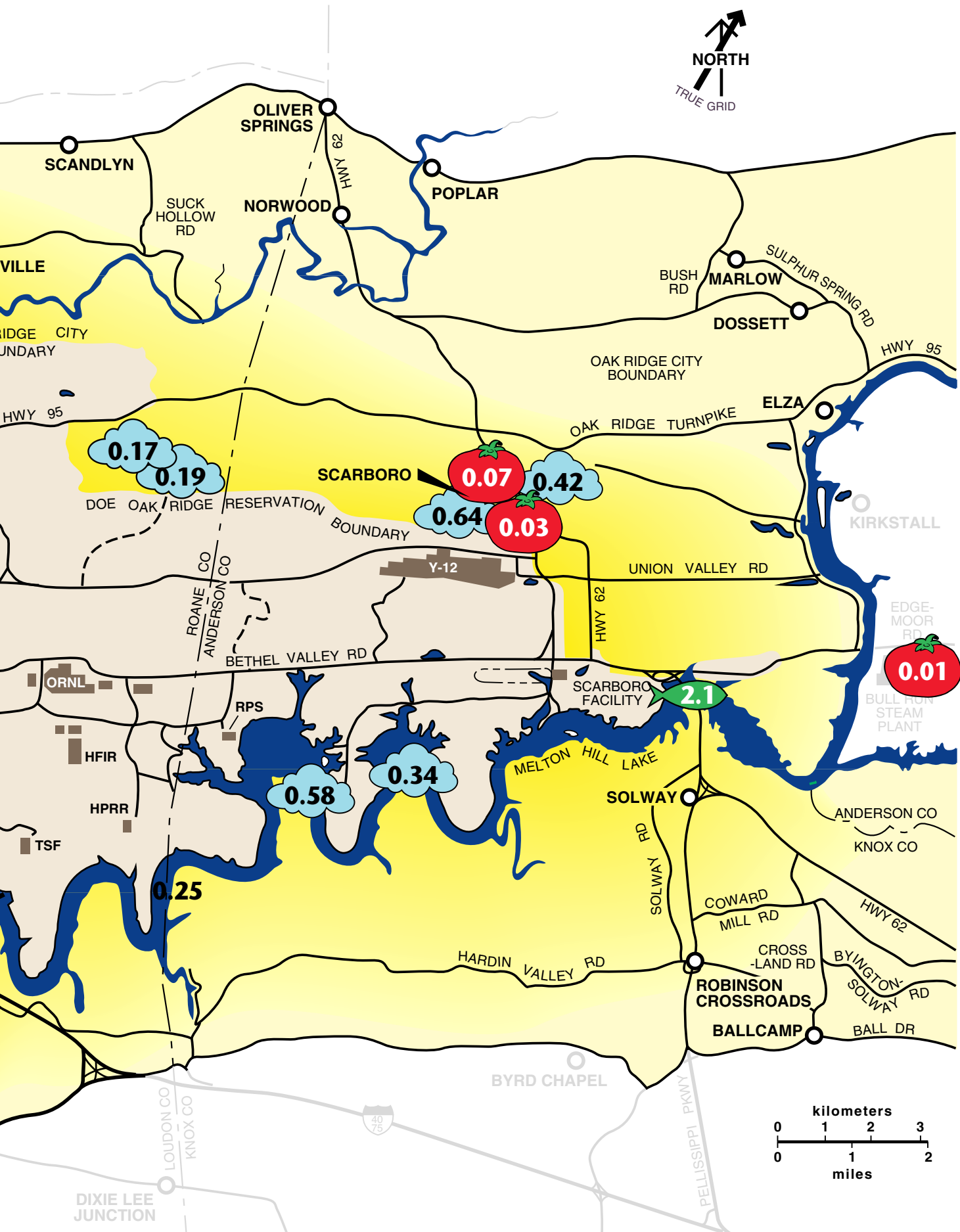
The map on this page shows the Department of Energy's possible contribution to the radiation dose that a person could receive from breathing the air and eating large quantities of local crops and fish. The radiation dose varies depending on the location. The highest dose, 0.73 mrem per year, from breathing the air would be in the vicinity of Jones Island.

If you live in the vicinity of the Oak Ridge Reservation, you may receive up to an additional 4.2 mrem, or 1.4% of background, due to Department of Energy activities. If you live in the area and eat wildlife (an entire deer, goose, and turkey) from the area, the maximum possible amount of radiation you could receive is additional 5.7 mrem, or less than 2% of natural background.



Legend (all units are in mrem)

	Food crops		Ambient air
	Fish		Background radiation 300 mrem





contamination migrating off the Oak Ridge Reservation. Results at the Y-12 Plant have not changed since 1995 and indicate that groundwater contaminated with volatile organic compounds has migrated eastward across Scarboro Road and into Union Valley. There are no users of groundwater in the affected area; nevertheless, administrative controls restricting future groundwater use have been established.

Other Media

Other environmental media are sampled and analyzed to evaluate the impact of the Oak Ridge Reservation on its surroundings and to comply with federal and state regulations. These media include sediment, hay, vegetables, milk, fish, white-tailed deer, Canada geese, and eastern wild turkeys. Samples are analyzed for radioactive elements and for chemicals of interest (such as metals, pesticides, and PCBs in fish). Samples are taken from the Oak Ridge Reservation and from surrounding communities.



Hay

Another environmental pathway that is evaluated is hay grown and harvested on the Oak Ridge Reservation and sold to local farmers. Analyses of hay from six locations on the Oak Ridge Reservation show that essentially all of the dose from consuming beef and milk from cattle that ate the hay would have come from cesium-137. The dose from eating beef and drinking milk from cattle that ate this hay in 1998 was estimated to be about 0.017 mrem.

Vegetables

Locally grown vegetables are another potential pathway for contaminants from the Oak Ridge Reservation to enter the human food chain. Tomatoes, lettuce, and turnip greens were collected from five private gardens located around the Oak Ridge Reservation. The maximum individual dose from eating tomatoes, lettuce, and turnips grown near the Oak Ridge Reservation in 1998 was estimated to be about 3.3 mrem; subtracting the natural potassium-40, the maximum dose would be about 0.07 mrem.



Milk

Milk is a potential exposure pathway for some airborne radionuclides such as tritium, iodine, and strontium, which can be deposited on pasture grass that is eaten by dairy cows. An individual who drank 310 liters (82 gallons) of milk collected from nearby farms could have received a dose from radionuclides that could have been emitted from the Oak Ridge Reservation of between 0.053 and 0.099 mrem.



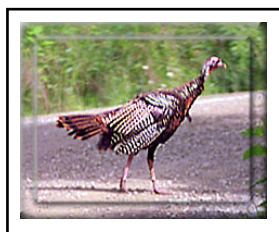
Fish

Members of the public could potentially be exposed to contaminants originating from Department of Energy activities through consumption of fish caught in area waters. This exposure pathway was monitored as part of the reservation surveillance program in 1998 by collecting and analyzing fish from three Clinch River locations, one located upstream and two downstream from Oak Ridge Reservation inputs. In 1998, most contaminants were undetected in sunfish and catfish samples. For PCBs, reported values for sunfish and catfish were below the federal Food and Drug Administration tolerance level of 2 parts per million; for mercury, all reported values were below the Food and Drug Administration action level of 1 part per million. The maximum radiation dose that could result from eating sampled fish was calculated to be 2.3 mrem/year, including the contributions of naturally occurring radionuclides.



White-Tailed Deer


The fourteenth annual deer hunt managed by Department of Energy and the Tennessee Wildlife Resources Agency was held on the Oak Ridge Reservation during the fall of 1998. From the total harvest of 336 animals, 3 were confiscated because they were above the established release limits for radioactivity. The remaining 333 deer had an average field-dressed weight of about 38.6 kg (85 pounds). Assuming 55% of the dressed weight is edible, the average deer would yield about 21 kg (46.8 pounds) of meat, yielding a total harvest of edible meat of about 7062 kg (15,568 pounds). The average dose for an individual consuming an average-sized deer from the Oak Ridge Reservation was estimated to be 0.2 mrem (as corrected for naturally occurring potassium-40).



Eastern Wild Turkey

Forty-eight eastern wild turkeys were harvested on the Oak Ridge Reservation in 1998 during the two wild turkey hunts. None of the turkeys was confiscated because of radioactivity levels. The average weight of the turkeys was 8.5 kg (19 pounds). A person who ate an average turkey, assuming 50% of the weight was edible meat, could have received a dose of about 0.04 mrem.

Canada Geese

On an annual basis, geese on and near the Oak Ridge Reservation are rounded up and screened for radioactive contamination. The areas selected to collect the geese are chosen because they are near contamination sources that the geese might get into. The live geese are placed into a counting chamber to determine the level of radioactivity in their bodies (only gamma radiation is measured). During the 1998 roundup, whole-body gamma scans were conducted on 112 geese 58 from Oak Ridge National Laboratory, 25 from East Tennessee Technology Park, 4 from Y-12, 21 from the Oak Ridge Marina, and 4 from Melton Hill Dam. Of the 112 geese, checked for radiation, 38 were retained because the radiation in their bodies exceeded the established release limit. The retained geese were collected at the west end of the Oak Ridge National Laboratory. The highest dose a person could have received from eating a released goose was about 0.5 mrem. 





Environmental Management Program Community and Reservation Activities

In 1989 the Oak Ridge Reservation was placed on the Environmental Protection Agency's National Priorities List, which names waste sites across the country most in need of cleanup. Sites on this list, more commonly known as "Superfund" sites, are subject to the process specified in the Comprehensive Environmental Response, Compensation, and Liability Act. This law requires federal agencies and private-sector companies to investigate and remedy abandoned or uncontrolled hazardous waste sites where a release has occurred or may occur. It also requires public involvement to ensure that citizens are informed of and are involved in making decisions about cleanup efforts.

Use and Reuse of Contaminated Land

Innovative solutions are often required to deal with unique and complex issues on the Oak Ridge Reservation. For example, to provide a consistent land-use approach that would involve stakeholders in cleanup and reuse of contaminated reservation land, the Department of Energy's Environmental Management Program developed a strategy in 1994 and 1995 called the Common Ground process. This process was citizen-driven and provided the public's views on preferred land-use options for the Oak Ridge Reservation.

In September 1995, Department of Energy Order 430.1 was issued, which defines and documents Department of Energy's commitment to comprehensive integrated planning with stakeholder involvement for land-use management at each Department of Energy site. In response to this order, Department of Energy Oak Ridge Operations Office established an integrated land and facility use process for decision-making for proposed changes in land use outside the immediate plant boundaries. Under the integrated plan, each plant identifies and plans land- and facility-use changes based on programmatic need. Any changes in land or facility uses outside the plant boundaries, however, must be approved by the process. The following priorities, which summarize stakeholder input to the Common Ground process, are established by the process:

- Preserve and protect land for existing and future Department of Energy mission-related programs;
- Maintain land and facilities to promote sustainable economic development;
- Protect the environment, meet the requirements of scientific and technical education, and support educational research opportunities on the Oak Ridge Reservation.

EnvironMENTAL Fair

An EnvironMENTAL Fair has been held in Oak Ridge at the American Museum of Science and Energy since 1992. From the original 1-day affair, it has expanded to two days to accommodate the increase in student attendance which has grown over the years from 3000 to 7500 students. In addition, volunteers now include stakeholders as well as Department of Energy and contractor volunteers. The 1998 EnvironMENTAL Fair was held on September 23 and 24 and included 6th, 7th, and 8th graders from Anderson, Roane, Rhea, Meigs, and Loudon counties, among others. More than 50 booths of scientific demonstrations, experiments, and activities related to the environment were included in the 1998 fair.



1998 EnvironMENTAL Fair

Community Nature Walks

Building on the successful pilot community hikes in 1996, Oak Ridge National Laboratory with the American Museum of Science and Energy sponsored public wildflower and bird walks in 1998. The walks were led by volunteers from the Oak Ridge National Laboratory, JACOR Environmental, and the Tennessee Wildlife Resources Agency so that no costs accrued to participants, Oak Ridge National Laboratory, or the American Museum of Science and Energy.

Oak Ridge National Environmental Research Park

The Oak Ridge National Environmental Research Park is a 21,980-acre “outdoor laboratory” and biosphere preserve that provides protected, biologically diverse land area for environmental research and education. It represents the eastern deciduous forest, having more than 1100 species of plants and 315 wildlife species, some of which are federally or state-listed rare species. The area also plays a significant role as a breeding and nesting ground for migratory birds.

The park is an Oak Ridge National Laboratory user facility. Its outstanding biodiversity provides a foundation for ecological research and environmental studies. More than 700 individuals have conducted research in the Oak Ridge National Environmental Research Park User Facility in the last five years. Users include students and faculty from more than 75 colleges and universities, as well as participants from Oak Ridge National Laboratory and other state and federal agencies.



*Drawing by student artist,
Miko Charbonneau*


Site-Specific Advisory Board

In 1998, the Site-Specific Advisory Board continued to advise the Department of Energy on environmental management issues such as recommendations for cleanup levels, technology development, future land use, and long-term waste management issues. Throughout 1998, the Site-Specific Advisory Board held regular board meetings, as well as topic-specific meetings. All meetings were open to the public. Site-Specific Advisory Board information, including meeting schedules, meeting minutes, membership, and recommendations to the Department of Energy, are available on the Web at http://www.ornl.gov/doe_oro/em/ssab/hpage.htm. Major highlights and accomplishments are also available to the public in the *Oak Ridge Reservation Environmental Management Site-Specific Advisory Board 1998 Annual Report*.



Public meeting

Public Involvement and Participation

The Department of Energy's public involvement program held regular stakeholder meetings in 1998, where citizens were given updates and detailed information on environmental management work on the reservation. The Department of Energy also hosted numerous other workshops and public meetings. 





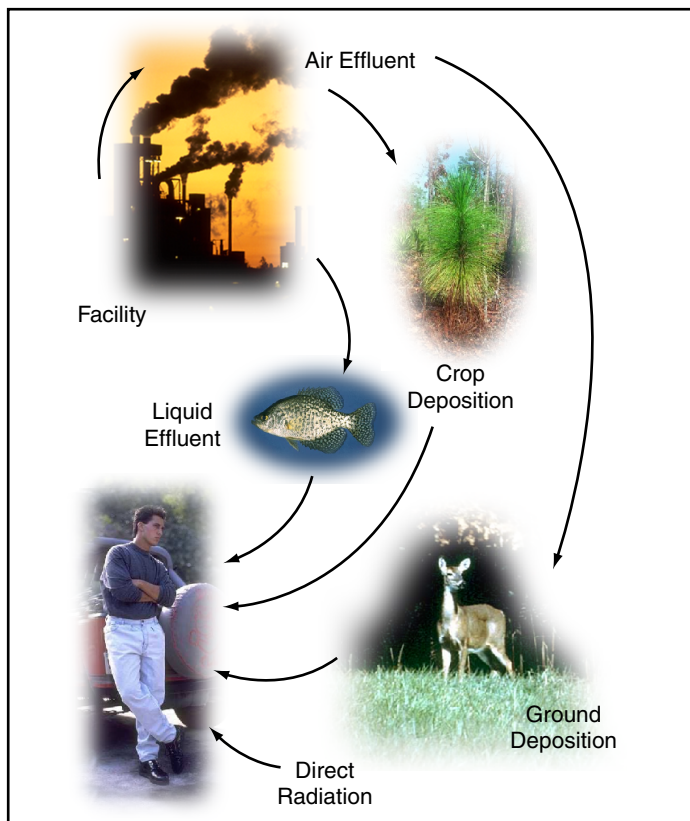
Radiation...What Is It?

It comes from outer space, the ground, and even from within our own bodies. Radiation is all around us and has been present since the birth of this planet. It is found in the food we eat, and even our own bodies give off some radiation. Naturally occurring radioactive materials were discovered in 1896. Less than 50 years later, the physicist Enrico Fermi split the atom, producing the first man-made radioactive materials. Today, both man-made and natural radiation are part of our lives. We use radioactive materials for beneficial purposes, such as generating electricity and diagnosing and treating medical problems. For example, Americans receive 200 million X-rays every year. Though radiation offers many benefits, exposure to it can also threaten our health and the quality of our environment. We cannot eliminate radiation from our environment. We can, however, reduce our risks by controlling our exposure to it.

Atoms are the microscopic building blocks that make up everything around us. Some atoms are unstable or somehow become unstable, and these atoms give off energy in the form of radiation. There are different types of radiation, some more energetic than others. One type of radiation, non-ionizing radiation, has enough energy to move atoms but not enough to alter them chemically.

We measure radiation dose in units called rem (small doses are measured in millirem; one rem = 1,000 millirem). Scientists estimate that the average person in the United States receives a dose of about 360 millirem of radiation per year. Eighty percent of that exposure comes from natural sources: radon gas, the human body, outer space, and rocks and soil. The remaining 20 percent comes from man-made radiation sources, primarily medical X-rays.

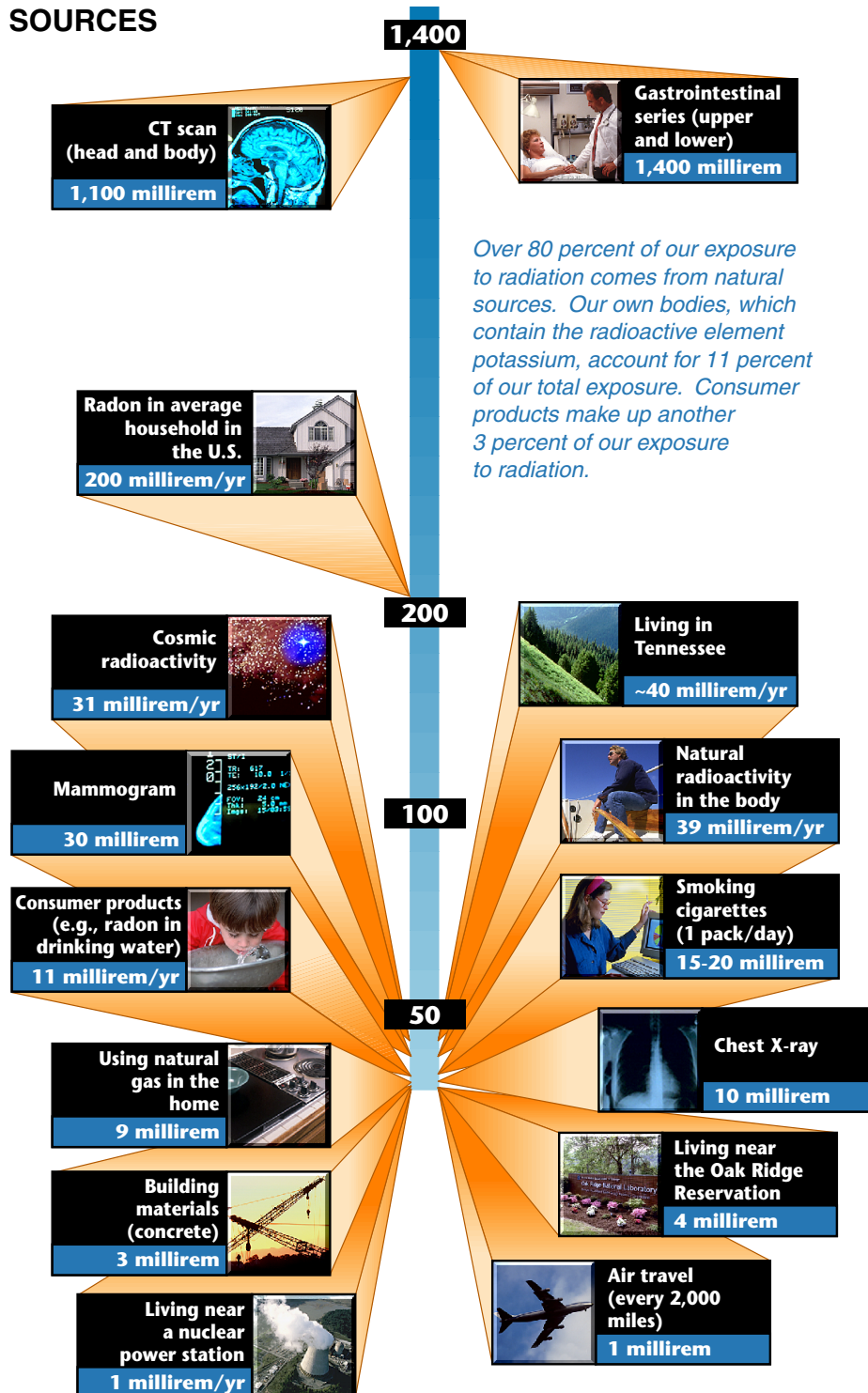
Radiation is a carcinogen. In this respect, it is similar to many hazardous chemicals found in the environment that can cause cancer. It may also cause other adverse health effects, including genetic defects in the children of exposed parents or mental retardation in the children of mothers exposed during pregnancy. However, the risk of developing cancer due to radiation exposure is much higher than the risk of these other effects. Much of our knowledge about the risks from radiation is based on studies of over



We can receive internal or external exposure to chemicals, radioactive materials, and radiation by way of a number of pathways. We receive radiation directly from cosmic radiation and from particles embedded in soil and suspended in air and water. We can breathe air or drink water that have both chemical and radiological contaminants suspended in them. In addition, airborne contaminants that settle on grass in pastures and hayfields can be eaten by cows, and the contaminants can show up in the milk we drink. Similarly, contaminants can be retained in fish and game animals.

100,000 survivors of the atomic bombs at Hiroshima and Nagasaki. In these studies, which have continued over the last 40 years, scientists have been able to observe the effects of a wide range of radiation doses, including doses comparable to an average person's lifetime dose from naturally-occurring background radiation (about 20,000 millirem). We have learned many things from these studies. The most important are:

RELATIVE DOSES FROM RADIATION SOURCES

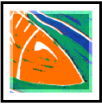


- The higher the radiation dose a person receives, the greater the chance of developing cancer.
- It is the chance of cancer occurring, not the kind or severity of cancer, that increases as the radiation dose increases.
- Most cancers do not appear until many years after the radiation dose is received (typically 10 to 40 years).

Current evidence suggests that any exposure to radiation poses some risk (i.e., there is no level below which we can say an exposure poses no risk). For the entire dose of radiation we accumulate over a lifetime from natural background radiation, the risk of developing cancer is estimated to be about one in one hundred. Based on this estimate, several percent of all fatal cancers in the U.S. are caused by background radiation. The additional contribution from all man-made sources of radiation is much smaller.

The average annual radiation exposure for a person living in the U.S.A. is 360 millirem.





Interviews with Department of Energy Managers



Leah Dever, Manager, Oak Ridge Operations

I was pleased when the students of Karns High School asked if they could interview me for this summary document, for having only recently become part of the Oak Ridge community, I feel a genuine desire to acquaint myself with as many stakeholders as possible. "Moving Forward Together" is a most appropriate theme for this year's environmental report, for it affirms my foremost objective as manager of Department of Energy Oak Ridge Operations — to work closely with you in our many missions and challenges. I'm certain that by maintaining a positive spirit we can and will move forward together and accomplish these difficult tasks. I look forward to this alliance with you.

Leah Dever (handwritten signature)



Bob Poe, Assistant Manager, Environment, Safety, and Quality

It is my hope that this year's Oak Ridge Reservation Annual Site Environmental Report will provide you the data you need to assess the impact of Department of Energy activities on the environs of Oak Ridge. The Annual Site Environmental Report and this summary are important mechanisms for communicating this information to the public. We have made some changes in the format of the full Annual Site Environmental Report this year with that in mind and would welcome your feedback on ways to make it even better.

Robert W. Poe (handwritten signature)

How does the environment play a role in decisions that you make?

The environment plays a significant role in the decisions we make. We use National Environmental Protection Act analysis, including public involvement, to assist in making significant decisions. We are bound by applicable environmental laws and regulations. We perform our work in a manner intended to protect the environment.

As Assistant Manager for Environment, Safety, and Quality, I support operational activities carried out on the Oak Ridge Reservation. I provide environmental experts to assist site operations with their efforts to abide by applicable laws and regulations.

How do the facilities here in Oak Ridge rate compared with other facilities in the world where waste management is a concern?

In addition to my staff and that of the contractors, the state and Region IV of the Environmental Protection Agency oversee environmental activities on the Reservation. Radioactive materials and chemicals that pose a hazard have control levels established in state and federal requirements, which our activities must meet. Our compliance with these requirements has been good for many years. Therefore, I believe we would compare favorably with other facilities in the world where similar activities are performed.

As in any industrial setting, things have been done in the past that are not good by today's standards. We are currently cleaning up these past mistakes, with input from stakeholders, so that appropriate usage can be made of facilities or land in the future. You would find similar situations of unacceptable contamination on many industrial sites anywhere in the world. We're not posing a significant risk to the community, and we're working to clean up our contaminated areas.

How does Department of Energy make sure contractors are environmentally responsible and what are the primary contaminants released by operations on the reservation?

There are a number of mechanisms. Most importantly, we work in a constructive partnership with the regulators and our contractors to achieve our missions in an environmentally acceptable manner. Contractors who violate permit conditions are subject to fines and penalties under various environmental



statutes. Department of Energy contractors have provisions to reduce or disallow fees earned by the contractor under the contract if requirements are not met.

The Department of Energy has many contracts with various contractors. These contractors are Department of Energy's agents for accomplishing work. Department of Energy experts conduct oversight of the contractor operations to ensure compliance with the law. Specific requirements are defined in the contract. Contractors must obtain permits from the Environmental Protection Agency or the state which identify federal and state requirements. Right now, my organization has 72 people whose responsibility it is to oversee environment and safety activities on the Reservation. The *Environmental Monitoring on the Oak Ridge Reservation* report describes the actual releases from the site and how well the site operations meet the permit requirements.

○ *What steps is the Department of Energy taking to clean up the environment?*

The Reservation has been characterized to identify areas of significant contamination. We are working to clean up areas that pose the greatest risk first. That prioritization process is done in a partnership with the state and public. We are cleaning up old lagoons, quarries, and groundwater as first priority. Other items will be addressed based on risk and budgets. It is going to take a long time to clean up these places.

That depends on the particular issue. The Department of Energy, the state, the Environmental Protection Agency, and our stakeholders work with us to identify priorities. Money from Congress is applied to those priorities. We are working, in some cases, on the technology needed to clean up situations. Many innovative approaches are ongoing to address environmental concerns.

○ *On a scale of 1 to 10, 10 being the safest, how safe is the general public in terms of radiation?*

I would rate the Oak Ridge facilities a 10-9. Very little work is done that has to do with high radiation fields. There are lots of controls for radiation.

Probably a 10, but there are those who might argue. All measurements show that we are causing only a fraction of the allowed dose to the public based on measurements of contaminants released in all possible pathways.

○ *In your professional opinion, how protected is the general public surrounding the facilities?*

Oak Ridge Operations is on the Environmental Protection Agency National Priority List under a superfund-like program for federal activities. Because of this, a number of restrictions exist (no eating of fish from East Fork Poplar Creek, hunting is controlled, etc.) for the protection of the public. We are currently talking with Environmental Protection Agency about doing more sampling to better assess the level of contamination exposure to the general public in some areas. We are constantly trying to improve the protection of the people who live here in Oak Ridge.

There is no data that indicates adverse impacts on the health of the general public because of Department of Energy activities. The Scarboro Community has raised some concern over health issues, but the monitoring stations in the community and surrounding the facilities show that levels are significantly less than allowed levels (very low). Likewise, we are continuing to investigate a number of allegations regarding worker health concerns.

○ *Is there anything the general public should be concerned with in terms of their safety or environment?*

The general public needs to be aware of the security around the sites. On the site, there are areas of concern, but not to the public. The public really has no need to worry.

In terms of actual harm, no.

○ *What would be classified as a major catastrophe and what would be the chances of this happening?*

The worst-case scenario would be an atmospheric release of hazardous chemicals or radioactivity. Each plant has multiple safeguards in place to prevent or control such an occurrence.

There is an operating reactor at Oak Ridge National Laboratory, and if it were out of control, it could be an issue. The consequences would be localized. Workers in populated portions of the Reservation wouldn't have to worry about health effects. At Y-12, a criticality of fissile materials could cause problems for workers in the vicinity. Most incidences would have on-site consequences. The buffer of land between operations and the public is a key feature to protect the public from accidents, so the public should not be affected. We have processes and controls in place to prevent or control such disasters.

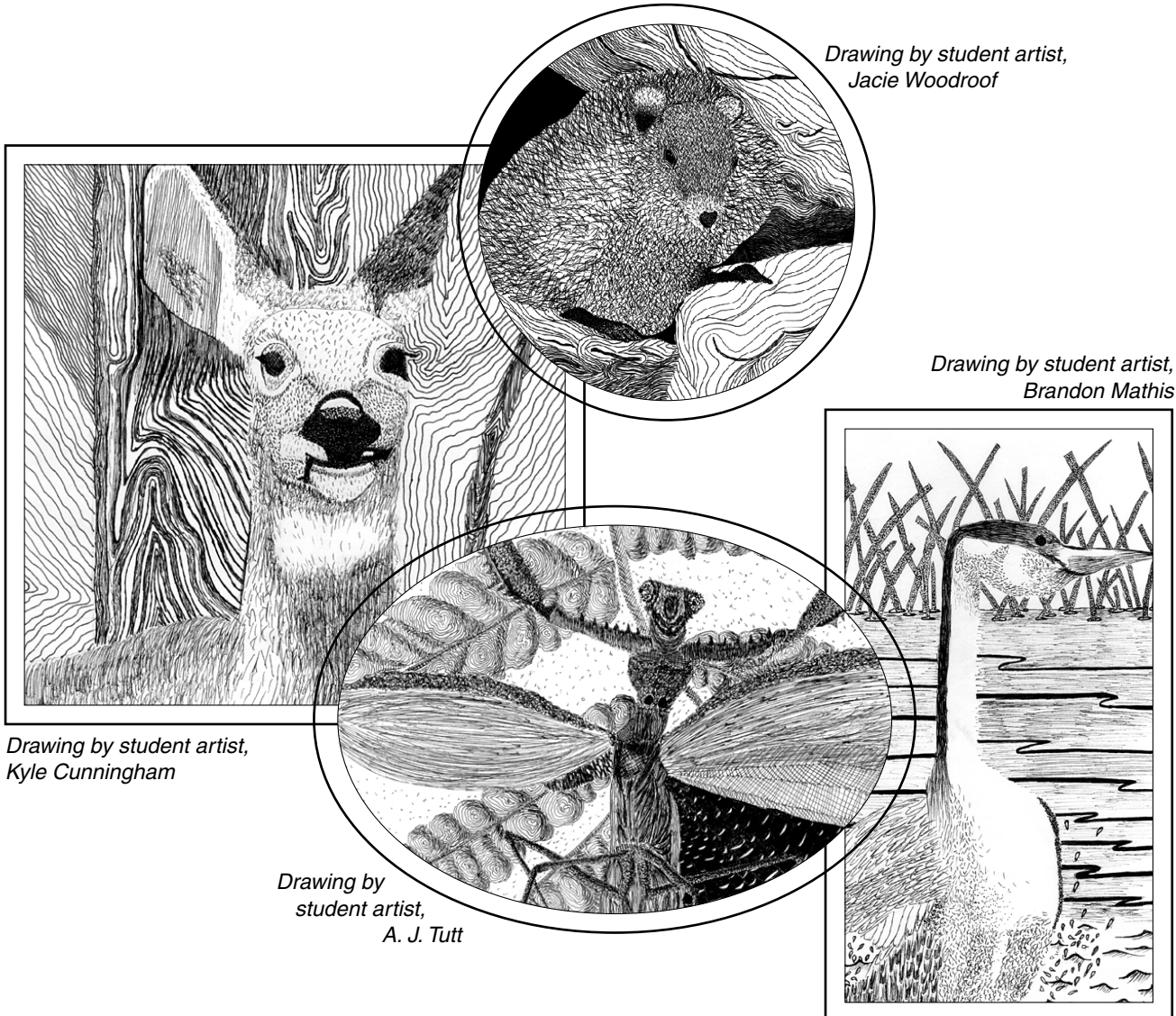




Oak Ridge Reservation Annual Site Environmental Summary

The latest information on environmental topics in Oak Ridge can be obtained on the World Wide Web:

- http://www.ornl.gov/Env_Rpt/aser98/aser.htm provides access to the *Annual Site Environmental Report*
- <http://www.doe.gov> reaches the national Department of Energy Web site
- <http://www.oakridge.doe.gov/> reaches the Department of Energy Oak Ridge Operations Web site
- <http://www-internal.ornl.gov/~dmsi/cip/cip.htm> gives you the Comprehensive Integrated Plan for the Oak Ridge Reservation
- <http://www.bechteljacobs.com/emef/newsfacts/facsheet.htm> gives you a list of fact sheets on each of the Oak Ridge environmental management projects
- <http://www.em.doe.gov> takes you to the national Department of Energy environmental management Web site
- <http://www.ornl.gov/emef/facts/public.htm> provides public involvement information for the environmental management program in Oak Ridge
- <http://www.ornl.gov> provides access to all Oak Ridge National Laboratory, Y-12 Plant, East Tennessee Technology Park, and other sites of local interest



*Drawing by student artist,
Jacie Woodroof*

*Drawing by student artist,
Brandon Mathis*

*Drawing by student artist,
Kyle Cunningham*

*Drawing by
student artist,
A. J. Tutt*