4.7 AIR QUALITY AND CLIMATE/NOISE

The following sections describe the affected environment at Y-12 and the surrounding region with respect to meteorology and climatology, nonradiological air quality, and radiological air quality.

4.7.1 Meteorology and Climatology

The city of Oak Ridge lies in a valley between the Cumberland and Blue Ridge mountain ranges and is bordered on two sides by the Clinch River. The Cumberland Mountains are 16 km (10 mi) to the northwest while the Blue Ridge Mountains, which include the Great Smoky Mountains National Park, are 51 km (32 mi) to the southeast (DOE 1999k). The ROI specific to air quality is primarily the Bear Creek Valley for Y-12. This valley is bordered by ridges that generally confine facility emissions to the valley between the ridges.

The climate of the region may be broadly classified as humid continental. The Cumberland Mountains to the northwest help to shield the region from cold air masses that frequently penetrate far south over the plains and prairies in the Central United States during the winter months. During the summer, tropical air masses from the south provide warm and humid conditions that often produce thunderstorms. Anti-cyclonic circulation around high-pressure systems centered in the western Gulf of Mexico can bring dry air from the southwestern United States into the region, leading to occasional periods of drought.

The mean annual temperature for the Oak Ridge area is 14.0 EC (57.2 EF). The coldest month is usually January, with temperatures averaging about 2.2 EC (36 EF), occasionally dipping as low as –31 EC (–24 EF). July is typically the hottest month of the year, with temperatures averaging 24.9 EC (76.8 EF), occasionally reaching over 37.8 EC (100 EF). In the course of a year, the difference between the maximum and minimum daily temperatures averages 12.5 EC (22.5 EF). The 1998 average temperature was 15.8 EC (60.4 EF) (DOE 1999k).

Winds in the Oak Ridge area are controlled in large part by the valley-and-ridge topography. Prevailing winds are either up-valley (northeasterly) daytime winds or down-valley (southwesterly) nighttime winds. Wind speeds are less than 11.9 km/hr (7.4 mph) 75 percent of the time (Figure 4.7.1–1). Tornadoes and winds exceeding 30 km/hr (18.5 mph) are rare in the Oak Ridge area, although on February 21, 1993, a tornado did strike the east end of Y-12, uprooting trees but causing minimal damage to buildings and equipment. Air stagnation is relatively common in eastern Tennessee (about twice as common as in western Tennessee). An average of about two multiple-day air stagnation episodes occur annually in eastern Tennessee, to cover an average of about 8 days per year. August, September, and October are the most likely months for air stagnation episodes (DOE 1999k).

Source: Computer Modeling Results.

FIGURE 4.7.1–1.—*Wind Rose Data for Y-12.*

The 30-year annual average precipitation is 138.5 cm (54.5 in), including about 24 cm (9.3 in) of snowfall. Precipitation in 1998 was 128.4 cm (50.6 in). Precipitation in the region is greatest in the winter months (December through February). Precipitation in the spring exceeds the summer rainfall, but the summer rainfall may be locally heavy because of thunderstorm activity. The driest periods generally occur during the fall months, when high-pressure systems are most frequent (DOE 1999k).

4.7.2 Air Quality

Airborne discharges from DOE Oak Ridge facilities, both radioactive and nonradioactive, are subject to regulation by EPA, the TDEC Division of Air Pollution Control, and DOE Orders. Each ORR facility has a comprehensive air regulation compliance assurance and monitoring program to ensure that airborne discharges meet all regulatory requirements and therefore do not adversely affect ambient air quality. Common air pollution control devices employed at the three Oak Ridge facilities include exhaust gas scrubbers, baghouses, and other exhaust filtration systems designed to remove contaminants from exhaust gases before release to the atmosphere. Process modifications and material substitutions are also made to minimize air emissions. In addition, administrative control plays a role in regulating emissions (DOE 1999k).

4.7.2.1 *Nonradiological Air Quality*

Regional Air Quality

As directed by the *Clean Air Act* of 1970 (42 U.S.C. §7401), the EPA has set the National Ambient Air Quality Standards (NAAQS) for several criteria pollutants to protect human health and welfare (40 CFR 50). These pollutants include particulate matter less than 10 microns in diameter (PM_{10}), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), lead (Pb), and ozone (O_3). The nearest area not in attainment with the NAAQS is Atlanta, GA.

Nonradiological air quality is defined by the concentration of various pollutants in the atmosphere expressed in units of parts per million (ppm) or in micrograms per cubic meter. The standards and limits set by Federal and state regulations are provided in concentrations averaged over incremental time limits (e.g., 30 minutes, 1 hour, 3 hours). The averaging times shown in the tables in this section correspond to the regulatory averaging times for the individual pollutants.

TDEC implements and enforces the NAAQS and regulations on additional pollutants. In addition to the NAAQS, the TDEC has set standards for gaseous fluorides expressed as HF. Table 4.7.2–1 presents the NAAQS and Tennessee State ambient air quality standards. The EPA approved more restrictive ambient standards for ground-level ozone and particulate matter that became effective on September 16, 1997 (62 FR 38855). However, on May 14, 1999, in response to challenges filed by industry and others, a three-judge panel of the U.S. Court of Appeals for the District of Columbia Circuit issued a split opinion (2 to 1) on the these new clean air standards. The Court vacated the new particulate standard and directed EPA to develop a new standard, meanwhile reverting back to the previous PM_{10} standard. The revised ozone standard was not nullified; however, the judges ruled that the standard "cannot be enforced" (EPA 1999b). On October 29, 1999, the full U.S. Court of Appeals for the District of Columbia supported the lower court's decision with a split ruling. EPA intends to have the Justice Department take the case to the U.S. Supreme Court in 2001. Therefore, it is uncertain at this time when new ozone and particulate matter standards will become enforceable.

An area is designated by the EPA as being in attainment for a pollutant if ambient concentrations of that pollutant are below the NAAQS, or, in nonattainment if violations of the NAAQS occur. In areas where insufficient data are available to determine attainment status, designations are listed as unclassified. Unclassified areas are treated as attainment areas for regulatory purposes. ORR is located in Anderson and Roane Counties in the Eastern Tennessee-Southwestern Virginia Interstate Air Quality Control Region (AQCR) 207. AQCR 207 is designated by EPA (40 CFR 81.343) as:

- "Better than national standards" for SO_2
- "Unclassifiable/attainment" for CO and O_3
- "Cannot be classified or better than national standards" for NO_2
- "Not designated" for lead

The ORR is designated a Class II area with respect to the *Clean Air Act's* (CAA) Prevention of Significant Deterioration (PSD) regulations (40 CFR 51.166). The PSD regulations provide a framework for managing the existing clean air resources in areas that meet the NAAQS. Areas designated PSD Class II have sufficient air resources available to support moderate industrial growth. A Class I PSD designation is assigned to areas that are to remain pristine, such as national parks and wildlife refuges. Little additional impact to the existing air quality is allowed with a Class I PSD designation. Industries locating within 100 km (62 mi) of Class I Areas are subject to very strict Federal air pollution control standards. The nearest Class I PSD Area is the Great Smoky Mountains National Park, approximately 56 km (35 mi) southeast of the ORR.

Air Quality Monitoring Data

The TDEC performs ambient air monitoring throughout the State of Tennessee and within the vicinity of the ORR. Concentration of regulated pollutants observed during 1999 at locations near the ORR are presented in Table 4.7.2–2. As the data indicate, the first highest 1-hr carbon monoxide concentration and the first, second, and third highest 1-hr ozone concentration exceed the standards.

During 1997, ambient concentrations of mercury vapor were measured at four on-site monitoring stations at Y-12 (Figure 4.7.2–1). Outdoor airborne mercury vapor at Y-12 is primarily the result of vaporization from mercury-contaminated soils, fugitive (non-stack) emissions from former mercury-use area buildings, and releases from coal burning at the Y-12 Steam Plant. Table 4.7.2–3 presents the results of the mercury monitoring program at Y-12 (DOE 1999k). The observed concentrations of mercury vapor are well below the ACGIH threshold limit value of 50 $\mu g/m^3$.

TABLE 4.7.2–1.—*National Ambient Air Quality Standards and Tennessee Ambient Air Standards*

Pollutant	Averaging Time	NAAQS Standard	Tennessee Standard
Ozone (O_3)	1-hr	235 μg/m^3 / 0.12 ppm	235 μg/m^3 / 0.12 ppm
Carbon monoxide (CO)	8-hr	10,000 μg/m^3 / 9 ppm	10,000 μg/m^3 / 9 ppm
	1-hr	40,000 μg/m^3 / 35 ppm	40,000 μg/m^3 / 35 ppm
Nitrogen dioxide (NO_2)	Annual	100 μg/m^3 / 0.053 ppm	100 μg/m^3 / 0.053 ppm
Sulfur dioxide (SO_2)	Annual	80 μg/m^3 / 0.03 ppm	80 μg/m^3 / 0.03 ppm
	24-hr	365 μg/m^3 / 0.14 ppm	365 μg/m^3 / 0.14 ppm
	30-minute	--	1,021 μg/m^3 / 0.4 ppm
Particulate matter (PM_{10})	Annual	50 μg/m^3	50 μg/m^3
	24-hr	150 μg/m^3	150 μg/m^3
Lead	Calendar Quarter	1.5 μg/m^3	1.5 μg/m^3
Gaseous fluorides (as HF)	30-day	--	1.2 μg/m^3 / 1.5 ppb
	7-day	--	1.6 μg/m^3 / 2.0 ppb
	24-hr	--	2.9 μg/m^3 / 3.5 ppb
	12-hr	--	3.7 μg/m^3 / 4.5 ppb
Total Suspended Particulates (TSP)	24-hr	–	150 μg/m^3

Source: TDEC 1997.

TABLE 4.7.2–2.—–*Tennessee Department of Environment and Conservation Ambient Air Monitoring Data for 1999 in the Vicinity of Y-12/Oak Ridge Reservation*

Pollutant	Averaging Time	TN standard (Fg/m^3)	Maximum concentration (Fg/m^3) 1st	2nd	3rd	4th	Nearest monitoring location
Sulfur dioxide (as SO_x)	3-hr	1,300	241	220	--	--	Anderson Co.
	24-hr	365	49.7	47.1	--	--	
	Annual	80	7.9	--	--	--	
Total suspended particulates[a]	Annual geometric mean	260	107	87	77	77	Knox Co.
Particulate matter (≤10 Fm)[b]	24-hr	150	71	58	54	50	Knox Co.
	Annual	50	30.6	--	--	--	
Carbon monoxide	1-hr	40,000	12,712	7,329	--	--	Knox Co.
	8-hr	10,000	4,466	4,352	--	--	
Ozone[b]	1-hr	235	240	240	240	226	Anderson Co.
Nitrogen dioxide (as NO_x)	Annual	100	11.3	--	--	--	Roane Co.
Lead[c]	Calendar quarterly mean	1.5	0.33	0.15	0.14	--	Roane Co.

[a] TDEC secondary standard. 1997 monitoring data.

[b] New standards may be applicable in the future; see discussion in section 4.7.2.1.

[c] 1998 monitoring data.

Source:TDEC 1998, TDEC 2000.

Source: DOE 1999k.

FIGURE 4.7.2–1.—*Locations of Ambient Air Monitoring Stations for Mercury Vapor and Uranium.*

TABLE 4.7.2–3.—*Results of Y-12 Ambient Air Mercury Monitoring Program*

Ambient Air Monitoring Site	Mercury Vapor Concentration (μg/m^3)				
	1998 Average	1997 Average[a]	1996 Average[a]	1995 Average[a]	1986-88 Average[a]
Station No. 2 (east end of Y-12 Plant)	0.0048	0.0048	0.004	0.005	0.010
Station No. 8 (west end of Y-12 Plant)	0.0074	0.0065	0.006	0.007	0.033
Bldg. 9422-13 (SW of Bldg. 9201-4)	0.044	0.032[b]	0.030	N/A[c]	N/A[c]
Bldg. 9805-1 (SE of Bldg. 9201-4)	0.057	0.064[b]	0.058	0.066	0.099
Reference site (1988[d])	N/A	N/A	N/A	N/A	0.006
Reference site (1989[e])	N/A	N/A	N/A	N/A	0.005

[a] The American Conference of Governmental Industrial Hygienists 8-hour day, 40-hour work week standard equals 50 μg/m^3.
[b] Data for period from January 1 through September 30, 1997.
[c] Site established in late 1995.
[d] Data for February 9 through December 31, 1988 at Rain Gage No. 2 on Chestnut Ridge in the Walker Branch Watershed.
[e] Data for January 1 through October 31, 1989 at Rain Gage No. 2 on Chestnut Ridge in the Walker Branch Watershed.
Source: DOE 1999k.

As the data indicate, annual average mercury vapor concentrations have declined in recent years when compared with concentrations measured from 1986 through 1988. Of the three sites operating since 1986, all three recorded significantly lower annual averages for mercury vapor concentration when compared with the 1986 through 1988 average. The decrease in ambient mercury recorded at Y-12 since 1989 is thought to be related to the reduction in coal burned at the Y-12 Steam Plant beginning in 1989 and to the completion prior to 1989 of several major engineering projects (e.g., New Hope Pond closure, the PIDAS, Reduction of Mercury in Plant Effluent, and Utility Systems Restoration).

In addition to the mercury vapor sampling stations, three low-volume uranium particulate monitoring stations were operated during 1997 by Y-12 (see Figure 4.7.2–1). Table 4.7.2–4 presents the uranium concentrations measured at monitoring stations during 1998 For 1998 the average 7-day concentration of uranium at the three monitored locations ranged from a low of 0.00001μg/m^3 at Stations 5 and 8 to a high of 0.00044 μg/m^3 at Station 4.

TABLE 4.7.2–4.—*Uranium Mass in Ambient Air at Y-12, 1998*

Station	Number of Samples	7-day concentration (μg/m^3)		
		Maximum	Minimum	Average
4	51	0.00044	0.00002	0.000011
5	34	0.00026	0.00001	0.00008
8	52	0.00036	0.00001	0.000011

Source: DOE 1999k.

TABLE 4.7.2–5.—*Actual vs. Allowable Air Emissions from the Oak Ridge Y-12 Steam Plant, 1998*

Pollutant	Emissions tons/yr (kg/yr)		Percentage of Allowable
	Actual	Allowable	
Particulate matter	31 (28,123)	1,118 (1,014,250)	2.8
Sulfur dioxide	2,545 (2,308,824)	20,803 (18,872,481)	12.2
Carbon monoxide	22 (19,958)	311 (282,139)	7.1
Nitrogen oxides	1,386 (1,257,379)	9,741 (8,837,035)	14.2
Volatile organic compounds	2.1 (1,905)	17 (15,422)	12.4

Source: DOE 1999k.

TABLE 4.7.2–6.—*Chemical Pollutant Emissions from Y-12 During 1998*

Pollutant	Emissions tons/yr (kg/yr)
Hydrochloric acid[a]	48.05 (43,591)
Lead[a,b]	0.0055 (5)
Methanol[a]	21.86 (19,831)
Nitric acid[a]	0.147 (133)

[a] *Superfund Amendments and Reauthorization Act* (SARA), Title III, Section 313 chemical.
[b] Lead is regulated as an ambient air pollutant.
Source: DOE 1999k.

Emissions

The release of nonradiological contaminants into the atmosphere at Y-12 occurs as a result of plant production, maintenance, and waste management operations and steam generation. Most process operations are served by ventilation systems that remove air contaminants from the workplace. TDEC has issued over 50 air permits that cover Y-12 emission sources. The allowable level of air pollutant emissions from emission sources in 1997 was approximately 10,033 tons per year of regulated pollutants. The actual emissions are much lower than the allowable amount (DOE 1999k).

The level of pollutant emissions is expected to decline in the future because of the changing mission of Y-12 and downsizing of production areas. More than 90 percent of the pollutants are attributed to the operation of the Y-12 Steam Plant. Nonradiological airborne emissions of materials have been estimated and are provided in Tables 4.7.2–5 and 4.7.2–6.

Practices have successfully been implemented to minimize releases of ozone-depleting refrigerants to the atmosphere. Requirements for refrigeration-system and motor vehicle air-conditioner maintenance compliance are being met. The use of chlorofluorocarbon (CFC) refrigerants in chillers, direct expansion air conditioners, and process coolers will be eliminated, either by direct replacement with new equipment that operates with "ozone-friendly" refrigerants or by retrofit of existing equipment with new components to operate on "ozone-friendly" refrigerants (DOE 1999k).

4.7.2.2 *Radiological Air Quality*

Atmospheric emissions of radionuclides from DOE facilities are limited by EPA regulations found under National Emission Standards for Hazardous Air Pollutants (NESHAP), 40 CFR 61, Subpart H. The EPA effective dose equivalent (EDE) limit of 10 mrem per year to members of the public for the atmospheric pathway is also incorporated in DOE Order 5400.5, "Radiation Protection of the Public and the Environment." To demonstrate compliance with the NESHAP regulations, DOE annually calculates maximally exposed individual (MEI) and collective doses and a percentage of dose contribution from each radionuclide emitted using the CAP88 computer code. For 1998 all ORR facilities were in compliance with the Radiological NESHAP dose limit. Results of Y-12 compliance modeling are discussed under the radiological emissions section below. Details on the annual compliance modeling are also reported in the ORR Annual Site Environmental Report.

Air Quality Monitoring Data

The ORR maintains a perimeter air monitoring network of eight stations at the reservation perimeter and one at an off-site reference location. Surveillance of airborne radionuclides includes measurement of ambient levels of alpha-, beta-, and gamma-emitting radionuclides and tritium. Monitoring locations were selected based on atmospheric dispersion modeling which determined the locations most likely to be affected by routine releases from the Oak Ridge facilities.

Four of the eight stations are located in the vicinity of Y-12; these monitoring locations are shown in Figure 4.7.2–2. Station 40 monitors the east end of Y-12, and Station 37 monitors the overlap of Y-12, ORNL, and ETTP emissions. On-site Station 48 is located approximately 3 km (2 mi) to the southeast of Y-12. Station 46, which measures off-site impacts of emissions from Y-12, is located in the Scarboro Community of Oak Ridge. To provide an estimate of background radionuclide concentrations, an additional station is located at a site not affected by releases from the ORR. Reference samples are collected from Station 52 (Fort Loudon Dam) located approximately 24 km (15 mi) southwest of ORNL (not shown on Figure 4.7.2–2). Results of monitoring data collected at the various stations during 1998 are shown in Table 4.7.2–7.

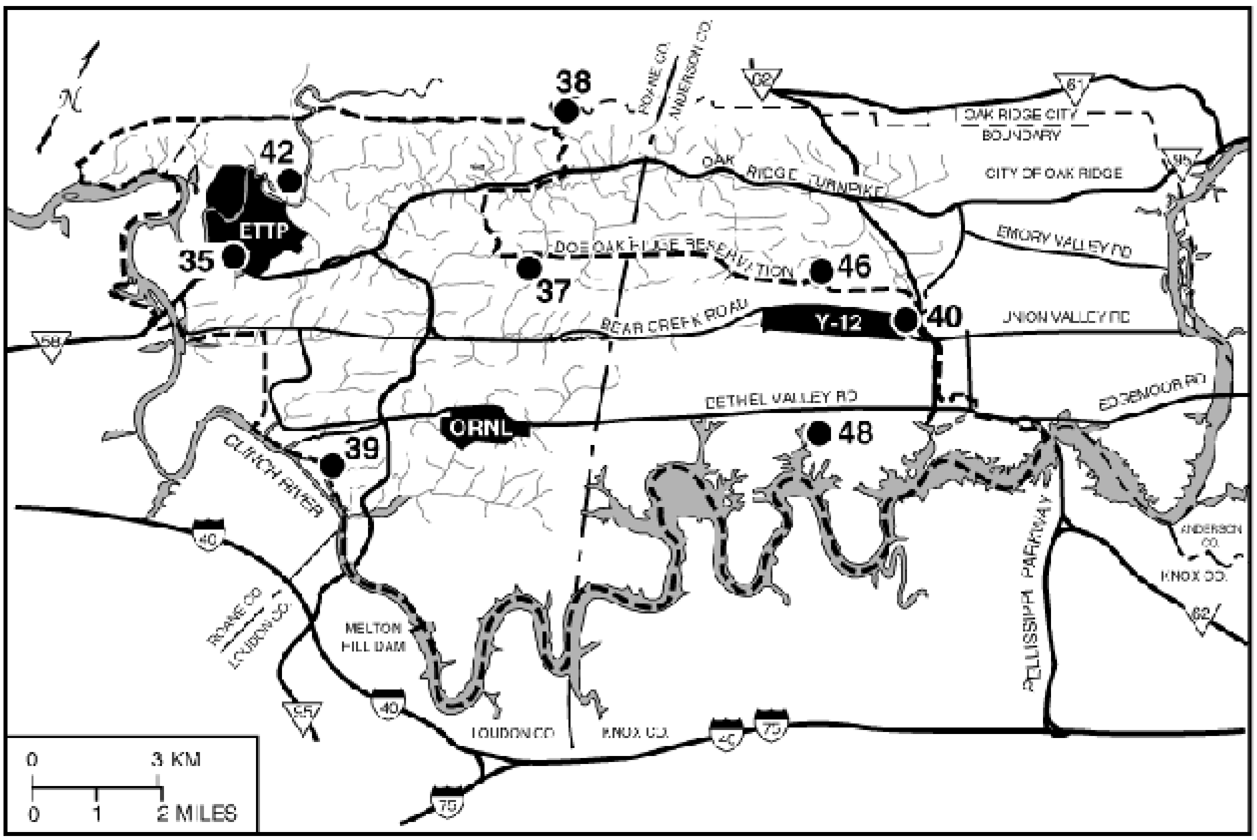
Radiological Emissions

NESHAP regulations for radiological emissions require continuous emission sampling of major sources (a "major source" is considered to be any emission point that potentially can contribute greater than 0.1 mrem/year EDE to an off-site individual). Of the 57 stacks at Y-12, 51 were active stacks and 6 were temporarily shut down during 1998. Forty-five of those stacks were considered to be major sources. Thus, at the end of 1998, 51 active stacks were being monitored at Y-12 (DOE 1999k).

The release of radiological contaminants, primarily uranium, into the atmosphere at Y-12 occurs almost exclusively as a result of plant production, maintenance, and waste management activities. An estimated 0.017 Ci (9.97 kg) of uranium was released into the atmosphere in 1998 as a result of Y-12 activities.

For 1998, six emissions points at Y-12 were modeled; each of these points includes one or more individual sources of emissions. The total effective dose equivalent (TEDE) to the hypothetical MEI from Y-12 emissions was estimated at 0.53 mrem, which is 5.3 percent of the 10 mrem per year EPA standard. This dose is also significantly less than the 300 mrem per year dose that the average individual receives from natural sources of radiation. The MEI for Y-12 is located about 1,080 m (0.7 mi) north-northeast of the Y-12 release point. The collective (population) EDE due to Y-12 emissions was estimated at 4.3 person-rem, which is approximately 35 percent of the collective EDE for the entire ORR (DOE 1999k).

ORNL-DWG 92M-5318R2



Source: 1999k.

FIGURE 4.7.2–2.—*Locations of Oak Ridge Reservation Perimeter Air Monitoring Stations in the Vicinity of Y-12.*

TABLE 4.7.2–7.—*Radionuclide Concentrations at Oak Ridge Reservation Perimeter Air Monitoring Stations During 1998*[a, b]

Radionuclide	Station 35	Station 37	Station 38	Station 39	Station 40	Station 42	Station 46	Station 48	Station 52[c]
Beryllium-7	1.8×10^{-14}	1.8×10^{-14}	2.2×10^{-14}	1.8×10^{-14}	2.6×10^{-14}	2.8×10^{-14}	3.7×10^{-14}	2.7×10^{-14}	3.1×10^{-14}
Cobalt-60	d	d	6.8×10^{-17}	d	d	d	d	4.2×10^{-17}	d
Cesium-137	d	2.5×10^{-17}	d	d	2.3×10^{-17}	d	d	3.9×10^{-17}	3.6×10^{-17}
Potassium-40	d	d	d	d	*d*	d	d	d	4.7×10^{-16}
Tritium-3	d	2.6×10^{-12}	6.9×10^{-13}	d	3.5×10^{-12}	d	d	8.1×10^{-13}	3.3×10^{-12}
Uranium-234	1.1×10^{-17}	1.0×10^{-17}	8.5×10^{-18}	5.5×10^{-18}	1.8×10^{-17}	1.0×10^{-17}	1.5×10^{-17}	7.0×10^{-18}	5.0×10^{-18}
Uranium-235	4.5×10^{-19}	5.9×10^{-19}	8.5×10^{-19}	d	1.0×10^{-18}	d	d	4.6×10^{-19}	7.5×10^{-19}
Uranium-238	1.4×10^{-17}	1.5×10^{-17}	1.2×10^{-17}	8.6×10^{-18}	1.3×10^{-17}	1.3×10^{-17}	1.5×10^{-17}	7.1×10^{-18}	4.6×10^{-18}
Gross alpha	2.0×10^{-15}	1.5×10^{-15}	d	d	1.9×10^{-15}	3.0×10^{-15}	d	2.2×10^{-15}	2.4×10^{-15}
Gross beta	4.6×10^{-15}	3.7×10^{-15}	4.0×10^{-15}	3.7×10^{-15}	4.7×10^{-15}	d	d	6.4×10^{-15}	d

[a] All values are mean concentration.
[b] Units are FCi/mL.
[c] Reference location.
[d] Not detected at 95 percent confidence level.
Source: DOE 1999k.

4.7.3 Noise

Major noise emission sources within Y-12 include various industrial facilities, equipment and machines (e.g., cooling systems, transformers, engines, pumps, boilers, steam vents, paging systems, construction and materials-handling equipment, and vehicles). Most Y-12 industrial facilities are at a sufficient distance from the site boundary so noise levels at the boundary from these sources would not be distinguishable from background noise levels.

EPA guidelines for environmental noise protection recommend an average day-night average sound level of 55 dBA as sufficient to protect the public from the effects of broadband environmental noise in typically quiet outdoor and residential areas (EPA 1974). Land-use compatibility guidelines adopted by the Federal Aviation Administration and the Federal Interagency Committee on Urban Noise indicate that yearly day-night average sound levels less than 65 dBA are compatible with residential land uses and levels up to 75 dBA are compatible with residential uses if suitable noise reduction features are incorporated into structures (14 CFR 150).

Sound-level measurements have been recorded at various locations within and near ORR in the process of testing sirens and preparing support documentation for the Atomic Vapor Laser Isotope Separation site. The acoustic environment along the Y-12 Site boundary in rural areas and at nearby residences away from traffic noise is typical of a rural location, with the day-night average sound level in the range of 35 to 50 dBA. Areas near the site within Oak Ridge are typical of a suburban area, with the average day-night sound level in the range of 53 to 62 dBA. The primary source of noise at the site boundary and at residences located near roads is traffic. During peak hours, the Y-12 Plant worker traffic is a major contributor to traffic noise levels in the area.

The State of Tennessee has not established specific community noise standards applicable to Y-12. The city of Oak Ridge has specific acceptable sound levels at property lines. Maximum allowable noise limits for the city of Oak Ridge are presented in Table 4.7.3–1 (Oak Ridge 2000).

TABLE 4.7.3–1.—*City of Oak Ridge Maximum Allowable Noise Limits Applicable to Oak Ridge Reservation*

	Decibel Level dBA					
Adjacent Use			**7 a.m. - 10 p.m.**			**10 p.m. - 7 a.m.**
	L_{50}	**L_{10}**	**Maximum Limit**	**L_{50}**	**L_{10}**	**Maximum Limit**
Residential	65	70	80	55	50	75
			7 a.m. - 12 Midnight			**12 Midnight - 7 a.m.**
	L_{50}	**L_{10}**	**Maximum Limit**	**L_{50}**	**L_{10}**	**Maximum Limit**
Business	70	75	80	70	75	80
Residential	75	NA	80	75	NA	80

Notes: "L_{10} - sound level, expressed in dBA, which is exceeded ten percent (%) of the time for a one-hour survey.
"L_{50} - sound level, expressed in dBA, which is exceeded fifty percent (%) of the time for a one-hour survey.
Source: Oak Ridge 2000.

4.8 SITE FACILITIES AND SUPPORT ACTIVITIES

The main area of Y-12 is largely developed. It encompasses 328 ha (811 acres), with 255 ha (630 acres) fenced (4 by 2 km [3 by 1 mi]). Approximately 580 buildings house about 714,317 m^2 (7.6 million ft^2) of laboratory, machining, dismantlement, and R&D areas. Because of the site's defense support manufacturing and storage facilities, the land in the Y-12 area is classified in DOE's industrial category.

Many of the buildings used for Y-12 production processes were built during the 1940s for the plant's original mission of eletromagnetically separated isotopes of uranium. These buildings have been modified over the years to accommodate changing missions. The separation of lithium isotopes using column exchange technology was performed at one time in some of the buildings, but that process was discontinued in the 1960s.

Generally speaking, the Y-12 Plant can be divided into three areas: the East End mission support area; the West End manufacturing areas; and the West End environmental area. East End shops are generally technical, administrative, and plant support function. The West End manufacturing area is generally considered an area inside the PIDAS fence. The area inside the PIDAS boundaries contains manufacturing and nuclear material storage facilities as well as technical and plant support operations and program management, product certification, quality control, product engineering and scheduling, maintenance, and utilities. The West End environmental area is managed by EM and contains tank farms, waste management treatment facilities, and storage areas; included are such facilities or areas as the Bear Creek Road Debris Burial Area, Rust Spoil Area, Liquid Organic Waste Storage Facility, Hazardous Chemical Disposal Area, Oil Landfarm, Oil Landfarm Contaminant Area, and Sanitary Landfill I.

In the following, a description of major DP and EM facilities located at the Y-12 Plant is provided. This is followed by a summary of site infrastructure. Appendix A provides detailed information concerning site facilities and utilities as well as the Y-12 Site facility planning and transition process, and major production processes.

4.8.1 Defense Programs Facilities

DP occupies around 427,350 m^2 (4.6 million ft^2) of facilities at the Y-12 Plant. Of this total, approximately 223,000 m^2 (2.4 million ft^2) are in major manufacturing facilities while approximately 195,100 m^2 (2.1 million ft^2) are in support facilities. Forty-nine DP buildings are in surplus; most of these are small support structures that are not process contaminated. The long-term objective is to plan for the removal of these facilities when it becomes cost-effective or a compliance requirement mandates action. Another 11 facilities are planned to be surplus by 2008, assuming the availability of funding for downsizing. The remainder of the DP buildings are anticipated to have a continuing mission.

All Y-12 facilities used in processing and storage of HEU are located in the protected area of Y-12 surrounded by the PIDAS. Appendix Figure A.4.1–1 shows the locations of major DP facilities. Appendix Table A.4–1 provides an overview of the DP facilities. The following summarizes information on the major DP facilities located at the Y-12 Plant.

4.8.1.1 *Building 9212 Complex*

The Building 9212 Complex includes Buildings 9212, 9818, 9815, 9980, and 9981. The largest, Building 9212, was constructed in the early 1940s. Over 100 operations or processes have been or are capable of being performed within the Building 9212 Complex. The primary missions performed in this Complex include the following:

- Casting of HEU metal (for weapons, reactor fuels, storage, and other purposes)
- Accountability of HEU from plant activities (quality evaluations, casting, storage)
- Recovery and processing of HEU to a form suitable for storage and/or future reuse and/or disposition (from plant activities, other DOE programs, and commercial scrap)
- IAEA sampling of surplus enriched uranium
- Packaging HEU for off-site shipment
- Preparation of special uranium compounds and metal for research reactor fuel

The Building 9212 Complex houses two major process areas: the Building 9212 Uranium Recovery Operations (also called Chemical Recovery operations) and the Metallurgical Operations. The Building 9212 Complex is currently not operating except for limited special operations. It is expected that all operations will resume after stand-down.

4.8.1.2 *Building 9206 Complex*

The Building 9206 Complex includes the primary Building 9206 and an immediately adjacent Building 9720-17. It is centrally located in Y-12 near the east end of the protected area. Building 9206 is a multistory facility constructed in the early 1940s. Contained in Building 9206 is an incinerator, which is currently permitted for burning combustible waste containing uranium. Building 9720-17, adjacent to the south side of Building 9206, was constructed in the 1950s.

Building 9206 has generally been reserved for intermediate enrichments (20 to 85 percent) of HEU. Its original design mission was to recover HEU from the electromagnetic separation process. In the mid 1950s, a UF_6 to UF_4 conversion facility using fluorine and hydrogen gas was installed to perform the same function. In the late 1960s Building 9206 underwent modifications to install denitration and fluid bed systems for the conversion of uranyl nitrate to UF_4. The mission of converting recovered uranyl nitrate from Savannah River back into metal was transferred to Building 9206 in 1973. The machining-turning- cleaning process was installed in the mid-1980s for recycling intermediate enrichments of uranium turnings. In 1988 shipments of uranyl nitrate from Savannah River were stopped. A year later the weapon production rate was severely decreased. In 1993 decommissioning of Building 9206 began. Since that time, most of the processes have been shut down, some processes have been removed from the facility, and there are no current plans to resume operations in Building 9206.

4.8.1.3 *Building 9215*

The 9215 Complex consists of Buildings 9215 and 9998. Building 9998 is physically attached to the northeast corner of Building 9215. Building 9215 was constructed in the early 1940s, and Building 9998 was added shortly thereafter. Both buildings have been expanded and modified over the years. Included in Building 9215 is a Blister Area where HEU parts and scraps are packaged and shipped. The Blister Area was constructed in the 1970s and is configured as an "L"-shaped steel frame structure with cement block shear walls.

The mission of the 9215 Complex is to provide for storage and handling of HEU inventories, to aid in the dismantlement of nuclear weapons, to provide fabricated metal shapes as needed for the nuclear weapons stockpile maintenance, and to support nuclear programs at other U.S. and foreign facilities. Materials stored in Building 9215 are considered to be part of the backlog awaiting processing. Not all of the materials will be processed in Building 9215. Except for the limited special operations noted above, the Building 9215 Complex is currently not operating, although it is expected that all operations will resume after stand-down.

4.8.1.4 *Buildings 9204-2 and 9204-2E*

Building 9204-2 was built in 1943 and has been used to support nuclear weapons production since then. As a result of a major upgrade program, Lithium Process Replacement, some of the major processes and equipment were upgraded in the early 1990s. In addition, a portion of Building 9204-2 is being modified for storage of HEU materials.

Building 9204-2E, which comprises the major portion of the building partition, was built in 1971 to house weapon assemblies. Four current HEU activities at Building 9204-2E are as follows: (1) Assembly of new or replacement weapons; (2) quality certification of components and assemblies; (3) disassembly of retired weapons assemblies; and (4) storage of retired assemblies, subassemblies, and components. Assembly and disassembly operations areas, five vault-type rooms, and one vault are located in the Building 9204-2E. Most of the HEU is either metal pieces or weapons components.

4.8.1.5 *Building 9204-4*

Building 9204-4 press operations include the forming of depleted uranium, depleted uranium alloys, and nonradiological material. Building 9204-4 is a three-story structure that was built in 1943. Areas within Building 9204-4 can be functionally classified as follows: (1) quality evaluation of current weapons production programs and disassembly of obsolete weapons; (2) metalworking operations (forging, forming, heat treating) and grit blast cleaning of depleted uranium, depleted uranium alloys, and metals such as steel and aluminum: (3) a Bonded Storage Area (occupying approximately 929 m^2 [10,000 ft^2]) and vault-type room for storage of SNM (occupying approximately 557 m² [6,000 ft²]); (4) radiography, ultrasonic, and other nondestructive testing; and (5) a plating area. The only active operational areas involving HEU within Building 9204-4 are quality evaluation, assembly, and storage in the vault-type room and the Bonded Storage Area. The plating area, while shut down, contains residual materials. The Bonded Storage Area and the vault-type room are set aside for the storage of HEU in drums.

4.8.1.6 *Building 9720-12*

Building 9720-12 is a warehouse facility located in the western portion of Y-12. The mission of Building 9720-12 is to provide storage for items and materials that have been removed from the Material Access Areas. The western portion of the facility is used for storage of combustibles that contain recoverable amounts of enriched uranium. The storage area is also used for other hazardous materials including RCRA waste, and drums of beryllium.

4.8.1.7 *Building 9201-5*

Building 9201-5 is a multi-story structure that was constructed in the early 1940s. The building is a large production/processing facility previously used for depleted uranium and nonuranium processing. Three small storage areas for enriched uranium combustibles have been established on the third floor of the building. The building has several collocated operations, including lithium hydride storage and arc melt operations. The third floor storage area also includes miscellaneous parts, combustibles, and depleted uranium.

4.8.1.8 *Building 9720-5*

Building 9720-5 historically has been used as a warehouse for weapons-related materials and reactor fuel. The facility was built in 1944 and has since been renovated. The current mission is as an operating warehouse used for short- and long-term storage of materials, including high-equity uranium, weapons assemblies, reactor fuel, and low-equity materials awaiting recycling.

4.8.1.9 *Building 9995*

Building 9995, the Analytical Chemistry Laboratory was constructed in 1952 and is located within the Y-12 PIDAS area. The facility was designed for, and is currently used as, an analytical chemistry laboratory, providing analytical support for DP, Work-for-Others, and operation and maintenance contractor regulatory compliance programs. Building 9995 has had two major expansions since it was originally constructed. A south addition was added in 1969 that is currently used for analytical development, and an annex office area was added in 1981. Building 9995 is equipped with approximately 150 chemical fuming hoods with supporting HVAC systems that form the primary engineered safety feature. Most chemical fume hoods in the building are original equipment; limited hood upgrades have been performed and approximately 20 hoods were replaced in the mid-1980s with additional units having been added or replaced at various times during laboratory alteration projects.

4.8.1.10 *Buildings 9119, 9983, and 9710-3*

Building 9119 is an office building located in the western end of Y-12. The current mission of the building supports a variety of DP related organizations.

Building 9983 is a small wood frame storage building located next to Building 9711-1 in the eastern half of Y-12. Radiological control instrument calibrations are performed in Building 9983. Y-12 personnel use HEU calibration sources for calibration purposes and to store sources awaiting disposal.

Building 9710-3 is an office building constructed of noncombustible materials and is located in the eastern section of Y-12. This building houses the Protective Services Force which uses HEU calibration sources to test the portal monitors at the Y-12 Plant.

4.8.1.11 *Building 9201-5W*

Building 9201-5W is used as a machine shop and performs machining, plating and support operations (including nondestructive testing and dimensional inspections) of depleted uranium, depleted uranium alloys, and nonradiological materials. Offices for shop supervision are provided on a mezzanine. Currently, the facility is on standby awaiting refurbishment.

4.8.1.12 *Building 9201-5N*

Activities conducted in Building 9201-5N include eletroplating parts, machining of beryllium, depleted uranium, and stainless steel parts, and dimensional inspection of parts. Barriers to exposure of workers or the public to radiation or chemical hazards or to releases of radioactive or toxic materials to the environment include gloveboxes, hoods, and ventilation systems with HEPA filters. Ventilation exhaust stacks are monitored for radiological and hazardous materials as appropriate.

4.8.1.13 *Buildings 9202 and 9203*

Building 9202 is a two-story R&D structure built in 1954. An addition, which houses a welding laboratory, was built in 1972. A small beryllium blank forming area is operated in the building. Building 9203 which was built in 1944. Activities conducted in Building 9203 include development of processes for material characterization and for measurements, and instrumentation and controls.

4.8.1.14 *Building 9996*

Building 9996 is used as a tooling and material storage facility to support operations in immediately adjacent portions of Building 9212.

4.8.1.15 *Building 9201-1*

Building 9201-1, built in 1955, is a large, general machine shop with several areas containing machining equipment and controls. Nominal storage for in-process parts and materials and offices for supervision are also provided. The building is used as a general machine shop for nonuranium metal and graphite parts.

4.8.2 Waste Management Facilities

The majority of waste management facilities at Y-12 are operated under the EM Program, but some are managed by DP. Waste management facilities are located in buildings, or on sites, dedicated to their individual functions, or are collocated with other waste management facilities or operations. Active facilities for the storage and treatment of LLW, mixed-LLW, RCRA-hazardous and TSCA-regulated waste as well as disposal facilities for non-hazardous waste are summarized in this section and in Appendix A.5. Many of the facilities are used for more than one waste stream.

The TDEC Division of Solid Waste Management (DSWM) regulates management of both hazardous and non-hazardous waste streams under RCRA. Facilities used to store or treat RCRA-hazardous waste at Y-12 are regulated by the DSWM as authorized by the EPA. These facilities may also be used to manage mixed waste (waste that are both RCRA-hazardous and radioactive). There are no facilities for the disposal of hazardous waste currently in operation at Y-12. Storage and physical treatment (e.g., shredding, compaction) of non-hazardous waste does not generally require a permit under RCRA. There are three landfills in operation for disposal of non-hazardous waste at Y-12. These disposal facilities are regulated by the TDEC DSWM as well.

TSCA-regulated waste that contains PCBs is managed at Y-12 in accordance with EPA regulations (40 CFR 761) and with a Federal Facilities Compliance Agreement (FFCA) for managing PCBs on the ORR (EPA 1997). Many requirements for the safe storage and handling of PCB-waste are similar to requirements for RCRA-hazardous waste. Therefore, PCB wastes and TSCA mixed waste (waste containing both PCBs and radioactivity) are often stored in facilities approved for RCRA-hazardous and mixed waste storage. Some Y-12 databases and reports group TSCA-regulated and RCRA-hazardous wastes together and refer to this grouping as hazardous waste.

DOE is authorized to manage radioactive waste that it generates under the *Atomic Energy Act of 1954*. Low-level radioactive waste (LLW) are generated during machining and other operations at Y-12. DOE stores, treats, and repackages, but does not dispose of LLW at Y-12. The majority of the LLW generated at Y-12 is otherwise uncontaminated scrap metal and machine turnings and fines. LLW at Y-12 is managed in accordance with DOE Orders (e.g., DOE Order 435.1), policy, and guidance related to management of radioactive waste. Management of this waste is not directly regulated by EPA or TDEC.

The following description of waste management facilities at Y-12 focuses on the facilities currently available for managing waste at Y-12 and not on facilities that are closed or inactive. The facilities are grouped by functional program area: storage, treatment, or disposal.

4.8.2.1 *Waste Storage at Y-12*

Information on these storage facilities is based on the following references: Bechtel Jacobs 2000, LMES 2000d, PAI 1996.

Storage for Mixed Waste Residues/Ash. Buildings 9212 and 9206 provide container storage areas for mixed waste residues or ash. A RCRA operating permit was issued on September 28, 1995 for these units.

The ash resulted from the burning of solvent- and uranium-contaminated solid wastes. The ash does not contain free liquids. Uranium-bearing solutions generated during the uranium recovery process (Building 9818) and laboratory analyses are also stored in these areas. These solutions, as well as the residues, are mixed (hazardous and radioactive) wastes and are being stored prior to further uranium recovery. Occasionally, uranium-bearing materials generated off-site may be stored in Buildings 9212 and 9206, prior to uranium recovery at Building 9212. Although a Phaseout/Deactivation Program Management Plan has been approved by DOE for Building 9206 and the recovery operations within this facility will no longer be operated, this building will continue to store hazardous and mixed waste for several years into the future.

Building 9212 Tank Farm. Building 9212 Tank Farm, a RCRA permit-by-rule facility, has never been placed in operation, but there are future plans to do so when Enriched Uranium Operations are restarted. The facility consists of three dikes containing four 37,854-L (10,000-gal) stainless-steel tanks that will eventually be used to collect nitrate waste from Building 9818 operations before being transferred to the West End Treatment Facility (WETF).

Liquid Storage Facility. The Liquid Storage Facility (Building 9416-35) of the Disposal Area Remedial Actions (DARA) Liquid Storage Treatment Unit is a hazardous and mixed waste storage and pretreatment facility built during the Bear Creek Burial Ground closure activities. It is located in Bear Creek Valley approximately 3 km (2 mi) west of Y-12, and operates under RCRA permit-by-rule. It collects, stores, and pre-treats groundwater and other wastewater received from the seep collection lift station, the DARA Solid Storage Facility, tankers, polytanks, and the diked area rainfall accumulation. Feed streams may contain oil contaminated with PCBs, VOCs, non-VOCs, and heavy metals. Most equipment is in an outdoor, containment area and includes: two 284,000-L (75,000-gal) bulk water storage tanks; a 22,700-L (6,000-gal) oil storage tank; gravity separator; two filtering units; composite monitoring station; and a tanker transfer station. Collected liquids are pe-treated by traveling through the gravity separator, filters, and composite monitoring station prior to entering bulk storage tanks. The wastewater is then transferred by tanker to the Groundwater Treatment Facility for further treatment.

Containerized Waste Storage Area. The Containerized Waste Storage Area (Buildings 9500-120, 9500-121, and 9500-149) consists of three concrete pads covering approximately 2,320 m^2 (24,800 ft^2). An impermeable dike for spill containment surrounds each pad. The area was previously RCRA-permitted and closed. It is currently being used for LLW storage.

PCB and RCRA Hazardous Drum Storage Facility. Building 9720-9 is a 1161 m^2 (12,500 ft^2), single-story, prefabricated metal building with slab on grade built in 1955. The facility provides a drum storage area for mixed and PCB waste, including an area for flammable waste. The building is used to store both RCRA and PCB mixed waste.

Container Storage Facility. Building 9720-12, a Container Storage Facility, also called the LLW Storage Areas, provides storage for mixed (hazardous and radioactive) waste residues, ash, and combustibles. It also contains some classified waste. A RCRA operating permit was issued on September 28, 1995. The ash is a product from burning solvent- and uranium-contaminated wastes. Unburned solvent- and uranium-contaminated solid wastes are also stored in Building 9720-12. The waste at Building 9720-12 contains no free liquids and is typically generated during the uranium recovery process. Some of this waste is also stored in Buildings 9212 and 9206, as described above.

Classified Waste Storage Facility. The Classified Waste Storage Facility (Building 9720-25) is a 1635-m^2 (17,600-ft^2), single-story building with masonry-bearing walls and a precast concrete roof system built in 1962. It provides storage for PCB-waste, LLW and mixed LLW, which is classified for national security purposes under provisions of the *Atomic Energy Act*. A RCRA operating permit was issued on September 28, 1995. The facility meets Y-12 Plant security requirements for classified waste management and guidelines for the management of LLW and mixed LLW.

PCB Storage Facility. The PCB Storage Facility (Building 9720-28) provides storage capability for PCB waste, primarily PCB-containing ballasts. Building 9720-28 is a 335 m^2 (3,600 ft^2), single-story building with masonry-bearing walls and a structural steel roof built in 1984.

RCRA and Mixed Waste Staging and Storage Facility. The RCRA Staging and Storage Facility (Building 9720-31) is a 610-m^2 (6,571-ft^2), single-story building with masonry-bearing walls and a precast concrete roof system built in 1986. A RCRA permit was issued on September 28, 1995. Solid, liquid, and sludge wastes are prepared for off-site shipment at this facility. The facility consists of seven storage rooms and seven staging rooms, each with a separate ventilation system. The staging rooms house small containers that are packed with compatible materials and shipped. The storage rooms hold larger containers, such as 208-L (55-gal) drums.

Production Waste Storage Facility . The Production Waste Storage Facility (also a Container Storage Area, Building 9720-32) has not yet been used for storage, but future use is planned. The building is separated into two areas, a smaller one for ignitable RCRA waste, and a larger area for non-ignitable waste. Both areas have curbing and may be used for containerized liquids if stored on self-containing pallets. A RCRA operating permit for the facility was issued September 3, 1996 for storage of reactive and ignitable hazardous and mixed waste. The facility houses the non-destructive assay equipment for Y-12 and has a design capacity for storage of 616,968 gal (2,335 m^3).

Low-Level Waste Storage Pad. The Low-Level Waste Storage Pad, is located in the Sludge Handling Facility (Building 9720-44) that originally provided water filtration and sludge dewatering to support a storm sewer cleaning and relining project. The facility is currently being used to store containers of LLW sludge.

Liquid Organic Solvent Storage Facility. The Liquid Organic Waste Storage Facility (Building 9720-45, OD-10) is a 209-m^2 (2,250-ft^2) single-story pavilion with metal posts and roof panels, built in 1987. A RCRA permit was issued on September 30, 1994. It contains four 24,600 L (6,500 gal) and two 11,400 L (3,000 gal) stainless-steel tanks for storage of ignitable nonreactive liquids, including those contaminated with PCBs and uranium. In addition, a diked and covered storage area provides space for 40,000 L (10,600 gal) of containerized waste. The facility is set up to segregate various spent solvents for collection and storage. Major solvent waste streams are transferred to tanks until final disposition.

RCRA and PCB Container Storage Area. The RCRA and PCB Container Storage Area (Building 9720-58) is a 390 m^2 (4,200 ft^2), single-story, prefabricated metal building with metal wall panels built in 1987. It holds a RCRA permit issued on September 28, 1995. It is a warehouse facility used for staging prior to treatment or disposal of PCB- and RCRA- contaminated equipment (e.g., transformers, capacitors, and electrical switchgear) and non-reactive, non-ignitable RCRA, mixed and PCB waste.

Classified Container Storage Facility . The Classified Container Storage Facility (Building 9720-59, also a Production Waste Storage Facility) is a 1403 m^2 (15,105 ft^2), single-story, prefabricated metal building with metal wall panels. Building 9720-59 was issued a RCRA permit on September 3, 1995 and stores both RCRA and PCB wastes.

DARA Solid Storage Facility. The DARA Solid Storage Facility (Building 9720-60) provides 1,625 m^2 (17,500 ft^2) of storage space for PCB-, RCRA-, and uranium-contaminated soil. The facility has a synthetic liner for leachate collection and a leak detection system. Collected leachate is transferred to the Liquid Storage Facility for pretreatment. The DARA Solid Storage Facility is an interim status facility under RCRA, but is now being managed through the CERCLA process. No additional wastes are being added to the facility.

OD7 Waste Oil Storage Tank Area. Building 9811-1, houses three areas for storage of RCRA liquids (OD7, OD8, and OD9), and is an 81-m^2 (874-ft^2) single-story prefabricated metal building with metal wall panels, built in 1986. OD7 contains a diked storage area for tanks (permitted September 30, 1994). The OD7 contains four 114,000-L (30,000-gal) tanks, two 37,900-L (10,000-gal) tanks, and associated piping and pumps. The OD7 facility is now inactive, and there are no plans to use it in the future.

OD8 Waste Oil Solvent Drum Storage Facility. The Waste Oil Solvent Drum Storage Facility (Building 9811-1, OD8) was issued a RCRA permit on September 28, 1995. It has a capacity for 750, 2,080 L (55 gal) drums and a smaller number of Tuff tanks. RCRA waste oil/solvent mixtures containing various concentrations of chlorinated and nonchlorinated hydrocarbon solvents, uranium, trace PCBs, and water for specific chemical constituents are stored at OD8 in 208 L (55 gal) drums and 1,140 L (300 gal) Tuff tanks.

OD9 Waste Oil/Solvent Storage Facility. The Waste Oil/Solvent Storage Facility (Building 9811-1, OD9) is a RCRA-permitted (September 30, 1994) storage facility that houses LLW, mixed-LLW, and hazardous waste, including PCBs. It consists of a diked area supporting five 151,000 L (40,000 gal) tanks, a tanker transfer station with five centrifugal transfer pumps, and a drum storage area. Four tanks house PCB and RCRA wastes contaminated with uranium. A fifth tank is empty. A diked and covered pad furnishes space for 33 m^3 (1,165 ft^3) of containerized waste. The diked area contains additional space for a sixth 151,000-L (40,000-gal) tank.

Depleted Uranium Oxide Storage Vaults I and II. The Depleted Uranium Oxide Storage Vaults I and II (Buildings 9825-1 and -2 oxide vaults) are located on Chestnut Ridge northeast of Building 9213. The vaults are constructed of reinforced concrete and provide a retrievable storage repository for uranium oxide, uranium metal, and a blended mixture of uranium sawfines and oxide. The vaults contain a negative pressure exhaust system that operates during material entry. The exhaust is filtered and monitored prior to its release to the atmosphere. The facility uses forklift trucks, electric hoists, and a motorized drum dumper. Waste is no longer accepted in the vaults. Building 9809-1 is also being used as storage for drummed, depleted uranium oxide materials; it is a 111 m^2 (1,200 ft^2), single-story building with masonry bearing walls and a structural steel roof system built in 1990.

West Tank Farm. The West Tank Farm provides storage for mixed and LLW sludge and is associated with the WETF. It operates under RCRA permit-by-rule and has five, 1.89 million L (500,000 gal) tanks that provide storage for mixed waste and three, 378,541 L (100,000 gal) tanks that provide storage for radioactively contaminated calcium carbonate sludge generated in the WETF treatment processes.

Oil Landfarm Soil Storage Facility. The Oil Landfarm Soil Storage Facility is a RCRA-interim status facility containing approximately 1377 m^3 (14,832 ft^3) of soil contaminated with PCBs and volatile organics (DOE 1993). The soil was excavated from the Oil Landfarm and Tributary 7 in 1989. The soil is contained in a covered, double-lined concrete dike with a leak-detection system. The leak-detection system will soon be modified to enhance detection capabilities.

Old Salvage Yard. The Old Salvage Yard, located at the west end of Y-12, contains both low-level uranium-contaminated and non-radioactive scrap metal. Most scrap currently sent to this area is contaminated. The Contaminated Scrap Metal Storage is an area within the Old Salvage Yard that is used to store uranium-contaminated scrap metal. Contaminated scrap is placed in approved containers and eventually will be transferred to the aboveground storage pads or shipped off-site for disposal. Non-contaminated scrap is sold when allowed.

Salvage Yard. The Salvage Yard is used for the staging and public sale of nonhazardous, non-radioactive scrap metal that has been approved by DOE for release. It consists of 3.2 enclosed ha (8 acre); 0.4 ha (1 acre) is paved. The New Salvage Yard provides accumulation and sorting space for the scrap metal. This facility is located on the north side of Bear Creek Road, near the Bear Creek Burial Grounds.

4.8.2.2 *Treatment of Waste at Y-12*

Information on these treatment facilities is based on the following references: Bechtel Jacobs 2000, LMES 2000d, PAI 1996.

Central Pollution Control Facility. The Central Pollution Control Facility (Building 9623), a 1858 m^2 (20,000 ft^2) multistory structural steel building with masonry walls, was built in 1985. The Central Pollution Control Facility operates under RCRA permit-by-rule and an NPDES permit issued in April 28, 1995. It is the primary facility for treatment of non-nitrated waste. It receives wastes that are acidic or caustic, oily mop waster containing beryllium, thorium, uranium, emulsifiers, and cleansers. It also receives waste already treated at other Y-12 facilities. The Central Pollution Control Facility provides both physical and chemical processing, including oil/water separation, neutralization, precipitation, coagulation, flocculation, carbon adsorption, decanting, and filtration. Treated water is discharged to EFPC through an NPDES monitoring station. Sludge from the treatment processes is transferred to the West End Tank Farm. Spent carbon cartridges and filters are sent to ETTP for storage.

Plating Rinsewater Treatment Facility. The Plating Rinsewater Treatment Facility treats dilute, non-nitrate bearing, plating rinsewater contaminated primarily with chromium, copper, nickel, and zinc. In addition, the facility can treat cyanide-bearing wastes and remove chlorinated hydrocarbons. It is currently used relatively little because the Plating Shop (Building 9401-2) that formerly produced most of Y-12's rinsewater has been deactivated. The facility’s neutralization, equalization, and cyanide destruction equipment are located outdoors in a diked basin. The remainder of the facility process is located in Building 9623 with the Central Pollution Control Facility.

Waste Coolant Processing Facility. The Waste Coolant Process Facility (Building 9983-78) treats machine coolant waste and mop water from machining operations containing heavy metals, including uranium compounds and uranium metallic fines. The equipment and controls are located outside. Gravity feed is used to separate oils and water. The waste oil is then transferred to OD9 (Building 9811-1) or containerized and stored, and the wastewater goes into an extended aerator reactor. Sludge and sediment from the oils are drummed and stored at. Sludge from the wastewater treated in the reactor is dried, drummed and sent to ETTP mixed waste storage. The treated wastewater is transferred to the Central Pollution Control Facility for further treatment and then discharged into EFPC.

Central Mercury Treatment System. The Central Mercury Treatment System (CMTS) is designed to treat mercury-contaminated sump water from former mercury use building. The CMTS was installed as part of the Y-12 Plant’s Integrated Mercury Strategy Program to achieve compliance with regulations and guidance addressing mercury contamination in EFPC. Sump water from Buildings 9201-5, 9201-4, and 9204-4 is treated at the CMTS. The CMTS is located at the Central Pollution Control Facility. A new outfall (Outfall 551) is the discharge point where treated wastewater is discharged in conformance to NPDES monitoring guidelines.

West End Treatment Facility. The WETF (Building 9616-7) treats mixed-LLW- and LLW-contaminated wastewater generated by Y-12 production operations and other DOE- ORO meeting the facility waste acceptance criteria under a RCRA permit-by-rule. Treatment methods include hydroxide precipitation of metals, sludge settling and decanting, bio-denitrification, bio-oxidation, pH adjustment, degasification, coagulation, flocculation, clarification, filtration, and carbon adsorption. Wastewaters are primarily nitrate bearing and include the following: nitric acid wastes, mixed acid wastes, waste coolant solutions, mop water, and caustic wastes. Wastes are received at the WETF in 8,927 L (5,000 gal) tankers, 1136 L (300 gal) polytanks, drums, carboys, and small bottles. Detailed waste characterization documentation and jar tests are used to determine the treatment scheme for wastewater shipments. Treatment at WETF is performed in three processes: Head End Treatment, West Tank Farm biological treatment, and Effluent Polishing. The Head End Treatment System consists of waste receiving, hydroxide precipitation of heavy metals, sludge settling, and decanting. Biological treatment in the West Tank Farm consists of bio-denitrification, then bio-oxidation. The Effluent Polishing System consists of pH adjustment, degasification, coagulation, flocculation, clarification, filtration, carbon adsorption, and effluent discharge to the EFPC through an NPDES monitoring station.

Legacy mixed-LLW treatment sludges are presently being removed from sludge storage tanks at the West Tank Farm for off-site disposal. Currently generated mixed-LLW and LLW treatment sludges are being accumulated and concentrated for final characterization and disposal. Other treatment residuals, such as spent carbon and personal protective equipment, are being sent for immediate off-site disposal where feasible or otherwise characterized for on-site treatment or disposal.

Organic Handling Unit for Mixed Waste. The Organic Handling Unit (Building 9815) provides storage and treatment of organic solutions containing enriched uranium. The uranium level in the waste material arriving at the Organic Handling Unit is typically less than 400 ppm. These wastes are characterized as mixed hazardous and radioactive wastes. Occasionally, enriched uranium-contaminated wastes generated off-site may be treated at the Organic Handling Unit. An assay reduction process is used to dilute the ^{235}U isotope with ^{238}U isotope in such a manner that they cannot be easily separated chemically or physically. This is accomplished by first mixing depleted uranyl nitrate with the organic solution and then neutralizing the organic solution by adding sodium hydroxide or other acceptable material. Since uranyl nitrate solution is not readily soluble in most organic solutions, "extractant" may be added to the organic solution.

Cyanide Treatment Unit. The Y-12 Cyanide Treatment Unit (located in Building 9201-5N) provides storage and treatment of LLW and mixed-LLW solutions containing metallic cyanide compounds from spent plating baths and precious metal recovery operations or other areas; the unit's RCRA permit was issued on September 28, 1995. Treatment is by chemical oxidation and pH adjustment. The cyanide reduction process performed within the unit is currently performed in 208 L (55 gal) containers. After waste is treated at the Cyanide Treatment Unit, it is transferred to the WETF for further treatment, then discharged to the EFPC. Biodenitrification Unit. The Biodenitrification Unit (Building 9818) has been in stand-down, but restart is anticipated. It is capable of treating nitrate-bearing, liquid mixed-LLW generated by enriched uranium recovery operations in Building 9212. The denitrification unit removes nitrates from the waste and also separates liquids and solids. The wastewater is then transferred to the WETF for further treatment, and the sludge is transferred to the West Tank Farm.

Biodenitrification Unit. The Biodenitrification Unit (Building 9818) has been in stand-down, but restart is anticipated. It is capable of treating nitrate-bearing, liquid mixed-LLW generated by enriched uranium recovery operations in Building 9212. The denitrification unit removes nitrates from the waste and also separates liquids and solids. The wastewater is then transferred to the WETF for further treatment, and the sludge is transferred to the West Tank Farm.

Uranium Recovery Operations. Uranium Recovery Operations (Building 9212) is a recovery process to increase production efficiency at Y-12. Liquid waste from the operation is transferred to the Biodenitrification Unit. The system is exempt from permitting requirements under RCRA.

Groundwater Treatment Facility. The Groundwater Treatment Facility (Building 9616-7) treats wastewater from the Liquid Storage Facility at Y-12 and seepwater collected at ETTP and East Chestnut

Ridge waste piles to remove volatile organic compounds (VOCs), non-VOCs, and iron. It is part of the DARA program to treat groundwater contaminated with LLW and mixed-LLW that is collected from the Bear Creek Burial Grounds. The Groundwater Treatment Facility is located at the far west end of Y-12, in the same building as the WETF. This facility uses an air stripping operation to remove VOCs. In addition, carbon adsorption eliminates nonvolatile organics and PCBs. Precipitation and filtration are used to remove iron. After treatment, wastewater is sampled and recycled if additional processing is required. Wastewater that meets discharge specifications is pumped into the EFPC through a NPDES monitoring station.

East End Mercury Treatment System. The East End Mercury Treatment System (EEMTS) is designed to treat mercury-contaminated sump water from Building 9201-2, a former mercury use building constructed in the late 1940s and located in the eastern part of the Y-12 Plant on Second Street directly south of the North Portal parking lot. The EEMTS was installed as part of the Y-12 Plant's Integrated Mercury Strategy Program to achieve compliance with regulations and guidance addressing mercury contamination in EFPC. Sump water from Building 9201-2 is treated at the EEMTS. A new outfall (Outfall 550) is the discharge point where treated water is discharged in conformance to NPDES monitoring guidelines. Mercury-contaminated wastewater is pumped from building sumps located in the basement of Building 9201-2 to the treatment unit installed on the first floor. The water is treated there and released to EFPC through the NPDES Outfall 550. The EEMTS process consists of influent filtration, granular-activated carbon adsorption, and associated water transfer equipment.

Steam Plant Wastewater Treatment Facility. The Steam Plant Wastewater Treatment Facility treats wastewater from Steam Plant operations, demineralizers, and coal pile runoff. Treatment processes include wastewater collection/sedimentation, neutralization, clarification, pH adjustment, and dewatering. The treatment facility uses automated processes for continuous operation. All solids generated during treatment are nonhazardous and are disposed of in the sanitary landfill. The treated effluent is monitored prior to discharge to the Oak Ridge public sewage system.

Uranium Chip Oxidation Facility. The Uranium Chip Oxidation Facility (Building 9401-5) is a 348 m^2 (3,750 ft^2), single-story, prefabricated building with metal wall panels built in 1987. The facility thermally oxidizes depleted and natural uranium machine chips under controlled conditions to a stable uranium oxide. Upon arrival, chips are weighed, drained of machine coolant, placed into an oxidation chamber, and ignited. The oxide is transferred into drums and transported to the uranium oxide storage vaults. The Uranium Chip Oxidation Facility is not designed to treat uranium sawfines. Hence, sawfines are currently blended with uranium oxide and placed in the oxide vaults as a short-term treatment method.

Waste Feed Preparation Facility. The Waste Feed Preparation Facility is a 335 m^2 (3,600 ft^2), single-story, prefabricated building with metal wall panels built in 1984 (Building 9401-4). This facility is no longer in operation. It was previously used to process and prepare solid LLW for volume reduction (compaction and repackaging) by an outside contractor or storage facility.

Steam Plant Ash Disposal Facility. The Steam Plant Ash Disposal Facility is used to collect, dewater, and dispose of sluiced bottom ash generated during operation of the coal-fired Y-12 Steam Plant. To comply with environmental regulations for landfill operations, it includes a leachate collection system and a transfer system to discharge the collected leachate into the Oak Ridge public sewage system. The dewatered ash is disposed of in Landfill VI.

4.8.2.3 *Disposal of Waste at Y-12*

On-site waste disposal facilities in operation at Y-12 are limited to industrial and construction/ demolition landfills. None of the landfills accept, or plan to accept, RCRA-hazardous, TSCA-regulated, or radioactive waste. Waste that contains residual radioactive materials at levels below authorized limits established in accordance with DOE Order 5400.5 may be accepted for disposal. All DOE facilities may receive materials containing residual radioactivity of any radionuclide on material surfaces provided that they are below limits specified in DOE Order 5400.5. Current waste acceptance criteria (WAC) for the landfills include a ceiling for residual radioactivity of 35 pCi/gm for total uranium on a volumetric basis. Materials containing uranium and other radioisotopes with residual levels of radioactivity below DOE authorized limits on a volumeric basis are accepted for disposal on a case-by-case basis. DOE is now reevaluating existing WAC of 35 pCi/gm for total uranium for the on-site disposal facilities, as well as future acceptance of materials containing residual levels of other isotopes, in accordance with guidance for the release and control of property containing residual radioactive material under DOE Order 5400.5 (DOE 1995 and 1997). Review of the WAC should not alter the type or classification of wastes accepted at these landfills. An overview of previously used landfills is included in Appendix Table A.5.3-1 for background information. Information on the disposal facilities is based on the following references: Burns 1993, FWC 1995, MMES 1992, MMES 1995b, PAI 1996, and Schaefer 2000.

Industrial Landfill IV. Industrial Landfill IV is used for disposal of classified, non-hazardous industrial waste, for construction/demolition waste, and for approved special waste. This landfill is intended for the disposal of classified waste. Approximately 12 percent of the landfill's design capacity has been filled. It has a footprint of about 1.6 ha (4 acres).

Industrial Landfill V. Industrial Landfill V is used for disposal of unclassified, non-hazardous sanitary/industrial waste and for approved special waste. Approved special wastes have included asbestos materials, empty aerosol cans, materials contaminated with beryllium, glass, fly ash, coal pile runoff sludge, empty pesticide containers, and Steam Plant Wastewater Treatment Facility sludge. The landfill area is located on Chestnut Ridge near the eastern end of the Y-12 Plant and serves Y-12, ORNL, ETTP, and other DOE prime contractors at Oak Ridge. The landfill is equipped with a liner and leachate collection system. Disposal of special waste is approved on a case-by-case basis by the State of Tennessee. Requests are filed with the state to provide disposal for additional materials as needed. The landfill is approximately 15 percent filled. The landfill has a footprint of almost 10.5 ha (26 acres) and is being constructed in phases as disposal capacity is needed.

Construction/Demolition Landfill VI. Construction/Demolition Landfill VI accepts unclassified, non-hazardous construction/demolition debris and approved special waste. Dewatered ash from the Y-12 Steam Plant is currently disposed of in Landfill VI. The facility has been constructed to 100% design capacity and has been in operation since 1993. It is approximately 93 percent filled and has a footprint of about 1.6 ha (4 acres).

Construction/Demolition Landfill VII. Construction/Demolition Landfill VII has been constructed and is on standby status. It will not be placed in service until Landfill VI has been filled to capacity. It has a footprint of slightly more than 12 ha (30 acres).

On-site Low-Level Waste Disposal Capability. Y-12 has no active disposal facility on-site for LLW or hazardous waste. All disposal activities at the Bear Creek Burial Grounds were terminated on June 30, 1991. These burial grounds were used to dispose of radiologically contaminated waste. Similar waste streams generated today are containerized and stored at Y-12 or are shipped off-site for disposal.

However, the Environmental Management Waste Management Facility that is currently under construction will provide a new disposal capability at ORR for various types of hazardous and radioactively-contaminated waste under certain conditions. This facility has only been approved to accept waste generated as a result of response actions to expedite cleanup of contamination that resulted from previous DOE and Atomic Energy Act operations on the ORR and that are conducted under CERCLA authorization (or in a few cases, under the Inactive Hazardous Substances Site Remedial Action Program [State Superfund] of the State of Tennessee).

The Environmental Management Waste Management Facility will use state-of-the-art disposal technologies, including lined cells with leachate collection capabilities. The WAC for the Environmental Management Waste Management Facility are still being developed and are subject to approval by DOE, EPA, and TDEC. It has a design capacity of 993,921 m^3 (1,300,000 yd^3). Section 3.2.2.2 describes the Environmental Management Waste Management Facility.

4.8.3 Site Infrastructure

An extensive network of existing infrastructure provides services to Y-12 activities and facilities. These are summarized in the following sections while more detailed information is provided in Appendix A.

4.8.3.1 *Roads and Railroads*

The Y-12 Site area contains 104 km (65 mi) of roads ranging from well-maintained paved roads to remote, seldom-used roads that provide occasional access. A 7-km (4-mi) spur from the CSX main line east of the city of Oak Ridge serves Y-12; DOE maintains an additional 5 km (3 mi) of rail at the Y-12 Site to serve on-site operations.

4.8.3.2 *Electrical Power*

Electric power is supplied by TVA and is distributed throughout the Y-12 Site via three 161-kV overhead radial feeders; these, in turn, feed eleven 13.8-kV distribution systems consisting of high-voltage transformers, switch gear, and 15-kV feeder cables; and the 13.8-kV feeders distribute power to approximately 400 distribution transformers located throughout the Y-12 Site. In addition, there is one 161-kV interconnecting overhead header. Some sections of the three lines are supported from suspension insulators on self-supporting steel towers; most sections, however, are supported on wooden-pole H-frame structures. Thirteen 13.8-kV distribution systems ranging in size from 20 MVA to 50 MVA are located within such buildings as 9201-1, 9201-2, 9201-3, 9204-4, 9201-4, 9201-5, 9204-1, and 9204-3. Each system consists of a high-voltage outdoor transformer with indoor switchgear, 15-kV feeder cables, power distribution transformers, and auxiliary substation equipment.

4.8.3.3 *Natural Gas*

Natural gas is used for furnaces, the Y-12 Steam Plant, and laboratories and is supplied via a pipeline from the East Tennessee Natural Gas Company at “C” Station located south of Bethel Valley Road near the eastern end of the Y-12 Plant. A 36-cm (14-in), 125-psig line is routed from “C” Station to the southwest corner of the Y-12 Plant perimeter fence. From this point, a 20-cm (8-in) line feeds the steam plant and a 15-cm (6-in) branch line serve the process buildings and laboratories in the east end of the Y-12 Plant. The western end of the Y-12 Plant, other than the Y-12 Steam Plant, is served by 10-cm (4-in) and 5-cm (2-in) headers that are fed from the steam plant line. In turn, two other pressure reducing stations, one at the steam plant and the other at Building 9202, reduce the gas pressure from 125 psig to 25 psig and 35 psig, respectively. The gas pressure is further reduced and the flow metered at each use point.

4.8.3.4 *Steam*

Heating and process steam is supplied from a Y-12 Steam Plant which was originally built in 1955 and upgraded and modernized several times since then. The Plant operates 24 hours/day, 365 days/year. It includes four coal-fired boilers, each of which is rated at 200,000 lb/hr at 500EF and 235 psig. Steam is distributed throughout the plant at 235 psig through main headers ranging in size from 5 cm (2 in) to 46 cm (18 in) in diameter. Condensate is collected and returned to the steam plant using a similar network of pipes; a majority of the returned condensate is used as feed to the demineralized water system.
Each boiler is capable of firing on either pulverized coal or natural gas and includes two coal pulverizes and four burners. Coal for the steam plant is purchased regionally, delivered by truck, and stored in a bermed area near the steam plant. Runoff from the coal pile is collected and treated in the Steam Plant Wastewater Treatment Facility prior to discharge to the sanitary sewer system. Natural gas is supplied from the Y-12 Plant system through an 8-in-diameter, 125-psig underground main; a pressure reducing station reduces the pressure to 25 psig for use in the burners.

4.8.3.5 *Raw Water*

The source of raw water for the Y-12 Plant and the city of Oak Ridge Filtration Plant is the Melton Hill Reservoir. Raw water is pumped approximately 2,743 m (9000 ft) from the reservoir to a 5.7 million L (1.5 million gal) storage tank and pumping station east of the plant. From the pumping station, raw water is pumped to a 91-MLD (24-MGD) filtration plant water system that also serves ORNL and the city of Oak Ridge. Separate underground piping systems provide distribution of raw and treated water within the Y-12 Plant. Raw water is routed to the Y-12 Plant by two lines: a 41-cm (16-in) main from the booster station, installed in 1943, and a 46-cm (18-in) main from the 61-cm (24-in) filtration plant feed line. The raw water system has approximately 8 km (5 mi) of pipes with diameters ranging from 10 cm (4 in) to 46 cm (18 in). The primary use of the raw water is to maintain a minimum flow of 26 million L/day (7 MGD) in the EFPC.

4.8.3.6 *Treated Water*

Treated water is routed from the city of Oak Ridge Filtration Plant to Y-12 facilities by three lines: one 61-cm (24-in) main and two 41-cm (16-in) mains. The total treated water system contains approximately 31 km (19 mi) of pipe ranging in size from 3 cm (1 in) to 61 cm (24 in) in diameter. The treated water system supplies water for fire protection, process operations, sanitary sewerage requirements, and boiler feed at the steam plant. Treated water usage at the Y-12 Plant averages 19 to 23 MLD (5 to 6 MGD) or 6,908 to 8,290 MLY (1,825 to 2,190 MGY). Ownership and operation of the treated water system was transferred from DOE to the city of Oak Ridge in May 2000.

4.8.3.7 *Demineralized Water*

Demineralized water is used to support various processes at the Y-12 Plant that require high-purity water. A central system located in and adjacent to Building 9404-18 serves the entire plant through a distribution piping system. This system consists of feedwater storage, carbon filters, demineralizers, a deaerator, and demineralized water storage tanks. The primary source of feedwater is condensate return, which is cooled and stored in two storage tanks of 49,210 L and 113,562 L (13,000 gal and 30,000 gal) capacity. The secondary source of feedwater is softened water from the steam plant; feedwater from the storage tanks is filtered, demineralized, deaerated, and stored until needed.

4.8.3.8 *Sanitary Sewer*

The Y-12 Site's sanitary sewer system was first installed in 1943 and expanded as the plant grew. Sanitary sewage from the Y-12 Plant flows by gravity to the West End Treatment Plant. Sewage from most buildings flows to a 46-cm (18-in) sewer main that leaves the east end of the plant near Lake Realty and connects to the city main near the intersection of Bear Creek and Scarboro roads. The current system capacity is approximately 1.5 MGD.

4.8.3.9 *Chilled Water*

The chilled water systems were renovated and upgraded during the mid-1990s. Most chillers that were more than 20 years old were replaced, and the new chillers were inspected and renovated to eliminate the use of chlorofluorocarbons and to restore the chillers to optimal mechanical condition.

4.8.3.10 *Industrial Gases*

Industrial gases include compressed air, liquid nitrogen, liquid oxygen, liquid argon, helium, and hydrogen.

Compressed air is supplied by three different systems that use compressors and associated air-drying equipment located throughout the Y-12 Plant. The high-pressure (110 psig) instrument air system serves specific production buildings in the west end of the Y-12 Plant. The low-pressure (100 psig) system also serves the production facilities in addition to serving the production support buildings and ORNL facilities located at Y-12. The Y-12 Plant air system (90 psig) serves those areas where air quality is not a concern. All three systems are supplied from the same set of compressors and are different only in the operating pressure and the cleanliness of the piping systems (i.e., the Y-12 Plant air piping system contains legacy oil and moisture from previous operations).

Liquid nitrogen is normally delivered to the Y-12 Plant by trailer truck. The Y-12 nitrogen supply system consists of five liquid-nitrogen storage tanks, a bank of atmospheric vaporizers, a steam-to-nitrogen vaporizer, and hot-water vaporizers. Nitrogen is delivered to all production facilities and laboratories at 90-psig through a network of 5-cm (2-in), 8-cm (3-in) and 10-cm (4-in) pipes.

Liquid oxygen is delivered to the Y-12 Plant by truck. The oxygen supply system consists of one 914,460-scf, vacuum-insulated storage tank for liquid oxygen. Oxygen is generated by passing the liquid oxygen through two banks of atmospheric vaporizers that have a capacity of 5800 scfh, or 4.1 million scf/month. The gas pressure is reduced to 90 psig, metered, and distributed to production facilities through a 5-cm (2-in) overhead pipeline.

Liquid argon also is delivered to the Y-12 Plant by trailer truck. The Y-12 Plant's argon system consists of five vacuum-insulated liquid storage tanks and 12 atmospheric fin-type vaporizers. The storage tanks have a combined capacity of 116,351 L (30,737 gal.) equivalent to approximately 3.4 million scf of gas. Gas is distributed to production areas and laboratories through a network of 5-cm (2-in) and 8-cm (3-in) pipes.

The Y-12 Plant receives and stores high-purity **helium** at 3,000 psig in a jumbo tube trailer. The helium facility at Building 9977-1 includes a jumbo tube trailer with a capacity of 160,000 scf. In addition, 36,000 scf of helium at 1800 psig is stored in a tube trailer and serves as emergency standby. The Building 9977-1 cylinder filing facility also houses the high pressure reducing station. Helium gas is distributed throughout the Y-12 Plant at 90 psig through a 5-cm (2-in) overhead pipeline.

The **hydrogen** supply at the Y-12 Plant is stored in Building 9977-2 in multi-cylinder tube trailers in open concrete block stalls. Four trailers are used on a rotating basis: one is in service, one is in ready standby, one is in emergency standby, and one is being refilled. Each trailer has a capacity of approximately 2,800 m^2 (30,000 scf), providing a total capacity of 8,400 m^2 (90,000 scf). Stored gas is pressurized at 2,000 psig. A two-stage pressure-reducing station delivers 50 psig gas through a meter. The gas is then distributed through a 5-cm (2-in) overhead pipeline to the Y-12 Plant and laboratory facilities.

4.8.3.11 *Telecommunications*

The four basic telecommunications systems within the Y-12 Plant are the Oak Ridge Federal Integrated Communications Network, the Cable Television Network (CATV), the unclassified Y-12 Intrasite Network, and the Y-12 Defense Programs Network (Y-12DPNet). The Oak Ridge Federal Integrated Communications Network consists of copper cable distributed throughout the Y-12 Plant and within all its buildings; this network is used for telephone, FAX, and special data and alarm circuits and is operated by USWest. The CATV network consists of coaxial cable that is run to selected sites within the Y-12 Plant. This network has the ability to send and/or receive video among the Oak Ridge plants, buildings at a given site, and some off-site locations. The unclassified Y-12 Intrasite Network consists of a fiber-optic backbone network with fiber-optic connectivity to most buildings within the Y-12 Plant; this network uses routed Ethernet service to separate Internet protocol sub-nets for each building. The Y-12 DPNET is the Classified Services Network and presently consists of a coaxial broadband network and a fiber-optic backbone network with fiber-optic connectivity to most buildings within the protected areas of the Y-12 Plant.

4.9 VISUAL RESOURCES

The ORR landscape is characterized by a series of ridges and valleys that trend in a northeast-to-southwest direction. The vegetation is dominated by deciduous forest mixed with some coniferous forest. Much of the ORR's open fields (about 2,020 ha [5,000 acres]) have been planted in shortleaf and loblolly pine; smaller areas have been planted in a variety of deciduous and coniferous trees (DOE 1995c).

For the purpose of rating the scenic quality of Y-12 and surrounding areas, the Bureau of Land Management's (BLM) Visual Resource Management (VRM) Classification System was introduced into this analysis. Although this classification system is designed for undeveloped and open land owned by BLM, this is the only system of it's kind available for the analysis of visual resource management and planning activities. Currently, there is no BLM classification for Y-12, however, the level of development at the plant would be consistent with VRM Class IV which would be used to describe a highly developed are (see Glossary for definition of VRM classes). Most of the land surrounding the Y-12 plant area would be consistent with VRM Class II and III; left to its natural state with little to moderate changes. Continued management of Y-12 land should focus on limiting construction and future plant activities to within current site boundaries, therefore, preserving the character of the surrounding landscape.

The viewshed, which is the extent of the area that may be viewed from the ORR, consists mainly of rural land. The city of Oak Ridge is the only adjoining urban area. Viewpoints affected by DOE facilities are primarily associated with the public access roadways, the Clinch River/Melton Hill Lake, and the bluffs on the opposite side of the Clinch River. Views are limited by the hilly terrain, heavy vegetation, and generally hazy atmospheric conditions. Some partial views of the city of Oak Ridge water treatment plant facilities located at Y-12 can be seen from the urban areas of the city of Oak Ridge (DOE 1995c).

Y-12 is situated in Bear Creek Valley at the eastern boundary of the ORR. It is bounded by Pine Ridge to the north and Chestnut Ridge to the south. The area surrounding Y-12 consists of a mixture of wooded and undeveloped areas. Facilities at Y-12 are brightly lit at night making them especially visible. There are no visible day-time plumes over Y-12.

Structures at Y-12 are mostly low profile reaching heights of three stories or less. An exception are two meteorological towers erected in 1985 located on the east and west ends of the complex. The East tower, located in a field between Lake Reality and Scarboro Road, reaches a height of 100 m (328 ft). The tower is painted orange and white and is the only structure at the Plant tall enough to require aviation beacons. The West tower is located on a slight rise across from the intersection of Old Bear Creek Road and Bear Creek Road. While this tower only reaches a height of 60 m (197 ft), it is actually higher in elevation than the East tower. These towers are used to measure and transmit meterological data to ETTP databases (Shelton 1999).

The Scarboro community is the closest developed area located to the north of Y-12. However, as a result of their separation by Pine Ridge, Y-12 is not visible from the Scarboro community.

4.10 CULTURAL AND PALEONTOLOGICAL RESOURCES

4.10.1 Cultural Resources

Cultural resources are those aspects of the physical environment that relate to human culture and society, and those cultural institutions that hold communities together and link them to their surroundings. The cultural resources present within the ORR region are complex because of the long prehistoric use of the area; the relocation of the Cherokee from villages during historic times; the presence of well-established settlements prior to acquisition by the Federal government; the continuity of traditional American folklife traditions; and the importance of ORR facilities in the history of nuclear research and production activities for World War II and the Cold War era. An extensive discussion of cultural resources of the ORR region can be found in the DOE-ORO Cultural Resource Management Plan (Souza 1997).

A short history of the human use of the area surounding the ORR and Y-12 is presented to provide a background for the discussion of cultural resources. The ROI for cultural resources is the ORR. The ROI defines the general resource base and relevant cultural and historical contexts for addressing impacts in the area of potential effects. An area of potential effects is the geographic area within which an action may cause changes in the character or use of an historic property (36 CFR Section 800.2[d]). The resources of the ROI provide a comparative basis for establishing the relative importance of resources in the area of potential effects and considering the intensity of potential impacts. The area of potential effects for this SWEIS is the Y-12 Site.

Regional Cultural History. Archaeologists and historians have developed a basic framework to describe changes observed in the cultural traditions of the region. Human occupation and use of the East Tennessee Valley between the Cumberland Mountains and the southern Appalachians is believed to date back to the Late Pleistocene, at least 14,000 years ago. Archaeologists have traditionally believed that these Paleo-Indian bands subsisted primarily by hunting the large game of that era and collecting wild plant foods. More recent research indicates that a more generalized subsistence strategy was probably practiced. In response to warmer and drier climatic conditions and the subsequent loss of Pleistocene megafauna, hunter-gatherers practiced a more diverse subsistence strategy by targeting smaller game and increasing their plant gathering activities. More sedentary adaptations on river terraces and floodplains and labor specialization occurred concurrently with the development and refinement of fishing gear and the exploitation of additional plant materials. Between 3000 and 900 B.C., larger, multifamily communities evolved and primitive horticulture first appeared. Trade goods such as marine shell, copper goods and soapstone bowls also are first found on sites dating to this period. The introduction of pottery and a continued pattern of multiseasonal settlement along river terraces, refinement of agricultural practices, and the use of a broader scope of food resources characterized the next 1,800 years.

During the Mississippian cultural periods (900 A.D. to historic times), larger scale, permanent communities developed first along the alluvial terraces and later on the second river terraces in rich bottomlands suitable for intensive agriculture. These expanding villages included multiple structures, storage pits and hearths, mounds, stockades, plazas, and semisubterranean earth lodges. Archaeological evidence reflects an increasingly complex and specialized society with a high degree of organization, which included the development of elite classes. Just prior to Euro-American contact in the late 17th century, however, there appears to have been a breakdown in the hierarchies and a scaling back of both village size and elaborate public structures. The first Euro-Americans to visit the region were French and English traders and trappers who were soon followed by permanent settlers. These newcomers introduced a variety of domesticated animals, fruit trees, food crops, beads, metal, glass, and other raw materials and derived products to the native inhabitants, now known as the Overhill Cherokee. After a series of conflicts, most of the Cherokee were forcibly relocated to the Oklahoma Territory in 1838. Small, close-knit, agricultural communities developed and continued until 1942 when 23,705 ha (58,575 acres) were purchased by the U.S. government as a military reservation. To contribute to the development of nuclear weapons for the war effort, three production facilities (including Y-12) and a residential townsite were built inside the reservation. New facilities were constructed on the ORR after the war and new missions continued through the Cold War period to the present.

Cultural Resource Types. For this SWEIS, cultural resources have been organized into the categories of prehistoric resources, historic resources, and traditional cultural properties and practices. These types are not exclusive and a single cultural resource may have multiple components. Prehistoric cultural resources refer to any material remains, structures, and items used or modified by people before the establishment of a Euro-American presence in the region in the 17th century. Examples of prehistoric cultural resources recorded on the ORR include villages, potential burial mounds, camps, quarries, and scatters of prehistoric artifacts, such as pottery shards, shell remains, or stone tool-making debris.

Historic cultural resources include the material remains and landscape alterations that have occurred since the arrival of Euro-Americans in the region. Examples of historic cultural resources in the ORR area include homestead and agricultural features, foundations, roads, scatters of historic artifacts, post–contact Cherokee sites, and buildings associated with the Manhattan Project.

Traditional cultural properties and practices refer to places or activities associated with the cultural heritage or beliefs of a living community that are important in maintaining cultural identity. Examples of traditional cultural properties may include natural landscape features; places used for ceremonies and worship; places where plants are gathered that are used in traditional medicines and ceremonies; places where artisan materials are found; places where traditional arts are practiced or passed on; and features of traditional subsistence systems. Impacts to the maintenance of traditional cultural practices are also considered in this SWEIS.

Cultural Resources of ORR and Y-12. Methods used to identify the presence of cultural resources and to determine eligibility vary among the resource types. Pedestrian surveys are used to locate archaeological resources and a separate excavation phase is often required to evaluate archaeological resources for National Register of Historic Places (NRHP) eligibility. Approximately 90 percent of the ORR has been surveyed, on a reconnaissance level, for prehistoric and historic archaeological resources. Less than 5 percent has been intensely surveyed. To date, over 44 prehistoric sites and 254 historic sites, including 32 cemeteries, have been recorded within the current boundaries of the ORR. Fifteen prehistoric sites and 35 historic archaeological resources are considered eligible for listing on the NRHP (Souza 1997).

Several archaeological surveys have been conducted at Y-12 in the past. Surveys are not currently required for activities that do not exceed the depth and extent of previous ground-disturbing activities (PA 1994). Outside of the developed Y-12 Plant area, previously recorded and inventoried archaeological sites have been revisited and evaluated. Only one prehistoric archaeological site, a light scatter of artifacts, has been recorded in the Y-12 Site area. The remains of 16 pre-World War II structures and 7 historic period cemeteries have been identified. Of these, one pre-World War II structure (849A) has been determined eligible for the NRHP based on its early date of construction, current integrity, and its potential to contain undisturbed cultural features. A field review indicated that because of past disturbance the potential for discovery of NRHP-eligible archaeological resources was considered low. Likewise, remaining undisturbed areas are not considered likely locations for significant archaeological resources (DuVall and Associates 1999). It is assumed, however, that archaeological resources could exist in areas that have not yet been inventoried or that subsurface archaeological deposits may occur below shallow disturbances. Even in areas that have been inventoried, data collected on resource locations could be incomplete due to human error or conditions such as heavy vegetation cover, which can seriously affect the ability to see sites on the ground. Unidentified and unevaluated resources are treated as eligible until formal evaluation has been completed.

The survey of historic buildings and structures requires archival research to determine the role that the building may have played in historic events or its architectural significance, and field documentation to assess its current historical integrity. The NRHP has an additional eligibility requirement of "exceptional importance" that applies to properties less than 50 years old. All buildings and structures on the ORR have been surveyed and evaluated for NRHP eligibility. Of 254 pre-World War II buildings and structures evaluated, 35 were determined eligible for the NRHP as individual properties. Two concentrations of pre-war structures have also been designated as the Wheat Community and Gravel Hill Historic Districts. Surveys of World War II and post-World War II buildings encompassing the original Oak Ridge Townsite, ORNL, ETTP, the Oak Ridge Institute for Science and Education, and Y-12 have identified 5 Historic Districts with over 275 contributing structures, 1 designated and 2 proposed National Historic Landmark Properties, and over 25 individual buildings that have been determined eligible for listing on the NRHP. These properties are associated with the Manhattan Project or subsequent activities on the ORR. Other structures, and facility equipment of recent scientific significance that have been previously determined not eligible for listing on the NRHP due to their age or lack of historical context, may be reevaluated for future inclusion (Souza 1997).

All buildings and structures in Y-12 have been surveyed and evaluated. A historic district has been proposed which encompasses the original Y-12 Plant and consists of 92 contributing buildings and structures. The properties in this district are considered significant for their association with the Manhattan Project, Y-12's development as a nuclear weapons components plant after World War II, early nuclear research, and the engineering merits of many of the properties. The proposed district includes buildings that appear to meet the criteria of "exceptional importance" required for listing properties that are less than 50 years old.

Two buildings in Y-12 have been proposed for National Historic Landmark status as individual properties. Building 9731 is the oldest facility completed at Y-12 and played a major part in the Manhattan Project. The prototype calutron was housed and operated in this building and the building was also the location of the original production of stabilized metallic isotopes used in nuclear medicine. Building 9204-3 (Beta-3) functioned as a uranium enrichment facility during World War II and is significant for its pioneering role in the nuclear research in enriched uranium and the separation of stabilized isotopes (Thomason 1999).

Traditional cultural properties and practices are identified through ethnographic and folklore studies, and through direct consultation and site visits with tribal or other traditional practitioners. Ancestors of the Eastern Band of the Cherokee Indians and the Cherokee Nation of Oklahoma may be culturally affiliated with the prehistoric use of the ORR area. Procedures for consultation with the Cherokee regarding traditional cultural properties, religious use, excavation, and discovery of cultural items are in place. No Native American traditional use areas or religious sites are known to be present on the ORR or in the Y-12 Site area.

Also, no artifacts of Native American religious significance are known to exist or to have been removed from the ORR or Y-12 (Souza 1997).

As noted in the discussion of historic resources, the ORR and the Y-12 Site areas contain numerous cemeteries associated with Euro-American use of the area prior to World War II. These resources are likely to have religious or cultural importance to descendants and the local community. No other traditional, ethnic, or religious resources have been identified on the ORR and Y-12 Site areas.

4.10.2 Paleontological Resources

Paleontological resources are the physical remains, impressions, or traces of plants or animals from a former geologic age. Paleontological resources are important mainly for their potential to provide scientific information on paleoenvironments and the evolutionary history of plants and animals. Impact assessments for paleontological resources are based on the research potential of the resource, the quality of the fossil preservation in the deposit, and on the numbers and kind of resources that could be affected. Resources with high research potential include deposits with poorly known fossil forms fossils which originate from areas that are not well studied, well-preserved terrestrial vertebrates, unusual depositional contexts or concentrations, or assemblages containing a variety of different fossil forms.

Paleontological Resources of ORR and Y-12. The ORR is underlain by bedrock formations predominated by calcareous siltstones, limestones, sandstones, siliceous shales, and siliceous dolostones. The majority of geologic units with surface exposures on the ORR contain paleontological materials. All of these paleontological materials consist of common invertebrate remains which are unlikely to be unique from those available throughout the East Tennessee region.

4.11 ENVIRONMENTAL MANAGEMENT

In the Waste Management PEIS (DOE 1997c), DOE evaluated the environmental impacts of alternatives for managing five waste types generated by defense and research activities at a variety of DOE sites around the United States including ORR. Of the five waste types evaluated, ORR manages the following four types: LLW, mixed-LLW, TRU waste, and hazardous waste. DOE decided on January 23, 1998, that ORR TRU waste would be sent to the Waste Isolation Pilot Plant (WIPP) in Carlsbad, NM. DOE decided on August 5, 1998, that the ORR would continue to ship hazardous waste offsite for treatment and disposal. DOE’s perferred alternative for management of LLW and mixed-LLW was issued December 5, 1999 (64 FR 69241, December 10, 1999). For the management of LLW and mixed-LLW, DOE prefers regional disposal at the Hanford Site and Nevada Test Site. ORR would continue disposal of LLW generated on-site including Y-12's. The ROD for LLW and unified LLW treatment and disposal was consistent with those preferred alternatives and was issued on February 25, 2000 (65 FR 10061, February 25, 2000). Currently, Y-12 stores liquid LLW and mixed-LLW for treatment and disposal. Solid LLW is currently stored pending ORR availability of off-site disposal or planned on-site disposal facilities. Solid mixed-LLW is shipped to ETTP for incineration and off-site commercial vendors for treatment and disposal (DOE 1999i, DOE 1997c).

Section 4.11.1 addresses the generation of waste from routine operations. Section 4.11.2 addresses the generation of waste from environmental restoration activities. Section 4.11.3 addresses the current status of Y-12's Pollution Prevention Program. The sections discuss the program's background and current elements, including details in areas of waste generation, waste facilities, administrative polices, assessments, technology transfer, recycling/reuse, treatment, and energy and water conservation.

4.11.1 Waste Generation from Routine Operations

The major waste types generated at Y-12 from routine operations include LLW, mixed-LLW, hazardous waste, and nonhazardous waste. Table 4.11.1–1 presents a summary of waste generation totals for routine operations at Y-12, ORNL, and ETTP during 1998. Other waste includes sanitary and industrial wastewater, PCBs, asbestos, construction debris, general refuse, and medical wastes. Y-12 and ETTP do not generate or manage high-level waste or TRU waste. In 1998, ORNL generated 3 m^3 (3.9 yd^3) of TRU waste during routine operations.

Low-Level Waste. Solid LLW, consisting primarily of radioactively contaminated scrap metal, construction debris, wood, paper, asbestos, filters containing solids, and process equipment is generated at Y-12. In FY 1998, Y-12 generated approximately 2,224 m^3 (2,909 yd^3) of LLW, of which 1,000 m^3 (264,172 gal) was liquid. Liquid LLW is treated in several facilities including the WETF (DOE 1996b). Y-12 is the largest generator of routine LLW at Oak Ridge.

TABLE 4.11.1–1.—*Summary of Waste Generation Totals by Waste Type in Kilograms (Cubic Meters)[a] for Routine Operations at Y-12, ORNL, and ETTP*

Waste Type	Y-12 (FY 1998)	ORNL (FY 1998)	ETTP (FY 1998)
Low-Level Waste	2.2 million (2,224)	291 (0.3 million)	0.1 million (123)
Mixed Low-Level Waste[b]	0.2 million (204)	4,000 (4 million)	0.15 million (151)
Hazardous Waste[b]	18,000 (18)	26,000 (26)	2,000 (2)
Sanitary/Industrial	6.8 million (6,795)	0.8 million (822)	0.4 million (390)

[a]Assumes 1000 kilograms (1 metric ton) equals 1 cubic meter.
[b]Includes TSCA wastes.
Source: LMES1999a.

Mixed Low-Level Waste. Mixed waste and LLW subject to treatment requirements to meet Land Disposal Restrictions (LDRs) under RCRA are generated and stored at Y-12. DOE is under a State Commissioner's Order (October 1,1995) to treat and dispose of these wastes in accordance with milestones established in the *Site Treatment Plan for Mixed Waste on the Oak Ridge Reservation* (DOE 1997) and for DOE to comply with an FFCA that went into effect June 12, 1992. TSCA-regulated waste (containing PCBs) that is also radioactive waste is managed under a separate FFCA, first effective February 20, 1992 (EPA 1997, revised).

Hazardous Waste. RCRA-hazardous waste is generated through a wide variety of production and maintenance operations. The majority of RCRA-hazardous waste is in solid form. Some RCRA-hazardous waste is treated on-site and may then be disposed of as nonhazardous waste. The remaining hazardous waste is shipped off-site for treatment and disposal at either DOE, or commercially-permitted, facilities (LMES 1999a, DOE 1999b). Information of waste management facilities at Y-12 is presented in Section 4.8 and in Appendix A.

Other Waste Types. Industrial wastewater is discharged from several locations including the WETF. Sanitary wastewater is discharged to the city of Oak Ridge publicly owned treatment works. For a detailed discussion of wastewater discharges, see Section 4.5. PCBs are transported to permitted facilities for treatment and disposal. Medical wastes are autoclaved to render them noninfectious and are then sent to a Y-12 sanitary industrial landfill as are asbestos wastes and general refuse. Construction, demolition, and nonhazardous industrial materials are disposed of in a construction/demolition landfill for hazardous waste facilities at Y-12 (DOE 1996b).

Capacities. Excess treatment and disposal capacity exist both on-site and off-site for hazardous waste facilities at Y-12. While exceedances of 1-year storage limit are possible, routine shipments should be adequate to prevent such an occurrence. Treatment on-site and disposal capacity of mixed waste facilities is increasing. Storage capacities at Y-12 are not currently exceeded. Capacities for LLW are adequate. Details are provided in Appendix A.

4.11.2 Waste Generation from Environmental Restoration Activities

Environmental Restoration Waste. EPA placed ORR on the National Priorities List (NPL) on November 21, 1989. EPA Region IV and TDEC completed a Federal Facility Agreement (FFA) effective January 1, 1992. This agreement coordinated ORR inactive site assessment and remedial action. By 2006 greater than 95 percent of the current EM work scope will be completed with 99 percent of the planned risk reduction accomplished. Groundwater, surface water, and soil contamination will be remediated to a level consistent with future use of these sites as identified in the CERCLA and RCRA processes. Long-term surveillance, maintenance, and post-closure activities will continue past 2006 (DOE 1999k, DOE 1996b, DOE 1996c).

Environmental restoration wastes for Y-12, ORNL, and ETTP are presented in Table 4.11.2–1. Environmental restoration waste is primarily contaminated soils and liquids generated from monitoring wells, soil removal, and cleaning of environmental restoration equipment. Table 4.11.2–1 addresses LLW, mixed-LLW, hazardous waste, and sanitary/industrial waste.

TABLE 4.11.2–1.—*Summary of Cleanup/Stabilization Related Waste Generation by Waste Type in Kilograms (cubic meters)[a] in 1998*

Waste Type	Y-12	ORNL	ETTP
Low-Level Waste	0 (0)	0.3 million (273)	0.24 million (237)
Mixed Low-Level Waste[b]	1.0 million (990)	29,000 (29)	0.65 million (646)
Hazardous Waste[b]	1.3 million (1,298)	14,000 (14)	2,000 (2)
Sanitary/Industrial	0.45 million (453)	0.77 million (770)	0.7 million (715)

[a] Assumes 1,000 kilograms equals 1 cubic meter.
[b] Includes TSCA wastes.
Source: DOE 1999i.

4.11.3 Pollution Prevention

The *Pollution Prevention Act* of 1990 and the *Hazardous and Solid Waste Amendments* of 1984 enabled Federal agencies to implement the pollution prevention program. NEPA's original purpose, which was to promote efforts that will prevent or eliminate damage to the environment was complemented by both acts. This relationship was further strengthened in a 1993 memorandum from the CEQ, which recommended that Federal agencies incorporate pollution prevention principles, techniques, and mechanisms throughout their NEPA planning and decision making processes. To comply with the waste minimization requirements, DOE-ORO established a Pollution Prevention and Waste Minimization Program. This section provides detailed information regarding pollution prevention and waste minimization at Y-12. For completeness and comparison, information regarding pollution prevention and waste minimization at ORNL and ETTP has also been included.

EPA has published strategies and guidelines to help facilities meet regulatory requirements. The *Pollution Prevention Act* establishes an environmental protection hierarchy, with source reduction as the most desirable environmental management option. If pollution cannot be prevented at the source, then the following waste management options should be explored in order of preference: reuse, recycling, treatment, and disposal. Waste avoidance is accomplished by source reduction or the recycling of solid wastes regulated by RCRA. Pollution prevention complements the concept of waste avoidance by focusing on source reduction and other practices that reduce or eliminate pollutants through increased efficiency in the use of raw materials, energy, water, or other resources or protection of natural resources by conservation. Waste avoidance is an applied element of the pollution prevention process.

Y-12 Pollution Prevention Program. The Y-12 Pollution Prevention Program is consistent with DOE and other legal requirements and designed to eliminate or minimize pollutant releases to all media and incorporate a pollution prevention ethic into the facility. In 1998, Y-12 reported 36 pollution prevention projects accounting for approximately 13,601 m^3 (13,601,247 kg) in waste reduction. The reported cost savings/avoidance was estimated at \$3.6 million. In 1997, Y-12 reported 46 projects, 18,916 m^3 (18,916,347 kg) of reduction, and a cost savings/avoidance of \$4.5 million (DOE 1999i).

This program has been distinguished with several awards including the White House Closing the Circle Award in 1995. More recently, two awards for an innovative approach to environmental restoration work at Y-12 were the 1998 Oak Ridge Operations Pollution Prevention Award and DOE's National Pollution Prevention Award, for work performed on the Chestnut Ridge Filled Coal Ash Pond Project and the Pollution Prevention Information Management System to track pollution prevention projects (DOE 1999k).

Source Reduction. Source reduction emphasizes the aspect of preventing and reducing the creation of wastes through process change, material substitution, and administrative policies. Efforts at Y-12 to reduce and eventually eliminate emissions and waste at the site have proven successful, shown by a decrease of LLW by more than 62 percent from 1993 to 1998. These reductions have meant significant savings on the cost of waste disposal as well as notable improvement to the environment. Cost savings/avoidance show a reduction of over \$2 million during the last several years. Table 4.11.3–1 compares waste generation data for 1993 and 1998. Table 4.11.3–2 shows specific waste generation reduction measures to reduce for all waste types. Table 4.11.3–3 shows (for 1998) ORNL and ETTP efforts.

TABLE 4.11.3–1.—*Reduction in Waste Volumes at Y-12 from Total Operations in Kilograms (cubic meters)*[a]

Waste Type	1993	1998	% Reduction
Low-Level Waste	5.8 million (5,760)	2.2 million (2,200)	62
Mixed Low-Level Waste	2.6 million (2,630)	1.2 million (1,200)	54
Hazardous Waste	9.9 million (9,920)	1.3 million (1,300)	84
Nonhazardous Waste	43.9 million (43,900)	7.2 million (7,200)	84

[a]Assumes 1,000 kilograms equals 1 cubic meter.
Source: DOE 1999b; LMES 1999a.

Process Changes. Process changes (i.e., affirmative procurement, equipment or redesign procedural controls) were examined to ensure that wastes are avoided to an extent that is technically and economically feasible. In 1999, Y-12 began implementation of Affirmative Procurement Initiatives. The training and guidelines for all employees includes appropriate protocol for the purchase of the EPA-designated items, as well as appropriate protocol for making purchases (such as searching several databases before making outside purchases). The guidelines will also include steps to disposition materials when useful life has expired (DOE 1999i).

Material Substitution. Material substitution is the replacement of otherwise harmful chemicals with a more environmentally-friendly product which achieves the same level of efficiency. For example, since reducing the usage of solvents and cleaners containing CFCs by 98 percent, emissions have been reduced by 92 percent since 1992.

Administrative Policies. Top management is committed to take appropriate action to support the objectives of the Pollution Prevention and Waste Avoidance Program by ensuring the availability of adequate personnel, budget, training, and materials. Administrative polices at Y-12 assure involvement of all employees in the facilities program through the implementation of a Pollution Prevention and Waste Avoidance team, employee incentives, program feedback, employee training, database tracking system, and cost allocation. Information sharing and benchmarking activities included the Y-12 Pollution Prevention staff presenting an exhibit at the TDEC Annual Hazardous and Solid Waste Management Conference. The exhibit highlighted pollution prevention initiatives at the site such as the award fee incentive program, project successes, and other recognition programs. The Y-12 Plant Recycle Training and Procedure was revised to include a 12-minute video that outlines recycling initiatives at Y-12. A new informational brochure has also been prepared that provides recycling guidelines for plant recycling initiatives and activities (DOE 1999i).

TABLE 4.11.3–2.—*Pollution Prevention and Waste Avoidance Accomplishments at Y-12 in 1998*

Reduction Techniques	Specific Reduction Measures
Process Changes	Inventory reduction
Affirmative Procurement	Recycled materials purchased Disposition of material considered before purchase Content of hazards considered before products are purchased
Technical Redesign	Asbestos/Fibrous Waste Compactor Lathe modification eliminating LLW cutting fluid
Procedural Controls	Anion determination by microbore ion chromatography Implemented new oil preparation procedure Reduced analytical sample size
Maintenance Procedures	Consolidated waste oils from 8 storage tanks into 3 storage tanks using automated system Upgraded oiling system of various machines having excessive oil leaks
Material Substitution	Substituted lead-free wire for lead wire Filter substitution to acrylic, resin bonded, graded density cartridge filters for cotton string wound cartridge filters Switched to digital imaging from traditional photographs
Administrative Polices	Progress Reports
Pollution Prevention/Waste Avoidance Team	Set goals for reducing volume of wastes and other pollutants Performed waste stream assessments Member of Environmental ALARA Team
Employee Incentives	Conducted the 1998 Y-12 Plant Pollution Solutions Award Program ORR Pollution Prevention Program receives award
Employee Training	Recycle Training revised
Database Tracking	Provided demonstration of the Oak Ridge Reservation Pollution Prevention Information Management System to the West Valley Nuclear Facility
Waste Characterization	RCRA Annual Report Evaluated 838 waste streams Eliminated a regulated waste oil stream Elimination of F-listed waste stream
Recycling and Reuse	Established plant swap shop database for surplus reusable material Welding rod and wire were sold/donated for reuse Antifreeze recycling Scrap Metal Removal CFC Management Fluorescent and incandescent bulb recycling Dry transformers recycled Computer donations Scrap non-precious metal recycling including lead Cardboard recycling Auto parts recycling including tires Coal ash reuse as fill material at the Y-12 landfill Lead acid battery recycle Wood recycling as mulch Paper and office material recycling including toner cartridges, mixed paper, file folders, and aluminum cans

Source: DOE 1999i.

TABLE 4.11.3–3.—*Summary of Pollution Prevention Activities at Y-12, Oak Ridge National Laboratory and East Tennessee Technology Park in 1998*

Site	Number of Pollution Prevention Projects	Waste Reduction (m^3)	Reported Savings (Thousands)
Y-12	29	11,127	$2,429
ORNL	24	40,290	$14,566
ETTP	46	11,019	$5,287

Source: DOE 1999i.

Recycling and Reuse. Waste reduction and elimination are promoted through the implementation of onsite and offsite recycling, reuse, and reclamation activities. In 1998, the cleanup/cleanout campaign sold various scrap metals to an outside vendor for cleaning and recycling. This eliminated the need to transfer the scrap and reduce mixed-LLW by approximately 700 m^3 (916 yd^3) for a reported cost savings/avoidance of nearly $300,000. The scope of the recycling program focuses on hazardous and office-generated waste.

Solid waste recycling features techniques used to reduce landfill usage including source reduction of waste streams wherever feasible and efforts to achieve total recycling of waste streams such as paper, aluminum, and scrap wood. The Y-12 recycling program was designed to support four major goals: (1) increase the longevity of the Y-12 landfill, (2) reduce costs to Y-12, (3) conserve energy and natural resources, and (4) comply with federal waste minimization regulations. Due to the success of the plant-wide paper and aluminum recycling program (98 percent of aluminum cans were recycled in 1995), additional waste streams have been identified and targeted for recycling. These streams include coal ash recycling, automotive recycling in the Y-12 garage, fluorescent bulbs, toner cartridges, and implementation of the Y-12 Swap Shop (DOE 1999i).

Assessments. Y-12 created a Pollution Prevention and Waste Avoidance team to coordinate and track a program that promotes the exchange of related information. In 1998, the Y-12 Program evaluated over 838 waste streams, of which 148 waste streams were generated in 1998. Of these 148 generating waste streams, 68 met reduction goal criteria. There were 35 pollution prevention projects identified covering 36 waste streams, and 77 waste streams will be evaluated in the future, some of which currently meet reduction goal criteria (DOE 1999i).

Technology Transfer. The purpose of technology transfer programs is to enhance the competitiveness of U.S. industries in the global economy. Technology transfer opportunities will also aid in reducing DOE's cost for maintaining nuclear competence by making on-site facilities available to U.S. industries.

To reduce future emissions and stabilize wastes to meet LDR standards, DOE technology transfer efforts include the development of DOE and/or commercially available technologies. Y-12 is partnering through the Oak Ridge Centers for Manufacturing Technology sponsored by DOE's Office of Technology Development to develop and implement technologies. These technologies are to facilitate compliance with current and future environmental laws, regulations, and agreements; minimize the generation of wastes; clean up DOE sites at less cost than current technologies; and ensure a trained work force is available. For example,researchers are currently investigating the potential to selectively extract uranium from contaminated soils from the uranium processing facility at Y-12 (LMES nda).

Energy Conservation. The Y-12 energy management team reduced plant-wide energy use by 43.1 percent over a 13-year period and won a 1996 Renew America Award for its energy efficiency efforts (DOE 1996d).

Water Conservation. In 1994, 7.4 billion L (1.9 billion gal) of filtered water were consumed. By 1998, this decreased by 21 percent to 5.7 billion L (1.5 billion gal) of water.

4.12 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY/RADIATION

Current activities associated with routine operations at Y-12 have the potential to affect worker and public health. Air emissions from Y-12 can expose both groups to radioactive and nonradioactive materials. Liquid effluents discharged to nearby water bodies may affect downstream populations using the water for drinking water purposes and recreation. Additionally, workers are exposed to occupational hazards similar to those experienced at most industrial work sites.

The following discussion characterizes the human health impacts from current releases of radioactive and nonradioactive materials at Y-12. It is against this baseline that the potential incremental and cumulative impacts associated with the No Action – Planning Basis Operations Alternative and other alternatives can be compared and evaluated.

4.12.1 Public Health

Radiological. In 1998, the potential MEI dose from Y-12 operations was 1.9 mrem. Atmospheric releases from Y-12 operations results in a dose of 0.53 mrem. Radioactivity in liquid effluents from ORR results in an MEI dose of 1.44 mrem. The MEI dose standard for all pathways is 100 mrem per year. The standard for airborne releases is 10 mrem per year and applies to the sum of doses from all airborne pathways (inhalation, submersion in a plume, exposure to radionuclides deposited on the ground surface, and consumption of foods contaminated as a result of deposition of radionuclides). Both the airborne and all pathway EDEs for the MEI are significantly below these limits. Additionally, DOE standards include a limit of 4 mrem per year to the MEI from the drinking water pathway. Of the estimated MEI dose of 2.1 mrem per year, 0.4 is from the drinking water pathway which is well below the 4 mrem limit. Table 4.12.1–1 summarizes these doses to the MEI.

Based on 1990 census data, the population within 80 km (50 mi) of Y-12 is approximately 880,000. In 1998 the collective EDE to that population (i.e., the total dose received by all 880,000 people) was 4.3 person-rem from atmospheric releases at Y-12. Populations drinking water from various water treatment plants downstream of Y-12 potentially received a collective dose equivalent of 1.8 person-rem. These doses from air and liquid releases represent approximately 0.002 percent of the collective dose received from naturally occurring sources of radiation. Based on a dose to risk conversion factor of 5.0×10^{-4} fatal cancers per person-rem (ICRP 1991), the collective EDE of 6.13 person-rem could result in less than one additional latent cancer death within the population. The collective dose is also presented in Table 4.12.1–1.

A more detailed discussion of sources of radiation exposure, calculating radiation doses, and estimating risk from exposure to radiation is presented in Appendix D, Human Health and Worker Safety.

TABLE 4.12.1–1.—*Potential Radiological Impacts to the Public Resulting from Normal Operation of Y-12*

Affected Environment	Dose
Maximally exposed individual (public)	
Atmospheric releases	
Dose (mrem/yr)	0.53
Percent of natural background[a]	0.18
Liquid releases	
Dose[b] (mrem/yr)	1.44
Percent of natural background[a]	0.48
Atmospheric and liquid releases	
Dose[c] (mrem/yr)	2.1
Percent of natural background[b]	0.9
Offsite population within 80 km	
Atmospheric and liquid releases	
Dose[d] (person-rem/yr)	6.13
Percent of natural background[a]	2.3×10^{-3}
Fatal cancer risk[e]	3.0×10^{-3}

[a] Dose from natural background radiation levels the average individual is exposed to is 300 mrem per year; to the population within 80 kilometers (880,000 persons) background levels are estimated to be 264,000 person-rem.
[b] Dose to the MEI include liquid effluents for ORR (drinking water at the Kingston Water Plant, fish consumption from Clinch River and Poplar Creek, and other water recreational activities), and direct shoreline radiation of 1 mrem to an individual at Poplar Creek.The dose does not include MEI dose from eating deer, geese, or turkey.
[c] This assumes that the same person receives both the maximum air and liquid doses, which is highly unlikely.
[d] Dose includes population exposure to radionuclides in airborne releases and consumption of drinking water from downstream sources.
[e] Based on dose-to-risk conversion factor of 5.0×10^{-4} latent cancer fatalities per person-rem of radiation exposure to the general public (ICRP 1991).
Source: DOE 1999k.

4.12.2 Worker Health

Radiological. One of the major goals of DOE is to keep worker exposures to radiation and radioactive material as low as reasonably achievable (ALARA). The purpose of an ALARA program is to minimize doses from both external and internal exposures. Such a program must evaluate individual and collective doses to ensure the minimization of both.

The average annual dose to an involved worker at Y-12 during 1998 was 11.4 mrem. The dose to the involved workforce of 3,563 radiation workers was estimated to be 40.6 person-rem. The individual and collective doses for the entire work force of 5,128 workers from 1990 to 1998 can be found in Table D.2.3.1–1 in Appendix D, Human Health and Worker Safety.

Workers exposed to radiation have a risk of 0.0004 per person-rem of contracting a fatal cancer (ICRP 1991 and NCRP 1993). Based on this dose to risk conversion factor, the entire exposed population of Y-12 radiation workers could expect to receive an additional 0.016 cancer deaths due to their 1998 exposure. Thus, as with the public, the annual radiation dose to Y-12 workers results in a calculated cancer fatality risk that is extremely small in comparison to the natural incidence of fatal cancer.

Y-12 worker doses have typically been well below DOE worker exposure limits. Table 4.12.2–1 lists the individual and collective doses for all radiation (involved) workers from 1990 to 1998, as presented in the Y-12 Dosimetry Record System database. Table 4.12.2–2 lists the individual collective doses for all monitored workers from 1990 to 1998. Monitored workers include radiation workers, nonradiation workers, and visitors.

Chemicals used at Y-12 that are of particular concern due to their extensive use in plant operations and the nature and the potential adverse health effects from exposure include mercury, beryllium, PCBs, polycyclic aromatic hydrocarbons, and volatile organic compounds. In addition to the risks from these chemicals, workers at Y-12 are at risk from potential industrial accidents, injuries, and illnesses due to everyday operations. Details on the consequences to worker exposures to workplace chemicals and to other potential sources of impacts to health and safety are discussed in Appendix D, Human Health and Worker Safety.

TABLE 4.12.2–1.—*Y-12 Radiological Worker Annual Individual and Collective Radiation Doses*

Year	Number of Radiological Workers	Average Individual Worker Dose (mrem)	Radiological Worker Collective Dose (person-rem)
1990	2,907	14.8	43.16
1991	3,050	7.3	22.27
1992	2,787	13.1	36.46
1993	2,701	6.8	18.48
1994	2,533	5.4	13.58
1995	2,924	3.1	9.10
1996	3,140	3.1	9.73
1997	3,552	2.96	10.51
1998[a]	3,563	11.4	40.61

[a]1998 data reflect higher doses due to the use of a more conservative risk model in 1998 than that used in previous years and the restart of some uranium operations.
Source: Y-12 1999b.

TABLE 4.12.2–2.—*Annual Radiation Doses for All Monitored Y-12 Workers*

Year	Number of Monitored Workers	Average Individual Worker Dose (mrem)	Site Worker Collective Dose (person-rem)
1990	9,799	5.0	48.95
1991	10,824	2.7	29.60
1992	10,273	3.7	37.91
1993	9,995	2.1	20.52
1994	9,748	1.6	15.31
1995	9,327	1.1	10.27
1996	9,159	1.2	10.90
1997	4,758	2.2	10.69
1998[a]	5,128	8.0	41.24

[a]1998 data reflect higher doses due to the use of a more conservative risk model in 1998 than that used in previous years and the restart of some uranium operations.
Source: Y-12 1999b.

4.13 ENVIRONMENTAL JUSTICE

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," signed by President Clinton in February 1994, requires each Federal agency to formulate a strategy for addressing environmental issues in human health- and environment- related programs, policies, planning and public participation processes, enforcement, and rulemakings. The White House memorandum accompanying the Executive Order directs Federal agencies to "analyze the environmental effects . . . of Federal actions, including effects on minority communities and low income communities, when such analysis is required by NEPA."

Any disproportionately high and adverse human health effects on minority populations or low income populations that could result from the Y-12 alternatives being considered are assessed for an 80-km (50-mi) radius around the site, the area for which health effects are assessed. Any health effects resulting from discharge to water pathways would also be assessed for this area. Minority and low-income populations in this area are shown in Figures 4.13–1 and 4.13–2, respectively. Figure 4.13–3 shows the census tracts surrounding the ORR. Minority populations for these tracts are shown in Table 4.13–1, and low-income populations are shown in Table 4.13–2. Socioeconomic impacts associated with environmental justice concerns are assessed for the four-county ROI described in Section 4.3, Socioeconomics.

Approximately 880,000 people live within a 80-km (50-mi) radius of ORR. Minorities compose 6.1 percent of this population. In 1990, minorities composed 24.1 percent of the population nationally and 17 percent of the population in Tennessee. There are no federally recognized Native American groups within 80 km (50 mi) of the Y-12 Plant. The percentage of persons below the poverty level is 16.2 percent, which is slightly higher than the 1990 national average of 13.1 percent but much lower than the statewide figure of 30 percent (Census 1990).

The Scarboro community is a primarily minority community located approximately 1 km (0.5 mi) north of Y-12. This community has been included in a number of epidemiological health studies conducted by an independent group overseen by the Tennessee Department of Health outlined in Appendix D. Mercury health studies have shown that estimates for mercury intake for Scarboro residents exceeded standards for inhalation of mercury during the years of peak mercury release in the late 1950s. Impacts of uranium releases to the air on the community between 1944 and 1995 were analyzed to determine if cancer risks from uranium releases are elevated for this community. The analyses reported career screening indexes that were slightly lower than the investigators decision guide for carcinogens, but with a great deal of uncertainty.

The Health Studies Report of PCB releases from the ORR prior to the early 1970's outlined in Appendix D concluded that some fishermen at the Clinch River and Watts Bar Reservoir have eaten enough fish from these sources to affect their health, including excess cancers, but estimates of how many have been affected are not possible at this time. Further studies were recommended, including studies of fish and turtle consumption, PCB blood levels in people consuming fish, PCB levels in core samples from the Clinch River and the Watts Bar Reservoir, PCB levels in the soils near EFPC, and PCB levels in cattle grazing near the creek. There are no populations in the area completely dependent on consumption of these fish from the Clinch River and the Watts Bar Reservoir for subsistence.

TABLE 4.13–1.—*Population Distribution by Race in Oak Ridge Census Tracts*

Tract	Total Population	White		Black		Other non-white		Hispanic[a]	
		Total	%	Total	%	Total	%	Total	%
201	2,767	1,620	58.5	951	34.4	196	7.1	19	0.7
202	6,260	5,820	93.0	228	3.6	212	3.4	124	2.0
203	4,395	4,107	93.4	232	5.3	56	1.3	39	0.9
204	4,544	4,231	93.1	251	5.5	62	1.4	93	2.0
205	3,932	3,625	92.2	257	6.5	50	1.3	26	0.7
206	2,735	2,478	90.6	158	5.8	99	3.6	72	2.6
301	2,567	2,438	95.0	71	2.8	58	2.3	64	2.5
Total	27,200	24,319	89.4	2,148	7.9	733	2.7	437	1.6

[a]Hispanic origin may be any race and is included in other totals.
Source: Census 1992.

TABLE 4.13–2.—*Oak Ridge Families Living Below Poverty Level, by Census Tract (1989)*

Census Tract	Number of Families Below Poverty Level	Percentage of Total Families in Census tract Below Poverty Level
201	142	20.9
202	68	3.8
203	59	4.4
204	95	7.0
205	195	17.6
206	0	0
301	9	1.1

Source: Census 1990.

Source: Census 1992.

FIGURE 4.13–1.—*Minority Population in the Region of Influence.*

Source: Census 1992.

FIGURE 4.13–2.—*Low Income Population in the Region of Influence.*

FIGURE 4.13–3.—*City of Oak Ridge Census Tracts.*