

Supplement to the Environmental Report

for the American Centrifuge Lead Cascade Facility

in Piketon, Ohio



Revision 0

Docket No. 70-7003

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LA-2605-0002S

**SUPPLEMENT TO THE ENVIRONMENTAL REPORT
FOR THE AMERICAN CENTRIFUGE LEAD CASCADE FACILITY
in Piketon, Ohio**

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<u>Page No.</u>	<u>Revision</u>
Cover Page	0
Inside Cover Page	0
ULOEP-1	0
ULOEP-2	0
i	0
ii	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0

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TABLE OF CONTENTS

1.0	INTRODUCTION	1
2.0	ALTERNATIVES.....	4
3.0	DESCRIPTION OF THE AFFECTED ENVIRONMENT	5
4.0	ENVIRONMENTAL IMPACTS.....	6
5.0	MITIGATION MEASURES	9
6.0	ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS	10
7.0	COST BENEFIT ANALYSIS	10
8.0	SUMMARY OF ENVIRONMENTAL CONSEQUENCES.....	10
9.0	LIST OF REFERENCES.....	10
10.0	LIST OF PREPARERS.....	11
11.0	GLOSSARY	11

LIST OF TABLES

Table 1-1	Regulatory Permits.....	2
Table 4-1	Maximum Public Radiation Dose	7
Table 4-2	Recordable Injury/Illness Rates.....	7
Table 4-3	Waste Quantities for Major Waste Types	9

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1.0 INTRODUCTION

An Environmental Report was submitted by USEC Inc. (USEC) during the initial licensing process for the American Centrifuge Lead Cascade Facility (here after referred to as the Lead Cascade) located on the Portsmouth Gaseous Diffusion Plant (PORTS) reservation in Piketon, Ohio. The Lead Cascade materials license (SNM-7003) was issued to USEC in February 2004 and in October 2008 was extended for 30 months. The Lead Cascade license limits possession of nuclear material to 250 kilograms of uranium hexafluoride (UF₆). Based on the information provided in the initial Environmental Report for the Lead Cascade (LA-2605-0002), the U.S. Nuclear Regulatory Commission (NRC) determined that construction of the Lead Cascade would not represent a significant environmental impact. This document supplements the Environmental Report for the Lead Cascade, and is being submitted in accordance with 10 *Code of Federal Regulations* (CFR) 51.60.

Environmental information regarding the site was also provided in the Environmental Report for the American Centrifuge Plant (ACP) (LA-3605-0002) to support licensing of a commercial uranium enrichment facility. This Environmental Report incorporated and, in some instances, updated and expanded, information provided in the Environmental Report for the Lead Cascade. The NRC utilized the ACP Environmental Report to support development of an Environmental Impact Statement for construction and operation of the ACP. The NRC approved and issued to USEC a license to construct and operate the ACP utilizing the same facilities as the Lead Cascade on April 13, 2007.

The necessary modifications to facilities were made, and machine parts were manufactured, transported, and assembled as proposed in the Lead Cascade License Application. The Lead Cascade began initial operations on June 6, 2007 and associated releases to air and water, exposure to personnel, and personnel injuries/illnesses have been monitored to enable assessment of environmental impacts. Based on this monitoring, it was concluded that operation of the Lead Cascade has not resulted in any unanticipated releases, discharges, or exposures to the environment, the public, or employees. Information resulting from actual machine manufacture, transportation, assembly and operation is included in this Supplement. The Environmental Assessment, Finding of No Significant Impact will be further substantiated, as the operational data provided in this Supplement will demonstrate that the environmental impacts associated with the Lead Cascade are less than were originally anticipated.

This Supplement addresses changes that have occurred for items discussed in the original Environmental Report that were not incorporated into the Environmental Report for the ACP. This Supplement updates estimated data with actual operational data wherever possible.

Changes to the License Application and Supporting Documents are reviewed and approved in accordance with 10 CFR 70.72 requirements. Depending on the type of change, prior NRC approval may or may not be necessary. An update to the Environmental Report for the Lead Cascade is being provided which reflects changes that have been made since issuance of the license for the Lead Cascade. Changes to the Lead Cascade activities as they were described in the Environmental Report are being discussed in this Supplement.

Section 1.1 (Background of USEC and PORTS) of the Environmental Report for the Lead Cascade discussed the status of the PORTS as being in Cold Standby, meaning that the facility could be restarted at some point in the future, if required. That plant transitioned to Cold Shutdown status on October 1, 2005 and the Decontamination & Decommissioning (D&D) of inactive facilities began. In August of 2010 the U.S. Department of Energy (DOE) awarded the contract for complete D&D of the gaseous diffusion plant (excluding facilities supporting other site entities, including the Lead Cascade and ACP). Mobilization for D&D is underway.

Section 1.5 (Applicable Regulatory Requirements, Permits, and Required Consultations) of the Environmental Report for the Lead Cascade discussed the regulatory permits necessary to construct and operate the Lead Cascade. The required permit applications were submitted to the appropriate regulatory agency and the necessary permits are in place for construction and operation of the Lead Cascade. Table 1-1 below provides an updated listing of Regulatory Permits.

Table 1-1 Regulatory Permits

Submittal	Agency	Date Submitted	Agency Response	Comments
AIR				
X-3001 Purge Vacuum/Evacuation Vacuum Vent Permit To Install (PTI)	Ohio Environmental Protection Agency (OEPA)	Submitted March 26, 2004	Final PTI Issued July 22, 2004	After no more than one year Air PTIs are rolled into site Title V Permit, which was updated on 6/8/2010 and is awaiting agency response.
Diesel Fuel Storage Tank PTI (X-3001 Aboveground Storage Tank)	Ohio Department of Commerce	Submitted April 19, 2005	Final PTI Issued July 25, 2005	After no more than one year Air PTIs are rolled into site Title V Permit, which was updated on 6/8/2010 and is awaiting agency response.
X-3001 PTI (11 Air Sources: {1} Feed Cart {2} Sample Carts {2} Dump Carts {5} Maint. Gulpers)	OEPA	Submitted December 8, 2004	OEPA Issued Final PTI March 15, 2005	After no more than one year Air PTIs are rolled into site Title V Permit, which was updated on 6/8/2010 and is awaiting agency response.
High Efficiency Particulate Air (HEPA) Filtered Vacuum Cleaners Number 1 and Number 2 (PTI)	OEPA	Submitted May 3, 2005	Final PTI Issued August 16, 2005	After no more than one year Air PTIs are rolled into site Title V Permit, which was updated on 6/8/2010 and is awaiting agency response.
Ice Solve HEPA Filtered Air Cleaner	OEPA	Submitted February 26, 2009	Final PTI issued June 10, 2009	After no more than one year Air PTIs are rolled into site Title V Permit, which was updated on 6/8/2010 and is awaiting agency response.

Submittal	Agency	Date Submitted	Agency Response	Comments
Nikro HEPA Filtered Vacuum Cleaners Numbers 3, 4, 5, and 6 (PTI)	OEPA	Submitted March 9, 2009	Final PTI issued July 9, 2009	After no more than one year Air PTIs are rolled into site Title V Permit, which was updated on 6/8/2010 and is awaiting agency response.
Pump Down Cart Number 1 (PTI)	OEPA	Submitted May 1, 2009	Final PTI issued December 15, 2009	After no more than one year Air PTIs are rolled into site Title V Permit, which was updated on 6/8/2010 and is awaiting agency response.
USEC Title V Permit Modification (includes all USEC air source PTIs)	OEPA	Title V Renewal Submitted February 10, 2008 Title V Update Submitted June 8, 2010	OEPA response pending	An updated request for a general renewal of the Title V permit (including the Lead Cascade sources) was submitted to and accepted by OEPA in 2008. A further modification application (including Lead Cascade air sources) was submitted and accepted in 2010. OEPA rules allow an automatic extension of existing air permits (PTIs and/or Title V) if the application is submitted within schedule and OEPA does not explicitly act on the submission prior to permit expiration.
National Emission Standards for Hazardous Air Pollutants (NESHAP) Startup Notification	U.S. Environmental Protection Agency (USEPA)	Submitted October 20, 2006	NA	Due to the small amount of radionuclide's involved, the Lead Cascade only requires a notification in the annual NESHAP Report. No response from USEPA is required prior to construction or operation.
WATER				
Obtain DOE Consent for Installation of Composite Samplers/Flow Measuring Devices at DOE Outfalls	DOE	Submitted Request to DOE November 23, 2004	DOE Concurrence January 7, 2005	
National Pollutant Discharge Elimination System (NPDES) Permit (all United States Enrichment Corporation outfalls)	OEPA	Submitted Modification Request August 24, 2007, Renewal Submitted January 2010	Modification issued May 1, 2008	Permit Modification transferred X-2230M and X-2230N outfalls from DOE's NPDES Permit to United States Enrichment Corporation's NPDES Permit. NPDES Permit expired July 31, 2010. Operating under expired permit until OEPA takes action on new permit.

Submittal	Agency	Date Submitted	Agency Response	Comments
NPDES Permit (all United States Enrichment Corporation outfalls)	OEPA	Submitted Modification Request August 24, 2007, Renewal Submitted January 2010	Modification issued May 1, 2008	Permit Modification transferred X-2230M and X-2230N outfalls from DOE's NPDES Permit to United States Enrichment Corporation's NPDES Permit. NPDES Permit expired July 31, 2010. Operating under expired permit until OEPA takes action on new permit.
SOLID WASTE				
None			NA	OEPA has adopted the Federal exemption for Mixed Waste effective December 7, 2004 (Ohio Administrative Code 3745-266). No permit submittal is required relative to Lead Cascade waste.
			NA	Waste Tracking initiated 2-2004
Emergency Planning & Community Right-to-Know Act/Superfund Amendments and Reauthorization Act Title III				
			NA	Chemical Inventory and Material Safety Data Sheet initiated 2-2004
Occupational Safety and Health Administration (OSHA)				
			NA	OSHA Log and RII tracking initiated 2-2004

2.0 ALTERNATIVES

Once the Lead Cascade Materials License was issued by the NRC, USEC followed through with implementation of the proposed action. The Lead Cascade was constructed within existing facilities at the PORTS site. Machine parts were manufactured, transported, and assembled into completed centrifuge machines and were installed in the facility. The Lead Cascade became operational on June 6, 2007.

The only alternative to continued operation of the Lead Cascade would be to terminate its operation. Continued operation of the Lead Cascade allows additional data to be obtained by completing additional reliability and performance testing, which supports the ultimate goal of successful deployment of the ACP.

The cumulative impacts of the Lead Cascade, when added to impacts from past, present, and future (i.e., 5 years) actions are insignificant when compared to the ACP 30-year construction and operating License, and PORTS reservations activities, including uranium hexafluoride deconversion by DOE Contractor and the upcoming D&D of the gaseous diffusion plant. Moreover, the Environmental Report for the ACP found the total cumulative impacts and

effects of the ACP are expected to be insignificant when compared to the federal, state, and local regulatory limits and the positive cumulative effects of job opportunities and revenues generated.

3.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

A review of Chapter 3.0 of the Environmental Report for the Lead Cascade was completed and updated information is provided by section in the following paragraphs.

Section 3.1.1 (PORTS Site) of the Environmental Report for the Lead Cascade noted that the typical electricity consumption rate is approximately 36.5 megawatts (MW). The 2009 electricity consumption rate for the site was 30.2 MW.

Section 3.2 (Land Use) of the Environmental Report for the Lead Cascade details how site access is limited and controlled. The Environmental Report for the Lead Cascade was prepared a short time after the September 11, 2001 terrorist attack on the United States. Additional security measures were taken at that time to limit access to the site by utilizing a single entry point (the main entry point from U.S. Route 23). Since that time, some access roads have been opened up, which allows public access to a portion of the site perimeter road. However, there is currently no public access to the Lead Cascade portion of the site.

Section 3.5.1 (Surface Water) of the Environmental Report for the Lead Cascade detailed the ownership of discharge points (outfalls) from the site. In support of the Lead Cascade operations, DOE and United States Enrichment Corporation NPDES permits have been modified to transfer ownership of certain discharge points. DOE now has four discharge points, of which three discharge to the X-6619 Sewage Treatment Plant (STP), and one via an unnamed tributary to Little Beaver Creek. United States Enrichment Corporation now has fourteen permitted discharge points of which ten discharge directly to surface water (Scioto River, Little Beaver Creek, Big Run Creek, Piketon DOE Tributary, and West Ditch), three to the X-6619 STP and one to the South Holding Pond.

Section 3.5.2 (Groundwater) of the Environmental Report for the Lead Cascade stated contaminated groundwater was treated at the X-622, X-622T, X-623, X-624, and X-625 Groundwater Treatment Facilities. Two of those facilities (X-622T and X-625) have since closed and one new facility (X-627) has been permitted by DOE. A revised listing is provided below.

- X-622 – Trichloroethane (TCE)-contaminated groundwater from the X-231B Southwest Oil Biodegradation Plot, the X-749 Contaminated Materials Disposal Facility, and the Peter Kiewit groundwater collection system is processed at the X-622 treatment unit using activated carbon and green sand filtration.
- X-623 – This groundwater treatment facility consists of an air stripper with off-gas activated carbon filtration and aqueous-phase activated carbon filtration. X-623 provides treatment for contaminated groundwater from the X-701B holding pond and three groundwater extraction wells in the X-701B plume area.

- X-624 – TCE-contaminated groundwater from the X-237 interceptor trench associated with the X-701B plume is treated via an air stripper with off-gas activated carbon filtration, plus carbon filtration of the effluent water.
- X-627 – TCE-contaminated groundwater treatment facility for the sumps from the X-700 and X-705 buildings.

The Lead Cascade air emissions sources have been incorporated into the United States Enrichment Corporation's Title V permit, which was issued by the Environmental Protection Agency (EPA) on July 31, 2003. The latest update to the Title V permit was submitted on June 8, 2010.

The latest information for the site air quality, employment statistics, and waste generation rates can be found in the Environmental Report for the ACP.

Information provided in the Environmental Report for the Lead Cascade in Tables 3.11-4, 3.11-5, 3.11-6, 3.11-7, and 3.11-8 was based on census data. At the time of writing of this Supplement, no new census data was available.

4.0 ENVIRONMENTAL IMPACTS

USEC followed through with the described proposed action, and the necessary facilities required to support the Lead Cascade were leased from DOE by the United States Enrichment Corporation then subleased to USEC, modified, and are being utilized for operation of the Lead Cascade.

The Lead Cascade has operated within the limits established by the Materials License and occupies a portion of one train in a single process building.

The X-7725 Recycle/Assembly Building was slated in the Environmental Report for the Lead Cascade for offices and completed machine transport area. As the project progressed, the need to utilize this building for storage, handling, and assembly of centrifuge machines/components was recognized.

Appendix C of the Environmental Report for the Lead Cascade previously stated that the number of chemical traps would be eight. The actual number of chemical traps required for the Lead Cascade is four.

In the initial Environmental Report for the Lead Cascade, the maximum public radiation dose was estimated to be up to $2.3E-2$ millirem per year (mrem/yr) due to gaseous releases and no public dose other than Naturally Occurring Radioactive Material (NORM) in liquid releases. It was noted that these anticipated doses were much lower than the EPA limit of 10 mrem/yr and the NRC Total Effective Dose Equivalent limit of 100 mrem/yr. The table below updates this information with data through calendar year 2009. The calculated public airborne radiation doses are all lower than the anticipated maximum, the EPA standard, and the NRC limit. In the liquid releases, the calculated doses are consistent with NORM as the only source of exposure.

Table 4-1 Maximum Public Radiation Dose

	Maximum Public Radiation Dose (Air)		
	Distance	Direction	Calculated Dose
CY	m		mrem
2006*	1,234	S	1.7E-06
2007	1,234	S	3.7E-06
2008	1,234	S	3.2E-06
2009	1,234	S	3.6E-06
* 2006 emissions only occurred from October through December.			

Section 3.12 (Table 3.12-1) of the Environmental Report for the Lead Cascade provided the PORTS recordable injury/illness (RII) rate by fiscal year. Table 4-2 below summarizes the Recordable Injury/Illness Rates from construction, component transportation, machine assembly, and operation of the Lead Cascade from calendar year 2004 through calendar year 2009. The table also provides the Bureau of Labor Statistics (BLS) National Average for Nonresidential Building Construction (NAICS 2362). This 2009 National Average is not yet available.

Table 4-2 Recordable Injury/Illness Rates

Year	# Hours Worked	# Recordable Injuries	RII Rate	BLS National RII Average for NAICS 2362
2004	126,106	0	0	5.9
2005	190,651	0	0	5.3
2006	210,147	0	0	5.2
2007	293,801	2	1.36	4.4
2008	448,818	2	0.89	4.3
2009	591,947	1	0.34	NA

Note: The rates are calculated based on the number of injuries/illnesses divided by the number of hours worked by employees multiplied by 200,000 hours.

The latest information for site utility usage (Section 4.1.3), transportation risks (Section 4.3.3), and staffing estimates (Section 4.11.1.3) can be found in the Environmental Report for the ACP.

The Environmental Report for the Lead Cascade added Indianapolis, Indiana, Tipp City, Ohio, Michigan, Missouri, and Utah as alternate manufacturing locations and possible transport cities.

At the time of the Environmental Report, the Lead Cascade was assumed to operate through December 2007. Data from this testing program has provided valuable assembly, operating and maintenance information, as well as operating experience for the American Centrifuge staff. In support of USEC's application for a \$2 billion loan guarantee from the U.S. Department of Energy, the company continues to operate a Lead Cascade test program with

AC100 commercial plant machines at the Piketon, Ohio plant. By increasing the number of operating machine hours, USEC provides additional assurance of performance, reliability and plant availability. USEC's suppliers continue to build components and assemble machines for the Lead Cascade program, demonstrating machine manufacturing capability and sustaining key infrastructure for remobilization.

It was estimated that an additional 45 jobs would be connected to the Lead Cascade. As of December 31, 2009, the Lead Cascade has brought approximately 139 jobs to Southern Ohio, with an average annual salary of \$72,840.00. On average annually, an additional \$10,124,822 flows into the Southern Ohio economy just from the Lead Cascade payroll. These jobs will be sustained during Lead Cascade operation.

Additionally, the presence of the Lead Cascade flows dollars into the local economy in the form of supplies and services necessary to support its operations. This includes food services, laundry services, janitorial and lawn care services, office supplies, laboratory supplies, gasoline, diesel fuel, etc.

Waste generation projections were provided in the initial Environmental Report for the Lead Cascade in Section 4.13.3.3 (Table 4.13-1). Table 4-3 below reflects actual Lead Cascade waste generation rates by waste category through calendar year 2009. The Lead Cascade waste has been, and will continue to be, managed in compliance with applicable waste management laws and regulations. Waste generation rates should remain fairly consistent with the 2008 and 2009 actual rates for the remainder of the Lead Cascade operations.

Table 4-3 Actual Waste Quantities for Major Waste Types

Material/Activity	Type of Waste Generated	Activity Phase	2005	2006	2007	2008	2009
Paper, construction debris, wood, concrete	Sanitary/industrial	Modification	A	A	A	A	A
Paper, office waste, bathroom supplies	Sanitary/industrial	Modification	A	A	A	A	A
Lubricants, maintenance debris	Non-regulated	Modification and Operations	2 ft ³	2 ft ³	1,337 ft ³	0	194.54 ft ³
Light bulbs and batteries	RCRA recycle	Modification and Operations	113 ft ³	75.9 ft ³	138 ft ³	185 ft ³	150 ft ³
Paper, office waste, bathroom supplies	Sanitary/industrial	Operations	510 yd ³	840 yd ³	1,290 yd ³	3,720 yd ³	3,030 yd ³
Refrigerant from withdrawal system	LLRW	Operations	0	0	0	0	0
Classified Waste	Non-regulated	Operations	0	0	0	0	0
Classified Waste	LLRW	Operations	0	0	0	0	0
General maintenance and facility materials	Mixed RCRA/LLRW	Operations	0	0	0	0	9 liters
General maintenance and facility materials	RCRA	Operations	7 ft ³	2 ft ³	5 ft ³	25 ft ³	2 ft ³
General maintenance and facility materials	LLRW	Operations	90 ft ³	<1 ft ³	N/A	90 ft ³	90 ft ³
General maintenance and facility materials	Non-regulated	Operations	B	B	B	B	B
PCB waste	TSCA	N/A	N/A	N/A	N/A	N/A	N/A
Asbestos waste	TSCA	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

- A. Modification Phase waste generated by contractors are not included in this table.
- B. The generation rate for general maintenance and facility materials are included in the annual total of the paper, office waste, bathroom supplies section of this table.

5.0 MITIGATION MEASURES

After reviews were completed of this chapter, it has been determined that no changes are required.

6.0 ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS

After reviews were completed of this chapter, it has been determined that no changes are required.

7.0 COST BENEFIT ANALYSIS

Federal and state political leadership and local residents continue to express strong support for the deployment of the full-scale uranium enrichment facility. This will not be possible without the continued operation of the Lead Cascade. The Lead Cascade has brought additional good paying jobs to the area and these employment dollars flow into the surrounding communities.

8.0 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

Operational data for three years of operation of the Lead Cascade confirm that releases and corresponding exposures from the Lead Cascade are well below regulatory limits and very small compared to other existing sources on the reservation.

Construction activities associated with the Lead Cascade were performed safely, and without serious injury to the workers. Three years of safe operation supports the implementation of adequate engineering controls, precautions, training, safety programs, and management measures. Continued operation of the Lead Cascade will be conducted in accordance with the already established and proven programs and procedures.

The Lead Cascade is operating within existing industrialized PORTS structures, so no change to existing land use patterns, plans, or destruction of wildlife habitat occurred or will need to occur in the future.

9.0 LIST OF REFERENCES

Below is a list of additional references used in the development of this Supplement:

LA-3605-0001	License Application for the American Centrifuge Plant
LA-3605-0002	Environmental Report for the American Centrifuge Plant
CAP-88-PC	Annual Dispersion Modeling/Public Dose Assessment for the American Centrifuge Lead Cascade
	BLS National RII Average for NAICS 2362

ESH-343-11-007I	Salary calculations for Supplement to the Lead Cascade Environmental Report
ESH-343-11-008I	Generation Rates for Supplement to the Environmental Report
ESH-343-11-009I	Lead Cascade RFD database table for Supplement to the Environmental Report
ESH-343-11-010I	Lead Cascade RII Data for Supplement to the Environmental Report

10.0 LIST OF PREPARERS

This Supplement was prepared by the Lead Cascade Facility Environmental Safety and Health staff.

11.0 GLOSSARY

The definitions listed below are either additional to support operational data provided or have been clarified to be consistent with the Environmental Report for the ACP. Otherwise, the Glossary of the Environmental Report for the Lead Cascade remains unchanged.

Absorbed Dose: The energy imparted to matter by ionizing radiation, also simply called dose. The unit of absorbed dose is the rad.

CAP88: A suite of computer models controlled and distributed by the EPA for modeling the dispersion of radionuclides in the atmosphere and the dose equivalents and total effective dose equivalent caused by those radionuclides. Later versions are labeled CAP-88PC to reflect that they can be run on PCs instead of mainframe computers. CAP88 is approved by the EPA for demonstration of compliance with radionuclide NESHAP.

Committed Dose and Committed Dose Equivalent: The dose or dose equivalent an organ or tissue would receive during a specific period of time (usually 50 years) as a result of intake (as by ingestion or inhalation) of one or more radionuclides from a defined release, frequently over a year's time. Also called the dose commitment.

Committed Effective Dose Equivalent (CEDE): The summation of the committed dose equivalent received by specified tissues of the body times a tissue-specific weighting factor. The sum is a risk-equivalent value and can be used to estimate the health effects risk of the exposed individual. The tissue-specific weighting factor representing the fraction of the total health risk resulting from uniform whole-body irradiation that would be contributed by the particular tissue.

Dose Equivalent: The product of absorbed dose in rad (or gray) and a quality factor, which accounts for the variation in biological effectiveness of different types of radiation. Dose equivalent is expressed in units of rem or Sievert, where 1 rem equals 0.01 Sievert.

Effective Dose Equivalent (EDE): The summation of the dose equivalent received by specified tissues of the body times a tissue-specific weighting factor. This sum is a risk-equivalent value and can be used to estimate the health effects risk of the exposed individual. The tissue-specific weighting factor represents the fraction of the total health risk resulting from uniform whole-body irradiation that would be contributed by that particular tissue.

Effluent: A gas or liquid discharged into the environment.

Hazardous waste: Any solid waste (can also be semisolid or liquid, or contain gaseous material) having the characteristics of ignitability, corrosivity, toxicity, or reactivity, defined by the *Resource Conservation and Recovery Act* and identified or listed in 40 CFR Part 261 or by the *Toxic Substances Control Act*.

Injury or Illness: An abnormal condition or disorder. Injuries include cases such as, but not limited to, a cut, fracture, sprain or amputation. Illnesses include both acute and chronic illnesses, such as, but not limited to, a skin disease, respiratory disorder or poisoning. NOTE: Injuries and illnesses are recordable only if they are new, work-related cases that meet one or more of the 29 CFR Part 1904 recording criteria.

Millirem (mrem): One one thousandth (1/1000) of a rem. A unit of radiation dose equivalent.

National Emission Standards for Hazardous Air Pollutants (NESHAP): A set of emission standards for EPA-designated hazardous air pollutants, including radionuclides emitted from specific classes or categories of new and existing sources. These were implemented in the *Clean Air Act* Amendments of 1977.

Roentgen equivalent man (REM): The unit of radiation dose equivalent.

Sanitary wastes: Wastes generated by normal housekeeping activities, liquid or solid (includes sludge), which are not hazardous or radioactive.