3. Environmental Management and Reservation Activities

Abstract

The 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. A number of monitoring and cleanup activities are conducted on the ORR under the Environmental Management Program to meet the legal requirements. Additional activities, such as wildlife management and activities that encourage public involvement, are also conducted.

3.1 INTRODUCTION

For nearly half a century, one of the primary missions of DOE and its predecessor agencies was the production of nuclear weapons for the nation's defense. Production of materials for nuclear weapons, which began on the ORR in 1943 as part of the Manhattan Project, also produced radioactive and hazardous wastes. In 1989 EPA placed the reservation on the NPL, which names waste sites across the country most in need of cleanup.

Once the reservation was added to the NPL, cleanup became subject to the process specified in CERCLA, more commonly known as Superfund. 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 cleanup decisions.

In 1990 DOE-HQ established the Office of Environmental Management, making DOE-ORO responsible for cleanup of the reservation; Martin Marietta Energy Systems, Inc., served as its managing and operating contractor. The following sections highlight (1) some of the environmental management activities for 1996 and (2) some related activities carried out to ensure good stewardship of the reservation.

3.2 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT

CERCLA activities continued throughout 1996 at ORNL. Several CERCLA removal actions were planned or performed at ORNL during this time period. Included in the removal actions taken at ORNL was the WAG 4 trench grouting project. The trench grouting project was conducted to reduce the amount of ^{90}Sr in the surface waters of ORNL. In addition, Building 3506 was demolished as a removal action to reduce risk to on-site workers and to provide sufficient work area for the Gunite and Associated Tanks (GAAT) Project, given the proximity of Building 3506 to the GAAT tanks in the South Tank Farm. Removal action activities continued at the Molten Salt Reactor Experiment (MSRE), and planning was performed in conjunction with the proposed removal action at 3001 Canal. An action memorandum was issued in 1996 for the removal of contaminated sludge from the old hydrofracture tanks.

The GAAT Project continued during 1996 with completion of project documentation and testing of tank dry wells for leakage. The GAAT

project is an interim remedial action that is to be taken by DOE. Activities associated with the GAAT CERCLA Treatability Study, conducted to determine the viability of using innovative sluicing and robotics technology, were continued during 1996. Among the activities associated with the Treatability Study was cold testing of sluicing technology that is to be used for removing sludge from the tanks.

Additionally, eight inactive liquid low-level waste (LLLW) tanks were remediated by removal, in situ grouting, and isolation. Remediation of the Inactive Liquid Low-Level Waste Tank System is not part of the scope of the GAAT Project, but is a separate project being performed under the aegis of the FFA.

WAG 6 CERCLA/RCRA groundwater monitoring continued under the auspices of the WAG 6 EMP (DOE 1995c). Continued characterization, modeling, and monitoring of groundwater at other sites within ORNL were performed during 1996.

The WOC Watershed remedial investigation was completed. Moreover, the remedial investigation/feasibility study (RI/FS) was issued for Surface Impoundments 3513 and 3524, located in the main plant area. The In Situ Vitrification project at WAG 7 was shut down because of an excursion of contaminants into the environment. The status of the project remains problematic.

3.3 OFF-SITE RESIDENTIAL DRINKING WATER QUALITY MONITORING PROGRAM

In 1996, responsibility for the Off-Site Residential Well Water Program was transferred from the ORR Surveillance Program to ER. The sampling program was incorporated into the Integrated Water Quality Program. No sampling took place in 1996. Sampling data from 1997 will be reported in the 1997 ASER.

3.4 THE DOE-ORO ENVIRONMENTAL MANAGEMENT RADIOLOGICAL SCRAP METAL PROGRAM

The DOE-ORO Environmental Management (EM) Scrap Metal Program has established a precedent-setting pursuit of commercial-sector recycling of its radioactive scrap metal. An estimated 1.46 billion lb of scrap metal may be produced during D&D of the three DOE gaseous diffusion plants. The prospect of this expanding inventory has prompted DOE-ORO to improve the scrap metal program by changing the approach from metal storage to aggressive recycling. The program focuses on environmental protection and recovery of the metal's value.

The program employs two methods: either decontamination, where possible, or smelting/forming the metals into items for use within the DOE complex. During FY 1996, 1,601,150 lb of ferrous and nonferrous contaminated scrap metals were shipped to commercial radioactive scrap metal processing companies. Of that, 513,150 lb were released for recycle or reuse following commercial decon-tamination, and 1,088,000 lb were commercially smelted and formed into shipping and storage containers for radioactive materials (Table 3.1).

Under the decontamination contract, title to the metal passes to the decontamination vendor, who decontaminates the metals and releases them to commercial scrap vendors. Secondary waste streams are disposed of by the decontamination vendor. A percentage of the proceeds from sales of the metal is recorded as credit with the vendor toward future shipments of scrap metal for decontamination and recycling.

Under the smelting contract, the metal remains the property of DOE and is reformed based on DOE specifications into a number of useful forms, such as shielding blocks, storage drums, or shielded containers. Slag from smelting operations is returned to DOE for disposal.

Table 3.1. DOE-ORO Environmental Management Radiological Scrap Metal Program summary of progress and relative cost

EM project	Recycling method	Amount recycled (lb)	Cost ($)		
			Recycling	Disposal[a]	Storage
Small-Scale Metals Recycle[b]	Smelting	1,072,000	1,565,763	1,338,447	1,608,000
Cooling-Tower Demolition[c]	Decontamination	459,000	605,880	573,120	688,500
K-1419 Batch Plant Demolition[d]	Decontamination	54,150	71,478	69,270	81,225
Tower Shielding Facility[e]	Smelting	16,000	23,370	24,135	24,000
Totals		1,601,150	2,266,491	2,004,973	2,401,725

[a]Disposal cost does not include associated costs, such as those from manifest preparation, disposal characterization such as the U.S. EPA toxicity characteristic leaching procedure (TCLP), or transportation facility capital recovery.

[b]Metals smelted and formed into sheets for fabrication of drums and strong-tight (ST) 90-ft^3 boxes.

[c]Metals decontaminated and released for private-sector use. Shipping and processing of an additional 150,000 lb of radiological scrap metal from this project await funding.

[d]Decontamination of metal in progress; it is anticipated to be free-released for private-sector use.

[e]Metal smelted into lead component of storage containers for use at the Idaho National Engineering and Environmental Laboratory (INEEL). INEEL provided an additional 26,000 lb of lead. Part of the High-Ranking Facilities Deactivation Project at ORNL, this work was funded through EM-60.

Recycling of radioactive scrap metal has saved money for DOE and has avoided the future costs that would have come from disposal of the material as low-level radioactive and/or hazardous waste. It has reduced the risk to human health and the environment and has reduced the amount of space occupied by the DOE radioactive scrap metal inventory. Competition among commercial vendors is expected to further reduce costs as the program expands locally and spreads across the DOE complex.

3.5 IN SITU VITRIFICATION PROJECT AT ORNL

DOE is treating the contaminated soil in Pit 1 in WAG 7 at ORNL by in situ vitrification. The pit was used for disposal of liquid radioactive waste in 1951. In 1981 it was filled with clean soil and capped with asphalt. The pit contains an estimated 38 Ci of radioactive material, primarily ^{137}Cs. Groundwater around the pit gives the contaminants a pathway out of the site.

The in situ vitrification technique fuses soil into a permanent, high-integrity glass in which radioactive contamination is fixed. Electrodes conduct electricity through the soil, which produces resistance heat, causing the soil to melt. A 25 × 25 × 15 ft plot would take about 10 days to reach 3,000°F and about a year to cool to normal temperatures.

The project at Pit 1 began in November 1992. Site preparation was completed in April 1995, and equipment installation was completed in February 1996. The initial melt began on April 3, 1996.

On April 21, 1996, an upheaval of steam and molten glass occurred on and around the off-gas

collection hood. No personnel were injured. The 15,000-lb, 50 × 50 × 6 ft hood was lifted, causing steam and some molten glass to be released. A fire began among combustible materials in the area of the upheaval. All electrical power to the equipment was turned off at the emergency switch, allowing firefighters access to the area; however, firefighting actions were not taken because of the potential for further steam releases. The intense heat dissipated quickly, and the small, smoldering fires self-extinguished within an hour.

Small, hairlike fibers of contaminated glass dispersed to the east and southeast of the hood, most of which were contained within the radiological boundaries of the project. Initial surveys of the personnel and firefighters at the site found no contamination. Loss of off-gas containment was minimal because of the high retention efficiency of the molten soil, the low contamination levels in the off-gas, and the brief time involved. Off-site and on-site uncontrolled release of contaminants was estimated at 0.2 µrem. An independent review board was assembled to conduct an investigation of the incident.

3.6 REMEDIATION UNDER WAY FOR THE MOLTEN SALT REACTOR EXPERIMENT FACILITY

Remediation of the MSRE facility continued during 1996. The facility operated from 1965 to 1969. The reactor was fueled by molten uranium tetrafluoride salt and was cooled by molten salts of lithium and beryllium. After being shut down, the reactor was mothballed. The fuel was solidified in tanks for long-term storage, and surveillance and maintenance programs were initiated.

In subsequent years, a number of potential problems were found in the facility. Samples of off-gas revealed that fluorine and uranium hexafluoride gas were being emitted, leading to the discovery of a 7-lb deposit of uranium in a charcoal-bed off-gas filter. Because the charcoal bed was within a water-filled chamber, it raised a concern that a nuclear criticality was possible. In addition, the fluorine had reacted with the charcoal to form chemically unstable compounds. These discoveries led to the initiation of remedial actions, which began in 1994 and are currently ongoing.

The MSRE remediation project was initiated to reduce and eliminate three potential risks: a nuclear criticality accident, an explosive release of radioactive material, and a release of reactive and/or radioactive gases. Since 1994, the water was drained from around the charcoal bed, and the atmosphere was replaced with an inert gas (CO_2); the charcoal bed was isolated from the off-gas system to prevent further migration of uranium and fluorine; and a hold-down ring was installed to contain the radioactive and reactive gas if the events posed in a "worst-case scenario" were to occur.

A system to remove uranium hexafluoride was designed, fabricated, and installed during 1995 and 1996. The system, which began operation on November 21, 1996, contains chemical traps that adsorb gases emitted by the MSRE. The traps are being stored until equipment can be fabricated to process and package the material for long-term storage.

On June 28, 1996, DOE issued an action memorandum for a removal action for the uranium in the charcoal bed. Once the gases are eliminated from the MSRE, the solid uranium deposits will be removed. A mockup of the charcoal bed has been built, and prototype robotic tools are being fabricated.

The final phase of the MSRE remediation project will involve removal of the fuel and flush salts from their storage tanks.

3.7 LAND APPLICATION OF SEWAGE SLUDGE

The city of Oak Ridge owns and operates a POTW that receives waste water from a variety of industrial, commercial, and residential generators in Anderson and Roane counties. One of the chief contributors is the Oak Ridge Y-12 Plant, which produces about 20% of the total influent. The POTW uses a standard activated-sludge process,

in which sludge from both primary and secondary sedimentation is fed into four anaerobic digesters. Under an agreement with DOE and the state of Tennessee, the city transports digested municipal sewage to approved sites on the ORR and applies the sludge as a soil conditioner and fertilizer. The city has been applying sludge at selected, state-approved sites on the ORR since 1983 (Fig. 3.1). The current sludge land-application program uses five sites totaling 160 acres on which about 224.6 tons (dry weight) of sewage sludge were applied in 1996. The sludge contains trace quantities of heavy metals and radionuclides; however, it is not considered to be RCRA or radioactive waste and is regulated under the provisions of 40 CFR 503 of the CWA.

Elevated levels of mercury were detected in the sewage sludge in November 1995. As a result, the land application of sludge was suspended until May 14, 1996. Sludge in excess of established limits (Table 1 of 40 CFR 503.13) was dewatered and disposed of in the Y-12 Plant Sanitary Landfill V under a special waste permit issued by the TDEC Division of Solid Waste. Land application resumed with approval from the TDEC Division of Water Pollution Control on May 14, 1996, after mercury levels subsided and compliance was reestablished with the established EPA and TDEC sludge land application protocol. The highest detected levels of heavy metals detected in 1996 are compared with established limits in Table 3.2.

3.8 HUNTING ON THE OAK RIDGE RESERVATION

3.8.1 Background

The current deer population on the ORR is considered to be typical and good, if not excellent,

ORNL-DWG 95M-7718

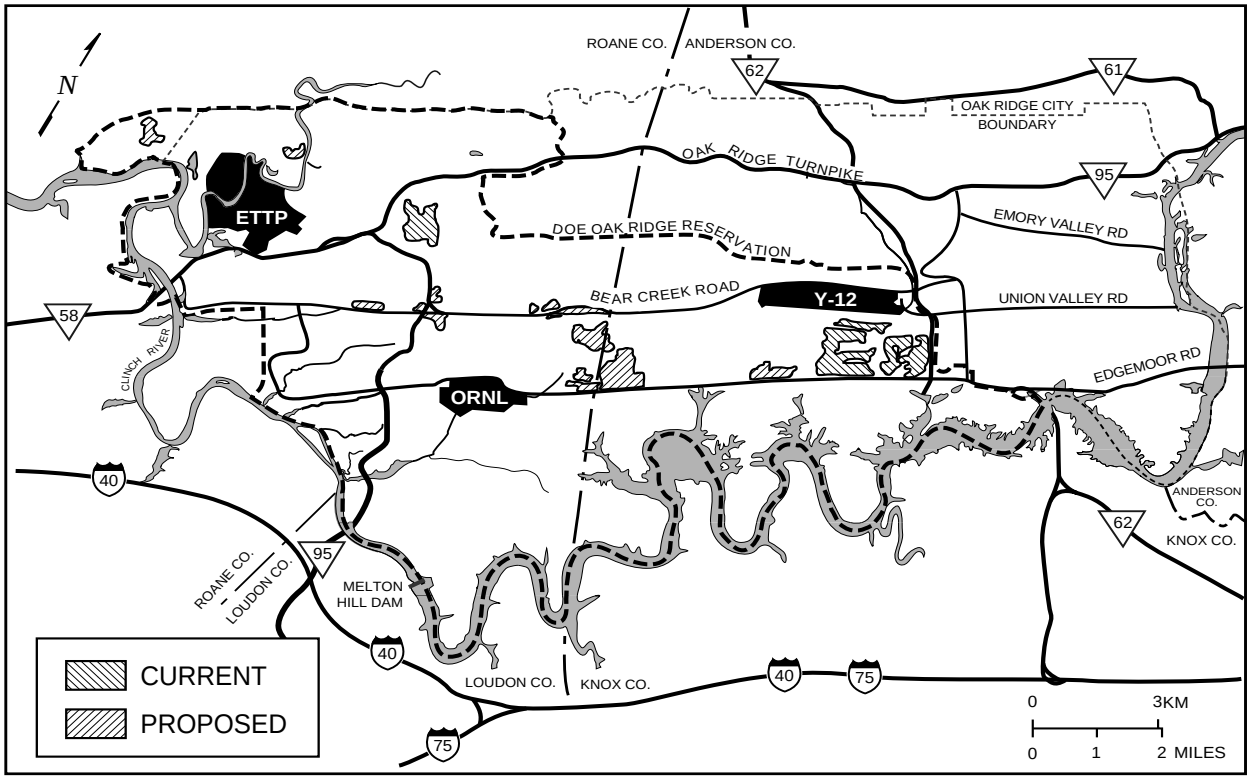

Fig. 3.1. Current and proposed sites for the land application of sewage sludge on the ORR.

Table 3.2. Highest levels of heavy metals detected in 1996 at the city of Oak Ridge POTW compared with limits established in 40 CFR 503.13 and 40 CFR 503.23

Heavy metal	Highest level detected in sludge	Limits	
		40 CFR 503.13, Table 1	40 CFR 503.23, Table 1
Arsenic	12.8	75	73
Cadmium	19.40	85	—
Chromium	171.0	*a*	600
Copper	520.0	4300	—
Lead	74.0	840	—
Mercury	8.2	57	—
Molybdenum	54.0	*a*	—
Nickel	39.7	420	420
Selenium	18.2	100	—
Zinc	1610	7500	—

[a]This limit has been excised by EPA.

for the region in terms of numbers and health. Estimates of deer populations are based on road kills, hunt statistics, and field observations of animals and habitat condition. A change in those observations would indicate a change in population size or health. The most recent samples of stomach parasites (collected in 1995) from deer indicate a healthy and probably stable (i.e., not overpopulated) population.

The recent growth in numbers in the deer herd on the ORR is a continuation of a nationwide trend that began in the 1930s because of restocking and protection from hunting. Deer numbers were very low throughout the region (and the continent) by the 1850s because of overhunting.

The number of road-killed deer began to rise in 1978 (Fig. 3.2). Part of the rise is likely a result of increased automobile traffic and speeds as well as an increase in deer numbers. Annual hunts were started in an effort to reduce that number. It was thought that annual road kills might rise as high as 400 if something was not done. The annual hunt has almost certainly been the major factor in reducing deer collisions. Although the hunts have successfully reduced road kills to around 150, the number may increase again as land use changes; one possible consequence of leasing land for industrial development is increased problems with deer.

Decreasing hunting pressure, especially of does (females), would almost certainly result in an increase in the population and therefore would result in more collisions with vehicles as well as increased ecological damage to the habitat from overbrowsing.

3.8.2 Deer and Turkey Hunts

Deer hunts are held each fall on the ORR. The first turkey hunts on the ORR have been scheduled for the spring of 1997 and should continue in subsequent years. (Details of the turkey hunts will be published in the 1997 ASER.) Hunters are selected through the TWRA statewide drawing for quota hunts. To be eligible, hunters must submit an application and must have a valid license of the appropriate type. Hunters may indicate preferences for particular hunts, and there is a ranking scheme so that hunters who are not selected one year have a greater chance of being selected in

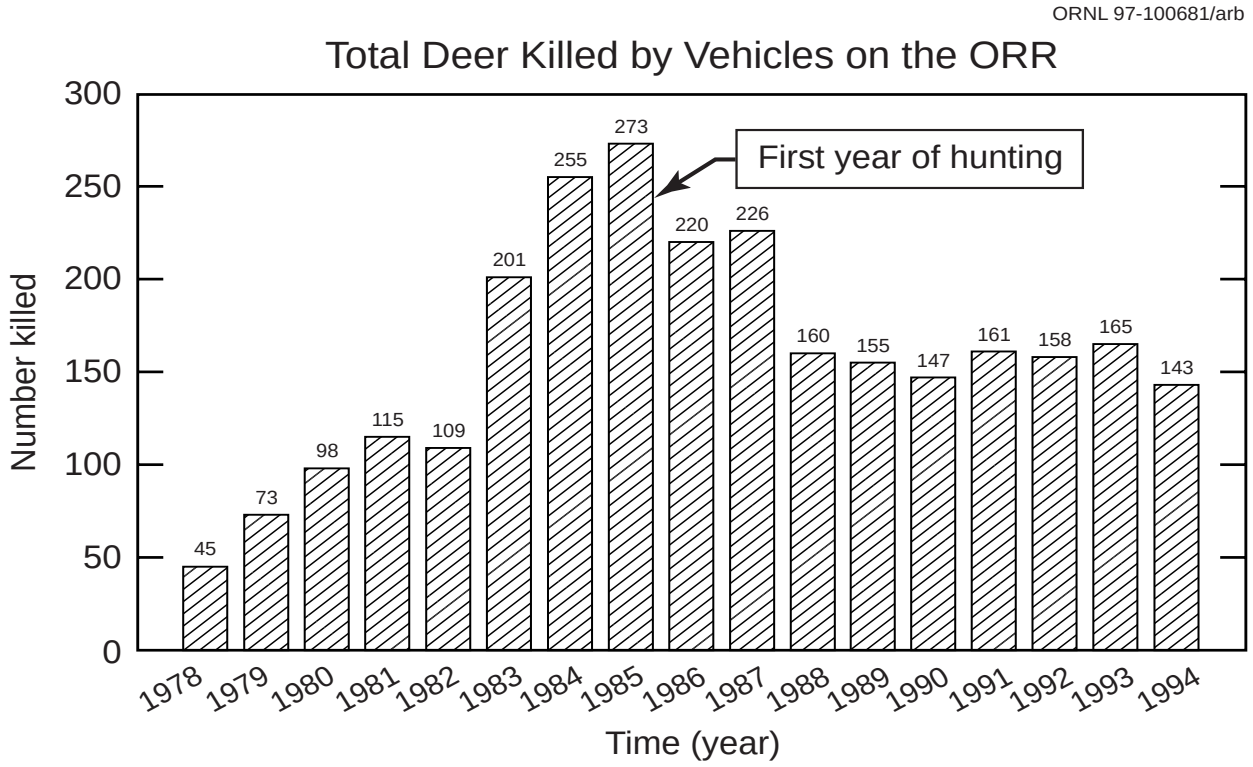

Fig. 3.2. Trend in road-killed deer on the Oak Ridge Reservation since 1978.

subsequent years. Selected hunters receive a color-coded map of the ORR, which shows the location of the checking station on Bethel Valley Road, delineates passable roads and the zones in which hunting is permitted, and has related information printed on the back. Maps for both hunts are similar and may be updated annually. Days are set aside for scouting before the scheduled hunts.

Successful hunters must bring their kill to the checking station. Deer should be field-dressed, and the liver should be retained. The weight, sex, and age of the animals are recorded. For deer, the number of antler points is also noted; for turkey, beard and spur length are measured. For deer, tissue samples (e.g., bone, liver, and muscle) are scanned on site. For turkey, a whole-body scan is conducted.

The checking procedure takes about 10 to 20 minutes, depending on the number of hunters in line. If an animal scans out at over the administrative limit for radioactive contamination, it is retained and the hunter is generally given another permit for a subsequent day or weekend. Confiscated animals are cut up, boxed, and sent to an incinerator.

Results of the 1996 hunts are detailed in Chap. 5. Dose information is detailed in Chap. 6. In addition to information about deer and turkeys, information is provided about migratory waterfowl (Canada geese) that may have visited the ORR.

3.9 PARTNERS IN FLIGHT SURVEY

Partners in Flight is an international program with partners from various governments, agencies, nongovernment groups, and volunteers collaborating in bird conservation and monitoring. ORNL is cooperating with TWRA in its monitoring program of breeding birds in Tennessee. Permanent plots on the ORR have been monitored by TWRA, ORNL staff, and volunteers from the

Tennessee Ornithological Society for three years as part of the Tennessee Partners in Flight program. The Tennessee Conservation League is coordinating data compilation for TWRA and will publish a three-year summary, probably later this year. A draft document has been written about birds of the ORR that contains some preliminary information about the Partners in Flight program. It is currently in review for publication in the journal *The Migrant*.

3.10 COMMUNITY HIKES BEGUN ON THE OAK RIDGE NATIONAL ENVIRONMENTAL RESEARCH PARK

In May 1996 ORNL began sponsoring community hikes on the Oak Ridge National Environmental Research Park. The hikes allowed participants from the local community to explore areas of the reservation usually closed to the public. The purpose of the hikes was to strengthen the local community's sense of pride in the ORR and to help them recognize its regional value.

The hikes drew 75 participants in spite of limited publicity. Four groups of hikers were led by expert guides, two to observe birds at Freels Bend and two to observe wildflowers on the Walker Branch Watershed. Both the large turnout and the comments recorded by the participants on evaluation sheets demonstrate the public interest in the natural riches on the ORR. Future hikes have been planned for 1997.

3.11 ETTP COOLING TOWER PROJECT

The ETTP Cooling Tower project eliminated huge cooling towers built some 50 years ago, when the gaseous diffusion process first was used to enrich uranium for the Manhattan Project. The process generated great amounts of heat, which was dissipated through several immense cooling towers, large wooden structures resting on concrete basins more than 20 ft deep, 60 ft wide, and 300 ft long. After the enrichment process was put on permanent standby in 1987, the towers did nothing but make an imposing skyline. Without presence of water, the structures dried out and created a serious fire hazard.

The project to tear down the towers (including the removal of 85,000 ft^3 of sediment in the basins) presented an opportunity for the team to apply innovative methods and commercially recognized approaches. Begun in the spring of 1994, the task followed DOE's Environmental Management commitment to the development of cost-effective and results-oriented solutions to restoration projects.

By the project's end, a total of 17,000 yd^3 of wood and 2,500 yd^3 of asbestos-containing materials were disposed of and more than 11,000 drums and 116 ST-5 boxes (4 × 4 × 6 ft) of sediment and wood chips were removed. More than 200,000 work hours were logged with only one recordable injury and no NOVs or notices of deficiency from any state or federal regulatory agency.

3.12 PUBLIC INVOLVEMENT ACTIVITIES

Several major environmental cleanup decisions were reached in 1996 with stakeholders playing key roles. As part of its public involvement program, DOE continued to hold regular stakeholder meetings to solicit input and disseminate information on environmental management work on the reservation. DOE also hosted other workshops and public meetings.

Some of the public involvement activities include the following:

- meetings to discuss the proposed privatization of treatment and disposal of ORR low-level mixed waste;
- two environmental management general stakeholder meetings in Harriman, Tennessee, and Oak Ridge, Tennessee;
- workshop on Lower East Fork Poplar Creek Remediation Project;

- initiation of workshops on the Environmental management Ten-Year Plan, now known as *Accelerating Cleanup: Focus on 2006* (http://www.em.doe.gov/acc2006/orindex.html);
- brown bag lunches on topics such as the WIPP and UF_6 Management Program; and
- meeting on the preapplication status of the RCRA permit for the TSCA Incinerator.

Meetings were also held on a variety of other topics.

3.12.1 EnvironMENTAL Fair

Approximately 3000 sixth graders from Knox County and the Cherokee Reservation in North Carolina attended the Fifth Annual EnvironMENTAL Fair, held Thursday, September 26, on the grounds of the American Museum of Science and Energy. Numerous activities sponsored at the fair tied into its theme this year, "Pollution Prevention/Waste Management." The fair was sponsored by DOE, LMES, LMER, and the American Museum of Science and Energy (Fig. 3.3).

3.12.2 Site-Specific Advisory Board

The Oak Ridge Environmental management Site Specific Advisory Board, formed in 1995, continued to advise DOE on environmental management issues such as recommendations for

Fig. 3.3. The 1996 EnvironMENTAL Fair was fun as well as an educational experience for the sixth graders who attended.

cleanup levels, technology development, and long-term waste management issues.

3.13 SOME WEB SITES AND A NEW TOLL-FREE NUMBER

You can get the latest information on environmental cleanup and waste management in Oak Ridge, including the Public Involvement Calendar, at the following web addresses:

- http://www.doe.gov reaches the national DOE Web site;
- http://www.em.doe.gov takes you to the national DOE environmental management Web site;
- http://www.ornl.gov provides access to all ORNL home pages, plus home pages for the Y-12 Plant, ETTP, ORAU, Energy Systems, and other sites of local interest; and
- http://www.ornl.gov/doe_oro/ reaches the DOE Oak Ridge Operations Web site.

Stakeholders outside the local calling area may reach the Environmental Management Community Relations Office by calling toll-free: 1-800-382-6938.