UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SECRETARY

December 23, 2013

COMMISSION VOTING RECORD

DECISION ITEM: SECY-13-0125

TITLE: REPORT TO CONGRESS ON THE HEALTH, SAFETY, AND ENVIRONMENTAL CONDITIONS AT THE GASEOUS DIFFUSION PLANTS LOCATED NEAR PADUCAH, KENTUCKY, AND PORTSMOUTH, OHIO

The Commission (with all Commissioners agreeing) approved the subject paper as recorded in the Staff Requirements Memorandum (SRM) of December 23, 2013.

This Record contains a summary of voting on this matter together with the individual vote sheets, views and comments of the Commission.

Annette L. Vietti-Cook
Secretary of the Commission

Attachments:
1. Voting Summary
2. Commissioner Vote Sheets

cc: Chairman Macfarlane
Commissioner Svinicki
Commissioner Apostolakis
Commissioner Magwood
Commissioner Ostendorff
OGC
EDO
PDR

SECY NOTE: THIS VOTING RECORD TO BE RELEASED TO THE PUBLIC 5 WORKING DAYS AFTER DISPATCH OF THE REPORT TO CONGRESS

VOTING SUMMARY - SECY-13-0125

RECORDED VOTES

	APRVD	DISAPRVD	ABSTAIN	NOT PARTICIP	COMMENTS	DATE
CHRM. MACFARLANE	X					12/13/13
COMR. SVINICKI	X				X	12/16/13
COMR. APOSTOLAKIS	X				X	12/12/13
COMR. MAGWOOD	X				X	12/12/13
COMR. OSTENDORFF	X				X	12/11/13

NOTATION VOTE

RESPONSE SHEET

TO: Annette Vietti-Cook, Secretary

FROM: Chairman Allison M. Macfarlane

SUBJECT: SECY-13-0125 – REPORT TO CONGRESS ON THE HEALTH, SAFETY, AND ENVIRONMENTAL CONDITIONS AT THE GASEOUS DIFFUSION PLANTS LOCATED NEAR PADUCAH, KENTUCKY, AND PORTSMOUTH, OHIO

Approved X **Disapproved** _____ **Abstain** _____

Not Participating _____

COMMENTS: **Below** ___ **Attached** ___ **None** X

SIGNATURE

12/13/13

DATE

Entered on "STARS" Yes X **No** ___

NOTATION VOTE

RESPONSE SHEET

TO: Annette Vietti-Cook, Secretary

FROM: COMMISSIONER SVINICKI

SUBJECT: SECY-13-0125 – REPORT TO CONGRESS ON THE HEALTH, SAFETY, AND ENVIRONMENTAL CONDITIONS AT THE GASEOUS DIFFUSION PLANTS LOCATED NEAR PADUCAH, KENTUCKY, AND PORTSMOUTH, OHIO

Approved X **Disapproved** _____ **Abstain** _____

Not Participating _____

COMMENTS: **Below** X **Attached** X **None** ___

I approve this report, subject to the attached edits. I also agree with Commissioner Ostendorff that the staff should provide a final summary report to Congress of NRC's oversight of USEC's Paducah Gaseous diffusion plant from October 1, 2013 through termination of Paducah's Certificate of Compliance.

SIGNATURE

12/16/13
DATE

Entered on "STARS" Yes ✓ No ___

KLS edits

U.S. NUCLEAR REGULATORY COMMISSION

REPORT TO CONGRESS

ON THE HEALTH, SAFETY,

AND ENVIRONMENTAL CONDITIONS AT THE

GASEOUS DIFFUSION PLANTS

LOCATED NEAR

PADUCAH, KENTUCKY,

AND PORTSMOUTH, OHIO

October 1, 2008~~,~~ to September 30, 2013

EXECUTIVE SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) provides this report to Congress as required by Section 1701 of the Atomic Energy Act (AEA). This is the fifth report issued on the health, safety, and environmental conditions of the gaseous diffusion uranium enrichment plants (GDPs) located near Paducah, Kentucky, and Portsmouth, Ohio, and covers the 5-year period from October 1, 2008, to September 30, 2013. The information in this report is current as of September 30, 2013, unless otherwise specified. As directed by the AEA, the NRC staff consulted with the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) in preparing this report.

DOE continues to be responsible for regulatory oversight of the non-leased portions of the Paducah GDP. The Portsmouth GDP leased facilities were returned to DOE and NRC's Certificate of Compliance (CoC) for the Portsmouth GDP was terminated in 2011. Located on the site of the Portsmouth GDP are the American Centrifuge Lead Cascade Facility (Lead Cascade) and the American Centrifuge Plant (ACP), both of which are regulated under NRC licenses issued pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 70, "Domestic Licensing of Special Nuclear Material." Except for the Lead Cascade and the ACP, the DOE is fully responsible for the regulatory oversight of all activities at the Portsmouth GDP site.

The Federal Reports Elimination Act of 1998 amended Section 1701 of the AEA to decrease the required frequency of this report to Congress from annually to one at least every 5 years, coinciding with the date on which a renewed CoC is issued by the NRC. The NRC last issued CoCs for the Paducah and the Portsmouth GDPs on December 31, 2008, pursuant to 10 CFR Part 76, "Certification of Gaseous Diffusion Plants." The Portsmouth GDP's CoC was terminated on October 12, 2011, and the Paducah GDP CoC is expected to be terminated within 5 years. ~~Consequently, the NRC staff expects this to be the last report to Congress on this matter.~~

The expiration date of the CoC for the Paducah GDP is December 31, 2013. The CoC holder is the United States Enrichment Corporation (USEC), which filed an application to renew its 2008 CoC for the Paducah GDP with the NRC on April 2, 2013. The NRC is not currently reviewing USEC's renewal application because USEC permanently ceased enrichment operations at Paducah in June 2013, and plans to request that the NRC terminate the 2008 Paducah CoC in 2014. In accordance with 10 CFR 76.55, if a sufficient application for a CoC is timely filed, the existing CoC does not expire until a final determination on the application is made by the NRC. USEC's activities at the Paducah GDP will continue to be governed by the 2008 CoC until the NRC terminates it.

On August 1, 2013, USEC provided the DOE with its two-year notice of its intent to terminate its lease of the Paducah GDP. The DOE has indicated that it expects the return of the facility to be in accordance with the terms and provisions of the 1993 lease agreement (as later revised). The DOE and USEC are currently negotiating a framework for the return of the leased Paducah GDP facilities. Upon the CoC's termination, the NRC will no longer have regulatory authority and the DOE will assume responsibility and regulatory authority of the Paducah GDP.

The NRC conducted the most recent review of USEC's performance at the Paducah GDP covering the period between January 1, 2011, and December 31, 2012 (such performance reviews are in addition to the required GDP inspections, which are performed every 24 months). The NRC's most recent performance review determined that the Paducah GDP continued to

conduct its activities safely and securely, while protecting public health, and the environment, and that there were no areas needing improvement. No events, which resulted in a significant release of radioactive material, occurred at the plant. Offsite radiological doses, as well as doses to the workers, are very low and within regulatory limits. However, on January 14, 2009, in accordance with plant procedures, the Paducah GDP Emergency Operations Center (EOC) was activated for an unclassified emergency. The unclassified emergency was a result of a significant leak of cooling water in a feed facility. The leak did not involve a radiation release and, therefore, there were no radiological impacts. On July 27, 2011, the Paducah EOC was activated for an "alert" (meaning that events may occur, are in progress, or have occurred that could lead to a release of radioactive material[s] but that the release is not expected to require a response by an offsite response organization to protect people offsite). This 2011 alert was due to a release of a nonradioactive toxic gas due to equipment failure.

During calendar years 2011 through 2012, the Paducah GDP operated between 900 and 1750 megawatts, and produced over 10 million separative work units (SWU) at record efficiency. A SWU is a measure of enrichment in the uranium enrichment industry; it represents the level of effort or energy required to raise the concentration of uranium-235 to a specified level, and is an indicator of the amount of enriched uranium. Until USEC ended enrichment operations in 2013, the Paducah GDP was the leading supplier of uranium fuel for the commercial nuclear power plants, and was the only GDP operating within the United States.

The Portsmouth GDP certificate was terminated on October 12, 2011, following the NRC's review and approval of USEC's request to terminate certified activities at the plant. Following return of the leased buildings to DOE and certificate termination, the DOE began major decontamination and decommissioning activities in most of the Portsmouth GDP buildings, except for those currently leased to USEC Inc. for the Lead Cascade and the ACP.

The NRC had reviewed USEC's performance at the Portsmouth GDP, covering the period between July 6, 2008, and July 10, 2010. The NRC determined that during this period the Portsmouth GDP ~~had conducted its activities safely and securely, while protecting public health, and the environment, and that there were no areas needing improvement. No events occurred at the Portsmouth GDP which resulted in a significant release of radioactive material. The Portsmouth GDP had~~ continuously provided adequate protection of public health, safety, safeguards, security, and the environment. Offsite radiological doses, as well as doses to the workers, ~~a~~were very low and within regulatory limits. From October 1, 2008, until its decertification, there were no significant events requiring activation of the EOC.

Although the CoC for the Portsmouth GDP site was terminated in 2011, USEC continues to develop its replacement technology involving gas centrifuges at this site at the American Centrifuge Lead Cascade Facility. The prototype for this technology is called the Lead Cascade. The purpose of the Lead Cascade is to demonstrate centrifuge enrichment technology for commercial use. The NRC received USEC Inc.'s application for a 10 CFR Part 70 license for the Lead Cascade on February 11, 2003. After conducting detailed safety, security, and environmental reviews, the NRC issued Materials License SNM-7003 to USEC Inc. for the Lead Cascade on February 24, 2004. USEC Inc. began to operate the Lead Cascade in August 2006.

On August 23, 2004, USEC Inc. submitted its application for a 10 CFR Part 70 license for the ACP. Following its review of the application, the NRC issued Materials License SNM-2011, authorizing the construction of the ACP. Initial construction activities at the Portsmouth GDP site began in 2007 and included contractor mobilization, personnel training and initial site

CHAPTER 1

BACKGROUND

The Paducah and Portsmouth gaseous diffusion plants (GDPs)[1] started enriching uranium in the 1950s. These facilities were built at a time when design standards and quality assurance standards were significantly different from current requirements, and documentation requirements were less stringent. However, the U.S. Department of Energy (DOE) replaced virtually all the uranium equipment at the Paducah GDP as a result of a major upgrade project in the 1970s and 1980s. In addition, in September 2003, both the material condition of the plants and the design and safety bases documentation were substantially upgraded as part of the completion of the U.S. Nuclear Regulatory Commission's (NRC) compliance plan requirements.

ENERGY POLICY ACT

In October 1992, Congress enacted the Energy Policy Act (EPAct), which amended the Atomic Energy Act of 1954 (AEA) to create the United States Enrichment Corporation (USEC). Provisions of the AEA direct DOE to lease the GDPs near Paducah, KY, and Portsmouth, OH, to USEC. These GDPs produced enriched uranium. Although the AEA, as amended, established the corporation as a Government entity, it also required that within 2 years after the transition date of July 1, 1993, the corporation prepare a plan for transferring ownership to private investors. Following the passage of the USEC Privatization Act in 1996, on July 28, 1998, the corporation was privatized through an initial public offering. In the *Lease Agreement Between The United States Department of Energy and The United States Enrichment Corporation* (hereafter referred to as the Lease) dated July 1, 1993, and in other subsequent agreements, DOE and USEC established the roles and responsibilities for each organization at both GDPs. The AEA also requires the NRC to report to Congress on the status of health, safety, and environmental conditions at the GDPs. The Federal Reports Elimination Act of 1998 (Public Law 105-363) was signed into law in November 1998. This bill amended Section 1701(b)(1) of the AEA to require the NRC to report to Congress "not later than the date on which a certificate of compliance is issued" instead of "at least annually." This is the fifth such report, and encompasses the 5-year period from October 1, 2008, through September 30, 2013, unless otherwise stated.

The AEA assigns safety, safeguards, and security regulatory responsibility to the NRC for enrichment operations at the GDPs. Further, the AEA required that within 2 years of the date of the passage of the EPAct, the NRC establish, by regulation, both (1) safety, safeguards, and security standards for the GDPs and (2) a certification process to ensure that USEC complies with these standards. This certification process is in lieu of any requirement for an NRC license. Thus, the AEA made the NRC regulation of the GDPs conditional on the issuance of new regulations, which were to be promulgated by October 1994. In accordance with these requirements, the NRC promulgated Title 10 of the *Code of Federal Regulations* (10 CFR) Part 76, "Certification of Gaseous Diffusion Plants," in September 1994.

The EPAct changes to the AEA provided for the possibility that USEC might not initially be able to comply with the safety, safeguards, and security standards established by the NRC. To address this contingency, the AEA permitted the NRC to approve continued USEC operation

[1] A listing of abbreviations and acronyms can be found in Appendix C.

of the GDPs if the NRC approved DOE-prepared plans for bringing the GDPs into compliance with any unsatisfied provisions of the ~~DOE~~ NRC regulations. On November 26, 1996, the NRC issued certificates of compliance (CoC) certifying USEC's operation of the GDPs in accordance with 10 CFR Part 76. The NRC also approved on this date a compliance plan for each GDP for achieving compliance with the NRC regulations for those areas not in full compliance. After an interim period allowing for USEC to transition to the NRC regulation in an orderly manner, the NRC began regulatory oversight of USEC's operations on March 3, 1997. In the fall of 2003, all compliance plan issues associated with the initial certification were completed.

The NRC has continued regulatory oversight of USEC's operation of the Paducah GDP for the entire period covered by this report. The NRC had regulatory oversight of the Portsmouth GDP until its 10 CFR Part 76 CoC was terminated in October 2011, at which time regulatory oversight was returned to the DOE.

NRC AND DOE INTERFACE AND RESPONSIBILITIES

The AEA does not require that DOE lease the entire GDP sites to USEC. For example, those areas containing legacy material from operations under DOE that are not required to support current enrichment activities are excluded from the lease. Consequently, DOE retains responsibility and regulatory oversight for the environmental protection, safety, safeguards, and security for those portions of the GDP sites that are not leased to USEC.

While the DOE regulatory oversight is limited to only the areas within the GDP sites that are not leased to USEC, the DOE holds the Federal arming and arrest authority at the GDPs, and controls the security force exercises at the GDPs. The AEA further assigns responsibility to DOE for the payment of any costs of decontamination and decommissioning, response actions, or corrective actions that are related to conditions existing before USEC and DOE entered into their lease agreement in July 1993.

Decommissioning activities ongoing at the Portsmouth GDP require a significant commitment by DOE. It is estimated that it may take 35 years or more to decommission 10 million square feet (ft^2) of floor space and complete the remediation of contaminated soils and ground water. The project will require an annual average employment of 1,000 workers. With this assignment, DOE retains responsibility for environmental restoration activities and legacy[2] waste management at the GDP sites and for the operation of facilities used for the storage of DOE-owned special nuclear and source material, such as the cylinder storage yards that contain depleted uranium hexafluoride (UF_6) generated before July 1993, and surplus uranium material in interim storage at the Portsmouth GDP.

DOE and USEC have entered into several agreements by which DOE has assumed responsibility for virtually all depleted UF_6 at the two GDP sites. A list of agreements between USEC and DOE related to depleted uranium management and disposition is included in Appendix B of this report, "Summary of Agreements Regarding the Paducah and Portsmouth Gaseous Diffusion Plants."

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[2] The term "legacy" refers to items that are a carryover from the period before DOE leased the facilities to USEC (e.g., legacy waste and legacy equipment).

In December 1993, the NRC and DOE approved a "Joint Statement of Understanding between the Nuclear Regulatory Commission and the Department of Energy on Implementing the Energy Policy Act Provisions on the Regulation of Gaseous Diffusion Uranium Enrichment Plants." This joint statement established the areas of responsibility between the NRC and DOE. In August 1994, the NRC and DOE approved an "Agreement Establishing Guidance for the NRC Inspection Activities at the Paducah and Portsmouth Gaseous Diffusion Plants between Department of Energy Regulatory Oversight Manager and Nuclear Regulatory Commission." This agreement supplemented the joint statement by defining, in more detail, the role of the NRC observers at the GDPs in the interim period during which DOE exercised public health and safety and common defense and security regulatory oversight of the leased GDPs.

In October 1994, the NRC and DOE signed an agreement providing for the conduct of inspection activities at the GDPs. It defined the way DOE and the NRC would cooperate to facilitate obtaining information and knowledge regarding the GDPs and USEC's operation thereof, through routine and special inspection activities, during the interim before the NRC took regulatory control of the facility.

In March 1995, the NRC and DOE established the "Agreement Defining Security Responsibilities at the Paducah and Portsmouth Gaseous Diffusion Plants between the Department of Energy Office of Safeguards and Security and the Nuclear Regulatory Commission." This agreement also supplements the joint statement by defining in greater detail the security roles and responsibilities of DOE and the NRC after NRC assumption of regulatory oversight of USEC activities.

In October 1997, the NRC and DOE signed a memorandum of understanding (MOU) entitled "Memorandum of Understanding between the Department of Energy and the Nuclear Regulatory Commission - Cooperation Regarding the Gaseous Diffusion Plants." This MOU defines the responsibilities of DOE and the NRC regarding continuing cooperation at the GDPs after NRC assumption of regulatory oversight for USEC activities. The MOU also clarifies the framework for coordination regarding issues that may involve DOE and NRC areas of responsibility. In addition to the recognition of these continuing DOE responsibilities, DOE and the NRC (1) agreed to exchange information and technical support, (2) defined responsibilities for emergency response, and (3) agreed that the manner in which issues identified during an inspection by either agency would be resolved would be the August 1994 "Agreement Establishing Guidance for NRC Inspection Activities at the Paducah and Portsmouth Gaseous Diffusion Plants Between Department of Energy Regulatory Oversight Manager and Nuclear Regulatory Commission."

In January 2001, the NRC and DOE signed a joint procedure (JP) entitled "Response to Emergencies in the Leased Areas at the Gaseous Diffusion Plants." The JP provides that the NRC would be the lead Federal agency (LFA) for responding to emergencies in areas leased to USEC, unless it were later determined that DOE or another agency should be the LFA. The JP also provides for continuous exchange of information between DOE and the NRC concerning emergencies and for coordination of any response actions.

In 2004, DOE and the NRC entered into an MOU pertaining to the USEC Inc.'s American Centrifuge Lead Cascade Facility (Lead Cascade) facility, which is located at the Portsmouth GDP. The purpose of the Lead Cascade is to demonstrate ~~the U.S.~~USEC Inc.'s centrifuge enrichment technology for commercial use. The MOU delineates the respective regulatory roles and responsibilities of DOE and the NRC over the facility. Similar to the aforementioned Lead Cascade MOU, in 2007 the NRC and DOE entered into an MOU covering

CHAPTER 2

GASEOUS DIFFUSION PLANT OPERATIONS

The principal process that the U.S. Nuclear Regulatory Commission (NRC) regulates at the gaseous diffusion plants (GDPs) is the production of enriched uranium (EU) for reactor fuel. The GDPs receive uranium hexafluoride (UF_6), enrich it (i.e., process the material to increase the concentration of fissionable uranium-235 [^{235}U]), and then ship the enriched UF_6 to other fuel cycle facilities where it is processed into fuel assemblies for use in nuclear power reactors.

In the gaseous diffusion separation process, UF_6 gas passes through a material (barrier) with small pores that are large enough to permit the transfer or diffusion of single molecules but are too small to permit bulk flow of the gas. The gas that emerges from the pores has a slightly higher concentration of ^{235}U atoms than the gas that does not pass through the barrier. This process creates two streams of gas, one with a higher ^{235}U concentration (enriched) and one with a lower concentration (depleted). Because the degree of enrichment achieved by the use of a single barrier (i.e., a single diffusion stage) is very small, the process must be repeated many times, employing a cascade of many stages to achieve the required enrichment levels. The outputs of the cascade are enriched uranium product and depleted uranium (DU). The DU is stored at the GDPs, awaiting ultimate disposition.

The main components of a GDP are: (1) large cylindrical vessels called diffusers that contain the barrier, (2) compressors used to compress the gas to the pressures needed to flow through the barrier tubes and from one stage to another, (3) electric motors to drive the compressors, (4) heat exchangers and cooling systems for removing the heat of compression from the UF_6, (5) piping for the stage and inter-stage connections, and (6) block and control valves to adjust and direct the gas flow. In addition to this process stage equipment, GDPs require: (1) auxiliary systems such as the UF_6 feed and withdrawal systems, (2) an extensive electrical power distribution system, and (3) cooling towers to dissipate the waste process heat.

NRC OVERSIGHT

The major areas of NRC oversight at the GDPs include: (1) plant operations, (2) nuclear criticality safety, (3) physical protection, (4) security of classified information, (5) material control and accounting (MC&A), (6) radiological controls for onsite and offsite personnel, (7) waste management, (8) transportation of radiological materials, (9) maintenance and surveillance, (10) training, and (11) emergency preparedness. The NRC is responsible for: ~~(1)~~ regulatory oversight of: (1) the design, operation, and maintenance of hardware (i.e., structures, systems, and components) relied on for safe operation; (2) operational aspects involving the human element, such as training, staffing, and adherence to procedures; and (3) management organization and controls necessary to ensure effective management oversight of facility operations. Management organization and controls include: (1) policies and procedures, (2) internal reviews and audits, (3) safety review committees, (4) configuration management, (5) records management, (6) event investigation and reporting, and (7) quality assurance programs.

The NRC also reviews and approves accident analyses and technical safety requirements (TSRs) developed by the United States Enrichment Corporation (USEC). The accident analyses describe potential credible accidents and the facility response to those accidents to demonstrate that the facility is capable of responding in a fashion that will not

jeopardize public health and safety. The TSRs define the safety envelope and operating parameters within which the facility is required to operate for safety.

As part of its oversight activities, the NRC issues certificate of compliance (CoC) amendments after a thorough review of design and operational information and conducts field inspections by specialists from both the NRC headquarters and NRC Region II. In addition, one NRC resident inspector was located at the Paducah GDP performing daily inspections covering a broad range of site activities during most of the reporting period covered by this report.

In October 2012, the NRC reduced annual inspection and oversight hours for the Paducah GDP because the plant continued to operate safely for over a decade under NRC's oversight. The NRC's inspection and oversight activities have concluded that the Paducah GDP continues to implement an effective nuclear safety program; inspection findings over the past 5 years indicate that most issues identified were of minor safety significance. Those more significant issues, typically associated with personnel performance and safety culture, have been adequately resolved, and the staff believes that the Paducah GDP has the elements of an effective corrective action program.

As a result of USEC's decision to cease enrichment activities in June 2013, the NRC staff performed an evaluation of its inspection program at the Paducah GDP and determined that an adjustment to the NRC's core inspection program for the site was necessary. The NRC staff determined that the current and expected material workload at the Paducah GDP are similar in risk to operations at a uranium conversion facility with additional aspects in the areas of MC&A, Security, Information Security, and Criticality Safety. Therefore, the Paducah GDP resident inspector was removed from the site at the end of Fiscal Year (FY) 2013.

ACTIVITIES AT THE PORTSMOUTH GDP

The Portsmouth GDP stopped uranium enrichment operations in 2001, and the plant remained in cold shutdown until the NRC terminated its Title 10 of the *Code of Federal Regulations* (10 CFR) Part 76 CoC on October 12, 2011. As such, the NRC no longer has regulatory oversight of activities at the site, except for those related to the American Centrifuge Lead Cascade Facility (Lead Cascade) and the American Centrifuge Plant (ACP).

The NRC coordinated with the U.S. Department of Energy (DOE) and USEC during the CoC termination process to accomplish a seamless regulatory transition of the Portsmouth GDP site to DOE. The NRC conducted a detailed review of USEC's request to terminate its 10 CFR Part 76 CoC activities at the plant. Prior to CoC termination, the NRC conducted inspections at the Portsmouth GDP that addressed information security, material control and accounting, and appropriate disposition of waste. Decontamination and decommissioning at the Portsmouth GDP is an ongoing project currently being performed by DOE's contractors.

The GDP lease agreement between USEC and DOE covered both the Portsmouth and Paducah GDPs and has a supplement that leases certain Portsmouth GDP facilities and property to USEC Inc. for the ACP. Although USEC no longer leases the facilities for enrichment operations at the Portsmouth GDP, the lease for ACP operation continues and was last renewed on June 23, 2008. The renewed lease runs for a period of 6 years, with a provision to extend for an additional 2 years. The current expiration date is July 1, 2014. More information about additional NRC-licensed activities under 10 CFR Part 70 in the Portsmouth GDP is provided in Chapter 8, "Regulatory Activities," of this report.

ACTIVITIES AT THE PADUCAH GDP

The Paducah GDP continued to be a leading supplier of low enriched uranium (LEU) fuel for the commercial nuclear power industry until enrichment operations ceased there in June 2013. During 2012, its last full operating year, the plant produced more than 5 million separative work units (SWU). When the material from the Megatons to Megawatts program (described below) is included, USEC had approximately 27 percent of the worldwide market share in 2012. The plant had recently been producing in the range of 5–6 million SWU each year. Operations over the past several years had been the most efficient in the past 25 years, due to keeping a record number of cells in operation. USEC employs approximately 900 personnel at Paducah, but that level will decrease over the coming year as USEC's activities at the site conclude.

During this reporting period, Paducah continueds to participate in the commercially financed Government-industry partnership, Megatons to Megawatts Program, in which bomb-grade uranium from dismantled Russian nuclear warheads is being processed into LEU to produce fuel for nuclear power plants in the United States. As of May 2013, 475.2 metric tons of weapons-grade (highly enriched) uranium has been down blended into 13,723 metric tons of LEU. According to USEC, this is equivalent to 19,008 nuclear warheads eliminated. This program has supplied the reactor fuel used to generate nearly 10 percent of U.S. electricity since 1995. The last LEU deliveryies to the United States from Russia under this partnership ~~are scheduled to conclude by December 31, 2013~~arrived in the Port of Baltimore on December 11, 2013.

CHAPTER 4

HEALTH, SAFETY, AND ENVIRONMENTAL STATUS

The U.S. Nuclear Regulatory Commission (NRC) has responsibility to ensure that the health and safety of the public and the workers at the gaseous diffusion plants (GDPs) are protected from hazards involving radioactive material and radiation. Title 10 of the *Code of Federal Regulations* (10 CFR) 76.60, "Regulatory Requirements Which Apply," requires the United States Enrichment Corporation (USEC) to comply with applicable sections of 10 CFR Part 20, "Standards for Protection Against Radiation." Health, safety, and environmental conditions are reflected in radiation doses received by workers and in radioactive effluents. This chapter contains information relating to the health, safety, and environmental conditions for the leased areas of the GDPs under NRC regulatory oversight. The U.S. Department of Energy (DOE) was contacted in the preparation of this report, and the input from DOE is included as Appendix A to this report, "Summary of DOE Activities at the Paducah and Portsmouth Gaseous Diffusion Plants."

DOE and USEC maintain onsite and offsite environmental dosimeters to monitor gamma radiation levels at the Paducah and the Portsmouth GDPs. The 2012 data from the environmental dosimeters at Paducah show that ambient gamma exposure levels at the site boundaries are very small and well within the NRC's regulatory limits. Similarly, the ~~most recent~~ 2010 data from the environmental dosimeters at Portsmouth show that ambient gamma exposure levels at the site boundaries there were also very small and well within the NRC's regulatory limits. Maximum annual doses to the nearest offsite individuals from exposure to radioactive effluents from USEC operations (DOE operations are discussed below), for calendar years (CYs) 2008 through 2012, are calculated to be no more than 1.5×10^{-4} millisievert (mSv) [(0.0148 millirem (mrem)] at the Paducah GDP and 5.1×10^{-4} mSv [0.051 mrem] at the Portsmouth GDP. These values are far below the NRC regulatory limit of 1 mSv/year (100 mrem/year) for members of the public, as specified in 10 CFR Part 20. Table 4-1 provides the maximum offsite individual doses for both GDPs.

Table 4-1
Maximum Offsite Individual Dose, Paducah and Portsmouth, 2008–2012[a]

Calendar Year	Paducah Maximum Offsite Dose, mSv/yr (mrem/yr)[b] Airborne Emissions	Portsmouth Maximum Offsite Dose, mSv/yr (mrem/yr) Airborne Emissions
2008	8.2×10^{-5} (0.0082)	5.3×10^{-5} (0.0053)
2009	1.2×10^{-4} (0.0118)	6.9×10^{-5} (0.0069)
2010	1.5×10^{-4} (0.0148)	5.1×10^{-4} (0.051)
2011	4.0×10^{-5} (0.0040)	N/A
2012	4.7×10^{-5} (0.0047)	N/A

[a] Data for 2013 will be provided in the National Emissions Standards for Hazardous Air Pollutants (NESHAP) report in mid-2014. Information on radiation doses for 2013 is to be provided through the NRC's Radiation Exposure Information and Reporting System (REIRS) in 2014.

[b] Sv—Sievert; rem—röentgen equivalent man

At Portsmouth, since the end of the last reporting period (2003–2008), there was a reduction in personnel exposures to radiation doses. This was primarily due to the following safety improvements:

- Focus on minimization of internal exposure during uranium recovery projects
- Transfer of approximately 100 radioactive sources for disposal during 2009-2010 in an effort to reduce the quantity of sources onsite
- Reduction of the number and size of radioactive material storage areas
- Continued focus on self-evaluation to strengthen the radiation protection program, which included the following:
    - direct observation by management
    - procedural adherence surveillances
    - boundary inspections
    - organization self-assessments
    - publication of a series of open line articles detailing site requirements for contamination control and radiation protection

CHAPTER 5

CERTIFICATION ACTIVITIES

The regulation in Title 10 of the *Code of Federal Regulations* (10 CFR) 76.45, "Application for Amendment of Certificate," describes the process for amending the certificates to cover new or modified activities. The U.S. Nuclear Regulatory Commission (NRC) may also impose additional requirements by issuing orders and/or adding conditions to the certificate of compliance (CoC).

AMENDMENTS TO THE PORTSMOUTH GDP CERTIFICATE

From October 1, 2008, until the CoC's termination in October 2011, The United States Enrichment Corporation (USEC) requested, and was granted, 4 amendments to its CoC for the Portsmouth gaseous diffusion plant (GDP). These amendments modified technical safety requirements (TSRs) that were necessary to release the facilities to the U.S. Department of Energy (DOE).

ORDERS ISSUED TO THE PORTSMOUTH GDP IN THE PAST 5 YEARS

There were no orders issued to the Portsmouth GDP during the period from October 1, 2008, until its CoC was terminated on October 12, 2011.

TERMINATION OF THE CERTIFICATE FOR THE PORTSMOUTH GDP

By letter dated March 15, 2011, USEC notified the NRC of its intention to cease all NRC-regulated activities at the Portsmouth GDP, and to terminate its CoC there. Subsequently, by letter dated June 28, 2011, USEC requested that the NRC terminate the 10 CFR Part 76 CoC for the Portsmouth GDP. After confirmation from USEC and DOE that the leased facilities and all NRC-regulated material and classified matter at the Portsmouth GDP had been transferred to DOE, and finding that all applicable regulatory requirements were met, the NRC terminated the CoC for the Portsmouth GDP on October 12, 2011.

AMENDMENTS TO THE PADUCAH GDP CERTIFICATE

From October 1, 2008, through September 30, 2013, USEC requested, and was granted, 13 amendments to its Paducah CoC. Most of the requests were administrative in nature, but were required because they modified one or more TSRs. One amendment was required to allow USEC to recover uranium hexafluoride feed material from cylinders that did not have a certified volume or water weight as now required by American National Standards Institute standard N14.1. The cylinders at issue were designed and fabricated before the N14.1 standard was initially issued. Another amendment was required to support a DOE aerial radiation survey.

ORDERS ISSUED TO THE PADUCAH GDP IN THE PAST 5 YEARS

The NRC issued a total of four orders from October 1, 2008 through September 30, 2013. All of these were confirmatory orders issued to address specific commitments by USEC regarding the following items: (1) training on Safety Conscious Work Environment and employee protection [Order EA-06-140, dated August 13, 2009]; (2) mailing of classified information [Order EA-08-280, dated August 18, 2009]; (3) willful misconduct by certain

CHAPTER 6

INSPECTIONS

Provisions in Subpart F, "Reports and Inspections," of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 76, govern U.S. Nuclear Regulatory Commission (NRC) inspections of the gaseous diffusion plants (GDPs). Based on such inspections, as documented in inspection reports, the NRC has authority to take enforcement action and issue civil penalties for violations of the Atomic Energy Act, NRC regulations, orders, or other applicable requirements. NRC provisions governing such actions are in 10 CFR Part 76, Subpart G, "Enforcement," and in 10 CFR Part 2, "Agency Rules for Practice and Procedure," among others.

Violations identified during NRC inspections are classified into one of four severity levels, with severity level (SL) I assigned to the most significant violations, and SL IV being assigned to the least significant. Additionally, there are violations characterized as "non-cited" violations (NCV) ~~which~~ that are identified and promptly corrected by the licensee. ~~They~~ NCVs are considered nonrecurring SL IV violations, corrected without NRC involvement, and not subject to formal enforcement action. Finally, there are other violations of minor safety or environmental significance that are below SL IV. These violations must meet certain criteria and are not subjected to formal enforcement action.

Escalated enforcement actions include: 1) SL I, II, and III notice of violations (NOVs); 2) NOVs associated with an inspection finding that could be evaluated as having low to moderate or greater safety significance; 3) civil penalties; 4) NOVs to individuals; 5) orders to modify, suspend, or revoke NRC licenses or the authority to engage in NRC-licensed activities; and 6) orders issued to impose civil penalties. Non-escalated enforcement actions include NOVs that are addressed by the NRC as SL IV or minor violations. More information about the NRC's enforcement policy is provided on the NRC Web site at http://www.nrc.gov/about-nrc/regulatory/enforcement.html.

As further detailed on Table 6-1 below, during the 5-year reporting period from October 1, 2008~~,~~ to September 30, 2013, the NRC performed a total of 44 inspections at the Paducah GDP. These inspections were conducted by the resident inspector at the Paducah GDP and inspectors from the NRC's Region II and the headquarters' offices. The results of each inspection are documented in NRC inspection reports. Each report describes the completion of multiple inspection procedures of various disciplines by the resident inspectors, regional inspectors, and/or headquarters inspectors. The reductions in inspections and inspection hours at the Paducah GDP for fiscal year (FY) 2013 reflect, in part, the discontinuation of enrichment activities there in June 2013.

The NRC performed a total of 21 inspections at the Portsmouth GDP (until October 12, 2011). These inspections were conducted by inspectors from the NRC's Region II and the headquarters' offices. The results of each inspection are documented in NRC inspection reports. Each report describes the completion of multiple inspection procedures of various disciplines by regional inspectors and/or headquarters inspectors.

Table 6-2
Number of Violations Identified per fiscal year, 2009–2013

	Paducah	Portsmouth
FY	Number of Violations	Number of Violations
2009	0	2
2010	1	0
2011	3	0
2012	3	N/A
2013	1	N/A
Total	**8**	**2**

For the Paducah GDP, a SL IV violation was issued in FY 2010 due to facility quality control staff performing safety functions in excess of the work hour limits. Three SL IV violations were issued to the Paducah GDP in FY 2011. One involved the failure to correctly label power supply, which resulted in a temporary loss of a required uranium hexafluoride gas detection system. The second violation was associated with the failure to use at least two independent criticality safety controls, as described in the related safety analysis report (SAR), for the design and operation of the crawl space above the C-310 product withdrawal room. The third violation involved the failure to make a required 24-hour report following an unplanned contamination event.

Three SL IV violations were issued in FY 2012. One violation involved crane operators failing to follow procedures when conducting overhead crane operations while handling, and in the area of, liquid-filled uranium hexafluoride (UF_6) cylinders. The second violation involved falsification of training records by a Paducah GDP contractor. The third violation involved the failure to maintain a second independent criticality safety control, as described in the related SAR. One SL IV violation was issued to the Paducah GDP in FY 2013, and it involved the failure to follow an operational procedure, which resulted in a release of UF_6 to the environment. Surveys of the areas in the plume path did not identify radioactive contamination and the results from bioassay sampling for the individuals working on that area were below the occupational dose limits in 10 CFR Part 20. USEC responded to the NOV providing the corrective actions already taken and other actions that it committed to complete by the end of October 2013. The NRC will confirm the implementation of corrective actions during the next inspection of the GDP.

For the Portsmouth GDP, two violations were issued in FY 2009 in the areas of plant operations and material control and accounting activities. One was the SL III violation described above involving the movement of a cylinder containing liquid UF_6 utilizing a mobile device other than an approved overhead crane or scale cart. The other was a SL IV violation for failure to perform verification audits of controlled items at the specified frequencies stated in the Fundamental Nuclear Materials Control Plan.

For each of the violations described in this section at both GDPs, USEC took immediate corrective actions to bring the facilities back into compliance with NRC regulations, and implemented comprehensive corrective action plans to prevent recurrence. The NRC reviewed USEC's implementation of corrective actions and determined that it appropriately addressed the violations identified.

CHAPTER 7

EVENT REPORTS

Title 10 of the *Code of Federal Regulation* (10 CFR) 76.120, "Reporting Requirements," contains the requirements for reporting certain events to the U.S. Nuclear Regulatory Commission (NRC). These provisions specify events that must be reported to the NRC within three different time limits and describe the contents and schedule for submitting written follow-up reports. First, the United States Enrichment Corporation (USEC) is required to report any criticality event, loss of special nuclear material, or emergency conditions that have been declared an Alert or Site Area Emergency, to the NRC Operations Center, within 1 hour after discovery. Second, events that prevent immediate protective actions necessary to avoid releases or exposures to radiation or radioactive materials that could exceed regulatory limits must be reported to the NRC Operations Center within 4 hours after discovery. The third reporting requirement specifies that (1) certain contamination events, (2) failure of certain technical safety requirements-required safety equipment with no backup equipment available, (3) fires or explosions that damage radioactive material or containers holding radioactive material, and (4) events that require offsite medical treatment of a contaminated person, must be reported to the NRC Operations Center within 24 hours. Further, USEC must report losses and compromises or possible compromises of classified information or materials, pursuant to 10 CFR 95.57, "Reports." Also, USEC reports any loss of contingency for Nuclear Criticality Safety (NCS) in accordance with NRC Bulletin 91-01, "Reporting Loss of Criticality Safety Controls," dated October 18, 1991. Although not required by 10 CFR Part 76, "Certification of Gaseous Diffusion Plants," USEC reports safety system actuations and notifications made to other State and Federal agencies. The U.S. Department of Energy (DOE) has a separate event reporting system for DOE-regulated operations, and DOE statistics are not included in this summary.

Between October 1, 2008, and September 30, 2013, there were a total of 29 reportable events at the Paducah gaseous diffusion plant (GDP). Between October 1, 2008 and October 12, 2011, there were three reportable events at the Portsmouth GDP. A summary of the event reports is provided below.

EVENT NOTIFICATION SUMMARY FOR THE PADUCAH GDP

The Paducah GDP reported a total of 39 events between October 1, 2008, and September 30, 2013. Of these, 10 events were retracted by USEC as not meeting the reporting criteria. Therefore, USEC reported a total of 29 NRC-reportable events during the reporting period. The causes for these events, as reported by USEC, included defective or failed parts (41 percent); human error (17.2 percent); management deficiency (14 percent); defective or design, manufacturing, or installation error (7 percent); equipment failure (7 percent); no cause reported (7 percent); failure to follow procedure or wrong procedure used (3.4 percent); and inadequate procedures (3.4 percent).

There were instances in which safety equipment required to be available and operable, or to function as designed, failed or was discovered not in a ready-to-use condition. The Paducah GDP reported 11 events of this kind, which were mainly related to autoclaves, uranium hexafluoride (UF_6) release-detection systems, a defect affecting a basic component that is subject to licensing requirements, Criticality Accident Alarm System, and fire protection equipment failures. Autoclave-related events consisted of failures of autoclave subsystems. Events related to UF_6 release detection systems mainly consisted of detector head failures,

control power loss, or inadvertent actuations of the alarm system. There were also events reported for instances in which fire protection equipment was declared inoperable. These incidents were mainly caused by corrosion, water leaks, or potential frozen conditions from ambient temperatures.

The Paducah GDP reported staffing their Emergency Operations Center for a non-classified emergency on January 14, 2009, when an operator observed a visible plume in a pipe trench in the feed vaporization facility. In accordance with plant procedures, the autoclaves in the facility were immediately isolated and other actions were taken for a possible UF_6 release. It was quickly determined that the plume was steam from a recirculating cooling water leak that was immediately controlled. There were no radiological impacts associated with this event.

A total of 6 events were reported at the Paducah GDP under NRC Bulletin 91-01, which requires reporting to the NRC any loss or degradation of NCS controls. For these events, the safety significance was minimal because of the maintenance of at least one of the two controls normally required.

EVENT NOTIFICATION SUMMARY FOR THE PORTSMOUTH GDP

During the period between October 1, 2008, and October 12, 2011, the Portsmouth GDP reported three events. These events involved (1) a fire lasting more than 15 minutes at the DOE portion of the site on July 16, 2009; (2) a spill of approximately 25 liters of enriched uranyl nitrate hexahydrate due to an incorrect replacement of a plug in a valve; and (3) a release of contaminated material to an offsite location housing contractor's staff performing work at the GDP. The Portsmouth GDP did not report any events under NRC Bulletin 91-01.

CHAPTER 8

REGULATORY ACTIVITIES

The United States Enrichment Corporation (USEC) is required to comply with all U.S Nuclear Regulatory Commission (NRC) regulations applicable to gaseous diffusion plants (GDPs), most specifically, Title 10 of the *Code of Federal Regulations* (10 CFR) Part 76, "Certification of Gaseous Diffusion Plants." Other NRC regulations or portions thereof that apply include the following:

1. 10 CFR Part 19, "Notices, Instructions, and Reports to Workers: Inspection and Investigations"
2. 10 CFR Part 20, "Standards for Protection Against Radiation"
3. 10 CFR Part 21, "Reporting of Defects and Non-compliance"
4. 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material"
5. 10 CFR Part 71, "Packaging and Transportation of Radioactive Material"
6. 10 CFR Part 73, "Physical Protection of Plants and Materials"
7. 10 CFR Part 74, "Material Control and Accounting of Special Nuclear Material"
8. 10 CFR Part 95, "Security Facility Approval and Safeguarding of National Security Information and Restricted Data"

RULEMAKING ACTIVITIES

There were no significant GDP rulemaking activities during this reporting period.

EMERGENCY PREPAREDNESS EXERCISES

Under the requirements of 10 CFR 76.91, "Emergency Planning," USEC must conduct onsite exercises once every 2 years at both GDPs to test response to simulated emergencies. Participation of offsite response organizations, although recommended, is not required. In addition to the exercises, inspections of the emergency preparedness program at the GDPs were conducted once a year. Emergency preparedness exercises were conducted at both plants from October 1, 2008, to September 30, 2013, and the most recent emergency preparedness exercises are discussed below.

PADUCAH GDP EXERCISES

The NRC staff from the Region II office conducted an inspection of a Paducah GDP biennial emergency response exercise in September 2010. The inspectors determined that the exercise objectives and scenario adequately and thoroughly exercised major elements of the emergency plan. The inspectors concluded that the scenario was realistic and posed multiple challenges to the certificate holder and to offsite response agencies, and determined that the incident commander (IC) and other responding personnel performed in a manner that would have protected the workers' safety and resulted in appropriate response to the scenario. The inspectors observed that the IC and the field staff, along with personnel in the Emergency Operations Center (EOC), were successful in managing a large number of verbal and written communications. The general emergency response by the EOC management and staff appropriately addressed the declared emergency action level created by the stipulated scenario. The EOC properly evaluated emergency conditions and appropriately recommended protective actions. Personnel performed emergency classification and external notifications according to procedural requirements. The inspectors observed several critiques and concluded that they

At the conclusion of the exceedances discussion, KDOE representatives presented proposed corrective actions for USEC to resolve the enforcement proceedings. An official demand for remedial measures and civil penalty letter was delivered to USEC on July 16, 2013. USEC agreed to the remedial measure terms and paid the $6000 civil penalty to bring the enforcement action to a close.

THE PORTSMOUTH GDP

On May 3, 2010, the Ohio Environmental Protection Agency (OEPA) issued an order to USEC for violations identified by OEPA in November 2008. The violations involved USEC's noncompliance with the Ohio Administrative Code (OAC) for storing hazardous wastes in several tanks that were (1) not appropriately managed in accordance with the provisions of the OAC, (2) not appropriately labeled, and, (3) were stored for more than 90 days. The order also requested USEC to, within 90 days of the effective date of the order, submit to the Ohio EPA, for review and approval a Closure Plan(s) (plan) for the hazardous waste tanks. The order also imposed a $64,150.00 fine for USEC's failure to appropriately manage the wastes. In July 2010, USEC agreed to implement corrective actions, accepted the civil penalty, and provided a draft plan for OEPA's review and approval. On September 23, 2010, the OEPA Director approved the plan as submitted without comment or change. USEC completed the corrective actions as depicted in the plan and, on October 22, 2010, OEPA issued an approval letter for the completion of the plan for the management of the wastes. Finally, on November 5, 2010, USEC issued the termination of obligation to OEPA to formally close out the OEPA order.

On May 24, 2010, the EPA issued a notice of violation to the Portsmouth GDP as a result of Resource Conservation and Recovery Act (RCRA) non-compliances discovered during a June 2009~~,~~ EPA~~'s~~ RCRA compliance inspection. There were no civil penalties assessed and all findings and concerns were addressed by USEC in 2009. USEC provided closure of all cited violations by letter dated June 17, 2010. Via letter dated October 22, 2010, OEPA provided its approval of USEC's closure plan and verification of USEC's closure actions.

CHAPTER 10

SUMMARY ASSESSMENT OF PERFORMANCE

During the review period, the Paducah and Portsmouth gaseous diffusion plants (GDPs) provided adequate protection of health and safety and the environment and generally operated in compliance with the U.S. Nuclear Regulatory Commission (NRC) regulatory requirements. There were no radiation-related deaths or illnesses from the use of radioactive materials and no significant radiation exposures. At both plants, offsite radiological doses, as well as doses to the workers, remained very low and well within NRC regulatory limits. Neither facility incurred a loss or diversion of certified material, nor were there any nuclear criticality events. During the assessment period, the Portsmouth plant remained in a cold-shutdown condition until October 12, 2011, when the NRC terminated its certificate of compliance (CoC).

The NRC conducts licensee performance reviews (LPR) at each fuel cycle facility to determine whether safety and safeguards have been adequately maintained during a specific period. The performance areas evaluated during the LPR include safety operations, safeguards, radiological controls, and facility support. Although the GDPs are governed by CoCs rather than NRC licenses, they are nonetheless subject to performance reviews every 24 months, unless previous assessments had identified areas needing improvements, in which case the performance reviews will occur at least every 12 months. Below is a summary of the GDPs performance reviews conducted during the period of October 1, 2008 to September 30, 2013.

ASSESSMENT OF THE PADUCAH GDP PERFORMANCE

Overall performance and conduct of plant operations at the Paducah GDP were adequate. The NRC staff conducted a review of the United States Enrichment Corporation's (USEC) performance at Paducah covering the period from October 4, 2008, to December 31, 2010. The NRC staff evaluated USEC's performance in the areas of safety operations, radiological controls, facility support, and licensing activities. The results of the review were discussed in a public meeting held on May 24, 2011. The NRC did not identify any areas needing improvement.

The NRC also conducted a review of USEC's performance at the Paducah GDP covering the period from January 1, 2011, to December 31, 2012. The NRC staff evaluated USEC's performance in the areas of safety operations, radiological controls, facility support, and other topics. The results of the review were discussed in a public meeting held on May 2, 2013. The NRC did not identify any areas needing improvement. The next performance review will cover the period between January 1, 2013, and December 31, 2014.

Paducah plant maintenance and surveillance activities associated with safety-related systems, structures, and components were adequate. Reliability was demonstrated as shown in the plant personnel's handling of the cascade-related equipment during a period when the Paducah GDP operated at the highest power levels in the past 20 years.

ASSESSMENT OF THE PORTSMOUTH GDP PERFORMANCE

Overall performance at the Portsmouth GDP and conduct of plant operations were adequate. During the review period, the plant remained in a cold shutdown condition and started undertaking some remediation activities. The NRC conducted the most recent review of

USEC's performance at the Portsmouth GDP covering the period from July 6, 2008, to July 10, 2010. The NRC staff evaluated USEC's performance in the areas of safety operations, radiological controls, facility support, and special topics. The results of the review were discussed in a public meeting held on October 14, 2010. The NRC did not identify any areas needing improvement. For the period of July 11, 2010, until the Portsmouth GDP's certificate was terminated on October 12, 2011, the NRC conducted the appropriate inspections that verified safety and safeguards had been adequately maintained during this period and found USEC's performance and conduct of plant operations to be adequate.

APPENDIX A

SUMMARY OF DOE ACTIVITIES AT THE PADUCAH AND PORTSMOUTH GASEOUS DIFFUSION PLANTS

U.S. Department of Energy (DOE) activities at both the Paducah and Portsmouth gaseous diffusion uranium enrichment plants (GDPs) between October 1, 2008, and September 30, 2013, are described below.

INSPECTION AND INVESTIGATION ACTIVITIES AT PADUCAH

- Reviewed United States Enrichment Corporation's (USEC) completed activities to resolve the notice of violation (NOV) issued as a result of the return of a weapons authorization card (WAC) without the required training, and the non-cited violations (NCV) issued as a result of the incorrect application of the annual random drug testing selection process. The closure documentation provided was found to adequately resolve these violations. (FY 2009)

- Reviewed USEC's completed activities to resolve the issue of an intoxicated, armed, on-duty security police officer (SPO) at the Paducah GDP. The closure documentation provided was found to adequately resolve this issue. (FY 2010)

- Reviewed USEC's completed activities to resolve the NCV issued as a result of inadequate training of the Paducah GDP's security police officers on changes to the drug testing program. The closure documentation provided was found to adequately resolve the issue. (FY 2013)

- Reviewed USEC's completed activities to resolve the NOV issued as a result of an unacceptable arrangement of plumbing in the drug testing program collection facility at the Paducah GDP. The closure documentation provided to date was found to adequately resolve the issue; however, further closure documentation will be reviewed at the annual inspection scheduled for the fall of 2013. (FY 2013)

- Conducted a special review of USEC's Emergency Preparedness Program and participated in a full participation emergency management exercise at the Paducah GDP. (FY2010–FY2012)

INSPECTION AND INVESTIGATION ACTIVITIES AT PORTSMOUTH

- Performed a 100 percent inspection of the Portsmouth GDP security police officers with weapons authorization cards as a result of weaknesses identified during the DOE annual inspection. DOE later verified that USEC addressed these weaknesses and closed this issue. (FY 2010)

- Reviewed USEC's completed activities to resolve an accidental discharge of a weapon at the Portsmouth GDP. The corrective actions implemented by USEC, and the closure documentation provided were found adequate and the issue was closed. (FY 2010)

- Conducted a special review of USEC's emergency preparedness program and participated in a full participation emergency management exercise at the Portsmouth GDP. No issues or concerns were identified from DOE's observation of this exercise. (FY2009)

III. Agreements between DOE and USEC related to Depleted Uranium Management and Disposition at Paducah and Portsmouth

- The "Memorandum of Agreement Between the United States Department of Energy and the United States Enrichment Corporation Relating to Depleted Uranium," dated June 30, 1998, the "Agreement Between the U.S. Department of Energy ("DOE") and USEC Inc. ("USEC")," dated June 17, 2002, the "Cooperative Agreement Between Department of Energy and USEC Inc. Concerning the American Centrifuge Demonstration Project," dated March 23, 2010, the contract between DOE and USEC for DOE acquisition of separative work unit (SWU), dated March 13, 2012, and the "Cooperative Agreement Between Department of Energy and USEC, Inc. and American Centrifuge Demonstration, LLC Concerning the American Centrifuge Cascade Demonstration Test Program," dated June 12, 2012.
- The "Memorandum of Agreement Between the United States Department of Energy and the United States Enrichment Corporation Relating to Depleted Uranium," dated June 30, 1998, provided for the transfer to DOE of 2,026 48G cylinders containing approximately 16,674,000 Kg of depleted uranium (DU) generated by USEC's operations. In accordance with the agreement, USEC made the required full payment of over $50M to DOE, covering the entire quantity of DU to be transferred. Therefore, the liability to dispose of the full amount of USEC's DU specified in the agreement now rests with DOE, further reducing the quantity of DU to be ultimately disposed of by USEC. Within these major parameters of the agreement, USEC and DOE agreed to implement the actual transfer of the material on a schedule covering the period of FY 1999 through 2004. This agreement is complete and no further action is required.
- The "Agreement Between the U.S. Department of Energy ("DOE") and USEC Inc. ("USEC")," dated June 17, 2002, provided, in part, for the DOE taking title of depleted uranium from USEC operations during USEC's fiscal years 2002 and 2003 and one-half the amount of depleted uranium generated during USEC's fiscal years 2004 and 2005. Therefore, as a result of this June 17, 2002 agreement, USEC's liability associated with the disposal of USEC generated depleted uranium was reduced by the quantity of depleted uranium specified in this June 17, 2002 agreement.
- The "Cooperative Agreement Between Department of Energy and USEC Inc. Concerning the American Centrifuge Demonstration Project," dated March 23, 2010, transferred title to 13,312,411 kg of DU from USEC to DOE to enable USEC to release encumbered funds to support continued development and demonstration of the American Centrifuge technology. In 2012, DOE and USEC entered into a contract in which DOE acquired SWU in exchange for DOE's accepting title to, and eventual disposal responsibility for 13,073,045 kg of DU.

The "Cooperative Agreement Between Department of Energy and USEC Inc. and American Centrifuge Demonstration, LLC Concerning the American Centrifuge Cascade Demonstration Test Program," dated June 12, 2012, transferred title and responsibility for disposition from USEC to DOE of up to 39,200 metric ton (MT) DUF_6 (26,505 MT of DU at USEC tails purity)

NOTATION VOTE

RESPONSE SHEET

TO: Annette Vietti-Cook, Secretary

FROM: Commissioner Apostolakis

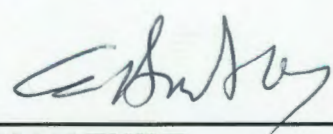
SUBJECT: SECY-13-0125 – REPORT TO CONGRESS ON THE HEALTH, SAFETY, AND ENVIRONMENTAL CONDITIONS AT THE GASEOUS DIFFUSION PLANTS LOCATED NEAR PADUCAH, KENTUCKY, AND PORTSMOUTH, OHIO

Approved X **Disapproved** _____ **Abstain** _____

Not Participating _____

COMMENTS: **Below** X **Attached** X **None** ___

I approve the report to Congress subject to the comment below and the attached edits. I agree with Commissioner Ostendorff that the staff should provide a final summary report to Congress of our oversight of the USEC's Paducah Gaseous Diffusion Plant from October 1, 2013, through termination of Paducah's Certificate of Compliance.



SIGNATURE

12/12/13

DATE

Entered on "STARS" **Yes** ✓ **No** ___

EXECUTIVE SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) provides this report to Congress as required by Section 1701 of the Atomic Energy Act (AEA). This is the fifth report issued on the health, safety, and environmental conditions of the gaseous diffusion uranium enrichment plants (GDPs) located near Paducah, Kentucky, and Portsmouth, Ohio, and covers the 5-year period from October 1, 2008, to September 30, 2013. The information in this report is current as of September 30, 2013, unless otherwise specified. As directed by the AEA, the NRC staff consulted with the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) in preparing this report.

DOE continues to be responsible for regulatory oversight of the non-leased portions of the Paducah GDP. The Portsmouth GDP leased facilities were returned to DOE and NRC's Certificate of Compliance (CoC) for the Portsmouth GDP was terminated in 2011. Located on the site of the Portsmouth GDP are the American Centrifuge Lead Cascade Facility (Lead Cascade) and the American Centrifuge Plant (ACP), both of which are regulated under NRC licenses issued pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 70, "Domestic Licensing of Special Nuclear Material." Except for the Lead Cascade and the ACP, the DOE is fully responsible for the regulatory oversight of all activities at the Portsmouth GDP site.

The Federal Reports Elimination Act of 1998 amended Section 1701 of the AEA to decrease the required frequency of this report to Congress from annually to one at least every 5 years, coinciding with the date on which a renewed CoC is issued by the NRC. The NRC last issued CoCs for the Paducah and the Portsmouth GDPs on December 31, 2008, pursuant to 10 CFR Part 76, "Certification of Gaseous Diffusion Plants." The Portsmouth GDP's CoC was terminated on October 12, 2011, and the Paducah GDP CoC is expected to be terminated within 5 years. ~~Consequently, the NRC staff expects this to be the last report to Congress on this matter.~~

The expiration date of the CoC for the Paducah GDP is December 31, 2013. The CoC holder is the United States Enrichment Corporation (USEC), which filed an application to renew its 2008 CoC for the Paducah GDP with the NRC on April 2, 2013. The NRC is not currently reviewing USEC's renewal application because USEC permanently ceased enrichment operations at Paducah in June 2013, and plans to request that the NRC terminate the 2008 Paducah CoC in 2014. In accordance with 10 CFR 76.55, if a sufficient application for a CoC is timely filed, the existing CoC does not expire until a final determination on the application is made by the NRC. USEC's activities at the Paducah GDP will continue to be governed by the 2008 CoC until the NRC terminates it.

On August 1, 2013, USEC provided the DOE with its two-year notice of its intent to terminate its lease of the Paducah GDP. The DOE has indicated that it expects the return of the facility to be in accordance with the terms and provisions of the 1993 lease agreement (as later revised). The DOE and USEC are currently negotiating a framework for the return of the leased Paducah GDP facilities. Upon the CoC's termination, the NRC will no longer have regulatory authority and the DOE will assume responsibility and regulatory authority of the Paducah GDP.

The NRC conducted the most recent review of USEC's performance at the Paducah GDP covering the period between January 1, 2011, and December 31, 2012 (such performance reviews are in addition to the required GDP inspections which are performed every 24 months). The NRC's most recent performance review determined that the Paducah GDP continued to

conduct its activities safely and securely, while protecting public health, and the environment, and that there were no areas needing improvement. No events which resulted in a significant release of radioactive material occurred at the plant. Offsite radiological doses, as well as doses to the workers, are very low and within regulatory limits. However, on January 14, 2009, in accordance with plant procedures, the Paducah GDP Emergency Operations Center (EOC) was activated for an unclassified emergency. The unclassified emergency was a result of a significant leak of cooling water in a feed facility. The leak did not involve a radiation release and, therefore, there were no radiological impacts. On July 27, 2011, the Paducah EOC was activated for an "alert" (meaning that events may occur, are in progress, or have occurred that could lead to a release of radioactive material[s] but that the release is not expected to require a response by an offsite response organization to protect people offsite). This 2011 alert was due to a release of a nonradioactive toxic gas due to equipment failure.

During calendar years 2011 through 2012, the Paducah GDP operated between 900 and 1750 megawatts, and produced over 10 million separative work units (SWU) at record efficiency. A SWU is a measure of enrichment in the uranium enrichment industry; it represents the level of effort or energy required to raise the concentration of uranium-235 to a specified level, and is an indicator of the amount of enriched uranium. Until USEC ended enrichment operations in 2013, the Paducah GDP was the leading supplier of uranium fuel for the commercial nuclear power plants, and was the only GDP operating within the United States.

The Portsmouth GDP certificate was terminated on October 12, 2011, following the NRC's review and approval of USEC's request to terminate certified activities at the plant. Following return of the leased buildings to DOE and certificate termination, the DOE began major decontamination and decommissioning activities in most of the Portsmouth GDP buildings, except for those currently leased to USEC Inc. for the Lead Cascade and the ACP.

The NRC had reviewed USEC's performance at the Portsmouth GDP, covering the period between July 6, 2008, and July 10, 2010. The NRC determined that during this period the Portsmouth GDP ~~had conducted its activities safely and securely, while protecting public health, and the environment, and that there were no areas needing improvement. No events occurred at the Portsmouth GDP which resulted in a significant release of radioactive material. The Portsmouth GDP~~ had continuously provided adequate protection of public health, safety, safeguards, security, and the environment. Offsite radiological doses, as well as doses to the workers, were ~~are~~ very low and within regulatory limits. From October 1, 2008, until its decertification, there were no significant events requiring activation of the EOC.

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GASEOUS DIFFUSION PLANT OPERATIONS

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In the gaseous diffusion separation process, UF_6 gas passes through a material (barrier) with small pores that are large enough to permit the transfer or diffusion of single molecules but are too small to permit bulk flow of the gas. The gas that emerges from the pores has a slightly higher concentration of ^{235}U atoms than the gas that does not pass through the barrier. This process creates two streams of gas, one with a higher ^{235}U concentration (enriched) and one with a lower concentration (depleted). Because the degree of enrichment achieved by the use of a single barrier (i.e., a single diffusion stage) is very small, the process must be repeated many times, employing a cascade of many stages to achieve the required enrichment levels. The outputs of the cascade are enriched uranium product and depleted uranium (DU). The DU is stored at the GDPs, awaiting ultimate disposition.

The main components of a GDP are: (1) large cylindrical vessels called diffusers that contain the barrier, (2) compressors used to compress the gas to the pressures needed to flow through the barrier tubes and from one stage to another, (3) electric motors to drive the compressors, (4) heat exchangers and cooling systems for removing the heat of compression from the UF_6, (5) piping for the stage and inter-stage connections, and (6) block and control valves to adjust and direct the gas flow. In addition to this process stage equipment, GDPs require: (1) auxiliary systems such as the UF_6 feed and withdrawal systems, (2) an extensive electrical power distribution system, and (3) cooling towers to dissipate the waste process heat.

NRC OVERSIGHT

The major areas of NRC oversight at the GDPs include: (1) plant operations, (2) nuclear criticality safety, (3) physical protection, (4) security of classified information, (5) material control and accounting (MC&A), (6) radiological controls for onsite and offsite personnel, (7) waste management, (8) transportation of radiological materials, (9) maintenance and surveillance, (10) training, and (11) emergency preparedness. The NRC is responsible for ~~(1)~~ regulatory oversight of: (1) the design, operation, and maintenance of hardware (i.e., structures, systems, and components) relied on for safe operation; (2) operational aspects involving the human element, such as training, staffing, and adherence to procedures; and (3) management organization and controls necessary to ensure effective management oversight of facility operations. Management organization and controls include: (1) policies and procedures, (2) internal reviews and audits, (3) safety review committees, (4) configuration management, (5) records management, (6) event investigation and reporting, and (7) quality assurance programs.

The NRC also reviews and approves accident analyses and technical safety requirements (TSRs) developed by the United States Enrichment Corporation (USEC). The accident analyses describe potential credible accidents and the facility response to those accidents to demonstrate that the facility is capable of responding in a fashion that will not

CHAPTER 4

HEALTH, SAFETY, AND ENVIRONMENTAL STATUS

The U.S. Nuclear Regulatory Commission (NRC) has responsibility to ensure that the health and safety of the public and the workers at the gaseous diffusion plants (GDPs) are protected from hazards involving radioactive material and radiation. Title 10 of the *Code of Federal Regulations* (10 CFR) 76.60, "Regulatory Requirements Which Apply," requires the United States Enrichment Corporation (USEC) to comply with applicable sections of 10 CFR Part 20, "Standards for Protection Against Radiation." Health, safety, and environmental conditions are reflected in radiation doses received by workers and in radioactive effluents. This chapter contains information relating to the health, safety, and environmental conditions for the leased areas of the GDPs under NRC regulatory oversight. The U.S. Department of Energy (DOE) was contacted in the preparation of this report, and the input from DOE is included as Appendix A to this report, "Summary of DOE Activities at the Paducah and Portsmouth Gaseous Diffusion Plants."

DOE and USEC maintain onsite and offsite environmental dosimeters to monitor gamma radiation levels at the Paducah and the Portsmouth GDPs. The 2012 data from the environmental dosimeters at Paducah show that ambient gamma exposure levels at the site boundaries are very small and well within the NRC's regulatory limits. Similarly, the ~~most recent~~ 2010 data from the environmental dosimeters at Portsmouth show that ambient gamma exposure levels at the site boundaries there were also very small and well within the NRC's regulatory limits. Maximum annual doses to the nearest offsite individuals from exposure to radioactive effluents from USEC operations (DOE operations are discussed below), for calendar years (CYs) 2008 through 2012, are calculated to be no more than 1.5×10^{-4} millisievert (mSv) [(0.0148 millirem (mrem)] at the Paducah GDP and 5.1×10^{-4} mSv [0.051 mrem] at the Portsmouth GDP. These values are far below the NRC regulatory limit of 1 mSv/year (100 mrem/year) for members of the public, as specified in 10 CFR Part 20. Table 4-1 provides the maximum offsite individual doses for both GDPs.

Table 4-1
Maximum Offsite Individual Dose, Paducah and Portsmouth, 2008–2012[a]

Calendar Year	Paducah Maximum Offsite Dose, mSv/yr (mrem/yr)[b] Airborne Emissions	Portsmouth Maximum Offsite Dose, mSv/yr (mrem/yr) Airborne Emissions
2008	8.2×10^{-5} (0.0082)	5.3×10^{-5} (0.0053)
2009	1.2×10^{-4} (0.0118)	6.9×10^{-5} (0.0069)
2010	1.5×10^{-4} (0.0148)	5.1×10^{-4} (0.051)
2011	4.0×10^{-5} (0.0040)	N/A
2012	4.7×10^{-5} (0.0047)	N/A

[a] Data for 2013 will be provided in the National Emissions Standards for Hazardous Air Pollutants (NESHAP) report in mid-2014. Information on radiation doses for 2013 is to be provided through the NRC's Radiation Exposure Information and Reporting System (REIRS) in 2014.

[b] Sv—Sievert; rem—röentgen equivalent man

NOTATION VOTE

RESPONSE SHEET

TO: Annette Vietti-Cook, Secretary

FROM: COMMISSIONER MAGWOOD

SUBJECT: SECY-13-0125 – REPORT TO CONGRESS ON THE HEALTH, SAFETY, AND ENVIRONMENTAL CONDITIONS AT THE GASEOUS DIFFUSION PLANTS LOCATED NEAR PADUCAH, KENTUCKY, AND PORTSMOUTH, OHIO

Approved X **Disapproved** _____ **Abstain** _____

Not Participating _____

COMMENTS: **Below** X **Attached** X **None** ___

I approve this report subject to the attached edits. I also agree with Commissioner Ostendorff that the staff should provide a final summary report to Congress of our oversight of the USEC's Paducah Gaseous diffusion plant from October 1, 2013 through termination of Paducah's Certificate of Compliance.

Wil Dc

SIGNATURE

12 December 2013

DATE

Entered on "STARS" **Yes** X **No** ___

EXECUTIVE SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) provides this report to Congress as required by Section 1701 of the Atomic Energy Act (AEA). This is the fifth report issued on the health, safety, and environmental conditions of the gaseous diffusion uranium enrichment plants (GDPs) located near Paducah, Kentucky, and Portsmouth, Ohio, and covers the 5-year period from October 1, 2008, to September 30, 2013. The information in this report is current as of September 30, 2013, unless otherwise specified. As directed by the AEA, the NRC staff consulted with the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) in preparing this report.

DOE continues to be responsible for regulatory oversight of the non-leased portions of the Paducah GDP. The Portsmouth GDP leased facilities were returned to DOE and NRC's Certificate of Compliance (CoC) for the Portsmouth GDP was terminated in 2011. Located on the site of the Portsmouth GDP are the American Centrifuge Lead Cascade Facility (Lead Cascade) and the American Centrifuge Plant (ACP), both of which are regulated under NRC licenses issued pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 70, "Domestic Licensing of Special Nuclear Material." Except for the Lead Cascade and the ACP, the DOE is fully responsible for the regulatory oversight of all activities at the Portsmouth GDP site.

The Federal Reports Elimination Act of 1998 amended Section 1701 of the AEA to decrease the required frequency of this report to Congress from annually to one at least every 5 years, coinciding with the date on which a renewed CoC is issued by the NRC. The NRC last issued CoCs for the Paducah and the Portsmouth GDPs on December 31, 2008, pursuant to 10 CFR Part 76, "Certification of Gaseous Diffusion Plants." The Portsmouth GDP's CoC was terminated on October 12, 2011, and the Paducah GDP CoC is expected to be terminated within 5 years. ~~Consequently, the NRC staff expects this to be the last report to Congress on this matter.~~

The expiration date of the CoC for the Paducah GDP is December 31, 2013. The CoC holder is the United States Enrichment Corporation (USEC), which filed an application to renew its 2008 CoC for the Paducah GDP with the NRC on April 2, 2013. The NRC is not currently reviewing USEC's renewal application because USEC permanently ceased enrichment operations at Paducah in June 2013, and plans to request that the NRC terminate the 2008 Paducah CoC in 2014. In accordance with 10 CFR 76.55, if a sufficient application for a CoC is timely filed, the existing CoC does not expire until a final determination on the application is made by the NRC. USEC's activities at the Paducah GDP will continue to be governed by the 2008 CoC until the NRC terminates it.

On August 1, 2013, USEC provided the DOE with its two-year notice of its intent to terminate its lease of the Paducah GDP. The DOE has indicated that it expects the return of the facility to be in accordance with the terms and provisions of the 1993 lease agreement (as later revised). The DOE and USEC are currently negotiating a framework for the return of the leased Paducah GDP facilities. Upon the CoC's termination, the NRC will no longer have regulatory authority and the DOE will assume responsibility and regulatory authority of the Paducah GDP.

The NRC conducted the most recent review of USEC's performance at the Paducah GDP covering the period between January 1, 2011, and December 31, 2012 (such performance reviews are in addition to the required GDP inspections which are performed every 24 months). The NRC's most recent performance review determined that the Paducah GDP continued to

conduct its activities safely and securely, while protecting public health, and the environment, and that there were no areas needing improvement. No events which resulted in a significant release of radioactive material occurred at the plant. Offsite radiological doses, as well as doses to the workers, are very low and within regulatory limits. However, on January 14, 2009, in accordance with plant procedures, the Paducah GDP Emergency Operations Center (EOC) was activated for an unclassified emergency. The unclassified emergency was a result of a significant leak of cooling water in a feed facility. The leak did not involve a radiation release and, therefore, there were no radiological impacts. On July 27, 2011, the Paducah EOC was activated for an "alert" (meaning that events may occur, are in progress, or have occurred that could lead to a release of radioactive material[s] but that the release is not expected to require a response by an offsite response organization to protect people offsite). This 2011 alert was due to a release of a nonradioactive toxic gas due to equipment failure.

During calendar years 2011 through 2012, the Paducah GDP operated between 900 and 1750 megawatts, and produced over 10 million separative work units (SWU) at record efficiency. A SWU is a measure of enrichment in the uranium enrichment industry; it represents the level of effort or energy required to raise the concentration of uranium-235 to a specified level, and is an indicator of the amount of enriched uranium. Until USEC ended enrichment operations in 2013, the Paducah GDP was the leading supplier of uranium fuel for the commercial nuclear power plants, and was the only GDP operating within the United States.

The Portsmouth GDP certificate was terminated on October 12, 2011, following the NRC's review and approval of USEC's request to terminate certified activities at the plant. Following return of the leased buildings to DOE and certificate termination, the DOE began major decontamination and decommissioning activities in most of the Portsmouth GDP buildings, except for those currently leased to USEC Inc. for the Lead Cascade and the ACP.

The NRC had reviewed USEC's performance at the Portsmouth GDP, covering the period between July 6, 2008, and July 10, 2010. The NRC determined that during this period the Portsmouth ~~GDP had conducted its activities safely and securely, while protecting public health, and the environment, and that there were no areas needing improvement. No events occurred at the Portsmouth GDP which resulted in a significant release of radioactive material. The Portsmouth GDP~~ had continuously provided adequate protection of public health, safety, safeguards, security, and the environment. Offsite radiological doses, as well as doses to the workers, ~~are~~ were very low and within regulatory limits. From October 1, 2008, until its decertification, there were no significant events requiring activation of the EOC.

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NOTATION VOTE

RESPONSE SHEET

TO: Annette Vietti-Cook, Secretary

FROM: COMMISSION OSTENDORFF

SUBJECT: SECY-13-0125 – REPORT TO CONGRESS ON THE HEALTH, SAFETY, AND ENVIRONMENTAL CONDITIONS AT THE GASEOUS DIFFUSION PLANTS LOCATED NEAR PADUCAH, KENTUCKY, AND PORTSMOUTH, OHIO

Approved X **Disapproved** _____ **Abstain** _____

Not Participating _____

COMMENTS: **Below** X **Attached** X **None** ___

I approve this report subject to the comments below and attached edits. I appreciate staff's thorough history and evaluation of the Gaseous Diffusion Plants. When we complete the termination of Paducah's Certificate of Compliance, we will have fulfilled our obligation under section 1701 of the Atomic Energy Act for oversight of USEC activities. I, however, do not support the staff's assertion in the report that this may be the last USEC oversight report to Congress. Rather, after we terminate Paducah's Certificate of Compliance, staff should provide a final summary report to Congress of our oversight of USEC's Paducah Gaseous Diffusion Plant from October 1, 2013, through termination of Paducah's Certificate of Compliance.

SIGNATURE

12/11/13

DATE

Entered on "STARS" **Yes** X **No** ___

EXECUTIVE SUMMARY

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The principal process that the U.S. Nuclear Regulatory Commission (NRC) regulates at the gaseous diffusion plants (GDPs) is the production of enriched uranium (EU) for reactor fuel. The GDPs receive uranium hexafluoride (UF_6), enrich it (i.e., process the material to increase the concentration of fissionable uranium-235 [^{235}U]), and then ship the enriched UF_6 to other fuel cycle facilities where it is processed into fuel assemblies for use in nuclear power reactors.

In the gaseous diffusion separation process, UF_6 gas passes through a material (barrier) with small pores that are large enough to permit the transfer or diffusion of single molecules but are too small to permit bulk flow of the gas. The gas that emerges from the pores has a slightly higher concentration of ^{235}U atoms than the gas that does not pass through the barrier. This process creates two streams of gas, one with a higher ^{235}U concentration (enriched) and one with a lower concentration (depleted). Because the degree of enrichment achieved by the use of a single barrier (i.e., a single diffusion stage) is very small, the process must be repeated many times, employing a cascade of many stages to achieve the required enrichment levels. The outputs of the cascade are enriched uranium product and depleted uranium (DU). The DU is stored at the GDPs, awaiting ultimate disposition.

The main components of a GDP are: (1) large cylindrical vessels called diffusers that contain the barrier, (2) compressors used to compress the gas to the pressures needed to flow through the barrier tubes and from one stage to another, (3) electric motors to drive the compressors, (4) heat exchangers and cooling systems for removing the heat of compression from the UF_6, (5) piping for the stage and inter-stage connections, and (6) block and control valves to adjust and direct the gas flow. In addition to this process stage equipment, GDPs require: (1) auxiliary systems such as the UF_6 feed and withdrawal systems, (2) an extensive electrical power distribution system, and (3) cooling towers to dissipate the waste process heat.

NRC OVERSIGHT

The major areas of NRC oversight at the GDPs include: (1) plant operations, (2) nuclear criticality safety, (3) physical protection, (4) security of classified information, (5) material control and accounting (MC&A), (6) radiological controls for onsite and offsite personnel, (7) waste management, (8) transportation of radiological materials, (9) maintenance and surveillance, (10) training, and (11) emergency preparedness. The NRC is responsible for~~: (1)~~ regulatory oversight of: (1) the design, operation, and maintenance of hardware (i.e., structures, systems, and components) relied on for safe operation; (2) operational aspects involving the human element, such as training, staffing, and adherence to procedures; and (3) management organization and controls necessary to ensure effective management oversight of facility operations. Management organization and controls include: (1) policies and procedures, (2) internal reviews and audits, (3) safety review committees, (4) configuration management, (5) records management, (6) event investigation and reporting, and (7) quality assurance programs.

The NRC also reviews and approves accident analyses and technical safety requirements (TSRs) developed by the United States Enrichment Corporation (USEC). The accident analyses describe potential credible accidents and the facility response to those accidents to demonstrate that the facility is capable of responding in a fashion that will not

CHAPTER 4

HEALTH, SAFETY, AND ENVIRONMENTAL STATUS

The U.S. Nuclear Regulatory Commission (NRC) has oversight responsibility to ensure that the health and safety of the public and the workers at the gaseous diffusion plants (GDPs) are protected from hazards involving radioactive material and radiation. Title 10 of the *Code of Federal Regulations* (10 CFR) 76.60, "Regulatory Requirements Which Apply," requires the United States Enrichment Corporation (USEC) to comply with applicable sections of 10 CFR Part 20, "Standards for Protection Against Radiation." Health, safety, and environmental conditions are reflected in radiation doses received by workers and in radioactive effluents. This chapter contains information relating to the health, safety, and environmental conditions for the leased areas of the GDPs under NRC regulatory oversight. The U.S. Department of Energy (DOE) was contacted in the preparation of this report, and the input from DOE is included as Appendix A to this report, "Summary of DOE Activities at the Paducah and Portsmouth Gaseous Diffusion Plants."

DOE and USEC maintain onsite and offsite environmental dosimeters to monitor gamma radiation levels at the Paducah and the Portsmouth GDPs. The 2012 data from the environmental dosimeters at Paducah show that ambient gamma exposure levels at the site boundaries are very small and well within the NRC's regulatory limits. Similarly, the ~~most recent~~ 2010 data from the environmental dosimeters at Portsmouth show that ambient gamma exposure levels at the site boundaries there were also very small and well within the NRC's regulatory limits. Maximum annual doses to the nearest offsite individuals from exposure to radioactive effluents from USEC operations (DOE operations are discussed below), for calendar years (CYs) 2008 through 2012, are calculated to be no more than 1.5×10^{-4} millisievert (mSv) [(0.0148 millirem (mrem)] at the Paducah GDP and 5.1×10^{-4} mSv [0.051 mrem] at the Portsmouth GDP. These values are far below the NRC regulatory limit of 1 mSv/year (100 mrem/year) for members of the public, as specified in 10 CFR Part 20. Table 4-1 provides the maximum offsite individual doses for both GDPs.

Table 4-1
Maximum Offsite Individual Dose, Paducah and Portsmouth, 2008–2012[a]

Calendar Year	Paducah Maximum Offsite Dose, mSv/yr (mrem/yr)[b] Airborne Emissions	Portsmouth Maximum Offsite Dose, mSv/yr (mrem/yr) Airborne Emissions
2008	8.2×10^{-5} (0.0082)	5.3×10^{-5} (0.0053)
2009	1.2×10^{-4} (0.0118)	6.9×10^{-5} (0.0069)
2010	1.5×10^{-4} (0.0148)	5.1×10^{-4} (0.051)
2011	4.0×10^{-5} (0.0040)	N/A
2012	4.7×10^{-5} (0.0047)	N/A

[a] Data for 2013 will be provided in the National Emissions Standards for Hazardous Air Pollutants (NESHAP) report in mid-2014. Information on radiation doses for 2013 is to be provided through the NRC's Radiation Exposure Information and Reporting System (REIRS) in 2014.

[b] Sv—Sievert; rem—röentgen equivalent man