DOE/ORO/2134

OAK RIDGE Reservation

Annual Site Environmental Report Summary

2001

Take Wing and Rise Together

Message from the Students

Dear DOE Stakeholders:

We're the ***fall 2002 Applied Communications class at Karns High School***. We were chosen by the Department of Energy to produce a summary of the *Oak Ridge Reservation Annual Site Environmental Report for 2001*. We gladly accepted this responsibility and took pride in being given the chance to prepare such an important document. To better understand the Oak Ridge Reservation we were taken to the Oak Ridge National Laboratory and East Tennessee Technology Park sites to begin our study, and we attended the Y-12 Safety Exposition.

DOE asked us to use our class's diverse creativity and imaginative personalities so that the document would be interesting and easy to understand, and in particular we were challenged to develop unique ways to explain radiation. We accepted the challenge and have employed new ideas and approaches to summarize the *Annual Site Environmental Report*. Davey Humphrey of our class was able to convince his dear friend Professor Rad to work with us on the Rad section, and though a little eccentric, he was fun to work with and we learned a lot from him; we hope you will too—thanks, Professor Rad.

We would like to thank everyone who worked with us from the Reservation. This document would not have been possible without the help of Dr. Timothy Joseph, Joan Hughes, Jennifer Webster, and the scientists that came to our class when we needed them. The class also adds a big thanks to all the men and women who built, maintain, and do research at this great Reservation to help protect and better our nation. It sure is a neat place.

Now that our summary is complete, we hope our class and Professor Rad have given you, the DOE stakeholders, a clearer understanding about the Oak Ridge Reservation, what goes on there, and how hard everyone works to take care of the environment.

Sincerely,

About the cover:

"Take Wing and Rise Together" A little bird, a bald eagle—each of equal importance, with a unique, critical contribution, as is every stakeholder, organization, agency, and industry. Just as the tiny bird on the cover plays a major role in the ecology of the forest, every member of the public has a meaningful role in the operations of the Oak Ridge Reservation. We must take wing and rise together, each contributing to keep the Oak Ridge Reservation the quality environment it is, while endeavoring for continual improvement. — ***Timothy Joseph***

Cover artwork: Andrew Tessier, Karns High School student artist
Layout and design: Gail S. Sweeden, Communications and Community Outreach, UT-Battelle

Contents

Credits

Department of Energy photo by Lynn Freeney

Top Row left to right: Lindsi Grimes, Casi Italio, Rebecca McCarter, and Emily McLin
Middle row left to right: Kent Hersha, Jordan Smith, Professor Rad, Davey Humphrey, Chris Torbett, Steven Hittinger, and Brandon Weigel
Bottom row left to right: Derek Scarbrough, Mike Tarter, Brandon Drummer, Scott Heptinstall, John Hoffman, Stephanie Cooper, Ashley England, Mike Davis, Debra Cagley, Joan Hughes, Jennifer Webster, and Timothy Joseph
Not pictured: Rob Dodson

Oak Ridge Reservation Annual Site Environmental Report Summary for 2001
on the World Wide Web: http:/www.ornl.gov/aser

Contributors

- **Fall 2002 Applied Communications Class** and **Spring 2002 Art Class Students**
  Karns High School
- **Andrea Haury** and **Bill Shinn**
  Art Teachers
  Karns High School
- **Joan Hughes**, Project Director
  Oak Ridge National Laboratory
- **Gail Sweeden**, Graphics, Creative Media
  Oak Ridge National Laboratory
- **Debra Cagley** and **Lindsi Grimes**
  Student Editors
  Karns High School
- **Jennifer C. Webster**, Instructor and
  English Department Chairperson
  Karns High School
- **Timothy W. Joseph**, Ph.D., Project Manager
  Department of Energy, Oak Ridge Operations Office
- **Frank Juan**, Cartoonist, Department of Energy,
  Oak Ridge Operations Office

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Preface

The Department of Energy and its contractors work closely together to monitor operations on the Reservation that have potential for offsite environmental impacts. As well, we monitor the environment extensively on and off the Reservation, collecting, analyzing, and reporting on tens of thousands of samples taken from water, air, soil, mud, plants, and animals. Results of these activities are reported to the regulators on an ongoing basis and, as importantly, to the public. Each year our contractors compile an *Annual Site Environmental Report* to provide detailed information about the prior year's monitoring activities and results, and a separate data volume provides the raw data for regulators and researchers who may wish to perform their own calculations.

We strive to keep all stakeholders informed on

1. how we measure and control pollutants from existing operations,
2. how we manage and control legacy contamination,
3. how chemical and radiological contaminants move within the environment,
4. locations where people might receive the highest exposure, and
5. what the potential risks could be due to environmental contamination.

This information is presented in the *Oak Ridge Reservation Annual Site Environmental Report* in detail.

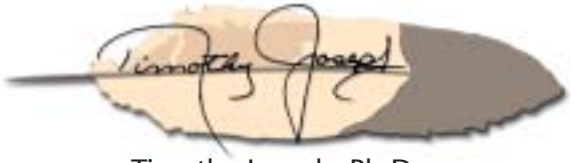
This summary document is written to pull together the items of greatest interest to the general public and to present them in an easily understood manner.

As a former high school science teacher, I am well aware that students have a keen capability to understand and a unique way of thinking, and they are able to get ideas across in a clear and effective way. Thus, I have once again asked for their help to provide you, our stakeholders, a summary that can be understood by all. I challenged them this year to concentrate on explaining radiation in a way that might allow everyone to better understand. The students took it upon themselves to seek assistance from Professor Rad, an interesting character indeed. He was able to help the class, and I hope you, our stakeholders.

I thank the Applied Communications Class of Karns High School for taking on the challenge, thinking out of the box, and performing so admirably—you were a great class to work with. Thanks also to the Karns art students, whose talents are seen throughout, especially the cover artist. The *Oak Ridge Reservation Annual Site Environmental Report* and summary can be found on the web at http://www.ornl.gov/aser.

As the *Oak Ridge Reservation Annual Site Environmental Report* project manager it is my ardent hope you find this summary useful and easy to read. I am always interested in stakeholder feedback on how the Department of Energy might improve the *Oak Ridge Reservation Annual Site Environmental Report* and/or this summary document, for they are written for you; I invite your input. I can be reached by phone at 865-576-1582, or by email at josepht@oro.doe.gov.

Genuine Regards,



Timothy Joseph, Ph.D.
Senior Scientist
US. Department of Energy
Oak Ridge Operations Office

How Oak Ridge Came To Be

Introduction

In the year 1798, European settlers signed a treaty with the Cherokee Indians and established a small community. This community was located between the Great Smoky Mountains and the Cumberland Plateau. Because it was extremely remote, it remained sparsely populated and mostly agricultural, untouched by the industrialized world. About 145 years after the settlers first inhabited the area, all that changed.

In 1942, the United States Army and the Tennessee Valley Authority were asked to supply large amounts of electricity for a secret project. Approximately 58,575 acres of land were acquired to begin construction, and by 1943, the Oak Ridge Reservation had become involved in the Manhattan Project. The task was producing vital components for the world's first nuclear weapons. These same weapons would help bring World War II to an end and save thousands of lives.

The Reservation contained three major installations: Y-12, K-25, and X-10, which were code names used during the Manhattan Project. Now, six decades later, the three sites continue to offer their services to meet the defense, energy, and research needs of the United States. X-10 is now called the Oak Ridge National Laboratory, K-25 is the East Tennessee Technology Park, and Y-12 is the Y-12 National Security Complex.

Today the Oak Ridge Reservation covers roughly 34,235 acres of land owned by the Department of Energy. Most of this area lies within the city limits of Oak Ridge. The Tennessee Valley Authority's Melton Hill and Watts Bar Reservoirs located on the Clinch and Tennessee Rivers define the southern and western boundaries of the Reservation, which is located roughly 25 miles from Knoxville, the nearest metropolitan area. The region around Oak Ridge, which comprises ten counties, boasts a population of about 805,500 people, and 3.7% of that population is employed at the Oak Ridge Reservation.

Workers toil together to help build the Oak Ridge National Laboratory.

L.P. Jernigan inserts slugs of reactor fuel into a fuel channel.

The culmination of the Secret City's first mission.

President and Mrs. John Kennedy visit the Graphite Reactor.

Oak Ridge As It Is Today

East Tennessee Technology Park

The East Tennessee Technology Park was built as the home of the Oak Ridge Gaseous Diffusion Plant. Construction began in the 1940s as a part of the Manhattan Project. The project's mission was the production of enriched uranium for nuclear weapons. Enrichment was initially carried out in two process buildings, K-25 and K-27. Production capacity was increased by the building of K-29, K-31, and K-33. K-25 and K-27 were shut down in 1964.

By 1985, demand had declined for enriched uranium. The gaseous diffusion cascades at the Oak Ridge Gaseous Diffusion Plant were placed in standby mode. Later that year, the gas centrifuge program was canceled. In 1987 the diffusion cascades were permanently shut down. In 1990 the Oak Ridge Gaseous Diffusion Plant was named "Oak Ridge K-25 Site"; in 1995, K-25 was renamed "East Tennessee Technology Park" to reflect its new mission. The East Tennessee Technology Park's mission is to reindustrialize and reuse site assets through leasing of facilities and to incorporate commercial organizations as partners in the ongoing environmental restoration, decontamination, and decommissioning of facilities; waste treatment and disposal; and activities associated with the enrichment activities. Currently, 38 companies are leasing properties at the East Tennessee Technology Park.

Y-12 National Security Complex

Since World War II, the number of buildings at the Y-12 Complex has doubled. Its mission and capabilities have changed as well. The first site mission was the separation of uranium-235 from the more abundant uranium-238 isotope by electromagnetic separation. The magnetic separators were decommissioned in 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 United States stockpile has some components manufactured at the Y-12 Complex. 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, the Y-12 Complex is a manufacturing facility that stretches over 811 acres. Its 500 buildings contain about 7 million square feet of floor space.

Oak Ridge National Laboratory

The Oak Ridge National Laboratory began in 1943 as part of the Manhattan Project and was the smallest of the three facilities. From its beginning as a wartime pilot plant, it has become one of the world's premier scientific centers and the Department of Energy's largest and most diversified

multiprogram national laboratory. As an award-winning multiprogram national laboratory, the Oak Ridge National Laboratory carries out research and development in a broad spectrum of scientific disciplines.

The Oak Ridge National Laboratory's research into fission, fusion, fossil, and other energy sources grew from wartime efforts to produce plutonium from uranium. The Graphite Reactor was established to demonstrate the feasibility of producing the plutonium needed to create the bomb dropped on Nagasaki, Japan. After the war, the Graphite Reactor produced the first electricity from nuclear energy and played an important role in the study of health hazards of radioactivity. The High Flux Isotope Reactor is a major producer of isotopes for medical and research needs. The Spallation Neutron Source, currently under construction, will be an accelerator-based neutron source that will provide neutron beams with up to ten times more intensity than any other source in the world. Construction began in 1999 and is scheduled for completion in 2006. The total cost of the project is $1.4 billion. Researchers from around the world will conduct research at the Spallation Neutron Source.

Environmental Compliance

Many activities on the Oak Ridge Reservation generate hazardous wastes or deal with cleanup and remediation of waste or legacy contamination from past work. These activities are subject to federal and state laws intended to protect the environment and public health. These laws define emission limits or prohibit the emission of toxic substances into the air, water, and ground; require plans to prevent spills, unplanned releases, and accidents, as well as plans to respond to any emergencies; and call for programs to monitor, measure, document, and report on compliance to regulatory agencies and the public.

The United States 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 Tennessee Department of Environment and Conservation's Department of Energy Oversight Division consists of 44 employees located in Oak Ridge to assure the public that their health, safety, and environment are being protected during environmental restoration and ongoing activities at the Oak Ridge Reservation.

Updates

- All Oak Ridge Reservation sites were in compliance with all applicable environmental regulations in 2001 except for a few instances.
- Each site achieved a National Pollutant Discharge Elimination System permit compliance rate greater than 99.9% in 2001.
- In 2001, all three Oak Ridge Reservation facilities operated in compliance with the regulatory dose limits of Tennessee Rule 1200-3-11-08 (Emission Standards for Hazardous Air Pollutants for Radionuclides) and met its emission and test procedures.
- No releases of reportable quantities of hazardous chemicals or asbestos were reported under the Comprehensive Environmental Response, Compensation, and Liability Act by any of the sites.
- Several private businesses are operating under leasing arrangements at the East Tennessee Technology Park under the Department of Energy reindustrialization initiative. Lessees are accountable to comply with all applicable standards and regulations and to obtain permits and licenses with local, state, and federal agencies as appropriate.

The following table defines and summarizes 2001 results for a few of the many federal and state laws and regulations with which the Department of Energy must comply.

Compliance Program	Noncompliances	Information
Clean Air Act	0	The EPA's dose limit from air emissions is 10 millirem per year. The total air dose from all three sites on the Oak Ridge Reservation was 0.78 millirem. There were no findings during regulatory inspections.
Clean Water Act	19*	The Clean Water Act compliance rate for all three sites was greater than 99.9%. There were no findings during regulatory inspections.
Comprehensive Environmental Response, Compensation, and Liability Act	0	Compliance with this act ensures that the environmental impacts of past and present activities on the Reservation are investigated and that necessary measures are taken to protect the public and the environment.
Endangered Species Act	0	This act dictates that plant and animal species be considered when projects could alter their habitats.
Federal Facility Compliance Act	0	This act was passed to bring federal facilities into full compliance with the Resource Conservation and Recovery Act.
Federal Insecticide, Fungicide, and Rodenticide Act	0	No restricted-use pesticide products are used at any of the three sites.
National Environmental Policy Act	0	This act provides a means to evaluate the environmental impacts of proposed projects and to examine alternatives.
National Historic Preservation Act	0	This act was passed to preserve historic properties throughout the nation.
Resource Conservation and Recovery Act	2**	All noncompliances were self-disclosed by site personnel and were not the result audit findings by the regulators.
Safe Drinking Water Act	0	This statute establishes drinking water regulations.
Toxic Substances Control Act	0	This law was enacted to regulate the manufacture, use, and disposal of chemical substances.

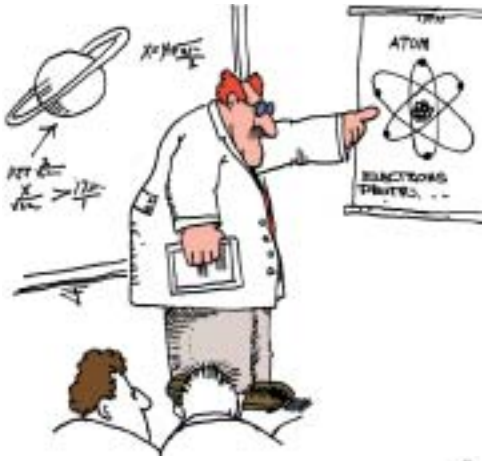
*A detailed description is available in the *Annual Site Environmental Report 2001* at http://www.ornl.gov/aser, Appendix D.
**A detailed description is available in the *Annual Site Environmental Report 2001* at http://www.ornl.gov/aser, Section 2.5.

Radiation—What Is It?

One of the toughest challenges our class faced in preparing this document was to write the radiation section in a clear and understandable manner. To do this we needed to fully understand radiation, so we talked with renowned scientists from ORNL. We also asked the world-famous Professor Rad to help us out. We'd like to share with you our discussion with Professor Rad.

DAVEY: Where does radiation come from, Professor, and just what is it?

PROFESSOR RAD: Well, let's get down and basic here. You know that an atom has a nucleus made up of protons, which have a positive charge, and neutrons, which are neutral, and that negatively charged electrons spin around the nucleus. Luckily, most atoms have the right number of protons, neutrons, and electrons. We call them stable. As you know, the number of those things determines what kind of atom it is; like carbon, hydrogen, or gold. But, if the number isn't just so, or if some rogue neutron hits the nucleus, the atom has a fit, becomes unstable, and starts tossing off particles or energy. It's called disintegration. If it loses part of the nucleus, the atom changes to another kind of atom. We call that radioactive decay. And guess what all this stuff coming off of the atom is?

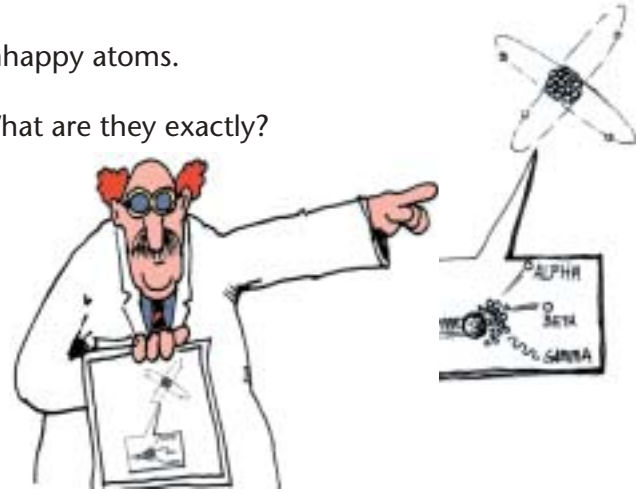


DEREK: Radiation!

PROFESSOR RAD: Right! From out-of-balance or unhappy atoms.

MIKE: But what about alpha, beta, and gamma? What are they exactly?

PROFESSOR RAD: Alright, listen up and look at this atom. Let's say that a rogue neutron hits the nucleus—bam! It knocks off two protons and two neutrons that stick together, which is really a helium atom nucleus. Well, that particle is called an alpha particle. When the atom sends it out, the atom becomes a different element, because remember, the number of protons and neutrons determines what element it is, and it just lost some so it changes. You know, when they talk about changing lead to gold? Well, that really can happen.



BRANDON: So what's beta radiation?

PROFESSOR RAD: A beta particle is more difficult to understand, but you're pretty sharp. If an atom has too many neutrons, it can change a neutron into a proton and an electron, and kick the electron out. That electron is the beta particle. Remember now, there are no electrons in the nucleus; what it does is change the neutron into a proton and an electron. It keeps the proton and kicks out the new electron and it's now happy. Got it?

SCOTT: Yup. But what about gamma?

PROFESSOR RAD: Gamma's the guy that's not a particle—it is pure energy we call electromagnetic radiation, just like light rays, which we call photons. Light is visible photons. Well, gamma is like light, only with a shorter wavelength, a lot more energy, and you can't see it. That's what an X ray is also. What happens is the atom is not very happy, so it changes the distribution of electric charges within its nucleus or even its shape, and to do so it needs to get rid of some energy so it gives off that energy as gamma rays. It's Einstein's $E = MC^2$, where matter is converted to energy. When you get a dental X ray, the machine bombards some atoms and it makes them excited and unstable, and they shoot off energy/X rays to try and get back to normal.

JOHN: Boy, sounds scary. How much radiation is out there anyway?

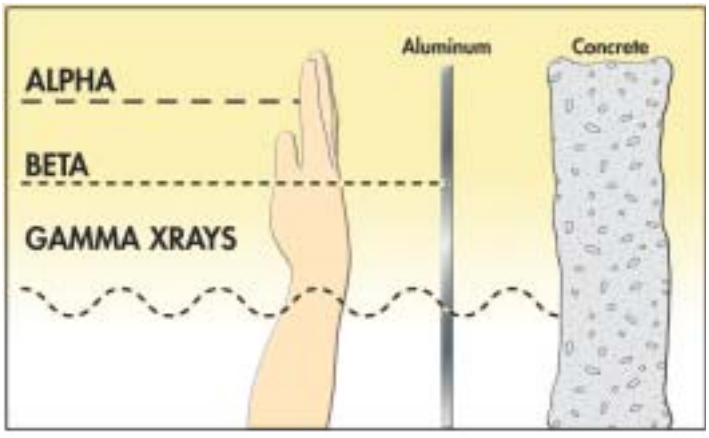
PROFESSOR RAD: It's not really scary at all. Radiation has been around since the earth was formed. Radiation is simply natural. Sure, man can make it, but even if we didn't, it's all around us. Radiation comes from outer space, hitting us all day long. It's in the food we eat and in the ground we walk on. Even our bodies are radioactive. So when you hold hands with your girlfriend, watch out, you're getting radiation from her and she's getting it from you.

STEPHANIE: You're kidding.

PROFESSOR RAD: Nope. And boy, if you smoke, you're really getting a lot more than lung pollution; you're getting a bunch of radiation. If you have a gas stove, it gives off radiation. Concrete does; bananas have potassium, which isn't the happiest atom around, and it gives off radiation. And that lantern mantle in your camping gear, it will make a Geiger counter sing like Hootie and the Blowfish. You just can't escape radiation, and you don't need to worry. We've lived with radiation since the dawn of man. It's like sunshine, which is full of ultraviolet radiation. We don't worry about it, we don't try and hide from it, but it can sure do damage if we get too much. If we want protection, we put on sunscreen and wear sunglasses. But we don't worry about the sun.

ROB: How powerful are those particles and rays anyway? They sound pretty bad.

PROFESSOR RAD: Well, just look at the picture I drew up. Alpha particles will not even penetrate your first layer of skin or your shirt, and they can only make it through a couple of inches of air. Beta particles can make it maybe a tenth of an inch into your skin, and through about 10 feet of air. Plastic, glass, or foil stop beta cold. Gamma's the strongest because it's not a particle, it's a ray. Gammas go whipping right through your body, travel hundreds of feet in the air, and it takes very dense material to stop them, such as concrete, lead, or steel.



MIKE: How is radiation exposure measured?

PROFESSOR RAD: Glad you asked. Radiation is measured in units called "rem." But we get so little we use millirem or mrem. There are 1,000 millirem in a rem.

DEBRA: So what does "rem" stand for?

PROFESSOR RAD: "Rem" stands for Roentgen Equivalent Man. Hang on now, don't panic. Those are just words. That thing we call a roentgen is just a way to measure exposure, or how much radiation

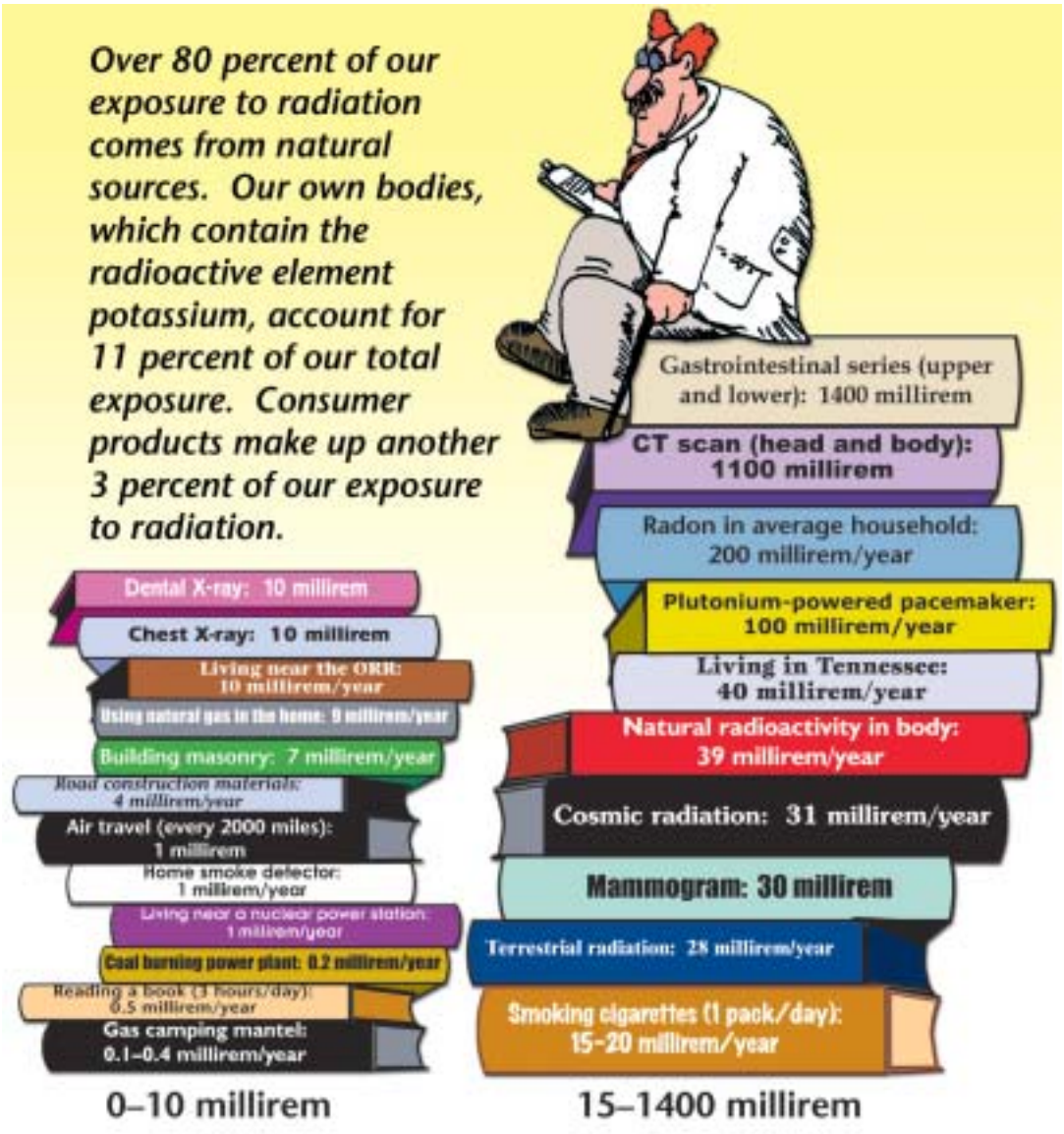
hits you, sort of like speed of a car, but roentgen alone doesn't say anything about the damage of the radiation. So we use what we call a dose equivalence, which is just a measure of the biological damage or harm produced by that many roentgens. That's why it has that silly name, Roentgen Equivalent Man. So just forget roentgen and think of "rem" and "damage" from radiation like "mph" is miles per hour or "speed." The more "rems" we get, the more damage to us. Did I confuse you?

KENT: Nope, I got it Professor. A rem tells me about the damage to my body from the energy in radiation, like how much my car's bumper will bend if I hit a pole at 1 or 30 miles per hour.

PROFESSOR RAD: Smart kid, you're absolutely right. Just don't hit it at 30 miles per hour, please.

JORDAN: So just how much radiation will hurt me, especially if it's all around me like you say? Is there any way to prevent getting exposed to radiation?

PROFESSOR RAD: Good question. You can't avoid it unless you live in a lead house and never eat or breathe. Most of the time you're being exposed to about 360 millirem each year just from living, breathing, and being a normal person. We call it "background radiation." Look at the books in my



library showing the radiation exposures you get from different things. I'm getting some from just sitting on them. Those high levels up near the top are man-made, but the benefit of things like X rays and Computerized Axial Tomography (CAT) scans are well worth the little additional risk we get from getting them.

CHRIS: How much radiation does it take to hurt the human body?

PROFESSOR RAD: Now that's a really good question. But it's like the bumper and speed. Some bumpers are stronger than others, but enough speed will crumple any bumper. People who work with radiation constantly are allowed to get up to 5,000 millirem a year. 10,000 millirem could result in getting cancer nearly 1% above the normal likelihood for getting cancer. If you were to get 100,000–200,000 millirem you might show symptoms of radiation sickness but would recover completely.

EMILY: How much radiation at one time will kill us?

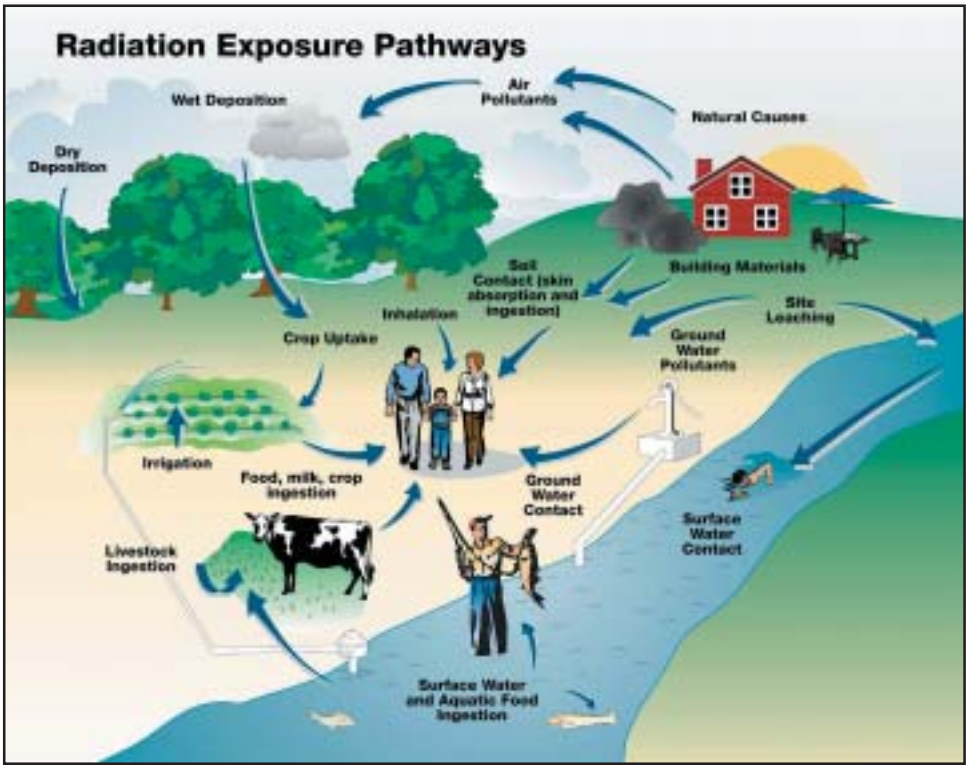
PROFESSOR RAD: If you got upwards of 500,000 or more millirem, you would be very sick but would recover with medical treatment. If you get, say 800,000 millirem or more, and didn't get medical treatment, you'd probably die within 60 to 90 days .

STEVEN: Wow! Is there enough radiation on the Oak Ridge Reservation to pose a serious threat?

PROFESSOR RAD: Sure, but it's very well protected and controlled. The highest level to any worker last year was 959 millirem, and the year before around 810 millirem. If a person living in Oak Ridge got the maximum exposure from all the sources of radiation released to the air from the Reservation in 2001, that person would receive about 0.8 millirem. That's less than even 1 millirem. I get more than that flying to California to talk to kids out there.

ASHLEY: How are we exposed to radiation?

PROFESSOR RAD: As you can see in the *Radiation Exposure Pathways* illustration, 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 honey, fish, and game animals.

REBECCA: I see that some fish are contaminated. What about that?

PROFESSOR RAD: Glad you asked. If you ate 46 pounds of the most highly contaminated fish, drank 193 gallons of the most highly contaminated water right from the lake, and sat for 67 hours on the worst mud shoreline, you would probably receive about 4 millirem per year. But I doubt anyone will do any of that, let alone all of it. Also, most of the radiation in the fish is in the bones, which you don't eat.

LINDSI: Then how come so many people are so concerned with the radiation coming from the Department of Energy's Oak Ridge Reservation?

PROFESSOR RAD: Best question yet. People have a right to be concerned, and radiation has a really bad name. You say "radiation" and people think you glow in the dark. It's all because the public often does not understand how little radiation comes from the Reservation. To some, any is too much. Yes, radiation is very bad for you when it's high, but on the Reservation it's controlled so well it's just not a danger. The amount that gets off the Reservation is extremely small and is simply inconsequential, especially when you know that the average amount of radon in some of our homes gives us 200 millirem each year and that in some homes the amount is many times higher. A couple of millirem is nothing compared with the approximately 360 millirem we get just living.

MIKE: Is there any way I can figure out how much radiation I get?

PROFESSOR RAD: Sure. Just use this chart, fill in the blanks, and you'll know.

CASI: Gee, thanks for setting us straight, Professor Rad. I understand now that the levels are low and there's nothing to be concerned about, but I still don't think I like radiation. It scares me.

PROFESSOR RAD: As it should. Believe me, everyone that works with radiation respects it, and that's why they control it so well. Don't sweat the tiny little bit you might get if you live near the Reservation. You get more from the concrete block in this school and every other school, store, building, road, or home made of concrete. Background radiation is part of our lives, and we just need to understand it. Understanding and putting things in perspective are key.

DAVEY: One last thing Professor. What's the name of your pet bird, and where'd you find that tie of yours?

CALCULATE YOUR OWN ANNUAL RADIATION DOSE

Sources	Effective Dose	Radiation (mrem)
Natural Radiation Sources:		
Inhaled radon daughters	200	
Cosmic rays	30	
Radionuclides in the earth (uranium and thorium)	30	
Radionuclides in the body (potassium and polonium)	40	
Natural background subtotal:		300
Man-Made Sources (average 60):		
Medical Uses of Radiation:		
Number of chest Xrays: _____ x 10 =		
Number of CAT scans: _____ x 1100 =		
Number of GI tract studies: _____ x 1400 =		
Number of dental Xrays: _____ x 10 =		
Medical subtotal:		
Other Manufactured Sources:		
If you live in a STONE structure, add 15 millirem		
If you live in a BRICK structure, add 10 millirem		
If you live in a WOOD structure, add 5 millirem		
If you smoke cigarettes, add 1000 millirem (polonium)		
Number of hours of travel on airlines _____ x 0.5 =		
Miscellaneous consumer products	1	
Nuclear power plant operations	0.05	
Worldwide fallout from nuclear weapons testing	1	
Manufactured sources subtotal:		
Total Annual Effective Dose Equivalent . . .		

PROFESSOR RAD: His name is Atom. My tie? A nice guy at the Department of Energy gave it to me for talking to the class. Like it?

DAVEY: Uh, yeah, sure! And it matches your hair.
PROFESSOR RAD: Thanks. I'll ask him to get you one.

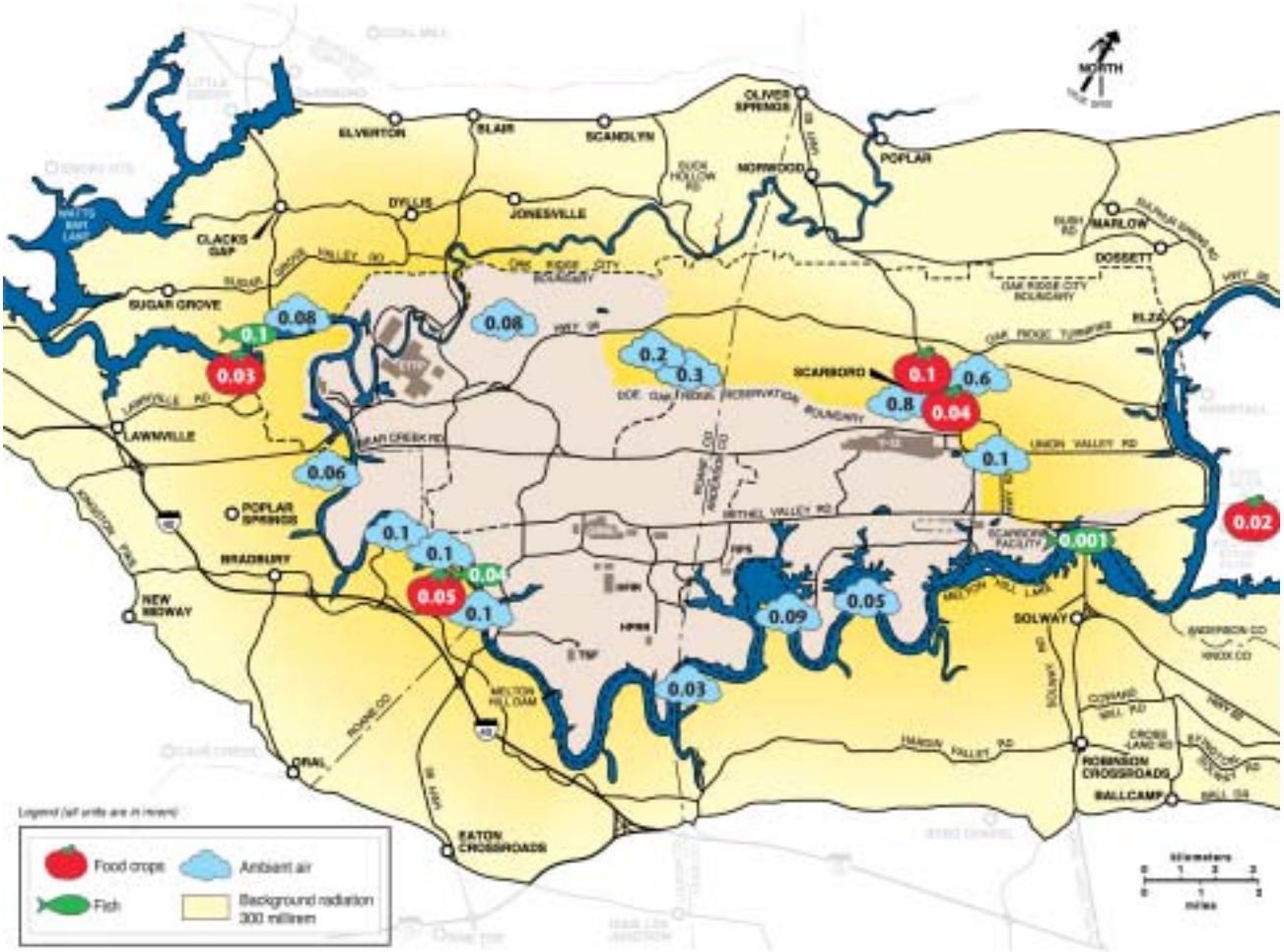
DAVEY: Don't bother.

Dose Map

Everyone is exposed to radiation through normal daily activities. A typical person in the United States receives approximately 300 millirem 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. In addition, about 60 millirem per year comes from man-made sources, such as medical and dental exams, air travel, and consumer products.

Monitoring of air, water, and wildlife on and near the Reservation provides data that are used to confirm that doses from radionuclides released from the Department of Energy activities are low and are in compliance with all laws.

The radiation dose (a measurement of the amount of energy from radiation) varies depending on location. If you live in the vicinity of the Oak Ridge Reservation, eat lots of fish and wildlife harvested locally, drink gallons of contaminated water, and get all the highest exposures possible, you could receive up to 10 millirem per year, about 3% of natural background.



Environmental Monitoring

Air

Effluent and ambient air are both sampled on the Oak Ridge Reservation. Effluent air flows from sources such as exhaust stacks and laboratory hoods. Ambient air is the normal air that exists in the surrounding area. Radiological and nonradiological air emissions from certain buildings and specific plant sites are monitored. The radiological and nonradiological ambient air monitoring programs for the facilities and the Oak Ridge Reservation show that plant emissions do not significantly affect local air quality.

In 2001 the air emissions for all permitted air emission sources at the three facilities on the Reservation were lower than the Tennessee Department of Environment and Conservation limits. The Tennessee Department of Environment and Conservation did not find any violations of air quality regulations at any facility during inspections.

External Gamma Radiation

External gamma radiation exposure rates are measured at many different locations on and off the Oak Ridge Reservation to tell whether radioactive releases from the Reservation are significantly increasing radiation levels above normal background levels. Normal levels of external gamma radiation exposure range from 20 to 73 millirem per year. That means everyone living in Tennessee is exposed to and receives a dose due to external gamma radiation from the natural environment. The average exposure rate across Tennessee is 45 millirem per year.

The average rate at perimeter air monitoring stations around the Oak Ridge Reservation during 2001 was about 36 millirem per year. Operations on the Reservation are not making a significant contribution to external gamma levels in the area.

Groundwater

Most residents in Oak Ridge do not rely on groundwater for drinking water. The local groundwater is used for irrigation and other industrial uses, and it is a potential pathway of contaminant transport and exposure to hazardous materials. Groundwater is monitored for organic compounds, metals, and major ions (which are electronically charged atoms and particles). Contaminants can be carried by groundwater past the Reservation boundary. Tests are performed to determine the water quality of springs, seeps, surface water, and groundwater. Most contamination is from former waste sites. There are no users of the groundwater in the affected areas. Groundwater monitoring at the Oak Ridge National Laboratory and at off-site wells has not detected groundwater contamination migrating off Department of Energy property. At the Y-12 Security Complex chlorinated volatile organic compounds have migrated off the Oak Ridge Reservation east of the plant into Union Valley at depths between 200–500 feet. Remediation is being conducted to mitigate plume migration. Meanwhile, there are no users of the groundwater, and restrictions have been established to prevent future use.

Surface Water

Surface water is another pathway for contaminants to move from the Oak Ridge Reservation into public areas. Water that is discharged from the Oak Ridge Department of Energy facilities directly into lakes and streams is called effluent discharge. Each of the three major sites has a permit for water discharges, and all effluents are monitored according to the permit requirements. Additionally, surface water from 22 locations on and around the Reservation is analyzed to compare with Department of Energy action levels and with the quality of water at reference locations to detect any potential contaminant releases.

Based on samples taken from surface water (even though all sampling locations are not drinking water sources), the dose to individuals from drinking that water could have been 0.1 millirem. The dose from the Reservation is similar to background and does not exceed levels normally found in nature.

Canada Geese

Canada geese are not harvested from the Oak Ridge Reservation, but hunts are held in adjacent areas. One hundred and thirteen geese were rounded up for a radiation screening in June 2001. None were found to be contaminated.

Eastern Wild Turkeys

Fifty-four wild turkeys were harvested during hunts held on the Oak Ridge Reservation in 2001. One wild turkey with contamination at levels above administrative limits for radioactivity was found. The data indicated that eating wild turkeys from the Reservation is not a significant pathway for radiological exposure to the public. Average weight of the turkeys was 11.16 kilograms (24.6 pounds).

White-Tailed Deer

Traditionally, deer on the Reservation are harvested at hunts conducted in October, November, and December. To protect the hunters, their harvested deer are tested for radiation. Due to security concerns following September 11, 2001, hunts were not held on the Reservation during the 2001 fall hunting season.

Vegetables

In 2001 samples of tomatoes, lettuce, and turnips grown at local gardens near the Oak Ridge Reservation were analyzed. None of the vegetables had radionuclides that were statistically significant or above naturally occurring background levels.

Fish

Consumption of fish caught around the Oak Ridge facilities is limited due to advisories for polychlorinated biphenyls issued by the Tennessee Department of Environment and Conservation. These advisories are for the entire reservoir, not just the areas around the Oak Ridge Reservation. Fish are collected from different locations near the Reservation and are analyzed for metals, pesticides, polychlorinated biphenyls, tritium, gross alpha, gross beta, gamma-emitting radionuclides, and total radioactive strontium. The maximum dose from eating local fish was calculated to be 0.2 millirem.

Hay

Analysis of hay from six locations on the Oak Ridge Reservation show that almost all of the dose from consuming beef and milk from cattle that eat this hay comes from the naturally occurring potassium-40 and beryllium-7 isotopes.

Milk

Milk samples are analyzed for tritium, strontium, and gamma-emitting radionuclides. Ingestion is one of the pathways of exposure to radiation for humans. The maximum dose from milk consumption could have been 0.05 millirem in areas near the Oak Ridge Reservation and 0.04 millirem from a remote reference location. The number 0.05 means five one hundredths (5/100) of a millirem.

Environmental Management

Production of materials for nuclear weapons beginning in 1943 at the Oak Ridge facilities produced hazardous and radioactive waste and resulted in contamination of facilities, structures, and environmental media. In 1989, the Oak Ridge Reservation was placed on the Environmental Protection Agency's National Priorities List. This is a comprehensive list of sites and facilities that have been found to pose a sufficient threat to human health and/or the environment. In 1990 Department of Energy Headquarters established the Office of Environmental Management, making the Department of Energy Oak Ridge Operations Office responsible for the cleanup of the Reservation. Much of the work done under the Office of Environmental Management on the Oak Ridge Reservation is performed as a result of the requirements of the Federal Facility Compliance Act and the Comprehensive Environmental Response, Compensation, and Liability Act, which also requires public involvement to ensure that citizens will be informed of cleanup decisions that may affect them or the area in which they live.

Public Involvement

The public is entitled to participate in decisions and exchange information regarding remediation of contaminated areas on the Oak Ridge Reservation. The Department of Energy Oak Ridge Operations Office encourages such participation by actively seeking and considering the views of its stakeholders, thereby providing the opportunity to influence decisions. Stakeholders include individuals, groups/ organizations, host communities, and other entities in the public and private sectors that are interested in or affected by Department of Energy activities and decisions.

Specific efforts by Department of Energy to provide information to the public and to solicit input from stakeholders have made the following sources available.

- The Oak Ridge Site Specific Advisory Board, a federally appointed citizen panel, provides advice and recommendations to the Department of Energy on environmental management activities (http://www.oro.doe.gov/em/ssab).

- The Tennessee Department of Environment and Conservation [http://www.state.tn.us/environment] contracts with the surrounding counties and the city of Oak Ridge through the Local Oversight Committee (http://www.localoversight.org) to provide independent public oversight of the Department of Energy Oak Ridge Operations Office and environmental management activities.

- The Department of Energy Information Center (phone: 865-241-4582) (http://www.oro.doe.gov/ foia/ doe_public_reading_room.htm) provides newsletters, reports, and tapes and transcripts of public meetings.

- The City of Oak Ridge Environmental Quality Advisory Board, appointed by the Oak Ridge City Council, provides counsel to the city government on environmental matters (http://orserv01.ci.oak-ridge.tn.us/ComDev-html/EQAB.htm).

- Information on each of the Oak Ridge environmental management projects is available at http://www.bechteljacobs.com/facts/facts-or.htm.

Community and Reservation Activities

BWXT Y-12 Safety Exposition

The BWXT Y-12 Safety Exposition is an exhibition of information, equipment, supplies, and success stories promoting the health and safety of workers, both at home at and work. Vendors were on hand to exhibit and demonstrate safety- and health-related products and equipment. The Y-12 Environmental Compliance Organization sponsored a booth at the Exposition with the theme of Y-12 Environmental Stewardship, which featured sampling instrumentation and posters that described the Y-12 Environmental program. The first exposition was held in 2001, and plans are to make this an annual event.

Karns High School Applied Communications Class *BWXT Y-12 photo by Tommy Maxwell*

First row left to right: John Hoffman, Stephanie Cooper, Ashley England, Casi Italio, Rebecca McCarter, Professor Rad, and Derek Scarbrough
Second row left to right: Mike Tarter, Scott Hepinstall, Brandon Weigel, Lindsi Grimes, Kent Hersha, Steven Hittinger, Jordan Smith, Brandon Drummer, Mike Davis, Emily McLin, Davey Humphrey, and Debra Cagley

Community Environmental Programs

Guided community nature walks on the Oak Ridge Reservation were conducted from March through May 2001. Thirteen volunteer guides led the nature walks, which included wildflower walks, bird walks, a wildlife and flower adventure, the Copper Ridge Nature Ramble , and a creekside ramble. A total of 162 persons participated in the eleven walks.

Oak Ridge National Environmental Research Park

The Oak Ridge National Environmental Research Park, a 21,980-acre "outdoor laboratory" and biosphere provides a protected, biologically diverse land area for environmental research and education.

It represents the eastern deciduous forest, having more than 1,100 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 ORNL 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. Users include students and faculty from more than 75 colleges and universities as well as participants from ORNL and other state and federal agencies.

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