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1.0 INTRODUCTION TO THE ENVIRONMENTAL REPORT

This Environmental Report (ER) constitutes one portion of an application submitted by AREVA Enrichment Services, LLC (AES) to the Nuclear Regulatory Commission (NRC) for a license to construct and operate a gas centrifuge uranium enrichment facility. The proposed facility, the Eagle Rock Enrichment Facility (EREF), will be located near Idaho Falls, Idaho. The ER for this proposed facility serves two primary purposes. First, it provides information that is specifically required by the NRC to assist it in meeting its obligations under the National Environmental Policy Act (NEPA) of 1969 (Pub. Law 91-190, 83 Stat. 852) (USC, 2008a) and the agency's NEPA-implementing regulations. Second, it demonstrates that the environmental protection measures proposed by AES are adequate to protect both the environment and the health and safety of the public.

AES has prepared this ER to meet the requirements specified in 10 CFR 51, Subpart A, particularly those requirements set forth in 10 CFR 51.45(b)-(e) (CFR, 2008a). The organization of this ER is generally consistent with the format for environmental reports recommended in NUREG-1748, Environmental Review Guidance for Licensing Actions Associated with NMSS Programs, Final Report August 2003 (NRC, 2003a).

The proposed facility will supply low-enriched uranium (5%) for use in commercial nuclear power plants. The facility will be located approximately 32 kilometers (20 miles) west of Idaho Falls, ID in Bonneville County on a 1,700 hectare (4,200 acre) site. The proposed facility will employ the gas centrifuge enrichment technology originally developed by Urenco, a consortium representing the governments of the United Kingdom, The Netherlands, and Germany. This technology has been used safely and successfully in Urenco's commercial operations for the last 35 years. This is the same technology that will be used at the National Enrichment Facility that was licensed by the NRC in June 2006 and is currently under construction in Lea County, New Mexico. This ER is part of an application for license to construct and then operate the EREF for 30 years.

The following are the key dates and milestones for the project to license, construct, and operate the proposed EREF.

Milestone	**Estimated Date**
Submit Facility License Application	December 2008
Requested License Approval	February 2011
Initiate Facility Construction	February 2011
Start First Cascade	February 2014
Complete Construction	February 2018
Achieve Full Nominal Production Output	March 2018
Submit License Termination Plan to NRC	February 2030
Complete Construction of D&D Facility	February 2032
D&D Completed	February 2041

A list and discussion of other alternatives to the EREF is provided in Section 1.1 and Chapter 2.

This ER evaluates the environmental impacts of the proposed facility. Accordingly, this document discusses the proposed action, the need for and purposes of the proposed action, and applicable regulatory requirements, permits, and required consultations (ER Chapter 1, Introduction to the Environmental Report); considers reasonable alternatives to the proposed action (Chapter 2, Alternatives); describes the proposed EREF facility and the environment potentially affected by the proposed action (Chapter 3, Description of Affected Environment); presents and compares the potential impacts resulting from the proposed action and its alternatives (Chapter 4, Environmental Impacts); identifies mitigation measures that could eliminate or lessen the potential environmental impacts of the proposed action (Chapter 5, Mitigation Measures); describes environmental measurements and monitoring programs (Chapter 6, Environmental Measurements and Monitoring Programs); provides a cost benefit analysis (Chapter 7, Cost-Benefit Analysis); and summarizes potential environmental consequences (Chapter 8, Summary of Environmental Consequences). A list of references and preparers is also provided in Chapter 9, References, and Chapter 10, List of Preparers, respectively.

The effective date of this ER is December 2008.

AREVA Enrichment Services

AREVA Enrichment Services (AES), LLC is a Delaware limited liability corporation. It has been formed solely to provide uranium enrichment services for commercial nuclear power plants. AES is a wholly owned subsidiary of AREVA NC Inc. AREVA NC Inc. is a wholly owned subsidiary of the AREVA NC SA, which is part of AREVA SA.

The AREVA NC SA is a corporation formed under the laws of France (“AREVA”), is governed by the Executive Board, and its owners are as follows.

- Commissariat à l’Energie Atomique (French Atomic Energy Commission) 78.96%
- French State 5.19%
- Caisse des dépôts and et consignations 4.61%
- ERAP 3.21%
- Electricité d ’France 2.42%
- Investment certificate holders 4.03%
- Framepargne 1.58%

AES is a Delaware corporation and is governed by the AES Management Committee. The names and addresses of the members of the AES Management Committee are as follows:

- Mr. Jacques Besnainou
  President and Chief Executive Officer of AREVA NC Inc.
  President of AREVA Inc.
  4800 Hampden Lane, Bethesda MD 20814, USA

  Mr. Besnainou is a citizen of the United States of America and a citizen of France

- Mr. Michael McMurphy
  Senior Executive Vice President
  Mine, Chemistry and Enrichment Sector, AREVA NC SA
  33 rue Lafayette, 75009 Paris, France

Mr. McMurphy is a citizen of the United States of America

- Mr. Francoix-Xavier Rouxel, Chairman of the Management Committee
  Executive Vice President, Enrichment Business Unit, AREVA NC SA
  33 rue Lafayette, 75009 Paris, France

  Mr. Rouxel is a citizen of France

- Mr. Gary Fox
  Executive Vice President, AREVA NC Inc
  4800 Hampden Lane, Bethesda, MD 20814

  Mr. Fox is a citizen of the United States of America and a citizen of Canada

- Mr. Nicolas De Turckheim
  Director, Enrichment Business Unit, AREVA NC SA
  33 rue Lafayette, 75009 Paris, France

  Mr. De Turckheim is a citizen of France

- Mr. Nicolas Fayet
  Chief Financial Officer, Enrichment Business Unit, AREVA NC SA
  33 rue Lafayette, 75009 Paris, France

  Mr. Fayet is a citizen of France

The President and Chief Executive Officer of AES is Sam Shakir, a citizen of the United States of America and a citizen of Canada. Any safety decision related to the operation of the facility will be made by the President of AES.

AES's principal location for business is Bethesda, MD. The facility will be located in Bonneville County near Idaho Falls, Idaho. No other companies will be present or operating on the EREF site other than services specifically contracted by AES.

AES is responsible for the design, quality assurance, construction, operation, and decommissioning of the enrichment facility. The President and CEO of AES report to the AES Management Committee.

Foreign Ownership, Control and Influence (FOCI) of AES is addressed in the AES Standard Practice Procedures Plan, Appendix 1 – FOCI Package. The NRC in its letter to Louisiana Energy Services dated March 24, 2003, has stated "…that while the mere presence of foreign ownership would not preclude grant of the application, any foreign relationship must be examined to determine whether it is inimical to the common defense and security [of the United States]." (NRC, 2003b) The FOCI Package mentioned above provides sufficient information for this examination to be conducted.

1.1 PURPOSE AND NEED FOR THE PROPOSED ACTION

As set forth in Section 1.2, Proposed Action, the proposed action is the issuance of an U.S. Nuclear Regulatory Commission (NRC) license under 10 CFR 70 (CFR, 2008b), 10 CFR 30 (CFR, 2008c) and 10 CFR 40 (CFR, 2008d) that would authorize AES to possess and use special nuclear material (SNM), source material and byproduct material, and to construct and operate a uranium enrichment facility at a site located in Bonneville County, Idaho. The proposed AES facility would provide enriched Uranium-235 (^{235}U) up to a nominal 5% by the gas centrifuge process, with a nominal production of three million separative work units (SWU) per year. The enriched uranium will be used primarily in commercial nuclear power plants in the United States (U.S.).

Uranium enrichment is critical to the production of fuel for U.S. commercial nuclear power plants, which currently supply approximately 20% of the nation's electricity requirements (EIA, 2007a). However, since the beginning of the decade, domestic uranium enrichment has fallen from a capacity greater than domestic demand to a level that is less than half of domestic requirements (DOE, 2002a). In fact, at present, less than 15% of U.S. enrichment requirements are being met by enrichment plants located in the U.S. (EIA, 2007b). Notwithstanding, forecasts of installed nuclear generating capacity suggest a continuing demand for uranium enrichment services, both in the U.S. and abroad. The current lack of domestic enrichment capacity relative to domestic requirements has prompted concern within the U.S. government. Indeed, in a July 25, 2002 letter to the NRC commenting on general policy issues raised by Louisiana Energy Services (LES) in the course of its pre-application activities, William D. Magwood, IV, then Director of the U.S. Department of Energy (DOE) Office of Nuclear Energy, Science and Technology, stressed the importance of promoting and developing additional domestic enrichment capacity. In this letter, DOE noted that "[i]n interagency discussions, led by the National Security Council, concerning the domestic uranium enrichment industry, there was a clear determination that the U.S. should maintain a viable, competitive, domestic uranium enrichment industry for the foreseeable future." In addition to identifying the policy objective of encouraging private sector investment in new uranium enrichment capacity, DOE has emphasized that "[t]he Department firmly believes that there is sufficient domestic demand to support multiple enrichers and that competition is important to maintain a healthy industry" (DOE, 2002a).

This DOE letter to the NRC is consistent with prior DOE statements concerning the importance from a national energy security perspective of establishing additional reliable and economical uranium enrichment capacity in the U.S. In DOE's annual report, "Effect of U.S./Russia Highly Enriched Uranium Agreement 2001," dated December 31, 2001 (DOE, 2001a), DOE noted that "[w]ith the tightening of world supply and the closure of the Portsmouth Gaseous Diffusion Plant by USEC, in May 2001, the reliability of U.S. supply capability has become an important energy security issue." With respect to national energy security, DOE further stated:

The Department believes that the earlier than anticipated cessation of plant operations at Portsmouth has serious domestic energy security consequences, including the inability of the U.S. enrichment supplier USEC to meet all its enrichment customers' contracted fuel requirements, in the event of a supply disruption from either the Paducah plant production or the Highly Enriched Uranium (HEU) Agreement deliveries. These concerns highlight the importance of identifying and deploying an economically competitive replacement domestic enrichment capability in the near term.

As reflected in DOE's July 25, 2002 letter to the NRC, the Department of State has similarly recognized that "[m]aintaining a reliable and economical U.S. uranium enrichment industry is an important U.S. energy security objective." (Magwood letter, citing unclassified excerpt from U.S.

Department of State cable SECSTATE WASHDC 212326Z DEC 01 (NOTAL)). Importantly, the letter emphasized that "the U.S. Government supports the deployment of Urenco gas centrifuge technology in new U.S. commercial enrichment facilities as a means of maintaining a reliable and economical U.S. uranium enrichment industry." Thus, current U.S. energy security concerns and policy objectives establish a clear need for additional domestic uranium enrichment capacity, a need that also has been recognized by Congress for some time. See e.g., S. Rep. No. 101-60, 101st Congress, 1st Session 8, 20 (1989) ("some domestic enrichment capability is essential for maintaining energy security"); H.R. Rep. No. 102-474, pt. 2, at 76 (1992) ("a healthy and strong uranium enrichment program is of vital national interest").

National security concerns and policy objectives also underscore the need for an additional reliable and economical domestic source of enrichment services. Congress has characterized uranium enrichment as a strategically important domestic industry of vital national interest, essential to the national security and energy security of the United States and necessary to avoid dependence on imports. S. Rep No. 101-60, 101st Congress, 1st Session 8, 43 (1989); Energy Policy Act of 1992, 42 U.S.C. Section 2296b-6. National security and defense interests require assurance that "the nuclear energy industry in the United States does not become unduly dependent on foreign sources of uranium or uranium enrichment services." S. Rep. No. 102-72, 102d Congress 1st Session 144-45 (1991). Indeed, in connection with the Claiborne Enrichment Center (CEC) proposed by LES in 1991, the NRC recognized "[t]he fact that USEC already exists to serve national security interests does not entirely obviate a role for LES in helping to ensure a reliable and efficient domestic uranium enrichment industry, particularly when USEC is the only domestic supplier." Louisiana Energy Services (Claiborne Enrichment Center), CLI-98-3, 47 NRC 77, 96 n. 15 (1998) citing H.R. Rep. No. 102-474, 102d Congress, 2d Session, pt. 1 at 143 (1992) (emphasis in original). Indeed, the NRC stated that "it might fairly be said that national policy establishes a need for a reliable and economical domestic source of enrichment services," and that "congressional and NRC policy statements" articulating such considerations of national policy "bear in [its] view, on any evaluation of the need for the facility and its potential benefits." CLI-98-3, 47 NRC at 95-96.

Increasing the supply of enrichment capacity to ensure a reliable global enrichment supply also supports U.S. non-proliferation objectives reflected in the Global Nuclear Energy Partnership (GNEP). Under GNEP's reliable fuel services program, nations with advanced nuclear technologies would provide fuel to meet the needs of other countries in order to reduce the motivation for countries seeking nuclear power to develop uranium enrichment capabilities. By participating in GNEP, growing economies can enjoy the benefits of clean, safe nuclear power while minimizing proliferation concerns and eliminating the need to invest in the complete fuel cycle (e.g., enrichment). AES's new facility would further the objectives of GNEP by augmenting international enrichment capacity and thereby increasing the reliability of global enrichment supply.

In December 2003 and August 2004, two companies that offer uranium enrichment services worldwide submitted applications to the NRC for licenses to build and operate new centrifuge based uranium enrichment plants in the U.S. In June 2006 and April 2007, respectively, the NRC issued those licenses; and construction is presently underway on both facilities (NRC, 2007a). In 2007, AREVA stated its intent to build a new centrifuge based uranium enrichment plant in the U.S. (AREVA, 2007a).

The AES facility would further attainment of the foregoing energy and national security policy objectives. The enriched uranium supplied by the AES facility would constitute a significant addition to current U.S. enrichment capacity. As noted above, when completed, the AES facility would supply low-enriched uranium at the nominal rate of 3 million separative work units (SWU) per year. This is equivalent to roughly 20 percent of the current U.S. enrichment services requirements.

Operation of the AES facility would foster greater security and reliability with respect to the U.S. low-enriched uranium supply. Of equal importance, it would provide for more diverse domestic suppliers of enrichment services. At present, U.S. enrichment requirements are being met principally through enriched uranium produced by USEC's 50-year old Paducah gaseous diffusion plant (GDP) and at non-U.S. enrichment facilities. Much of the foreign-derived enriched uranium being used in the U.S. comes from the down blending of Russian HEU, pursuant to a 1993 agreement between the U.S. and Russian governments that is administered by USEC. This agreement, however, is currently scheduled to expire in 2013.

In the license application for its proposed American Centrifuge Plant (ACP), USEC, which is currently the only domestic provider of enriched uranium to U.S. purchasers, explicitly recognized that the age of its Paducah facility, coupled with production cost considerations and the expiration of the U.S.-Russia HEU Agreement in 2013, necessitates deployment of more modern, lower-cost domestic enrichment capacity by the end of this decade (USEC, 2005a). The AES facility, which would begin production in 2014 and achieve full nominal production output by 2018, would help meet this need. The presence of multiple enrichment services providers in the U.S., each with the potential capability to increase capacity to meet potential future supply shortfalls, would enhance both diversity and security of supply for generators and end-users of nuclear-generated electricity in the U.S. As discussed in Section 1.1.2, Market Analysis of Enriched Uranium Supply and Requirements, purchasers of enrichment services view diversity and security of supply as vital from a commercial perspective as well.

The reliability and economics of the Enrichment Technology Company Ltd. (ETC) centrifuge technology to be deployed in the AES facility are well-established. This technology has been in use for over 30 years, and is currently deployed at Urenco's three European enrichment facilities. These facilities are located in Gronau, Germany; Almelo, Netherlands; and Capenhurst, United Kingdom (U.K.). These facilities had a combined annual production capability of 9.6 million SWU at the end of 2007, which when taken together with the Louisiana Energy Services facility that is presently under construction in the U.S. are in total scheduled to increase to 15 million SWU per year by the end of 2012 (Urenco, 2008). The duration of operations at these facilities and their collective SWU output confirms the operational reliability and commercial viability of the centrifuge technology that AREVA will install in the U.S.

Notwithstanding its initial development over three decades ago, the gas centrifuge technology to be deployed by AES remains a state-of-the-art technology. As a result of its longstanding use in Europe, the ETC centrifuge enrichment process has undergone numerous enhancements, which have increased the efficiency of the process, as well as yielded significant safety and environmental benefits. The advantages of the ETC centrifuge technology relative to other existing enrichment technologies are discussed further in Section 2.1.3.1, Alternative Technologies. Chief among these is that the ETC centrifuge enrichment process requires approximately 50 times less energy than the gas diffusion processes still in use in France and the U.S. In this regard, AREVA plans to deploy ETC centrifuge technology in a new enrichment facility to be constructed in France that will replace its old plant that uses the gas diffusion process.

1.1.1 Need for the Proposed Action

Consistent with the guidance contained in NUREG-1520 (NRC, 2002a) concerning the need for and purpose of the proposed action, this section sets forth information on the quantities of enriched uranium used for domestic benefit, domestic and foreign requirements for enrichment services, and potential alternative sources of supply for AES's proposed services for the period 2008 to 2025. Section 1.1.2.1, Forecast of Installed Nuclear Power Generating Capacity, presents a forecast of installed nuclear power generating capacity during the specified period; Section 1.1.2.2, Uranium Enrichment Requirements Forecast, presents a forecast of uranium enrichment requirements; Section 1.1.2.3, Current and Potential Future Sources of Uranium Enrichment Services, discusses current and potential future sources of uranium enrichment services throughout the world; Section 1.1.2.4, Market Analysis of Supply and Requirements, discusses market supply and requirements under alternative scenarios and various commercial considerations and other implications associated with each scenario.

1.1.2 Market Analysis of Enriched Uranium Supply and Requirements

An analysis of the market for uranium enrichment services during the period 2008 through 2025 is presented in the following subsections. The analysis considers several scenarios with and without the proposed introduction of new AES uranium enrichment capacity in the U.S. In the context of this analysis, it is important to recognize that the market for uranium enrichment services is international in nature. At the present time, the owners and operators of commercial uranium enrichment facilities that are located in six countries actively market uranium enrichment services worldwide. In addition, entities in several other countries enrich uranium to supply indigenous commercial requirements. Requirements for uranium enrichment services, which are associated with the operation of commercial nuclear power plants, presently exist in 28 countries. Market related changes that occur in one part of the world impact the supply and requirements situation throughout the world. Accordingly, in order to understand the behavior of the market for uranium enrichment services in the U.S., it is necessary to examine the world market.

1.1.2.1 Forecast of Installed Nuclear Power Generating Capacity

AREVA has prepared both Reference and High Nuclear Power Growth forecasts of installed nuclear power generating capacity by country and categorized the generating capacity in each forecast according to the following five world regions: (i) U.S., (ii) Western Europe, (iii) Commonwealth of Independent States (C.I.S.) and Eastern Europe, (iv) East Asia, and (v) remaining countries, which are grouped as Other.

Eastern Europe consists of the following emerging market economy countries that were in the past classified as Communist Bloc countries and are operating nuclear power plants: Bulgaria, the Czech Republic, Hungary, Lithuania, Romania and Slovakia. Of the 12 C.I.S. countries that were part of the former Soviet Union (F.S.U.), the three with nuclear power plants still operating are Russia, Ukraine and Armenia, and a fourth, Kazakhstan, may revive its nuclear program in the future.

East Asia includes Japan, the People's Republic of China (China), the Republic of Korea (South Korea), Taiwan and Vietnam.

These forecasts were based on AES's country-by-country and unit-by-unit review of current nuclear power programs and plans for the future. The resulting AES forecasts of future world nuclear generation capacity are dependent on the following factors:

- Nuclear generating units currently in operation and retirements among these units that occur during the forecast period;
- Capacity that is created by extending the operating lifetimes of units currently in operation beyond initial expectations through license renewal;

- Units under construction, already ordered, or firmly planned with likely near-term site approval; and
- Additional new capacity that will require site approval and will be ordered in the future.

The Reference Nuclear Power Growth forecast is consistent with current trends. Aggressive expansion plans in East Asia continue to translate into real growth, although public acceptance may impact this, as does the slowdown in growth of electric power demand and the increasing liberalization of the power market. The possibility of new plant construction in Europe has become a reality as Finland begins the first new European nuclear power plant construction since 1991; and as France follows with its own European Power Reactor (EPR). Nuclear moratoriums and phase out plans remain in place in some European countries; however, in many cases these plans are being questioned internally. Plant operating lifetimes extending beyond 40 years are becoming very common, rather than the exception. In the U.S., the prospects for new nuclear plant construction continue to improve. In the meantime, all U.S. plants with operating licenses scheduled to expire by 2025 are expected to pursue license renewal. Additions to plant generating capacities are being made in the form of plant uprates. The U.S. industry continues to make progress in preparation for new nuclear power plant orders, with the NRC expecting up to 23 Combined License (COL) application submittals for a total of 34 units over 2007 through 2010 period (NRC, 2008a). By the end of 2008, 17 COL application submittals, for a total of 26 units, had been submitted to the NRC.

In the Reference Nuclear Power Growth forecast, AES assumes that world nuclear capacity will be dominated by plants currently in operation (i.e., 430 units and 368.4 GWe at the end of 2006) over the forecast period of this report, accounting for 71% on a GWe basis of the total in 2015 and 27% in 2025. A small but significant contribution of 2% in 2015 and 2025 is obtained from capacity uprates and restarts of previously shutdown units. The growing importance of license renewal is also highlighted, reaching 16% in 2015 to 42% in 2025. Units currently under construction, firmly planned or proposed will account for 9% in 2015 and 11% in 2025, while additional new capacity will account for 3% in 2015 and 19% in 2025. Cumulative retirements over the same period will amount to 3% (24 units) of total operable capacity in the year 2015, 7% (58 units) in 2025, partially offsetting the new capacity expected to be added in the future.

The High Nuclear Power Growth forecast is generally consistent with announced owner/operator schedules for identified nuclear power plants in the mid term. This forecast projects an average annual growth rate of nuclear capacity consistent with growing world electric generation demand and an increased reliance on nuclear power. In East Asia, renewed public acceptance of nuclear power and strong economic growth is assumed. In the U.S., broad agreement regarding the need for new base load generation capacity, and more stringent environmental controls and associated costs imposed on fossil-fired capacity, including those associated with limits on carbon emissions, are also consistent with the new nuclear power plant orders that are assumed in the High Nuclear Power Growth forecast. Specifically, AES forecasts, prepared by a consultant, are consistent with the most recently published forecasts of installed nuclear generation capacity prepared by the DOE Energy Information Administration (EIA) (EIA, 2007c) (EIA, 2007d) and the World Nuclear Association (WNA) (WNA, 2007a).

In Europe, strong demand for electric power, recognition of nuclear power's economic and environmental benefits, a decline in the political clout wielded by organizations opposed to nuclear power, and widespread recognition of the inability of renewables to replace nuclear power would enable it to not only maintain, but to enhance its market share. Strong economic performance coupled with the ability to raise the capital necessary for new construction projects is assumed for the High Nuclear Power Growth forecast in the C.I.S. and Eastern Europe. In the High Nuclear Power Growth forecast, most countries are assumed to extend the operating licenses of existing nuclear generating capacity retiring after the year 2015 to 50 years or more, or replace that generating capacity, in order to maintain their portfolio of nuclear power plants.

In the High Nuclear Power Growth forecast, AES assumes that world nuclear capacity will continue to be dominated by plants currently in operation over the forecast period of this report. However, the contribution from plants for which operating licenses have been renewed and in particular new plants is also higher.

Figures 1.1-1 and 1.1-2 present AES's forecast and composition of world nuclear generation capacity in the five categories, discussed above, for the Reference and High Nuclear Power Growth forecasts, respectively.

In the U.S., it is expected that a significant portion of existing units with operating licenses scheduled to expire by 2020 will find license renewal to be technically, economically and politically feasible. In fact, the NRC granted the first license extension in the U.S. to the two unit Calvert Cliffs Nuclear Station in March 2000. By April 2008 a total of 48 units had been granted license extensions in the U.S. Applications for the renewal of operating licenses for 14 additional units have been submitted to the NRC for review, and the NRC has been notified of operator plans to submit license renewal applications for at least an additional 29 units during the next six years (NRC, 2008b). This accounts for 87.5% of the nuclear generating units currently operating in the U.S. As far back as March 2002, the NRC expected "that virtually the entire operating fleet will ultimately apply" to renew their operating licenses, which appears to have been quite accurate (NRC, 2002b). The transition to a competitive electric generation market has resulted in further plant investment in the form of plant power uprates. These have included more than 60 power uprates, representing approximately 3.3 Gigawatt electric (GWe) that have been approved by the NRC from the year 2000 (through April 2008), nine applications for power uprates that are currently under review by the NRC, and an additional 27 applications for power uprates that are expected by the NRC over the next five years (NRC, 2008c).

AREVA's Reference and High Nuclear Power Growth forecasts of installed nuclear power generating capacity are summarized in Table 1.1-1. World installed nuclear power capacity is forecast to rise by 11% on a GWe basis (28 units added) from 370.9 GWe (435 units) at the end of 2007 to 412.3 GWe (463 units) by 2015, which is about 1.3% per year during that period, and to rise an additional 18% on a GWe basis (48 units added) to 485.8 GWe (511 units) by 2025, which is about 1.7% per year during the 2015 to 2025 period, for the Reference forecast.

In the High Growth forecast, world installed nuclear power capacity is forecast to rise 23% on a GWe basis (76 units added) to 457.1 GWe (511 units) by 2015, which is about 2.6% per year during that period, and to rise an additional 32% on a GWe basis (121 units added) to 604.1 GWe (632 units) by 2025, which is about 2.8% per year during the 2015 to 2025 period.

In the U.S., installed nuclear power capacity is forecast to rise by 3% on a GWe basis (1 unit added) from 100.6 GWe (104 units) at the end of 2007 to 103.8 GWe (105 units) by 2015, and to rise an additional 9% on a GWe basis (7 units added) to 113.5 GWe (112 units) by 2025 for the Reference forecast, which is about 0.7% per year over the entire period. In the High Growth forecast, installed U.S. nuclear power capacity is forecast to rise about 5% on a GWe basis (2 units added) to 105.3 GWe (106 units) by 2015, and to rise an additional 14% on a GWe basis (11 units added) to 120 GWe (117 units) by 2025, which is about 1.0% per year over the entire period.

The installed nuclear power generating capacity forecasts are also presented as average values over selected time periods in Table 1.1-2 for consistency with the presentation of uranium enrichment requirement forecasts, which appear in Section 1.1.2.2.

As shown in Figures 1.1-3 and 1.1-4 for the world and U.S., respectively, these AES forecasts, which were prepared by Energy Resources International, Inc. (ERI), are consistent with the most recently published forecasts of installed nuclear generation capacity prepared by the DOE Energy Information Administration (EIA) (EIA, 2007c) (EIA, 2007d) and the World Nuclear Association (WNA) (WNA, 2007a).

More specifically, as illustrated in Figure 1.1-3, the AES Reference Nuclear Power Growth forecast for the world falls between the other two forecasts, with the AREVA forecast never being more than 1.8% higher than the average of the other two forecasts over the period 2015 through 2025. The AES High Nuclear Power Growth forecast for the world is 4.1% higher than the WNA High forecast in 2015, but by 2025 the two forecasts are identical. A corresponding forecast from EIA was not available for comparison.

As illustrated in Figure 1.1-4, the AES Reference Nuclear Power Growth forecast for the U.S. is 1.4% higher than the average of the other two in 2015, but by 2020 it is 2.3% lower than the average of the other two, and by 2025 it is 2.7% lower than the average of the other two forecasts. Similarly, the AES High Nuclear Power Growth forecast for the U.S. is 0.3% higher than the average of the other two in 2015, but by 2020 it is 2.2% lower than the average of the other two, and by 2025 it is 4.5% lower than the average of the other two forecasts. Figure 1.1-4 also shows the significant increase in the EIA forecast of installed nuclear power generating capacity for the U.S. that occurred between its February and December 2007 forecasts.

1.1.2.2 Uranium Enrichment Requirements Forecast

Forecasts of uranium enrichment services requirements were prepared by ERI for AES consistent with ERI's nuclear power generation capacity forecasts, which were presented in Section 1.1.2.1. A summary of the nuclear fuel design and management parameters that were used in developing the forecast of uranium enrichment requirements is as follows:

- Country-by-country average capacity factors rising with time from a world average of 81.5% in 2006 to 85% by 2011, where it remains. The average capacity factor for the U.S. remains at 90% through 2025;
- Long term Western world average tails assay is projected to decline from 0.27 $^{w}/_{o}$ ^{235}U, to 0.245 $^{w}/_{o}$ ^{235}U in 2007, and then rise to 0.26 $^{w}/_{o}$ ^{235}U by 2010, where it remains through 2025. C.I.S. and Eastern Europe tails assays are assumed to remain at 0.11 $^{w}/_{o}$ ^{235}U;
- Individual plant enriched product assays are based on plant design, energy production, design burnup, and fuel type. Actual operating company practices outside the U.S. make use of higher enriched product assays in some Western countries, where a 0.1 to 0.2 $^{w}/_{o}$ ^{235}U design margin is typical; and for fuel used in Russian designed LWRs, where Russian fuel design enrichments are typically 0.3 $^{w}/_{o}$ ^{235}U higher than for otherwise comparable Western fuel designs;
- Current plant specific fuel discharge burnup rates for the U.S., and country and reactor type specific burnup rates elsewhere, will continue to increase; an 8% increase to 50 GWD/MTU is projected by 2016;
- Country (for some non-U.S. countries) and plant (for the U.S. and other countries) specific fuel cycle lengths, for example, collectively averaging approximately 20 months in the case of the U.S., and 16 months for all of the world's light water reactors (LWRs), including those in the U.S.;

- Typical enrichment services delivery lead times (from the start of refueling outage) of 18 to 36 months for first cores and 6 to 12 months for reloads; U.S. and European lead times are at the lower end of the range, while lead times in East Asia are at the higher end of the range.

It should be recognized that on a year-to-year basis, there can be both upward and downward annual fluctuations in requirements for enrichment services. This reflects the various combinations of nominal 12 month, 18 month and 24 month operating/refueling cycles that occur at nuclear power plants throughout the world, as well as the timing of initial cores for new nuclear power plants. Therefore, interval averages are used as the basis for subsequent discussion.

Table 1.1-3 provides a forecast of average annual enrichment services requirements by world region for both the Reference and High Nuclear Power Growth forecasts that must be supplied from among the collective sources of uranium enrichment services.

As shown in Table 1.1-3, during the 2011 to 2015 period, world annual enrichment services requirements are forecast to average 50.8 and 56.4 million SWU per year for the Reference and High Nuclear Power Growth forecasts, respectively. The world requirements forecast for this period reflect a 9.5% and 21.6% increase over the estimated 2007 value of 46.4 million SWU for these two forecasts. AES forecasts that world annual enrichment services requirements will rise during the 2016 to 2020 period reaching 55.4 and 65.3 million SWU per year for the Reference and High Nuclear Power Growth cases, respectively. These world requirements forecast for this period reflect a 9.1% and 15.8% increase over the prior period values for these two forecasts. World annual requirements during the 2021 to 2025 period reach 60.7 and 74.4 million SWU per year for the Reference and High Nuclear Power Growth cases, respectively. These requirements reflect a 9.6% and 13.9% increase over the prior period values for these two forecasts.

Figures 1.1-5 and 1.1-6 provide comparisons of the AES forecasts with those published by WNA for world and U.S. requirements, respectively, for both the Reference and High Nuclear Power Growth forecasts. The most recently published WNA forecasts of world and U.S. uranium enrichment requirements (WNA, 2007b) are somewhat higher than the AES forecasts.

Specifically, as illustrated in Figure 1.1-5, the WNA Reference forecast for the world is 8.2% higher than the AES Reference World Nuclear Power Growth forecast in 2015, with the difference increasing to 18.7% by 2025. For the High Nuclear Power Growth forecasts, the WNA forecast is 5.9% higher than the AES High Nuclear Power Growth forecast in 2015, with the difference increasing to 27.0% by 2025.

For the U.S., as illustrated in Figure 1.1-6, the WNA Reference forecast is 4.9% higher than the AES Reference U.S. Nuclear Power Growth forecast in 2015, with the difference increasing to 8.0% by 2025. For the High Nuclear Power Growth forecasts, the WNA U.S. forecast is 1.3% higher than the AES High U.S. Nuclear Power Growth forecast in 2015, with the difference increasing to 15.4% by 2025.

The difference in enrichment requirements forecasts between WNA and AES is due to several factors, including WNA's assumption of higher long term average plant capacity factors, WNA's admitted tendency to overestimate nuclear fuel requirements by up to 3% for operating cycles in current nuclear power plants, and WNA's use of slightly lower tails assays. If the higher WNA forecasts for uranium enrichment requirements were used by AES in this analysis, then an even greater need for newly constructed uranium enrichment capability would be forecast.

1.1.2.3 Current and Potential Future Sources of Uranium Enrichment Services

It is of course uncertain how requirements for enrichment services are actually going to develop on a year by year basis as new nuclear power plants are built and come into operation, and where specific increments of supply will come from as new enrichment facilities are completed and begin operation.

Several long term sources of enrichment services, such as the Georges Besse GDP operated by AREVA and the Paducah GDP operated by USEC are expected to be removed from service during the coming years (AREVA, 2006a) (USEC, 2005a). Even though there are published schedules for several sources of future supply that are in various stages of the licensing and construction process, it can not be known with certainty when each will actually become operational; or whether one or more of these new facilities may encounter a problem of such significance that it may never be able to contribute to available supply. There is also the yet to be answered question of whether and, if so, to what extent, each of these new facilities might be further expanded over time to service larger amounts of world requirements.

In addition, there is the question of how other presently operating facilities, such as Urenco's three operating enrichment facilities in Europe, and Rosatom's four operating enrichment plants in Russia may be expanded in the future to meet projected, but as yet uncertain requirements. In addition, the smaller enrichment plants that are located in countries such as Japan, China, and Brazil must also be considered. Also, while they are not expected to be a significant source of supply in the long term, government HEU inventories currently play a role in meeting commercial requirements. Finally, General Electric (GE)-Hitachi Nuclear Energy (GEH) has initiated work that is based on Silex laser enrichment technology. If testing of this technology by GEH, which is presently scheduled to occur during 2008, is successful, then this may lead to commercialization of the GEH Global Laser Enrichment (GLE) Technology as a potential source of between 3.5 and 6 million SWU per year of commercial enrichment services supply at some point in the future (GEH, 2007).

In addition to the physical supply capacity that may or may not be available, one must be mindful of the extent to which any of the international trade constraints that are presently being imposed, and which may continue to be imposed on selected sources of supply in the future, could impede the market's ability to most effectively utilize physically available increments of supply to meet growing requirements.

Recognizing the national security implications of nuclear fuel supply, as previously discussed in Section 1.1, it is important to consider supply of uranium enrichment services in the context of current and expected future requirements that were described in Section 1.1.2.2.

1.1.2.3.1 Base Supply of Enrichment Services

Table 1.1-4 summarizes current and potential future Base sources and quantities of uranium enrichment services. As available, these sources include existing inventories of low enriched uranium (LEU), production from existing uranium enrichment plants, enrichment services obtained by blending down Russian weapons grade HEU, as well as the base capacity for enrichment plants presently under construction, AES's U.S. plant, and expansions in existing facilities, together with enrichment services that presently being obtained by blending down U.S. HEU. It should be noted in the context of the GDPs that the current annual "economically competitive and physically usable capability," is less than the facility's "nameplate rating." In the case of facilities that are in the process of expanding their capability, the annual production that is available to fill customer requirements during the year is listed, not the end of year capability.

The economically competitive and physically usable capability refers to that portion of the enrichment facility nameplate rating that is capable of producing enrichment services that can be competitively priced and delivered to end users. For instance, the cost of firm power during Summer can be several times higher than the cost of non-firm power that may be purchased under contract during the remainder of the year. In practice this limits the annual enrichment capability of electricity intensive gas diffusion enrichment plants. In addition, from the perspective of an operator of a nuclear power plant in the U.S., physically usable requires that the enriched uranium product be obtained from an enrichment plant that is not subject to international trade restrictions that prevents its use in commercial nuclear power plants in the U.S. In this context the Base supply in this analysis includes the annual amount of Rosatom enrichment services that are included in the 2008 Amendment to the Agreement Suspending the Antidumping Investigation on Uranium from the Russian Federation that may be exported to the U.S. (FR, 2008a). It is for all of the above reasons that it is not appropriate to simply add together the nameplate capacities of all presently operating and potential new enrichment facilities, if the objective is to arrive at a meaningful forecast of total useable world enrichment capability.

As shown in Table 1.1-4, current Base annual supply capability that is economically competitive and not constrained by international trade restrictions amounts to 46.7 million SWU for the Reference Nuclear Power Growth forecast. This is similar to the estimated 2007 total world requirement of 46.4 million SWU. As will be demonstrated in Section 1.1.2.4, the future does not presently offer any greater sense of security than the present with regard to supply adequacy relative to growing requirements for enrichment services.

This conclusion is generally consistent with other published analyses of the market for uranium enrichment services, unless it is simply assumed that every prospective source of supply will become reality (Lohrey, 2006) (Meade, 2007) (Neely, 2007) (WNA, 2007c).

Each of the sources of supply identified in Table 1.1-4 is discussed in more detail below.

AES believes there are virtually no excess LEU inventories beyond pipeline and strategic reserve that are available for release, and certainly no long term contribution to world supply can be expected from LEU inventories.

Existing AREVA enrichment capability refers to capability from the 10.7 million SWU per year (nameplate rating) Georges Besse I (GB I) GDP that is located near Pierrelatte, France. It should be noted that two to three million SWU per year of the physically available GB I enrichment capability is not economically competitive due to very high electric power costs at that higher operating range (NF, 2007)(NW, 2007)(NF, 2005). As a result of the high power costs, production will be limited to approximately 7.5 million SWU in 2008 and later. According to the schedule announced by AREVA, it is expected that GB I enrichment capability will be split between customer deliveries and pre-production as the new replacement centrifuge plant begins operations. This will enable AREVA to build up a surplus of enrichment services that it can use to supplement centrifuge production following the planned shut down of the GB I GDP while the replacement centrifuge plant capacity is ramping up. Although shutdown of GB I was originally planned for 2012 (AREVA, 2003)(ASN, 2007)(AREVA, 2006b), the exact timing of the shutdown is not yet defined. AREVA has stated that the shutdown will only occur when sufficient capacity from the new centrifuge facility is available and that the decision to extend the GBI operation depends on customer commitments. For the purposes of this analysis, some production from GBI is assumed into 2015.

AREVA is presently building a new enrichment plant near Pierrelatte, France that will result in the replacement of its existing GDP with a new 7.5 million SWU per year enrichment plant that utilizes ETC centrifuge technology. The current schedule brings the new plant, Georges Besse

II (GB II), into operation in 2009 with nameplate capacity of 7.5 million SWU per year installed by 2016 (AREVA, 2007b).

AES is also pursuing a license that will allow it to build and operate a nominal 3 million SWU per year centrifuge enrichment plant, using the same technology as will be deployed in GB II, in the **U.S.** Initial production is expected to occur in 2014 and full capacity is expected to be reached in 2018 (AREVA, 2007b).

In all figures that display projections of enrichment services supply and requirements, the **Urenco existing and new** centrifuge enrichment capability refers to capability from machines that are presently in operation or expected to be installed at Urenco's three European enrichment plants, which are located in Gronau, Germany; Almelo, Netherlands; and Capenhurst, United Kingdom. These plants had a combined annual production capability of 9.6 million SWU at the end of 2007, which after accounting for the expected installation rate of capacity at Urenco's U.S. enrichment facility (see next paragraph), is scheduled to increase to about 12.5 million SWU per year by the end of 2012 (Urenco, 2008). Urenco is estimated to have produced 9.3 million SWU of enrichment services during 2007, although actual deliveries were higher.

The Urenco subsidiary, Louisiana Energy Services (LES), is moving forward with construction of a new 3 million SWU per year National Enrichment Facility (NEF) in Lea County, New Mexico, using ETC centrifuge technology. An NRC license was issued in June 2006, and the Urenco subsidiary expects to bring the new plant into operation beginning in mid 2009 and to achieve full nameplate capability in 2013 (WNN, 2007a).

Existing USEC enrichment capability refers to capability from the 8 million SWU per year GDP, which is located in Paducah, Kentucky (USEC, 2007a). A renegotiated power pricing arrangement with the Tennessee Valley Authority (TVA) took effect in June 2006, and power costs are significantly higher as a result. A June 2007 extension of the TVA power contract increased the quantity of power supplied by 25% for three years and extended the contract through May 2012 (USEC, 2007a). While Paducah GDP production ranged between 5 and 5.5 million SWU over the past few years prior to the contract extension (USEC, 2007b) (USEC, 2006) (USEC, 2005b), the additional TVA power supplies will enable production as high as 6.4 million SWU. Approximately 12% of the Paducah GDP's capacity will be devoted to underfeeding operations (USEC, 2007c), leaving up to 5.7 million SWU for commercial enrichment sales. The Paducah GDP is expected to shut down in June 2012 (DOE, 2007a), although it could remain open several years longer if required and if further power contract extensions are successfully negotiated (Platts, 2007). State officials hope the life of the Paducah GDP can be extended by processing DOE tails material, but such operations would not contribute the supply needed to meet world nuclear power plant requirements for enrichment services.

USEC plans to replace the Paducah GDP with a new 3.8 million SWU per year centrifuge enrichment plant known as the American Centrifuge Plant (ACP). USEC has been conducting demonstration testing of its AC100 centrifuge machines since the beginning of 2008 and expects the ACP operations to begin in late 2009 and to achieve full nameplate capacity to be reached in 2012 (USEC, 2007d). According to USEC, risks and uncertainties associated with the ACP include USEC's success in its demonstration and deployment of the technology, including its ability to meet performance targets and schedule for the ACP, the cost of the ACP, and USEC's ability to secure required external financial support (USEC, 2008).

Rosatom is the new state-owned corporation overseeing both commercial and military nuclear activities in Russia, which were formally handled by the Federal Atomic Energy Agency (also known as Rosatom). Most commercial nuclear activities, including enrichment plants, are consolidated in the subsidiary corporation known as Atomenergoprom. The **Rosatom** uranium enrichment plant production capability refers to the production at four plants in Russia operating at close to a 100% capacity factor. Production is reduced approximately 5% from nameplate capacity due to the low operating tails assay employed. Resulting production for 2007 is estimated to be 24.5 million SWU. For 2007, approximately 7.5 million SWU was devoted to C.I.S. and Eastern European requirements at 0.11 $^{w}/_{o}$ ^{235}U operating tails assay, which will be referred to as **Rosatom Internal**.

Rosatom also provides enrichment services to Western customers, primarily in the form of enriched uranium product (EUP) produced at its enrichment plants, which will be referred to as **Rosatom Export** and which totaled 6.5 million SWU in 2007. Of this amount, current U.S. and European trade policies effectively limited the quantity of Russian enrichment services that were sold directly to Western customers to approximately 4.0 million SWU. An additional 2.5 million SWU is estimated to have been wholesaled to European enrichment suppliers in 2007, resulting in total Rosatom Exports of 6.5 (= 4.0+2.5) million SWU. The wholesaling arrangement with European suppliers is scheduled to end in 2010, but the direct exports to Western customers are forecast to have the potential to increase to 4.8 million SWU annually by 2015, and 5.6 million SWU by 2025.

Rosatom enrichment capacity is also used for additional purposes that do not directly contribute to the world enrichment supply shown in Table 1.1-4. Approximately 5.4 million SWU per year of enrichment services is used to create HEU blend stock from depleted tails material (Bukharin, 2004). Up to 2.3 million SWU per year of Rosatom enrichment capacity is used to recycle tails material (i.e., enrich tails up to natural uranium assay) for European suppliers, Urenco and AREVA. The tails recycling arrangement for European suppliers is scheduled to end around 2010. Since Rosatom's 2007 production capability is estimated at 24.5 million SWU, approximately 2.8 (= 24.5-7.5-6.5-5.4-2.3) million SWU per year of trade policy constrained, but otherwise available, Russian enrichment production remained potentially available. That 2.8 million SWU was used to further process tails from the Western exports to lower feed requirements, and to further process the European suppliers' residual tails material, as well as Russia's own tails material, to create "normal" uranium for internal use or sale.

It should be noted that the Rosatom Internal capacity would be increased to respond to greater requirements for enrichment services and that other applications of Rosatom's enrichment capability would be adjusted accordingly. To account for this, Rosatom Internal enrichment capacity under the High Nuclear Power Growth forecast is assumed to be several million SWU per year higher than under the Reference Nuclear Power Growth forecast. Rosatom Exports are also assumed to increase when the direct sales of almost 3 million SWU to the U.S. market begin in 2014, consistent with the terms of the 2008 Amendment to the Agreement Suspending the Antidumping Investigation on Uranium from the Russian Federation (FR, 2008a). Application of Rosatom enrichment capacity available for enrichment of tails to create normal uranium is reduced as necessary to accommodate these adjustments.

As older centrifuges reach their design lifetimes, Rosatom is replacing them with newer designs that have higher outputs. As a result, total Russian enrichment production is slated to increase to 27.4 million SWU by 2010, 31 million SWU by 2015 and 33.9 million SWU by 2021 (IBR, 2007)(WNA, 2007d). Not all of this enrichment capacity may be needed, particularly if Russia's aggressive nuclear power expansion plans are moderated, as is assumed for the Reference Nuclear Power Growth forecast.

The use of low operating tails assay and tails recycling operations at Russian enrichment plants make economic sense, as they reduce the plants' natural uranium feed requirements, which allows for greater uranium exports. Any transfer of enrichment capacity away from tails recycling and to new commercial enrichment sales will ultimately force Russia to reduce its natural uranium equivalent exports or to purchase natural uranium for eventual resale in the form of EUP. In contrast, operating at approximately 0.11 $^{w}/_{o}$ ^{235}U tails assay makes full use of available enrichment capacity for export and reduces the Russian enrichment complex's natural uranium feed requirements, which allows sales to Western customers in the form of EUP.

The **Russian HEU-derived LEU** is expected to remain at 5.5 million SWU per year through 2012, dropping to 5.3 million SWU in 2013 when the term of the current U.S.-Russian agreement for 500 MT HEU concludes. The 5.5 million SWU figure is based on the contractually agreed tails assay of 0.30 $^{w}/_{o}$ ^{235}U. However, it was equivalent to approximately 6.1 million SWU in 2007 when evaluated at the average Western transaction tails assay. AES expects that this arrangement will end in 2013 as scheduled (NF, 2006). It is important to note that in order to create and utilize the SWU contained in the LEU that is derived from the Russian HEU, approximately 5.4 million SWU contained in blend stock is required from Russian enrichment plants, as noted earlier. When the blending of Russian HEU ends, this capacity will become available to Rosatom for use in commercial sales, subject to any trade constraints that may still exist. An additional small quantity of SWU is derived from Russian HEU directly blended with European utility reprocessed uranium (RepU). The program has gradually expanded and now provides an estimated 0.7 million SWU per year in 2007 and approximately 0.6 million SWU per year thereafter (WNN, 2007b)(TVEL, 2007).

At present, **U.S. HEU** includes the 39 MT of HEU (approximately 3.9 million SWU equivalent) that is being used by TVA at a rate of approximately 0.35 million SWU per year over an eleven year period which began in 2005. It is assumed that similar DOE off-spec HEU will be added to the TVA program, allowing it to extend through 2021. While an additional 200 MT of HEU was declared excess to the U.S. nuclear weapons stockpile by DOE in November 2005, only 61 MT of this excess HEU might be expected to eventually become available to the commercial nuclear fuel market, which would take place over more than two decades (NNSA, 2007), as discussed in Section 1.1.2.3.2.

The **Other Existing and New** capability is dominated by approximately 1.0 million SWU of annual centrifuge enrichment capability in China, 0.3 million SWU of annual Japanese centrifuge enrichment capability, and 0.1 million SWU of annual capability from other countries. The majority of this capability is used internally, although China exports modest amounts to the U.S. and Europe. The Chinese enrichment capability uses centrifuges that are imported from Russia. The Chinese centrifuge enrichment capacity is expected to expand to 1.5 million SWU by 2012. China will continue to make use of Russian centrifuge technology for the expansion (Tenex, 2007). The current Japanese capability is declining, and should reach zero in 2009 due to high failure rates that have limited centrifuge operating lifetimes (JNFL, 2008). Development of a next generation centrifuge is under way and is now expected to result in a commercial plant with initial capacity of 0.15 million SWU in 2010 and full capacity of 1.5 million SWU in 2020 (JNFL, 2007). Brazil has begun operation of a small uranium enrichment facility, which is scheduled to gradually ramp up to 0.2 million SWU by 2012 and will be devoted to internal requirements (INB, 2006)(Brazil, 2006). Despite international efforts against it, Iran could have 0.1 million SWU in operation by 2010 (Iran, 2006)(WNN, 2007c).

Recycle materials contributed about 1.6 million SWU-equivalent to supply in 2006. Mixed Oxide (MOX) fuel is currently used in Europe and supplies 0.9 million SWU equivalent (ESA, 2007). MOX fuel use is expected to expand to Japan starting by 2010, and the disposition of military plutonium in MOX fuel in the U.S. and Russia could start as early as 2015. Russia also blends recycled uranium from VVER-440s, research reactors and submarines to create RBMK fuel containing about 0.7 million SWU equivalent, although the quantity is expected to decrease after 2010 (WNA, 2007e). Recycle materials are projected to supply a total of 2.2 million SWU by 2016.

1.1.2.3.2 Potential Supply of Enrichment Services

There are a number of potential sources of enrichment services that could be used to fill any deficits in supply. Potential Supply includes the following sources:

- Enrichment technology that GEH is pursuing separates isotopes by laser excitation, and is referred to as Silex. Silex has been under development for many years by the Australian company, Silex Systems Limited (SSL). In fact, USEC had been funding research on the Silex process under an agreement with SSL between 1996 and April 2003, at which time USEC concluded that it was unlikely that the Silex technology could be utilized to meet USEC's needs and that there were still "numerous technological hurdles that must be overcome" (USEC, 2003). In May 2006, GE and SSL entered into a commercialization and licensing agreement, granting GE exclusive rights to deploy the Silex uranium enrichment technology, which GEH has branded as global laser enrichment (GLE). If GEH ultimately makes the decision to deploy GLE commercially, following results of testing that is scheduled to occur during 2008, GEH then expects to have a commercial Lead Cascade operational by about 2012. This facility could be expanded by adding additional modules, with the potential for a base enrichment capacity of 3.5 million SWU per year, which GEH says could be expanded to produce as much as 6 million SWU per year (GEH, 2007);
- Expansion of the USEC/ACP from 3.8 million SWU per year up to 7.0 million SWU per year;
- Expansion of the LES/NEF from 3.0 million SWU per year up to 6.0 million SWU per year (in November 2008, LES announced its intention to increase the capacity of the NEF from 3 million SWU per year to 5.9 million SWU per year);
- Additional supply from Rosatom, if trade constraints are relaxed, reflecting its plans for expanded enrichment capacity, redirection of some of its existing enrichment capacity from creation of natural uranium equivalent material by the enrichment of tails to the enrichment of natural uranium for reactor fuel (IBR, 2007) (WNA, 2007d); and
- Of the 200 MT of HEU that was declared excess to the U.S. nuclear weapons stockpile by DOE in 2005, only 61 MT of this excess HEU might be expected to eventually become available to the commercial nuclear fuel market, which would take place over a period of more than two decades (NNSA, 2007). Upon down blending, the 61 MT HEU would yield not more than 10 million SWU. However, it is understood that at least one half of this material (i.e., 32 MT HEU), which is expected to be rejected by the U.S. Naval Reactor Program, is more likely to become available over a period of more than 40 years. If this material is made available over a period of 20 to 40 years, this would contribute an average of only 0.38 million SWU per year to the commercial nuclear fuel market through 2025. However, these enrichment services should be recognized as being highly speculative in any supply forecast that includes their use.

These potential future sources and the associated quantities of uranium enrichment services are summarized in Table 1.1-5 for the Reference Nuclear Power Growth forecast.

While it is possible that further expansion of Urenco's European enrichment capacity beyond 12.5 million SWU per year and AREVA/GBII beyond 7.5 million SWU per year might also occur, no announcements of such potential expansions have been made.

Also, the following additional potential sources of enrichment services are also possible, but not explicitly quantified in this analysis due to their relatively small and/or short-term contribution to meeting the world and U.S. long term enrichment requirements:

- Extended short term operation of the Paducah GDP by USEC;
- More aggressive expansion of new centrifuge capacity in Japan, China and elsewhere; and
- Minor adjustments to transaction and operating tails assays.

Potential sources of additional supply that might be used to close any projected supply deficit would require investment in new enrichment capacity and would also require that decisions be made with appropriate lead time.

As further background for the discussion that follows, it also is important to recognize that the owners and operators of nuclear power plants have two primary objectives in purchasing nuclear fuel, including uranium enrichment services (Rives, 2002) (Culp, 2002) (Malone, 2006) (Malone, 2008). The first objective is security of supply – that is adequacy of supply in the market that is sufficient to mitigate against unanticipated disruptions from one or more sources and the ability of the purchaser to rely on its suppliers to deliver nuclear fuel materials and services on schedule and within technical specifications, according to the terms of the contract, for the contract's entire term. The second objective is to ensure a competitive procurement process – that is the availability of qualified suppliers in the market and the ability of the purchaser to select from among multiple suppliers through a process that is conducive to fostering reasonable prices for the nuclear fuel materials and services that are purchased.

While one can postulate alternative supply scenarios, there are commercial considerations and other implications associated with each such scenario, many of which can have a significant impact on the purchasers' ability to achieve the two primary purchasing objectives just presented.

Nuclear power plants are a significant component of the U.S. electric power supply system, providing 20% of the electricity that is consumed in the U.S. each year. The current U.S. market for uranium enrichment services is characterized by annual requirements of approximately 14 million SWU. For the Reference Nuclear Power Growth forecast, enrichment requirements in the U.S. are expected to remain at about this level during period 2008 through 2015 and during the ten year period 2016 through 2025 they are forecast to average 15.1 million SWU per year. However, for the High Nuclear Power Growth forecast, during the ten year period of 2016 through 2025, U.S. requirements are expected to average 15.8 million SWU per year. The WNA High Nuclear Power Growth forecast indicates U.S. annual average requirements of 17.5 million SWU per year during that same ten year period of 2016 through 2025.

Operators of many nuclear power plants in the U.S., who are also the end users of uranium enrichment services in the U.S., view the future supply situation with concern. They see a world supply and requirements situation for economical uranium enrichment services that is presently in balance, but one that has a potential for significant shortfall if plans that have been announced by each of the primary enrichers (i.e., Scenario A, which includes LES, USEC and AES each proceeding to a successful conclusion with their respective plans to build new commercial centrifuge uranium enrichment plants in the U.S.) are not executed.

At the present time, many owners and operators of nuclear power plants in the U.S. view themselves as being largely dependent on a single indigenous enricher, USEC, whose only sources of enrichment services are (i) the Paducah GDP, an aging plant that has very high operating costs, and (ii) Rosatom, which is supplying the enrichment component of the HEU-derived LEU through USEC. These purchasers are concerned that the primary source of enrichment services that USEC delivers for use in their nuclear power plants is obtained from Russia and could be vulnerable to either internal or international political unrest in the future. Also, there is concern that neither the performance nor economics of the updated version of the DOE centrifuge technology that USEC is planning to use has been successfully demonstrated. This is not to say that the technology will not be successful, but there is still more work to be done and the economics remain unproven. Furthermore, while it is apparent that additional enrichment services will be required in the near future, and there are a number of potential sources of such enrichment services, as previously identified in Table 1.1-5, there have been no firm commitments made to deploy new enrichment capacity to meet these future requirements.

1.1.2.4 Market Analysis of Supply and Requirements

1.1.2.4.1 Scenario A – Base Supply of Enrichment Services

Scenario A represents the scenario that is being actively pursued by AREVA/AES, LES and USEC, consistent with schedules that have been announced by each company.

Having summarized the current and expected elements of supply in Section 1.1.2.3, it is useful to examine further the relationship between supply and requirements under this scenario. Figures 1.1-7 and 1.1-8 present the Base supply together with the Reference and High Nuclear Power Growth forecast requirements, respectively. The two requirements forecasts are shown in two different figures to allow for proper characterization of the Rosatom Internal supply, which is assumed to increase as necessary to meet internal C.I.S. and Eastern European requirements that increase under the High Nuclear Power Growth forecast through the diversion of enrichment capacity from other uses such as exports to Western nations and the enrichment of tails material to uranium with the ^{235}U assay of natural uranium.

As illustrated in Figure 1.1-7 for Scenario A, Base supply and Reference Nuclear Power Growth requirements are in very close balance between 2013 and 2020, although a small supply deficit averaging 0.9 million SWU per year or 1.6% of requirements does exist. However, during the period 2021 through 2025, the average annual economically competitive and physically usable production capacity that is not constrained by international trade agreements, together with the equivalent enrichment services derived from Russian HEU and other sources reflected in the tables previously provided (Available Supply) is forecast to be 57.6 million SWU. (It should be noted that this and subsequent values of supply and requirements are stated as average values over specified five year time periods. This is in contrast to the values previously presented in Table 1.1-4 which are values of enrichment capacity during individual years.) This is 3.1 million SWU per year (5.0%) less than average annual forecast requirements during this same period of 60.7 million SWU. This emphasizes the need for all of these supply sources, including the proposed AES centrifuge enrichment plant in the U.S. Furthermore, in order to provide for an adequate supply margin to accommodate any unexpected events that could disrupt enrichment of uranium at one or more of the world's enrichment plants, additional enrichment supply capacity would be beneficial from the perspective of nuclear power plant operators.

Under the High Nuclear Power Growth forecast, as illustrated in Figure 1.1-8 for Scenario A, while effectively in balance today, there is a deficit of Base supply relative to requirements beginning in 2013, which continues to grow over time.

During the period 2011 through 2015, the Available Supply is forecast to be 54.1 million SWU. This is 2.3 million SWU per year (4.1%) less than average annual forecast requirements during this same period of 56.4 million SWU for the High Nuclear Power Growth forecast.

Moving forward in time to the period 2016 through 2020, the Available Supply of 58.6 million SWU is 6.7 million SWU (10.3%) less than average annual forecast requirements during this same period of 65.3 million SWU.

Continuing with this scenario to the 2021 through 2025 period, the Available Supply of 63.2 million SWU is 11.2 million SWU (15.1%) less than average annual forecast requirements during this same period of 74.4 million SWU.

It is obvious from this comparison that under the Reference Nuclear Power Growth forecast, enrichment capacity from the proposed AES facility is necessary, and that additional enrichment capacity will be required to meet the deficit of supply relative to world requirements - a modest additional amount by 2014 and more significant amounts by 2021. Additional capacity would be welcome by nuclear power plant operators as early as 2013 to provide some level of supply margin relative to world requirements. Under the High Nuclear Power Growth forecast, additional enrichment capacity will be required by 2014 to meet the deficit of supply relative to world requirements.

With regard to considerations of national security, if it is assumed that the presently planned AES, LES and USEC facilities are completed and operate successfully in the U.S., then together with small contributions of equivalent supply from down blended U.S. HEU and limited recycle, they would provide an average of 9.9 million SWU per year of indigenous enrichment capacity during the 2016 to 2025 period. This would be capable of supplying only 66% of an average of 15.1 million SWU per year of annual U.S. requirements during the same period for the Reference Nuclear Power Growth forecast.

This is the scenario that is presently being pursued. It would result in the establishment of three indigenous long-term sources of energy efficient, low cost, reliable uranium enrichment services in the U.S., which is positive with respect to the security of supply objective. In addition, the presence of three indigenous enrichment facilities in the U.S., with potential expansion capability among them, should serve to foster competition and result in a more secure long-term source of indigenous uranium enrichment services. This would also support the objective of ensuring a competitive procurement process for U.S. purchasers of these services. Three indigenous enrichment suppliers would also provide protection against the prospect of severe supply shortfalls if, for example, Rosatom were not to deliver enrichment services into the U.S. beyond 2013. However, even under Scenario A it is apparent that additional enrichment services supply capacity will be required to meet commercial nuclear power plant requirements.

1.1.2.4.2 Scenario A* – Base Supply of Enrichment Services Without AES's U.S. Plant

The subsequent sections present alternatives to Scenario A wherein it is postulated that AREVA does not proceed with the construction and operation of its proposed gas centrifuge enrichment plant in the U.S. To provide perspective for these scenarios, Figures 1.1-9 and 1.1-10 illustrate the relationship between forecast uranium enrichment supply and requirements without the 3 million SWU per year AREVA centrifuge enrichment plant in the U.S.

As shown in Figure 1.1-9, beginning in 2014, if the AES facility is not built in the U.S., then a deficit in Available Supply is present and continues to grow each year. Moving forward in time to the period 2016 through 2020, the Available Supply without the AREVA plant in the U.S. of 52.3 million SWU is 3.1 million SWU (5.5%) less than average annual forecast requirements during this same period of 55.4 million SWU.

Continuing with this scenario to the 2021 through 2025 period, the Available Supply without the AES facility in the U.S. of 54.6 million SWU is 6.1 million SWU (10.0%) less than average annual forecast requirements during this same period of 60.7 million SWU.

Under the High Nuclear Power Growth forecast, as illustrated in Figure 1.1-10 for Scenario A* without the AES facility in the U.S., while effectively in balance today, there is a deficit in Base supply relative to requirements beginning in 2013, which continues to grow over time.

As shown in Figure 1.1-10, during the period 2011 through 2015, the Available Supply is forecast to be 53.9 million SWU. This is 2.5 million SWU per year (4.5%) less than average annual forecast requirements during this same period of 56.4 million SWU under the High Nuclear Power Growth forecast.

Moving forward in time to the period 2016 through 2020, the Available Supply of 56.4 million SWU is 8.9 million SWU (13.7%) less than average annual forecast requirements during this same period of 65.3 million SWU.

Continuing with this scenario to the 2021 through 2025 period, the Available Supply of 60.2 million SWU is 14.2 million SWU (19.1%) less than average annual forecast requirements during this same period of 74.4 million SWU.

With regard to considerations of national security, if it is assumed that the LES NEF and USEC ACP are completed and operate successfully in the U.S., then together with small contributions of equivalent supply from down blended U.S. HEU and limited recycle, they would provide an average of only 7.3 million SWU per year of indigenous enrichment capacity during the 2016 to 2025 period. This would be capable of supplying only 48% of an average of 15.1 million SWU per year of annual U.S. requirements during this same period for the Reference Nuclear Power Growth forecast.

1.1.2.4.3 Scenario B – Base Supply Without AES's U.S. Facility; Plus GEH Deployment of GLE

An alternative scenario is that the 3 million SWU per year AES centrifuge uranium enrichment plant is not built in the U.S. However, since an initial motivating factor for building this plant was to increase the amount of indigenous uranium enrichment capacity in the U.S., the first alternative considered is one that also provides for additional enrichment capacity located in the U.S. Under this Scenario B, it is postulated that testing on the Silex technology is successful during 2008 and the decision is ultimately made by GEH to proceed with commercial deployment of a 3.5 million SWU of commercial GLE capacity.

Scenario B is illustrated in Figures 1.1-11 and 1.1-12 for the Reference and High Nuclear Power Growth forecasts respectively.

During the period 2011 through 2015, if the AES facility is not built in the U.S. and the GLE facility is built, then the Available Supply is forecast to be 53.1 million SWU. This is 2.3 million SWU per year (4.5%) greater than the average annual forecast requirements during this same period of 50.8 million SWU under the Reference Nuclear Power Growth forecast.

Moving forward in time to the period 2016 through 2020, the Available Supply without the AES facility in the U.S. and with the GLE capacity is 55.8 million SWU or 0.4 million SWU (0.8%) greater than the average annual forecast requirements during this same period of 55.4 million SWU.

Continuing with this scenario to the 2021 through 2025 period, the Available Supply without the AES facility in the U.S. and with the GLE capacity is 58.1 million SWU or 2.6 million SWU (4.2%) less than average annual forecast requirements during this same period of 60.7 million SWU.

As noted above, the 3.5 million SWU per year GLE capacity is slightly greater than that of the proposed AES facility in the U.S. and results in a close match to the Reference Nuclear Power Growth forecast requirements. However, there is no margin for unexpected disruptions in supply that may occur.

Under the High Nuclear Power Growth forecast for Scenario B, without the AES facility in the U.S. and with the GLE capacity, during the period 2011 through 2015, the Available Supply is forecast to be 55.5 million SWU. This is 0.9 million SWU per year (1.6%) less than average annual forecast requirements during this same period of 56.4 million SWU under the High Nuclear Power Growth forecast.

Moving forward in time to the period 2016 through 2020, the Available Supply of 59.9 million SWU is 5.4 million SWU (8.3%) less than average annual forecast requirements during this same period of 65.3 million SWU.

Continuing with this scenario to the 2021 through 2025 period, the Available Supply of 63.7 million SWU is 10.7 million SWU (14.4%) less than average annual forecast requirements during this same period of 74.4 million SWU.

It is obvious from this comparison that under the Reference Nuclear Power Growth forecast additional enrichment capacity will be required to provide an adequate supply margin relative to requirements by 2014 and to meet the deficit in supply relative to requirements by 2021, and by 2014 to meet the deficit in supply relative to requirements under the High Nuclear Power Growth forecast.

With regard to considerations of national security, if it is assumed that the GLE facility, in addition to the LES NEF and USEC ACP, are completed and operate successfully in the U.S., then together with small contributions of equivalent supply from down blended U.S. HEU and limited recycle, they would provide an average of 10.8 million SWU per year of indigenous enrichment capacity during the 2016 to 2025 period. However, as was the situation with regard to Scenario A, this enrichment capacity would be capable of supplying only 72% of an average of 15.1 million SWU per year of annual U.S. requirements during the same period for the Reference Nuclear Power Growth forecast.

While providing for indigenous U.S. supply, there are several critical concerns associated with this alternative scenario. First, GEH has stated that there remains significant testing to be performed during 2008 before any deployment decision would be made. Therefore, Scenario B, far from being a certain alternative source of enrichment services, is at the present time highly speculative from both a technological and commercial perspective. Ultimately, GEH may decide not to proceed with construction and deployment of GLE. Even if it does make the decision to proceed, there remain uncertainties associated with the schedule and licensing of a new technology, and ultimately financing, building and operating it.

While GLE may eventually offer value as a supplier of enrichment services to the industry in the long term, it is not prudent to substitute (i) a potential source of supply for which the enrichment technology has not yet been commercially tested and a commercial plant deployment decision has not yet been made for (ii) the proposed AES facility in the U.S. that would be using commercially proven centrifuge enrichment technology that would be built and operated by a company that has been providing enrichment services world wide for many decades. The selection of Scenario B would not alleviate concerns among U.S. purchasers of enrichment services regarding long-term security of supply. Therefore, Scenario B is not viewed by AES as a responsible alternative to that of proceeding with the AREVA plant in the U.S.

1.1.2.4.4 Scenario C – Base Supply Without AES's U.S. Facility; Plus LES Expansion of NEF

An alternative scenario is that the 3 million SWU per year AES centrifuge uranium enrichment plant is not built in the U.S. However, since an initial motivating factor for building this plant was to increase the amount of indigenous uranium enrichment capacity in the U.S., the next alternative considered is one that also provides for additional enrichment capacity located in the U.S. Under this Scenario C, it is postulated that LES successfully completes and then, during the period 2015 through 2019, expands the NEF by an additional 3 million SWU per year of enrichment capacity

Scenario C is illustrated in Figures 1.1-13 and 1.1-14 for the Reference and High Nuclear Power Growth forecasts respectively.

During the period 2011 through 2015, if the AES facility is not built in the U.S. and expansion of the NEF takes place, then the Available Supply is forecast to be 51.6 million SWU. This is 0.8 million SWU per year (1.6%) greater than the average annual forecast requirements during this same period of 50.8 million SWU under the Reference Nuclear Power Growth forecast.

Moving forward in time to the period 2016 through 2020, the Available Supply without the AREVA plant in the U.S. and with the expansion of the NEF capacity of 54.6 million SWU is 0.8 million SWU (1.4%) less than average annual forecast requirements during this same period of 55.4 million SWU.

Continuing with this scenario to the 2021 through 2025 period, the Available Supply without the AES facility in the U.S. and with the expansion of the NEF of 57.6 million SWU is 3.1 million SWU (5.0%) less than average annual forecast requirements during this same period of 60.7 million SWU.

As noted above, the 3.0 million SWU per year of NEF expansion capacity is equivalent to capacity of the AES facility and results in a very close match to the Reference Nuclear Power Growth forecast requirements through 2020, although there is still no margin for unexpected disruptions in supply that may occur and a small supply deficit averaging 0.8 million SWU per year or 1.4% of requirements exists between 2016 and 2020. The supply deficit expands after 2020.

Under the High Nuclear Power Growth forecast for Scenario C, without the AREVA plant in the U.S. and with the expansion of the NEF capacity, during the period 2011 through 2015, the Available Supply is forecast to be 54.0 million SWU. This is 2.4 million SWU per year (4.3%) less than average annual forecast requirements during this same period of 56.4 million SWU under the High Nuclear Power Growth forecast.

Moving forward in time to the period 2016 through 2020, the Available Supply of 58.7 million SWU is 6.6 million SWU (10.2%) less than average annual forecast requirements during this same period of 65.3 million SWU.

Continuing with this scenario to the 2021 through 2025 period, the Available Supply of 63.2 million SWU is 11.2 million SWU (15.1%) less than average annual forecast requirements during this same period of 74.4 million SWU.

It is obvious from this comparison that under the Reference Nuclear Power Growth forecast that additional enrichment capacity will be required to fill a small deficit and provide an adequate supply margin relative to requirements by 2014 and to meet the larger deficit in supply relative to requirements by 2021, and by 2014 to meet the deficit in supply relative to requirements under the High Nuclear Power Growth forecast.

With regard to considerations of national security, if it is assumed that the LES NEF is completed and then expanded to provide a total of 6 million SWU per year of capacity, then together with small contributions of equivalent supply from down blended U.S. HEU and limited recycle, they would provide an average of 9.9 million SWU per year of indigenous enrichment capacity during the 2016 to 2025 period. However, as was the situation with regard to Scenario A, this enrichment capacity would be capable of supplying only 66% of an average of 15.1 million SWU per year of annual U.S. requirements during the same period for the Reference Nuclear Power Growth forecast.

However, it should be noted that at the present time, the LES NEF is not operational. In addition, LES has not publicly stated that a decision has been made to expand enrichment capacity of the NEF immediately upon completion of capacity that is presently under construction, as would be required under this scenario. An amendment to LES's license with the NRC would also be required. Ultimately, LES may decide not to proceed with such an expansion.

While LES offers value as a long term supplier of enrichment services to the industry, it is not prudent to substitute (i) potential sources of supply for which commercial plant expansion decisions have not yet been made, for (ii) the proposed AES facility in the U.S. using commercially proven centrifuge enrichment technology that would be built and operated by a company that has been providing enrichment services world wide for many decades. The selection of Scenario C would not alleviate concerns among U.S. purchasers of enrichment services regarding long-term security of supply. In addition, it would not result in an additional source of indigenous competitive supply, but just LES with greater enrichment capacity and USEC. Therefore, Scenario C is not viewed by AES as a responsible alternative to that of proceeding with the AREVA plant in the U.S.

1.1.2.4.5 Scenario D – Base Supply Without AREVA's U.S. Facility; Plus USEC Expansion of ACP

An alternative scenario is that the 3 million SWU per year AES centrifuge uranium enrichment plant is not built in the U.S. However, since an initial motivating factor for building this plant was to increase the amount of indigenous uranium enrichment capacity in the U.S., the next alternative considered is one that also provides for additional enrichment capacity located in the U.S. Under this Scenario D, it is postulated that USEC successfully completes the ACP and then, during the period 2013 through 2016, expands the ACP by an additional 3.2 million SWU per year of enrichment capacity, to attain its licensed maximum capacity of 7 million SWU per year.

Scenario D is illustrated in Figures 1.1-15 and 1.1-16 for the Reference and High Nuclear Power Growth forecasts respectively.

During the period 2011 through 2015, if the AES facility is not built in the U.S. and expansion of the ACP takes place, then the Available Supply is forecast to be 52.5 million SWU. This is 1.7 million SWU per year (3.3%) greater than the average annual forecast requirements during this same period of 50.8 million SWU under the Reference Nuclear Power Growth forecast.

Moving forward in time to the period 2016 through 2020, the Available Supply without the AES facility in the U.S. and with the expansion of the ACP capacity of 55.5 million SWU is 0.1 million SWU (0.2%) greater than average annual forecast requirements during this same period of 55.4 million SWU.

Continuing with this scenario to the 2021 through 2025 period, the Available Supply without the AES facility in the U.S. and with the expansion of the ACP of 57.8 million SWU is 2.9 million

SWU (4.7%) less than average annual forecast requirements during this same period of 60.7 million SWU.

As noted above, the 3.2 million SWU per year of ACP expansion capacity is slightly greater than the capacity of the AES facility and results in a very close match to the Reference Nuclear Power Growth forecast requirements. However, there is still minimal margin for unexpected disruptions in supply that may occur through 2020 and a growing supply deficit thereafter.

Under the High Nuclear Power Growth forecast for Scenario D, without the AES facility in the U.S. and with the expansion of the ACP capacity, during the period 2011 through 2015, the Available Supply is forecast to be 54.9 million SWU. This is 1.5 million SWU per year (2.7%) less than average annual forecast requirements during this same period of 56.4 million SWU under the High Nuclear Power Growth forecast.

Moving forward in time to the period 2016 through 2020, the Available Supply of 59.6 million SWU is 5.7 million SWU (8.8%) less than average annual forecast requirements during this same period of 65.3 million SWU.

Continuing with this scenario to the 2021 through 2025 period, the Available Supply of 63.4 million SWU is 11.0 million SWU (14.8%) less than average annual forecast requirements during this same period of 74.4 million SWU.

It is obvious from this comparison that under the Reference Nuclear Power Growth forecast that additional enrichment capacity will be required to provide an adequate supply margin relative to requirements by 2013 and to meet the deficit in supply relative to requirements by 2021, and by 2014 to meet the deficit in supply relative to requirements under the High Nuclear Power Growth forecast.

With regard to considerations of national security, if it is assumed that the USEC ACP is completed and then expanded to provide a total of 7 million SWU per year of capacity, then together with small contributions of equivalent supply from down blended U.S. HEU and limited recycle, they would provide an average of 10.5 million SWU per year of indigenous enrichment capacity during the 2016 to 2025 period. However, as was the situation with regard to Scenario A, this enrichment capacity would be capable of supplying only 70% of an average of 15.1 million SWU per year of annual U.S. requirements during the same period for the Reference Nuclear Power Growth forecast.

However, it should be noted that at the present time, the USEC ACP is not operational and USEC has also not obtained all the financing needed to construct the initial 3.8 million of capacity. In addition, USEC has not publicly stated that a decision has been made to expand enrichment capacity of the ACP immediately upon completion of capacity that is presently under construction, as would be required under this scenario. Ultimately, USEC may decide not to proceed with such an expansion.

While USEC offers value as a long term supplier of enrichment services to the industry, it is not prudent to substitute (i) potential sources of supply for which commercial plant expansion decisions have not yet been made, and in the case of USEC the enrichment technology not yet commercially proven, for (ii) the proposed AES facility in the U.S. using commercially proven centrifuge enrichment technology that would be built and operated by a company that has been providing enrichment services world wide for many decades. The selection of Scenario D would not alleviate concerns among U.S. purchasers of enrichment services regarding long-term security of supply. In addition, it would not result in an additional source of indigenous competitive supply, but just USEC with greater enrichment capacity and LES. Therefore, Scenario D is not viewed by AES as a responsible alternative to that of proceeding with the AES facility in the U.S.

1.1.2.4.6 Scenario E – Base Supply Without AES's U.S. Facility; Plus Potential Rosatom Expansion Capacity

Another alternative scenario is that the 3 million SWU per year AES centrifuge uranium enrichment plant is not built in the U.S. However, under this Scenario E, it is postulated that any additional Rosatom commercial enrichment expansion capacity that is not otherwise being used to meet C.I.S. and Eastern Europe or other Western world enrichment requirements would be made available. Under the Reference Nuclear Power Growth forecast the additional Rosatom commercial annual enrichment capacity is estimated to average 5.7 million SWU per year during the period 2011 to 2015, 6.2 million SWU per year during the period 2016 to 2020, and 5.2 million SWU per year during the period 2021 to 2025. Under the High Nuclear Power Growth forecast, due to increased requirements for enrichment services within the C.I.S. and Eastern Europe, this would average an additional 4.5 million SWU per year during the period 2011 to 2015, 3.9 million SWU per year during the period 2016 to 2020, and 1.9 million SWU per year during the period 2021 to 2025.

Scenario E is illustrated in Figures 1.1-17 and 1.1-18 for the Reference and High Nuclear Power Growth forecasts respectively.

During the period 2011 through 2015, if the AES facility is not built in the U.S. and additional Rosatom commercial enrichment capacity that is not otherwise being used to meet C.I.S. and Eastern Europe or other Western world enrichment requirements would be made available, then the Available Supply is forecast to be 57.2 million SWU. This is 6.4 million SWU per year (12.6%) greater than average annual forecast requirements during this same period of 50.8 million SWU under the Reference Nuclear Power Growth forecast.

Moving forward in time to the period 2016 through 2020, the Available Supply without the AES facility in the U.S. and with the potential Rosatom expansion is 58.5 million SWU or 3.1 million SWU (5.5%) more than average annual forecast requirements during this same period of 55.4 million SWU.

Continuing with this scenario to the 2021 through 2025 period, the Available Supply without the AES facility in the U.S. and with the potential Rosatom expansion is 59.9 million SWU or 0.8 million SWU (1.4%) less than average annual forecast requirements during this same period of 60.7 million SWU.

Under this Scenario E, there is a modest excess of supply relative to requirements, declining from about 6% of requirements in 2016 to 0% excess by 2022 after which there is a deficit of supply relative to requirements under the Reference Nuclear Power Growth forecast requirements.

Under the High Nuclear Power Growth forecast for Scenario E, the Available Supply without the AES facility in the U.S. and with the potential Rosatom expansion is forecast to be 58.4 million SWU during the period 2011 through 2015. This is 2.0 million SWU per year (3.5%) greater than average annual forecast requirements during this same period of 56.4 million SWU under the High Nuclear Power Growth forecast.

Moving forward in time to the period 2016 through 2020, the Available Supply without the AES facility in the U.S. and with the potential Rosatom expansion is 60.2 million SWU or 5.1 million SWU (7.8%) less than average annual forecast requirements during this same period of 65.3 million SWU.

Continuing with this scenario to the 2021 through 2025 period, the Available Supply without the AES facility in the U.S. and with the potential Rosatom expansion is 62.0 million SWU or 12.4

million SWU (16.6%) less than average annual forecast requirements during this same period of 74.4 million SWU.

It is obvious from this comparison that under the Reference Nuclear Power Growth forecast that additional enrichment capacity will be required to fill the deficit of supply relative to requirements by 2023, and under the High Nuclear Power Growth forecast by 2014.

With regard to considerations of national security, if it is assumed that the LES NEF and USEC ACP are completed and operate successfully in the U.S., then together with small contributions of equivalent supply from down blended U.S. HEU and limited recycle, they would provide an average of only 7.3 million SWU per year of indigenous enrichment capacity during the 2016 to 2025 period. This would be capable of supplying only 48% of an average of 15.1 million SWU per year of annual U.S. requirements during this same period for the Reference Nuclear Power Growth forecast.

Scenario E would not alleviate the desire on the part of U.S. purchasers for either additional indigenous uranium enrichment capability in the U.S. for security of supply purposes or provide for an additional U.S.-based source of supply competition since it is already assumed that Rosatom will be delivering enrichment services into the U.S. under the Amended Suspension Agreement. There is also the issue of whether such a significant U.S. dependence on Russia for enrichment services could make the U.S. vulnerable to adverse actions as a result of political disagreements and unrelated trade disputes that might arise from time to time between the U.S. and Russia. Consequently, neither the security of supply objective nor the objective of ensuring a long-term competitive procurement process for U.S. purchasers of these services could be assured. Therefore, Scenario E is not viewed by AES as a responsible alternative to that of proceeding with the AES facility in the U.S.

1.1.2.4.7 Scenario F – Base Supply Without AES's U.S. Facility; Plus Build the Equivalent Enrichment Capacity in Europe

Another alternative scenario is that the 3 million SWU per year AES centrifuge uranium enrichment plant is not built in the U.S. Under this Scenario F it is postulated that the equivalent enrichment capacity is built in Europe. From a supply and requirements perspective this would look like Scenario A, except for location of enrichment capacity and associated considerations.

With regard to considerations of national security, if it is assumed that the LES NEF and USEC ACP are completed and operate successfully in the U.S., then together with small contributions of equivalent supply from down blended U.S. HEU and limited recycle, they would provide an average of only 7.7 million SWU per year of indigenous enrichment capacity during the 2016 to 2025 period. This would be capable of supplying only 51% of an average of 15.1 million SWU per year of annual U.S. requirements during this same period for the Reference Nuclear Power Growth forecast.

While this approach may be physically possible, from a commercial perspective there are several reasons why this would be an unacceptable approach for AES. For example, there are a variety of risks associated with such factors as the uncertain level of European-sourced sales that might be achieved for AES in the U.S. market, significant concentration of its enrichment business in a single market supplied out of France, unpredictable changes in currency exchange rates, transatlantic shipping, and unknown future trade actions that could be undertaken by a protective U.S. government on behalf of its indigenous enrichers.

When these factors are considered collectively, AES presently views the commercial risk of building an additional 3 million SWU per year of enrichment capability in Europe specifically to serve the U.S. market as excessive. Furthermore, its decision in 2007 to pursue the licensing, construction and operation of an enrichment plant in the U.S. confirms that AREVA does not perceive expanding its centrifuge enrichment capability in Europe just to serve the U.S. market as being an attractive alternative to building new centrifuge capability in the U.S.

Furthermore, Scenario F would not alleviate the desire on the part of U.S. purchasers for either additional indigenous uranium enrichment capability in the U.S. or provide for an additional source of supply competition located in the U.S. Consequently, neither the security of supply objective nor the objective of ensuring additional competitive procurement process for U.S. purchasers of these services could be assured. For all of these reasons, Scenario F is not viewed by AES as a responsible alternative to that of proceeding with the AES facility in the U.S.

1.1.2.4.8 Scenario G – Base Supply Without AES's U.S. Facility; Plus Additional U.S. HEU-Derived LEU is Made Available to the Commercial Market

This alternative scenario assumes that the 3 million SWU per year AES centrifuge uranium enrichment plant is not built in the U.S. However, under this scenario, it is postulated that the U.S. government makes available additional HEU-derived LEU to the U.S. commercial market. This material was previously discussed in Section 1.1.2.3. Of the 200 MT of HEU that was declared excess to the U.S. nuclear weapons stockpile by DOE in 2005, only 61 MT of this excess HEU might be expected to eventually become available to the commercial nuclear fuel market, which would take place over a period of more than two decades (NNSA, 2007). Upon down blending, the 61 MT HEU would yield not more than 10 million SWU. However, it is understood that at least one half of this material (i.e., 32 MT HEU), which is expected to be rejected by the U.S. Naval Reactor Program, is more likely to become available over a period of more than 40 years. If this material is made available over a period of 20 to 40 years, this would contribute an average of only 0.38 million SWU per year to the commercial nuclear fuel market through 2025. However, these equivalent enrichment services should be recognized as being highly speculative in any supply forecast that includes their use. Furthermore, as shown here there is not sufficient U.S. HEU and equivalent enrichment services to compensate on a long term basis for the 3 million SWU per year of enrichment services that would have been provided by AES under Scenario A.

With regard to considerations of national security, if it is assumed that the LES NEF and USEC ACP are completed and operate successfully in the U.S., then together with these small contributions of equivalent supply from down blended U.S. HEU and limited recycle, they would provide an average of only 7.7 million SWU per year of indigenous enrichment capacity during the 2016 to 2025 period. This would be capable of supplying only 51% of an average of 15.1 million SWU per year of annual U.S. requirements during this same period for the Reference Nuclear Power Growth forecast.

Furthermore, there has been no clear statement by the U.S. government as to how much of this material will be made available for commercial use, and if it is, then on what schedule. Any forecast that includes use of the enrichment services that may be associated with this material must be recognized as highly speculative. The issue of replacement capacity for the proposed 3 million SWU per year AES enrichment plant in the U.S. is not resolved under Scenario G. Consequently, neither the security of supply objective nor the objective of ensuring a competitive procurement process for U.S. purchasers of these services could be assured.

1.1.2.4.9 Scenario H – Base Supply With GEH Deployment of GLE

Scenario H is included as a variation on Scenario A that recognizes the fact that GEH is currently pursuing uranium enrichment technology, as discussed in Section 1.1.2.3.2, and that it may ultimately decide to deploy GLE on a commercial basis. Under this Scenario H, AES assumes that GEH deploys a base enrichment capacity of 3.5 million SWU per year and that AES also proceeds with its U.S. enrichment plant.

As illustrated in Figure 1.1-19 for Scenario H, during the period 2011 through 2015, if the GLE facility is added to the Base supply identified in Scenario A, then the Available Supply is forecast to be 53.3 million SWU. This is 2.5 million SWU per year (4.9%) greater than the average annual forecast requirements during this same period of 50.8 million SWU under the Reference Nuclear Power Growth forecast.

Moving forward in time to the period 2016 through 2020, the Available Supply with both AES and GLE facilities in the US is 58.0 million SWU or 2.6 million SWU (4.8%) greater than the average annual forecast requirements during this same period of 55.4 million SWU.

Continuing with this scenario to the 2021 through 2025 period, the Available Supply with both AES and GLE facilities in the US is 61.1 million SWU or 0.4 million SWU (0.7%) greater than average annual forecast requirements during this same period of 60.7 million SWU.

Under the High Nuclear Power Growth forecast, as illustrated in Figure 1.1-20 for Scenario H, during the period 2011 through 2015, the Available Supply with both AES and GLE facilities in the US is forecast to be 55.7 million SWU. This is 0.7 million SWU per year (1.3%) less than average annual forecast requirements during this same period of 56.4 million SWU.

Moving forward in time to the period 2016 through 2020, the Available Supply with both AES and GLE facilities in the US is 62.1 million SWU or 3.2 million SWU (4.9%) less than average annual forecast requirements during this same period of 65.3 million SWU.

Continuing with this scenario to the 2021 through 2025 period, the Available Supply with both AES and GLE facilities in the US is 66.7 million SWU or 7.7 million SWU (10.4%) less than average annual forecast requirements during this same period of 74.4 million SWU.

For Scenario H, under the Reference Nuclear Power Growth forecast, enrichment capacity is adequate to provide a supply margin relative to world requirements that averages 4.8% of requirements during the period 2011 to 2020, and a supply margin of only 0.7% during the period 2021 to 2025; although a supply deficit appears in 2025 under this scenario. In contrast, Scenario H, under the High Nuclear Power Growth forecast demonstrates a growing deficit of supply relative to world requirements beginning in 2014.

With regard to considerations of national security, if it is assumed that the presently planned AES, LES and USEC facilities, together with a GEH plant, are completed and operate successfully in the U.S., then together with small contributions of equivalent supply from down blended U.S. HEU and limited recycle, they would provide an average of 13.4 million SWU per year of indigenous enrichment capacity during the 2016 to 2025 period. This would be capable of supplying 89% of an average of 15.1 million SWU per year of annual U.S. requirements during the same period for the Reference Nuclear Power Growth forecast.

In addition, the presence of four indigenous enrichment facilities in the U.S., with potential expansion capability among them, should serve to foster competition and result in a more secure long-term source of indigenous uranium enrichment services. This would also support the objective of ensuring a competitive procurement process for U.S. purchasers of these services. Four indigenous enrichment suppliers would also provide protection against the prospect of severe supply shortfalls if, for example, Rosatom were not to deliver enrichment services into the U.S. beyond 2013. However, even under Scenario H it is apparent that additional enrichment services supply capacity will be required to meet commercial nuclear power plant requirements under the High Nuclear Power Growth forecast.

1.1.2.4.10 Summary

Table 1.1-6 summarizes the results of Scenarios A through H for both the Reference and High Nuclear Power Growth forecasts from the perspective of world supply relative to requirements during each of the time periods previously discussed. The periods with supply deficits are highlighted.

In this context, it is evident that under the Reference Nuclear Power Growth forecast, enrichment capacity provided by the proposed AES facility in the U.S. or one of the other alternatives presented will be necessary to help meet requirements for enrichment services that arise from presently operating and yet to be built nuclear power plants. However, by 2021 it is also evident that neither the AES plant in the U.S. nor any of the alternatives will be adequate by itself to meet enrichment services requirements, which are forecast to continue to grow. Under the High Nuclear Power Growth forecast, by no later then 2014 it is apparent that no individual alternative would be adequate by itself to meet world enrichment requirements. Thus, not only will the AES enrichment facility be required in the U.S., but one or more of the other alternatives will also be required to meet forecast requirements.

With regard to considerations of national security, Table 1.1-7 summarizes the results of Scenarios A through H for both the Reference and High Nuclear Power Growth forecasts from the perspective of U.S. supply relative to U.S. requirements during the 2016 to 2025 time period, as previously discussed.

As shown in Table 1.1-7, there is a deficit of U.S. supply relative to U.S. requirements in each scenario. While this is not necessarily unexpected in a world market in which nuclear fuel supply moves both into and out of the U.S., it does highlight the potential advantage of having additional indigenous supply of uranium enrichment services from the perspective of national security.

The need for a new enrichment plant, such as the one proposed by AES, which with an enrichment capacity of 3 million SWU per year, which will represent approximately 5% of world requirements when it is operating at full capacity, becomes even more apparent if even a small supply margin relative to requirements is viewed as desirable by owners and operators of nuclear power plants. This margin would help to assure competition and also help mitigate the impact of potential operational difficulties and/or disruptions at any enrichment plant in the future. If viewed from the perspective of the adequacy of U.S. supply to meet U.S. requirements, then as shown in Table 1.1-7, the additional supply that would be made available by the presence of the AES enrichment facility in the U.S. would only serve to reduce the deficit, but would not eliminate it.

1.1.3 Conclusion

Including Scenario A, a total of eight alternative supply scenarios have been identified and summarized in Section 1.1.2.4 with respect to the available supply of enrichment services and the ability to meet future long term nuclear power plant operating requirements. While variations and/or combinations of these scenarios could be postulated, the shortcomings that have been identified are not resolved.

While it is apparent that sources of enrichment services in addition to those identified in Table 1.1-4 will be required in the near future, and that there are a number of potential sources of such enrichment services, as previously identified in Table 1.1-5, there have been no firm public commitments made to either deploy new commercial enrichment capacity (i.e., GLE – Scenarios B and H), further expand enrichment capacity that is already under construction (i.e., LES or USEC – Scenarios C and D); divert additional production from creation of natural uranium to provide enrichment services for production of LEU (i.e., Rosatom – Scenario E); build the equivalent size facility in Europe to serve the U.S. market (i.e., AES – Scenario F); or to down blend adequate quantities of government controlled HEU and make available the resulting enrichment component of the LEU (i.e., U.S. government – Scenario G) to meet these commercial nuclear power plant requirements. Therefore, the alternatives to building the 3 million SWU per year AES enrichment facility in the U.S., as described in Scenarios B through G, each have a greater degree of inherent uncertainty associated with them than Scenario A. Furthermore, when the critical nuclear fuel procurement objectives, security of supply and a competitive procurement process for U.S. purchasers of these services are considered, it becomes apparent that for long term planning purposes those alternatives, or even combinations thereof, are not acceptable. Accordingly, there is a demonstrated need for AES's proposed 3 million SWU per year enrichment plant in the U.S.

TABLES

Table 1.1-1 Summary of World Nuclear Power Installed Generating Capacity Forecasts (Page 1 of 1)

Year	Forecast	Nuclear Generation Capacity (GWe)					
		U.S.	Western Europe	C.I.S.[(a)] & E. Europe	East Asia	Other [(b)]	World
2007	Actual	100.6	122.8	47.1	77.6	22.8	370.9
2010	Reference High	102.6 102.6	120.0 126.3	46.3 49.1	80.7 84.2	27.6 28.7	377.2 390.9
2015	Reference High	103.8 105.3	121.5 129.1	56.8 67.1	96.9 114.5	33.2 41.1	412.3 457.1
2020	Reference High	108.1 111.9	117.1 133.8	69.1 84.5	115.4 145.1	38.7 55.5	448.4 530.8
2025	Reference High	113.5 120.0	117.2 143.9	76.3 97.8	134.5 172.5	44.3 69.9	485.8 604.1

(a) C.I.S. includes Armenia, Kazakhstan, Russian Federation and Ukraine; Eastern Europe includes Bulgaria, Czech Republic, Slovakia, Hungary, Lithuania and Romania.

(b) Argentina, Brazil, Canada, Egypt, India, Indonesia, Iran, Mexico, Pakistan, South Africa

Table 1.1-2 Summary of World Period Average Nuclear Power Installed Generating Capacity Forecasts

(Page 1 of 1)

Year/Period	Forecast	Nuclear Generation Capacity (GWe)					
		U.S.	Western Europe	C.I.S.[(a)] & E. Europe	East Asia	Other [(b)]	World
2007	Actual	100.6	122.8	47.1	77.6	22.8	370.9
2008-2010	Reference High	101.9 101.9	121.0 125.2	46.1 48.1	79.5 81.5	26.5 27.2	375.0 383.9
2011-2015	Reference High	102.9 103.5	122.3 127.7	50.9 57.3	90.5 101.3	30.4 34.6	397.0 424.3
2016-2020	Reference High	106.1 109.3	118.6 132.4	64.6 76.3	108.6 132.6	36.4 48.7	434.3 499.2
2021-2025	Reference High	110.9 116.3	116.9 139.3	73.8 93.2	126.7 162.1	42.0 63.9	470.4 574.8

(a) C.I.S. includes Armenia, Kazakhstan, Russian Federation and Ukraine; Eastern Europe includes Bulgaria, Czech Republic, Slovakia, Hungary, Lithuania and Romania.

(b) Argentina, Brazil, Canada, Egypt, India, Indonesia, Iran, Mexico, Pakistan, South Africa

Table 1.1-3 Summary of World Period Average Annual Enrichment Requirements Forecasts

(Page 1 of 1)

Year/Period	Forecast	Enrichment Requirements (Million SWU)					
		U.S.	Western Europe	C.I.S.[a] & E. Europe	East Asia	Other [b]	World
2007	Est. Actual	14.3	13.8	8.2	9.2	0.9	46.4
2008-2010	Reference High	14.1 14.1	13.8 14.2	8.4 9.0	10.0 10.6	0.9 1.0	47.2 48.9
2011-2015	Reference High	14.2 14.5	14.0 14.7	9.9 11.3	11.3 13.9	1.4 2.0	50.8 56.4
2016-2020	Reference High	14.7 15.3	13.6 15.3	11.9 14.4	13.4 17.1	1.8 3.2	55.4 65.3
2021-2025	Reference High	15.5 16.4	13.9 16.5	13.4 17.0	15.8 20.4	2.1 4.1	60.7 74.4

(a) C.I.S. includes Armenia, Kazakhstan, Russian Federation and Ukraine; Eastern Europe includes Bulgaria, Czech Republic, Slovakia, Hungary, Lithuania and Romania.

(b) Argentina, Brazil, Canada, Egypt, India, Indonesia, Iran, Mexico, Pakistan, South Africa

Table 1.1-4 Base Sources of Uranium Enrichment Services
(Page 1 of 1)

Item		Technology	Base Economically Competitive and Usable Supply Capability (Million SWU)			
			2007	2015	2020	2025
1	Urenco (Existing and Planned Expansions)	Centrifuge	9.3	12.5	12.5	12.5
2	AREVA GB I (Existing)	Diffusion	7.9	1.8	0.0	0.0
3	AREVA GB II (New)	Centrifuge	0.0	6.0	7.5	7.5
4	USEC Paducah (Existing)	Diffusion	5.2	0.0	0.0	0.0
5	Rosatom (Internal – C.I.S. & Eastern Europe – Ref. Case)	Centrifuge	7.5	10.9	11.7	12.6
6	Rosatom (Exports, but not U.S.)	Centrifuge	6.5	4.8	5.2	5.6
7	Russian HEU Blend Stock & Recycle	Centrifuge & Recycle	6.8	0.6	0.6	0.6
8	U.S. HEU	Inventory, down blending required	0.4	0.4	0.4	0.0
9	Other (Existing/New)	Centrifuge	1.4	2.8	3.4	3.4
10	LES (New)	Centrifuge	0.0	3.0	3.0	3.0
11	Recycle	Commercial Reprocessing; Weapons Pu Inv.	1.6	1.6	2.2	2.2
12	USEC (New)	Centrifuge	0.0	3.8	3.8	3.8
13	Rosatom (Exports to U.S.)	Centrifuge	0.0	2.8	3.1	3.6
14	AES US (New)	Centrifuge	0.0	0.8	3.0	3.0
	Total		46.7	51.5	56.3	57.9

Table 1.1-5 Potential Sources of Additional Uranium Enrichment Services (Page 1 of 1)

Item		Technology	Potential Economically Competitive and Usable Supply Capability (Million SWU)			
			2007	2015	2020	2025
15	GLE	Laser	0.0	3.5	6.0	6.0
16	USEC (Expansion)	Centrifuge	0.0	3.2	3.2	3.2
17	LES (Expansion)	Centrifuge	0.0	0.6	3.0	3.0
18	Rosatom – Potential Expansion	Centrifuge	0.2	6.0	6.3	4.9
19	U.S. HEU – Additional	Down Blending	0.0	0.4	0.4	0.4
	Total		0.2	13.7	18.9	17.5

Table 1.1-6 Summary of Supply and Requirements Scenarios (Page 1 of 2)

	Period Scenario	2007	2008-2010	2011-2015	2016-2020	2021-2025
	Reference Requirements	Average Annual Excess of Deficit of Supply Relative to World Requirements Million of SWU (Percent of Annual Requirements)				
A	Base Supply	0.2 (0.4%)	0.8 (1.8%)	0.9 (1.8%)	-0.9 (-1.6%)	-3.1 (-5.0%)
A*	Base Supply less AREVA in U.S.	0.2 (0.4%)	0.8 (1.8%)	0.7 (1.4%)	-3.1 (-5.5%)	-6.1 (-10.0%)
B	Base Supply less AREVA in U.S. plus GLE	0.2 (0.4%)	0.8 (1.8%)	2.3 (4.5%)	0.4 (0.8%)	-2.6 (-4.2%)
C	Base Supply less AREVA in U.S. plus Expanded NEF	0.2 (0.4%)	0.8 (1.8%)	0.8 (1.6%)	-0.8 (1.4%)	-3.1 (-5.0%)
D	Base Supply less AREVA in U.S. plus Expanded ACP	0.2 (0.4%)	0.8 (1.8%)	1.7 (3.3%)	0.1 (0.2%)	-2.9 (-4.7%)
E	Base Supply less AREVA in U.S. plus Potential Excess Rosatom	0.7 (1.6%)	2.9 (6.2%)	6.4 (12.6%)	3.1 (5.5%)	-0.8 (-1.4%)
F	Base Supply less AREVA in U.S. plus Equiv. Capacity in Europe	0.2 (0.4%)	0.8 (1.8%)	0.9 (1.8%)	-0.9 (-1.6%)	-3.1 (-5.0%)
G	Base Supply less AREVA in U.S. plus Additional U.S. HEU	0.6 (1.2%)	1.2 (2.6%)	1.1 (2.1%)	-2.7 (-4.8%)	-5.7 (-9.4%)
H	Base Supply plus GLE	0.2 (0.4%)	0.8 (1.8%)	2.5 (4.9%)	2.6 (4.8%)	0.4 (0.7%)
	High Requirements					
A	Base Supply	-0.1 (-0.3%)	0.0 (0.1%)	-2.3 (-4.1%)	-6.7 (-10.3%)	-11.2 (-15.1%)
A*	Base Supply less AREVA in U.S.	-0.1 (-0.3%)	0.0 (0.1%)	-2.5 (-4.5%)	-8.9 (-13.7%)	-14.2 (-19.1%)
B	Base Supply less AREVA in U.S. plus GLE	-0.1 (-0.3%)	0.0 (0.1%)	-0.9 (-1.6%)	-5.4 (-8.3%)	-10.7 (-14.4%)
C	Base Supply less AREVA in U.S. plus Expanded NEF	-0.1 (-0.3%)	0.0 (0.1%)	-2.4 (-4.3%)	-6.6 (-10.2%)	-11.2 (-15.1%)
D	Base Supply less AREVA in U.S. plus Expanded ACP	-0.1 (-0.3%)	0.0 (0.1%)	-1.5 (-2.7%)	-5.7 (-8.8%)	-11.0 (-14.8%)
E	Base Supply less AREVA in U.S. plus Potential Excess Rosatom	0.1 (0.1%)	1.7 (3.4%)	2.0 (3.5%)	-5.1 (-7.8%)	-12.4 (-16.6%)

Table 1.1-6 Summary of Supply and Requirements Scenarios

(Page 2 of 2)

	Period Scenario	2007	2008-2010	2011-2015	2016-2020	2021-2025
F	Base Supply less AREVA in U.S. plus Equiv. Capacity in Europe	-0.1 (-0.3%)	0.0 (0.1%)	-2.3 (-4.1%)	-6.7 (-10.3%)	-11.2 (-15.1%)
G	Base Supply less AREVA in U.S. plus Additional U.S. HEU	0.3 (0.5%)	0.4 (0.9%)	-2.1 (-3.8%)	-8.5 (-13.1%)	-13.8 (-18.6%)
H	Base Supply plus GLE	-0.1 (-0.3%)	0.0 (0.1%)	-0.7 (-1.3%)	-3.2 (-4.9%)	-7.7 (-10.4%)

Table 1.1-7 Summary of Supply and Requirements Scenarios for U.S. Only (Page 1 of 1)

	Scenario	2016-2025
	Reference Requirements	Average Annual Excess or Deficit of U.S. Supply Relative to U.S. Requirements Million of SWU (Percent of Annual U.S. Requirements)
A	Base Supply	-5.2 (-34.5%)
A*	Base Supply less AREVA in U.S.	-7.8 (-51.7%)
B	Base Supply less AREVA in U.S. plus GLE	-4.3 (-28.5%)
C	Base Supply less AREVA in U.S. plus Expanded NEF	-5.2 (-34.2%)
D	Base Supply less AREVA in U.S. plus Expanded ACP	-4.6 (-30.5%)
E	Base Supply less AREVA in U.S. plus Potential Excess Rosatom	-7.8 (-51.7%)
F	Base Supply less AREVA in U.S. plus Equiv. Capacity in Europe	-5.2 (-34.5%)
G	Base Supply less AREVA in U.S. plus Additional U.S. HEU	-7.4 (-49.2%)
H	Base Supply plus GLE	-1.7 (-11.3%)
	High Requirements	
A	Base Supply	-5.8 (-36.6%)
A*	Base Supply less AREVA in U.S.	-8.4 (-53.0%)
B	Base Supply less AREVA in U.S. plus GLE	-4.9 (-30.9%)
C	Base Supply less AREVA in U.S. plus Expanded NEF	-5.8 (-36.3%)
D	Base Supply less AREVA in U.S. plus Expanded ACP	-5.2 (-32.8%)
E	Base Supply less AREVA in U.S. plus Potential Excess Rosatom	-8.4 (-53.0%)
F	Base Supply less AREVA in U.S. plus Equiv. Capacity in Europe	-5.8 (-36.6%)
G	Base Supply less AREVA in U.S. plus Additional U.S. HEU	-8.0 (-50.6%)
H	Base Supply plus GLE	-2.3 (-14.5%)

FIGURES

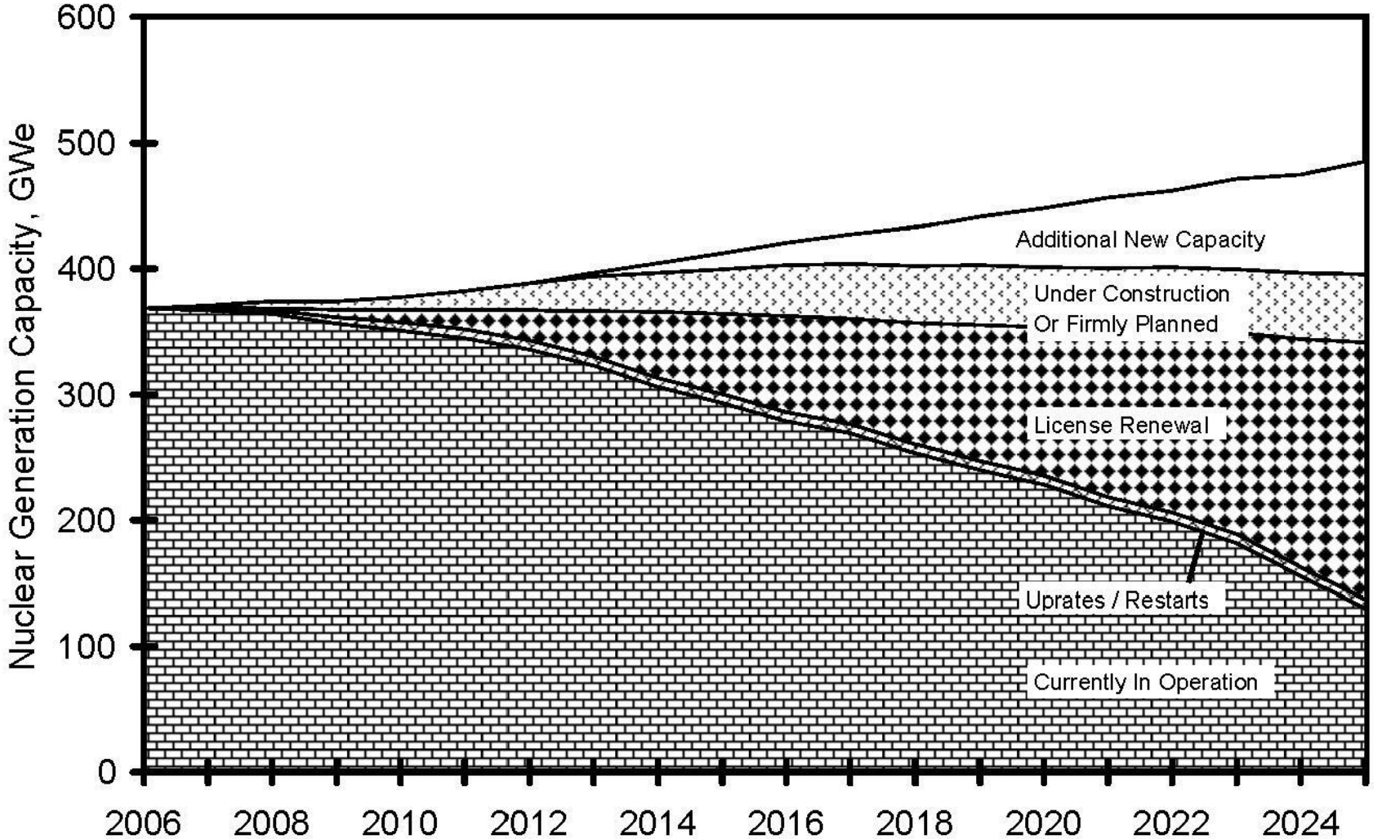

FIGURE 1.1-1 **Rev. 0**

Composition of World Nuclear Generation Capacity for Reference Forecast

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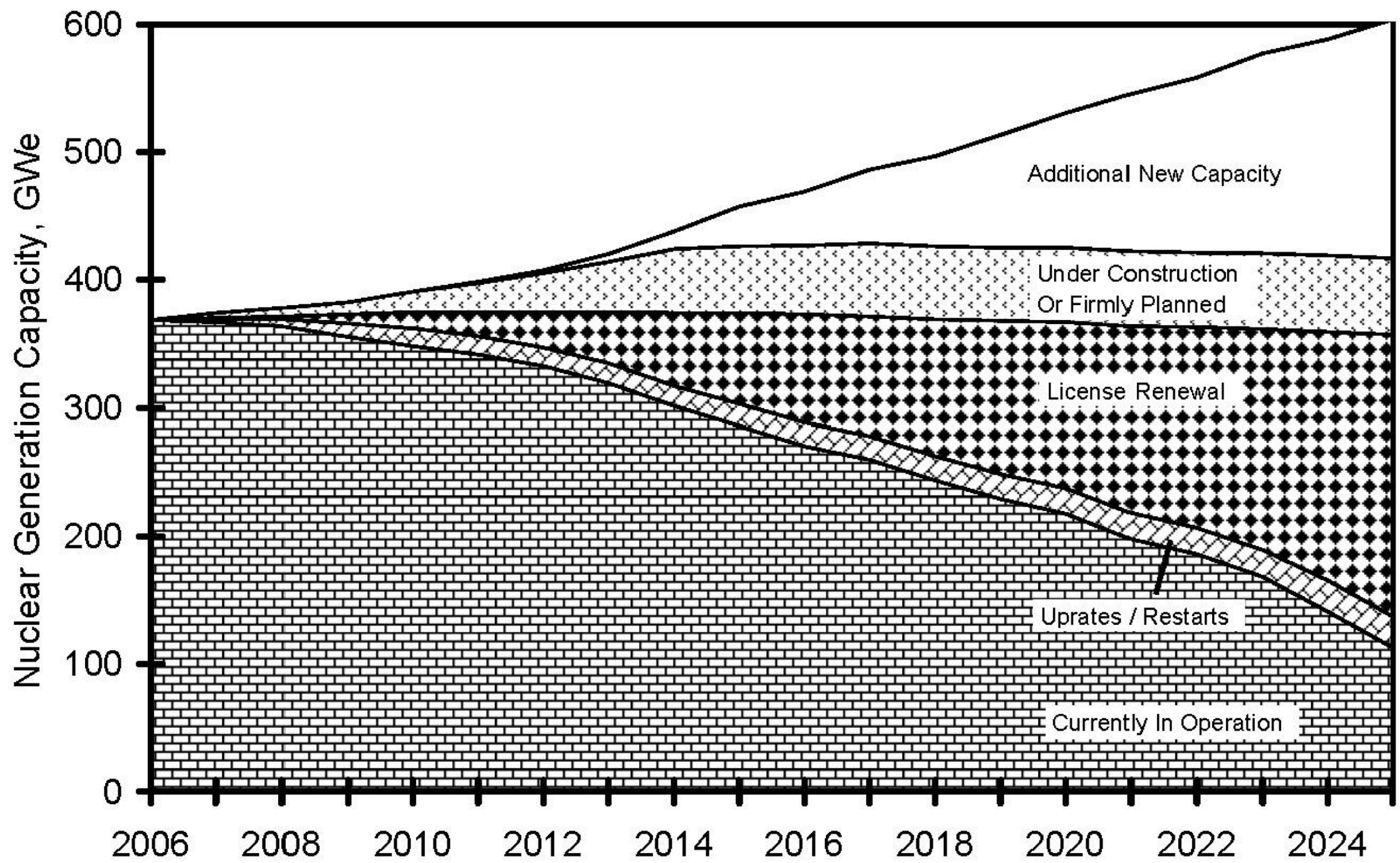

FIGURE 1.1-2 **Rev. 0**

Composition of World Nuclear Generation Capacity for High Forecast

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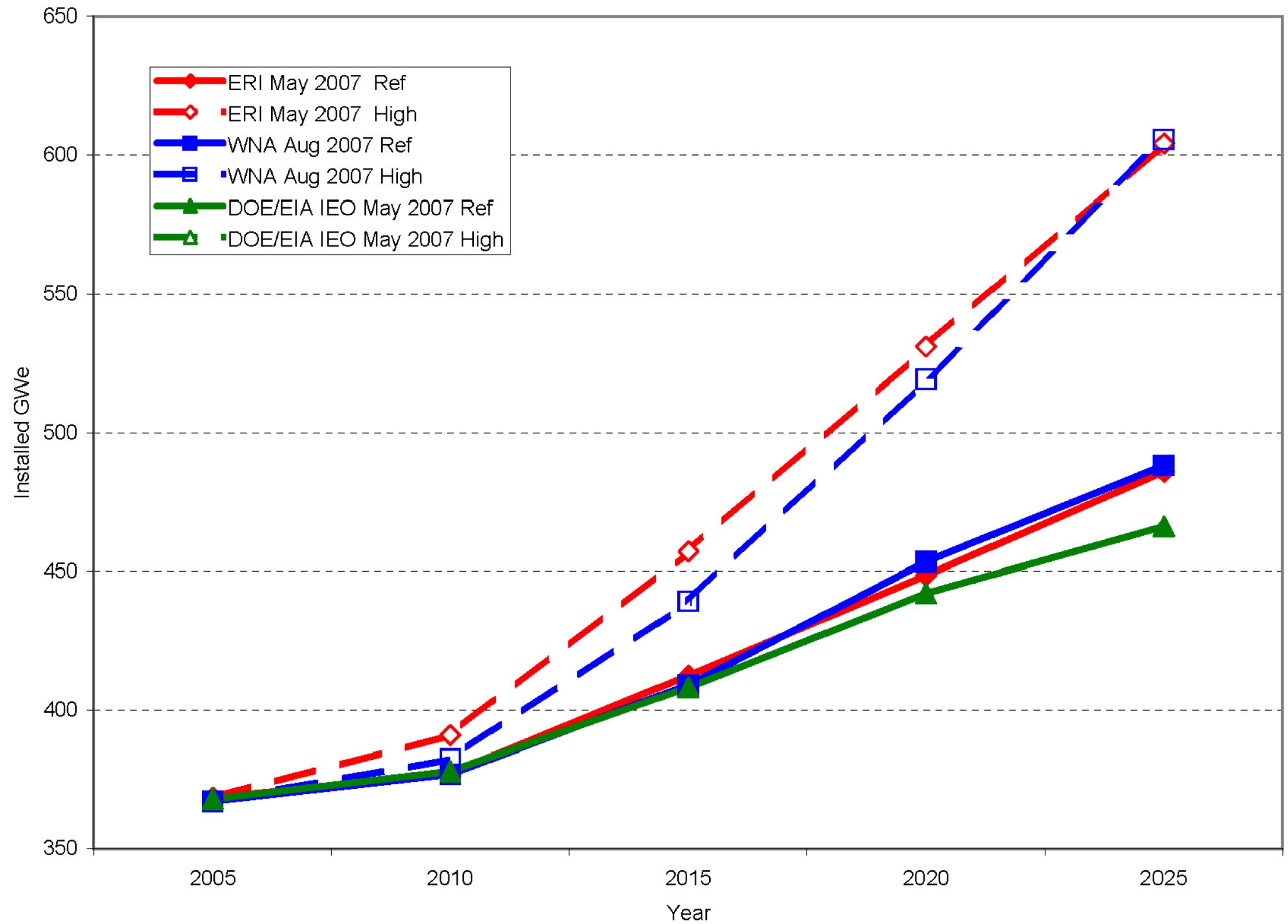

FIGURE 1.1-3 **Rev. 0**

Comparision of World Nuclear Generation Capacity Forecasts

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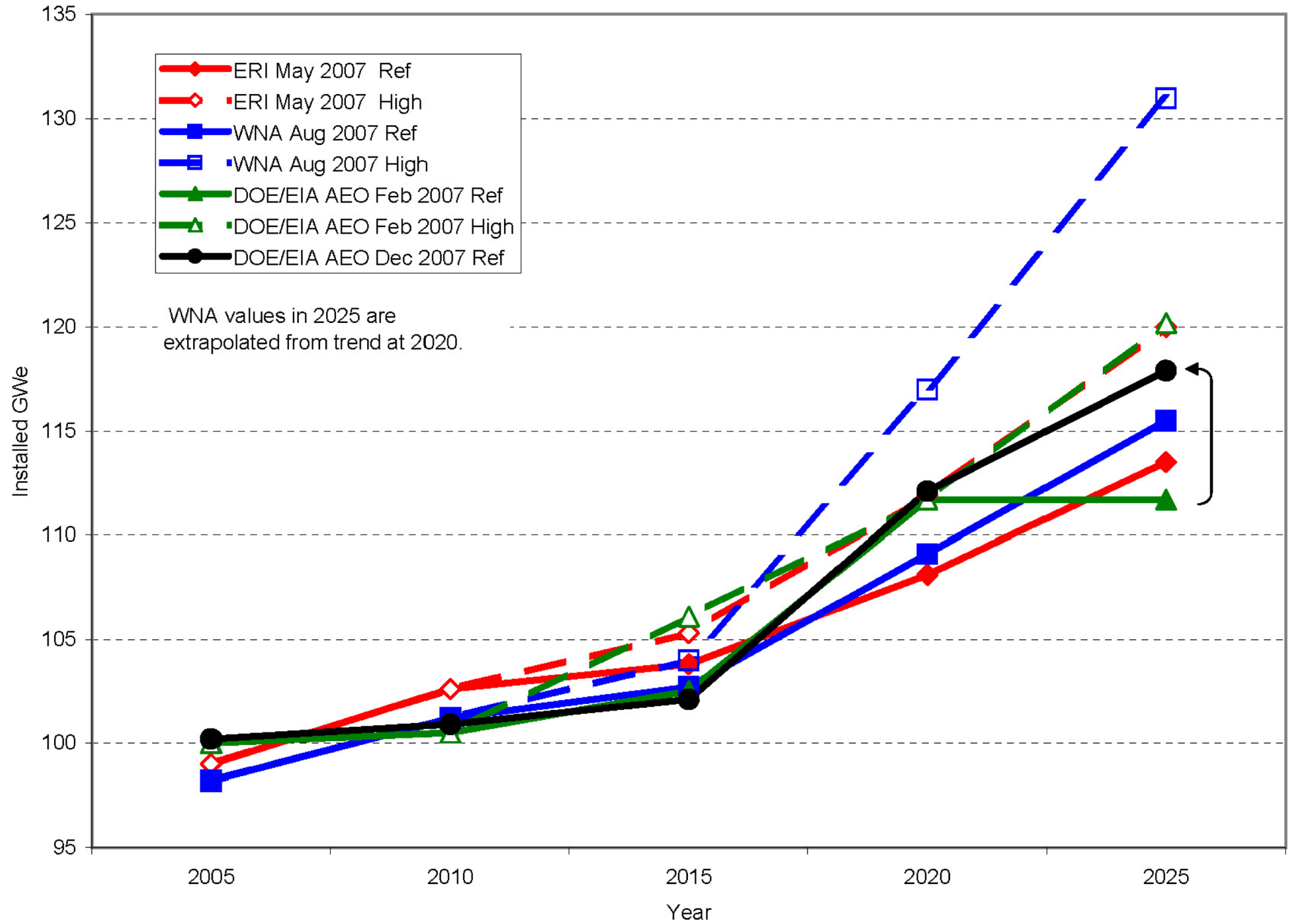

FIGURE 1.1-4 **Rev. 0**

Comparision of U.S. Nuclear Generation Capacity Forecasts

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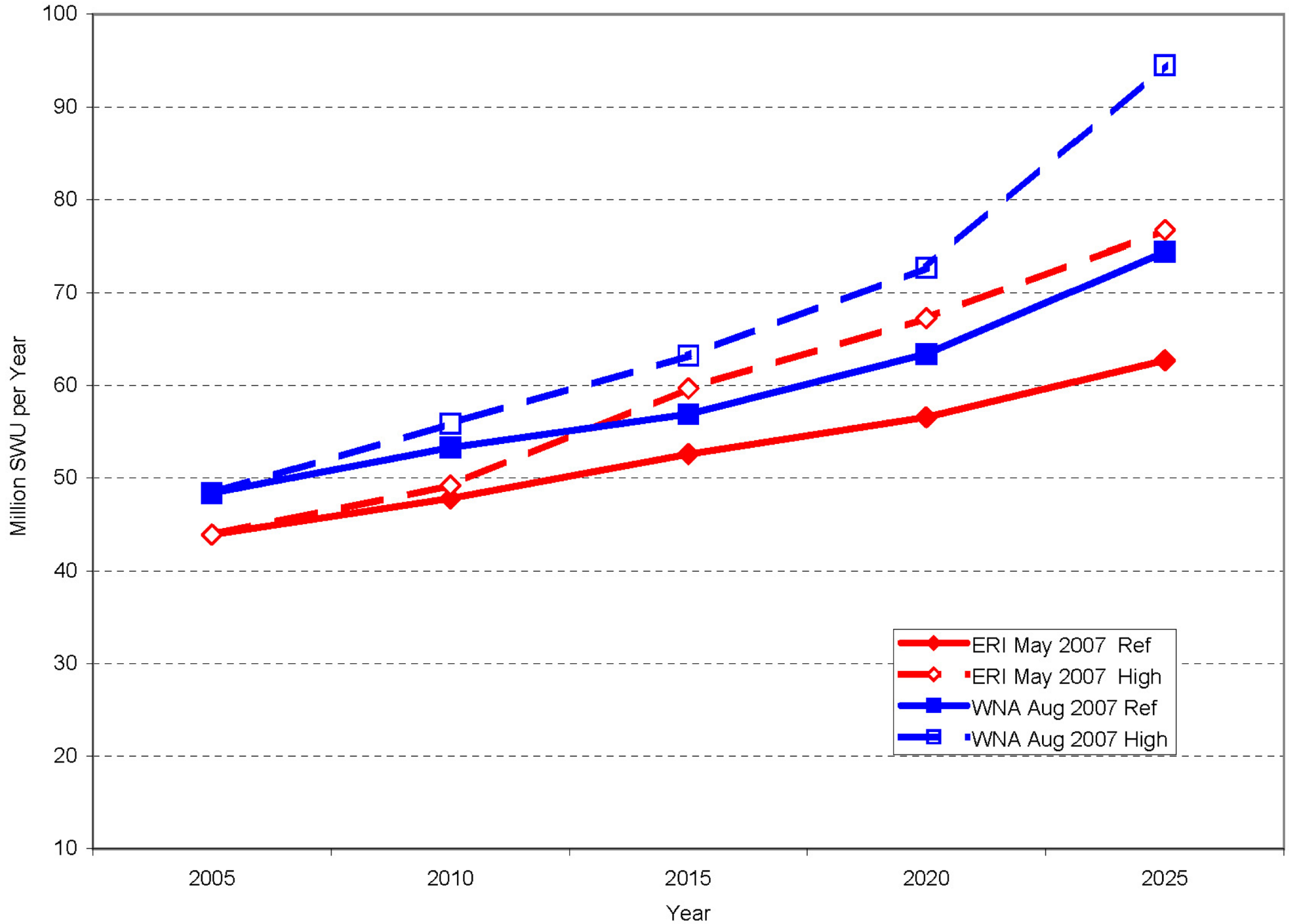

FIGURE 1.1-5 **Rev. 0**

Comparision of World Annual Enrichment Requirements Forecasts

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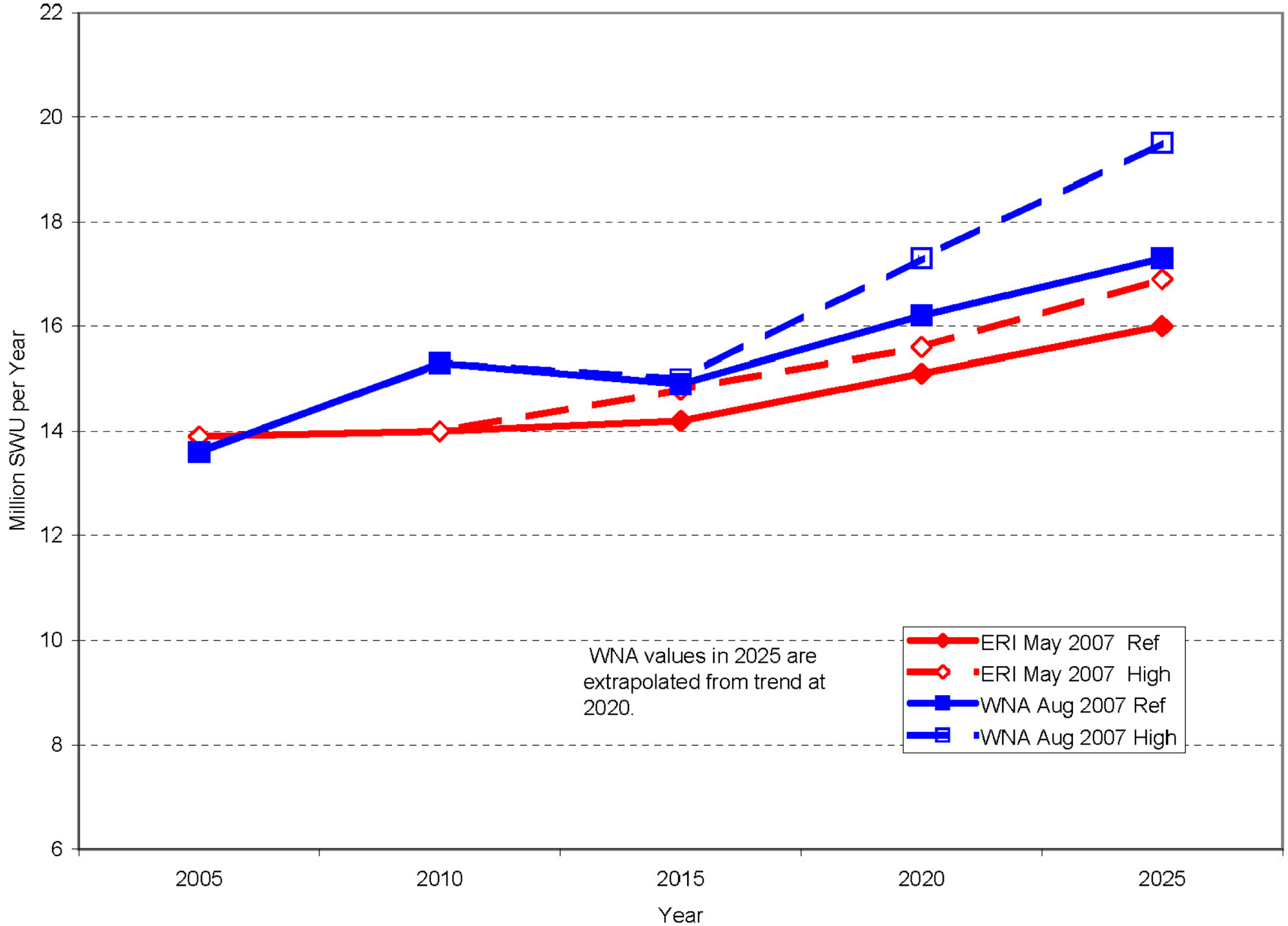

FIGURE 1.1-6 **Rev. 0**

Comparision of U.S. Annual Enrichment Requirements Forecasts

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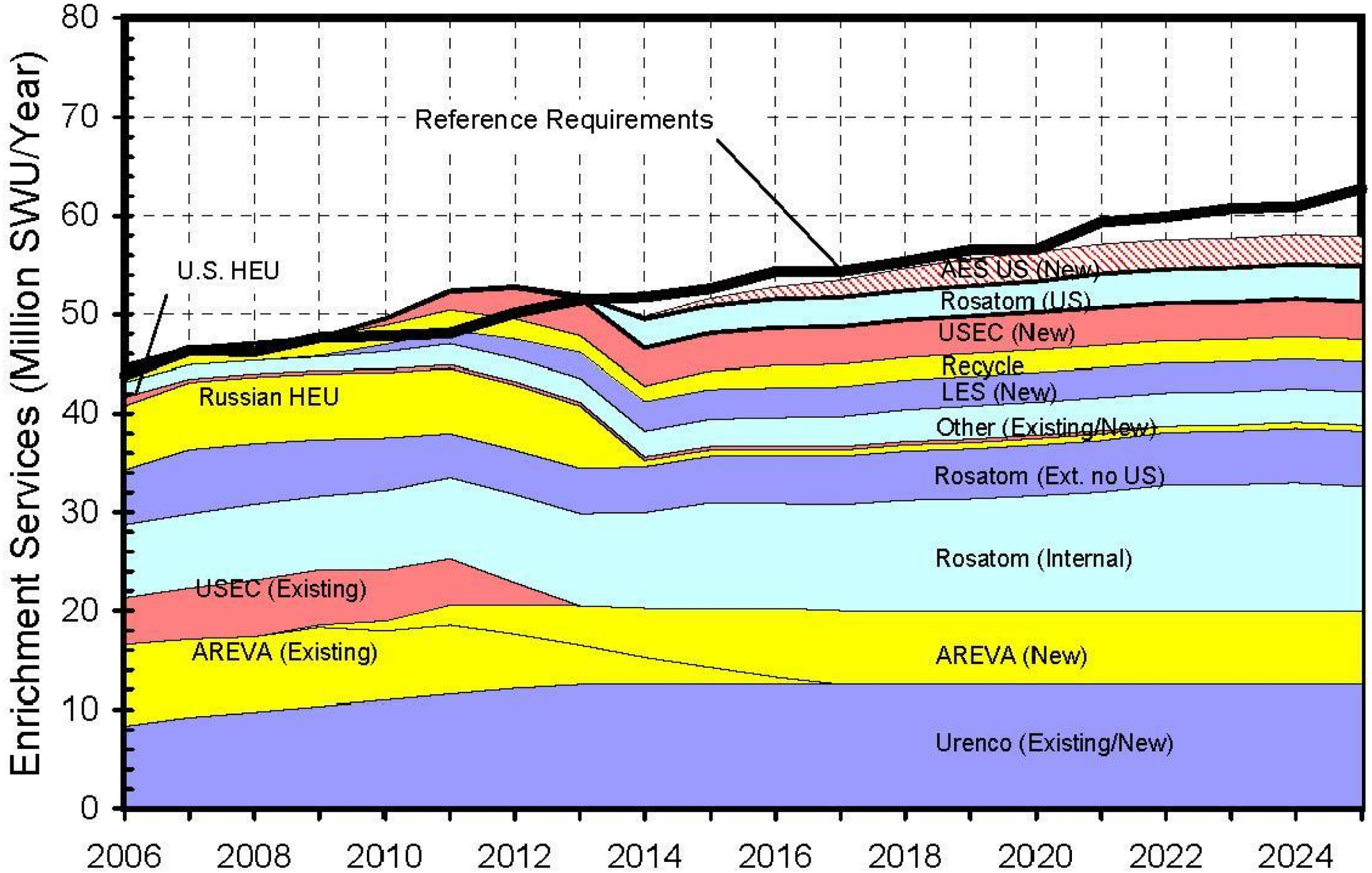

FIGURE 1.1-7 **Rev. 0**

Scenario A - Base Supply and Reference Nuclear Power Growth Requirements

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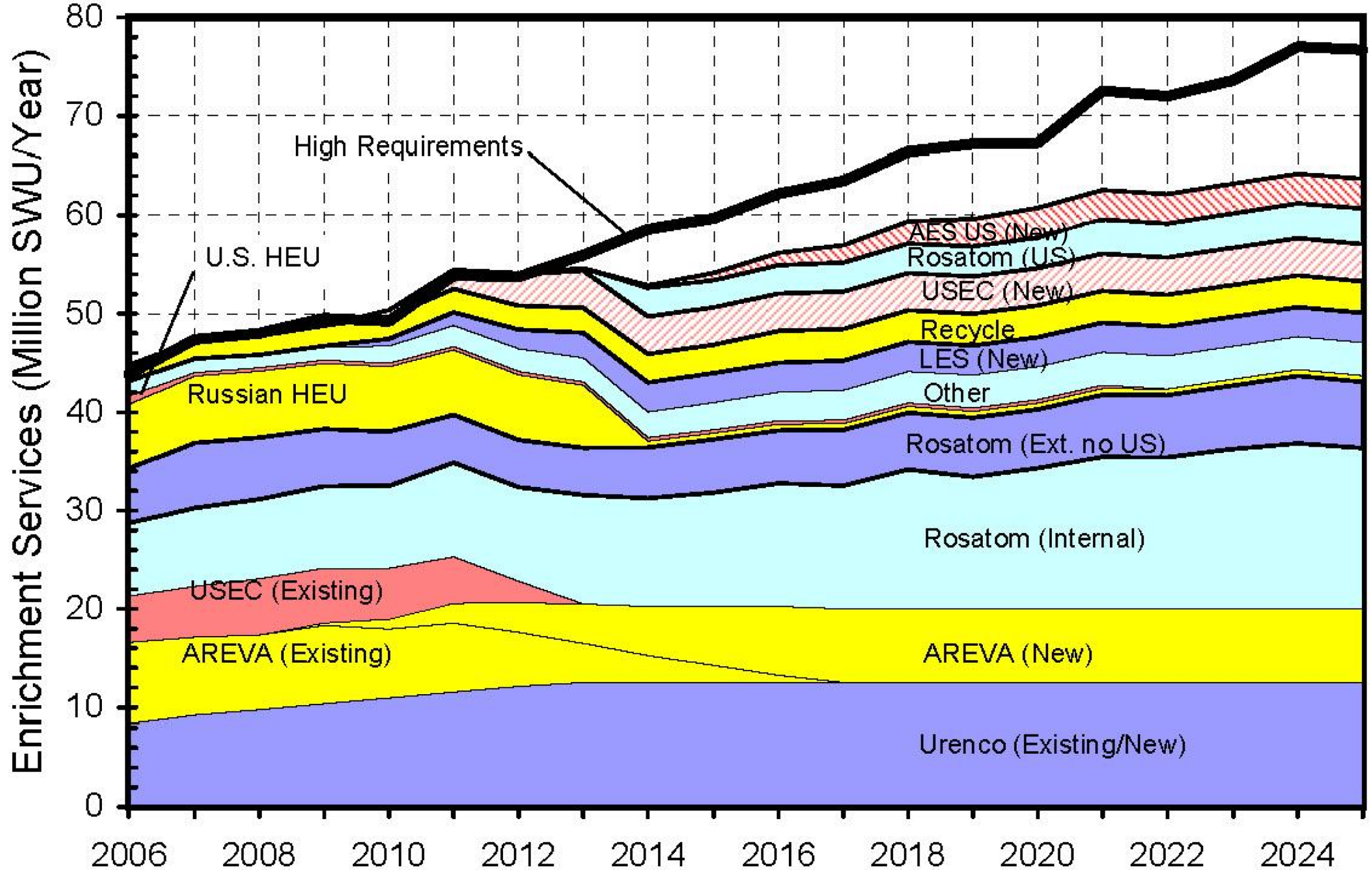

FIGURE 1.1-8 **Rev. 0**

Scenario A - Base Supply and High Nuclear Power Growth Requirements

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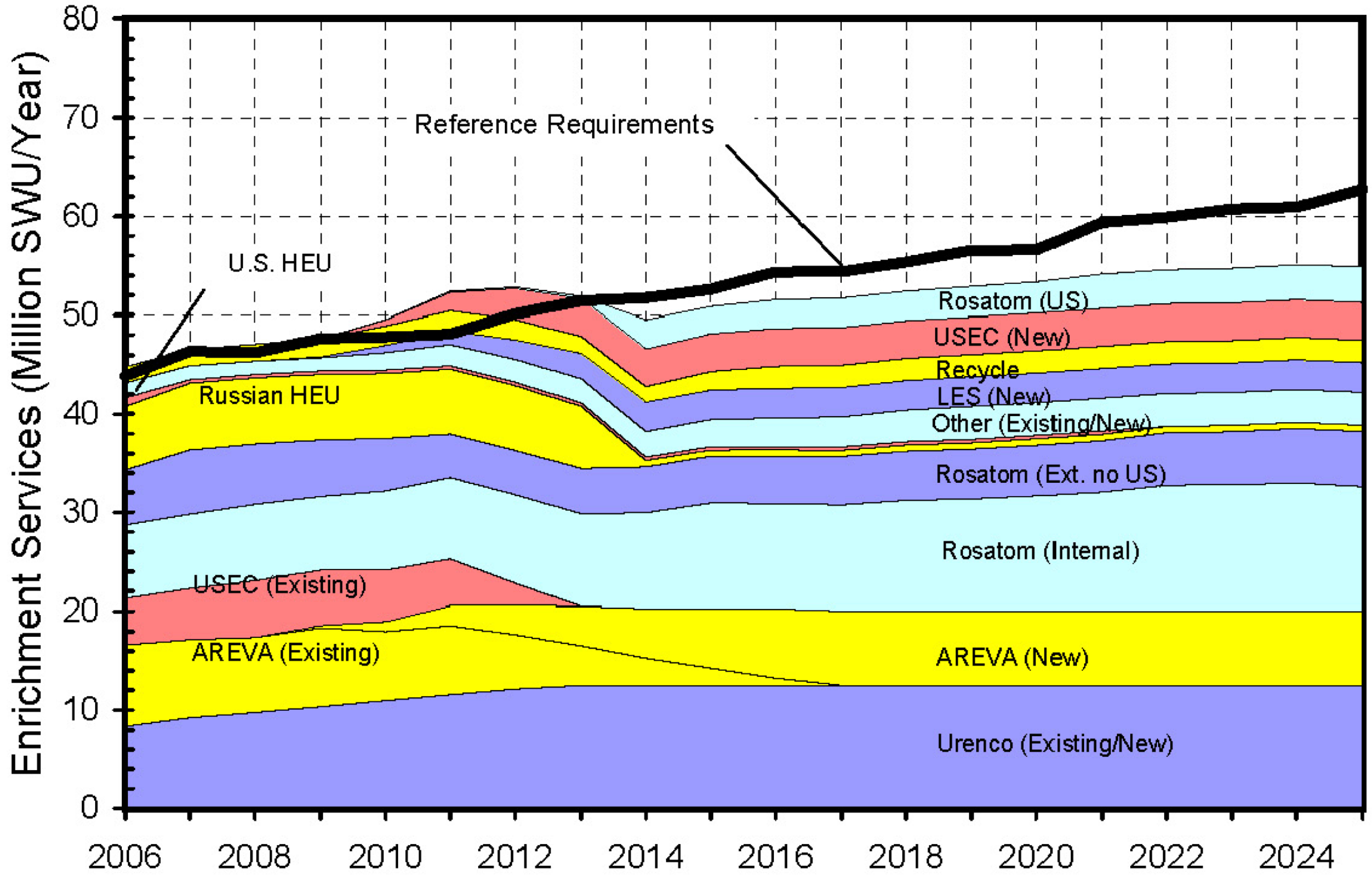

FIGURE 1.1-9 **Rev. 0**

Scenario A* - Base Supply and Reference Nuclear Power Growth Requirements Without AREVA's U.S. Plant

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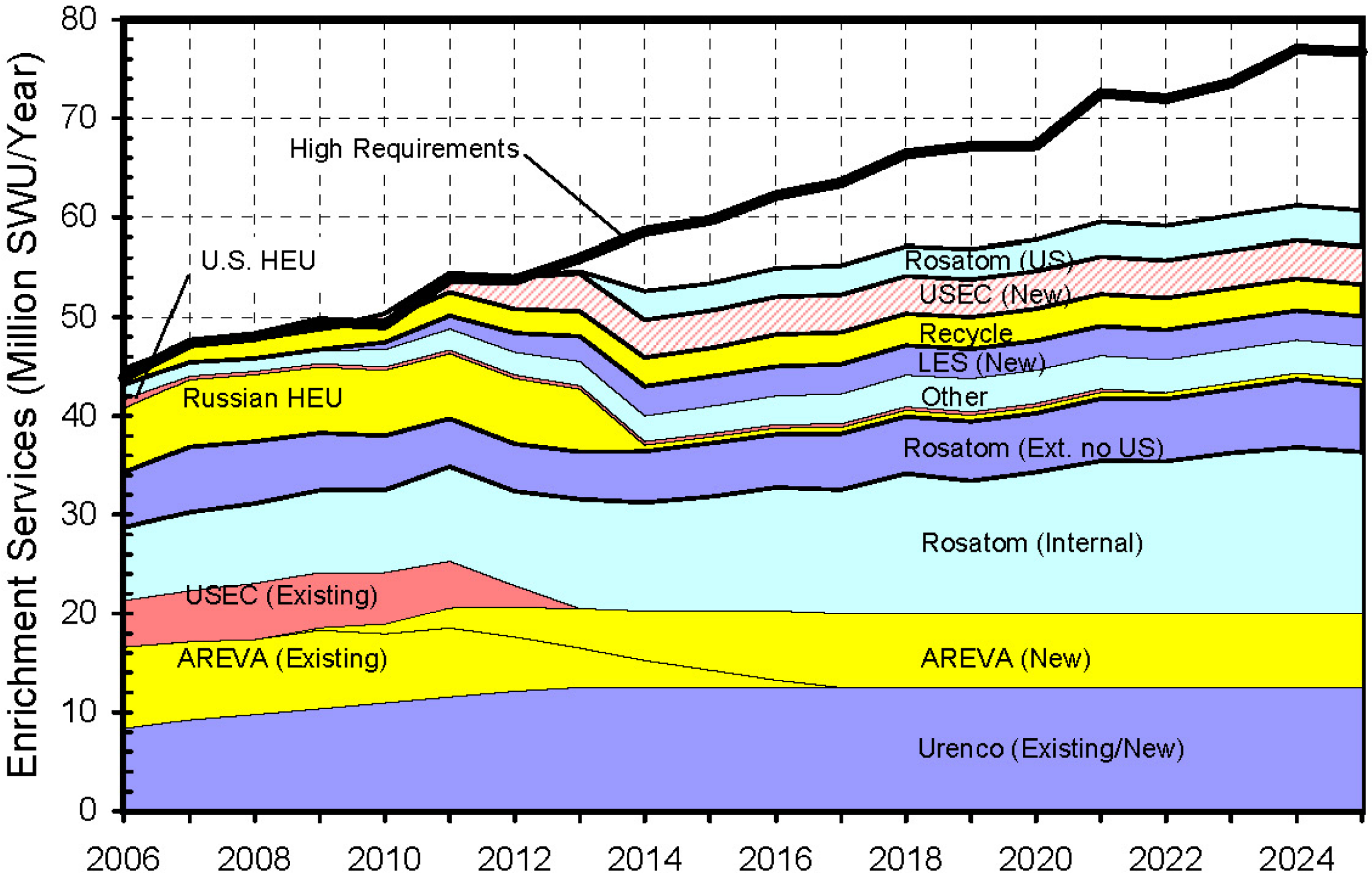

FIGURE 1.1-10 **Rev. 0**

Scenario A* - Base Supply and High Nuclear Power Growth Requirements Without AREVA's U.S. Plant

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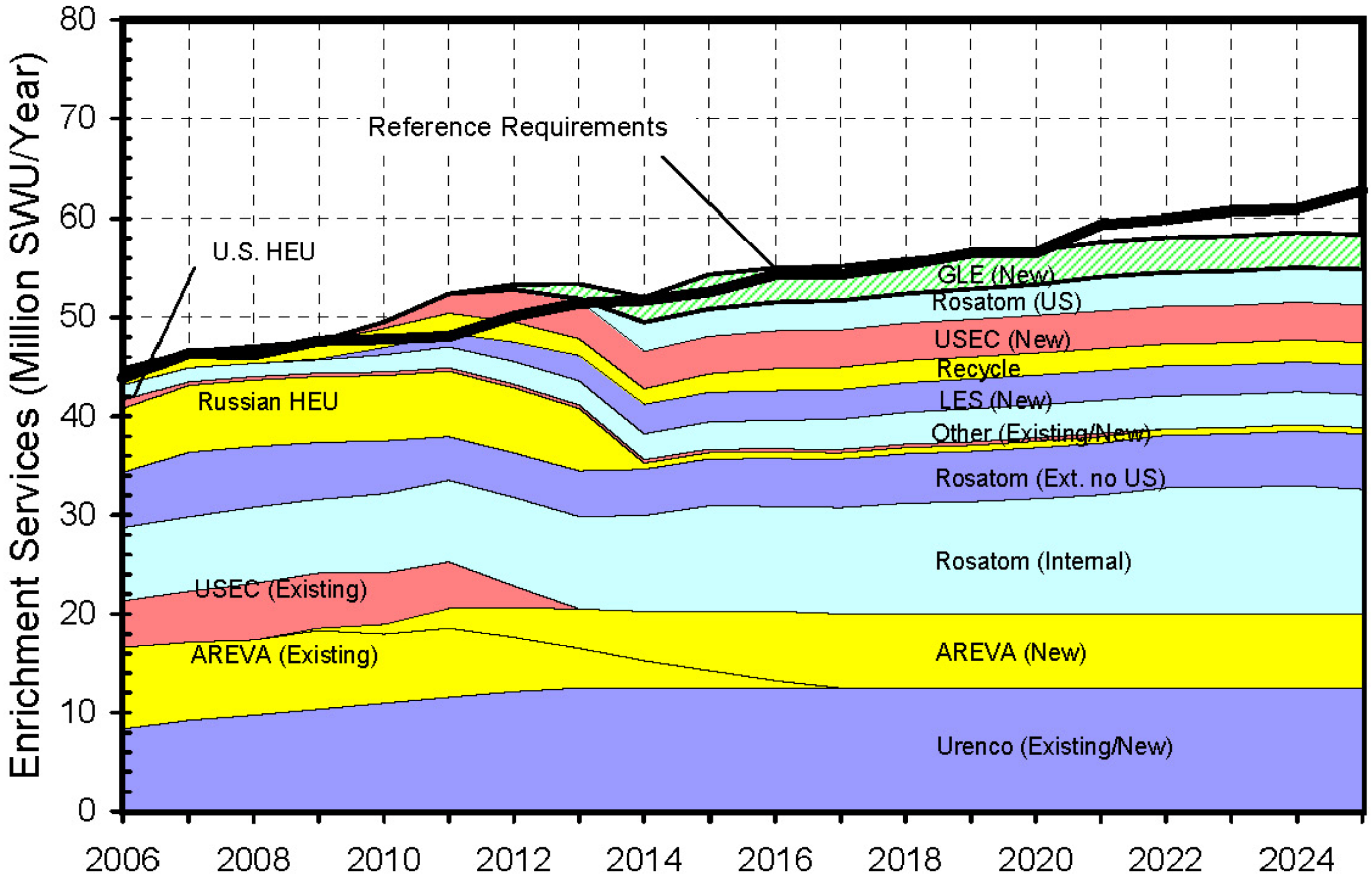

FIGURE 1.1-11 **Rev. 0**

Scenario B - Base Supply and Reference Nuclear Power Growth Requirements Without AREVA's U.S. Plant; Plus GEH Deployment of GLE

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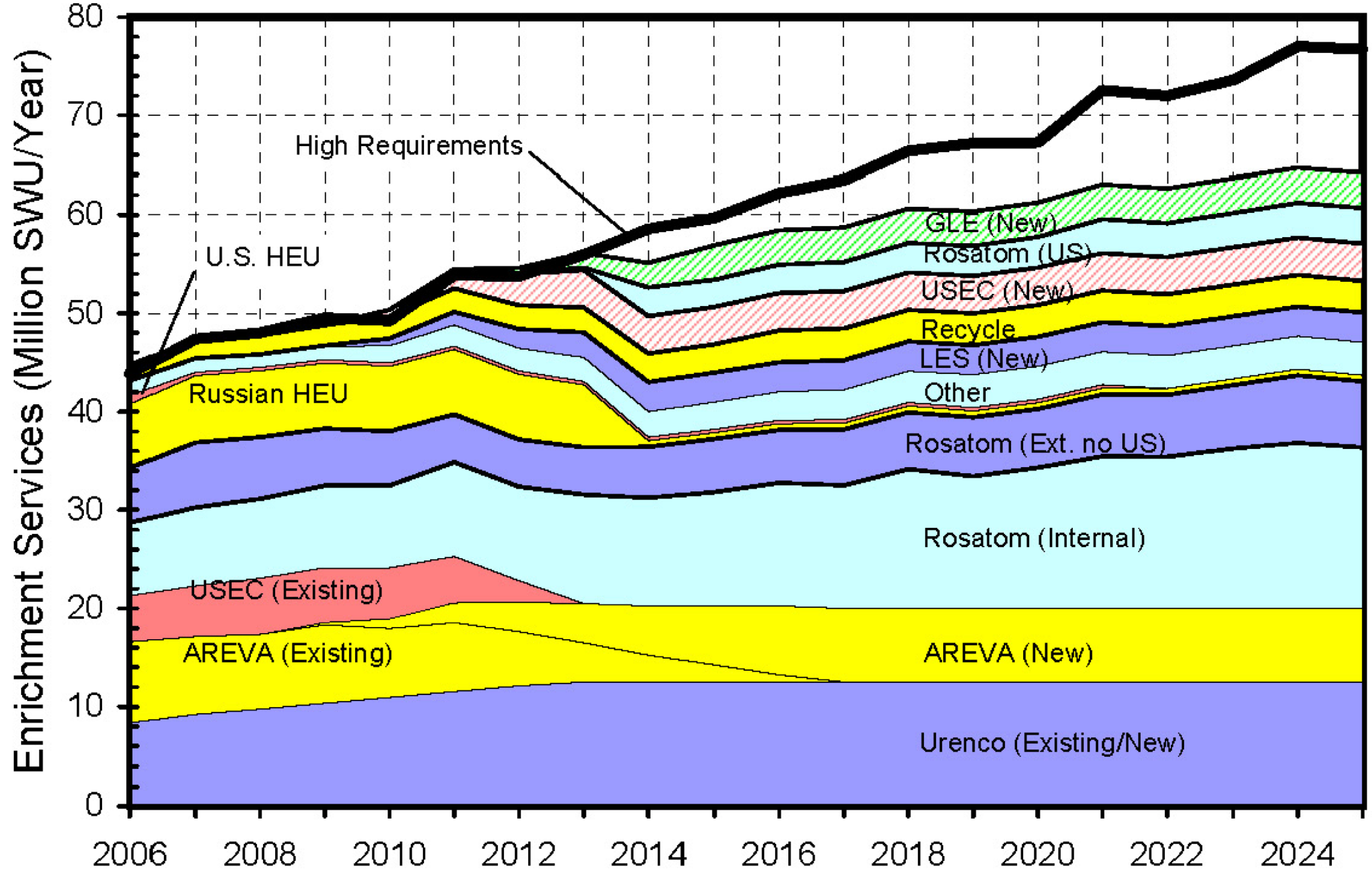

FIGURE 1.1-12 **Rev. 0**

Scenario B - Base Supply and High Nuclear Power Growth Requirements Without AREVA's U.S. Plant; Plus GEH Deployment of GLE

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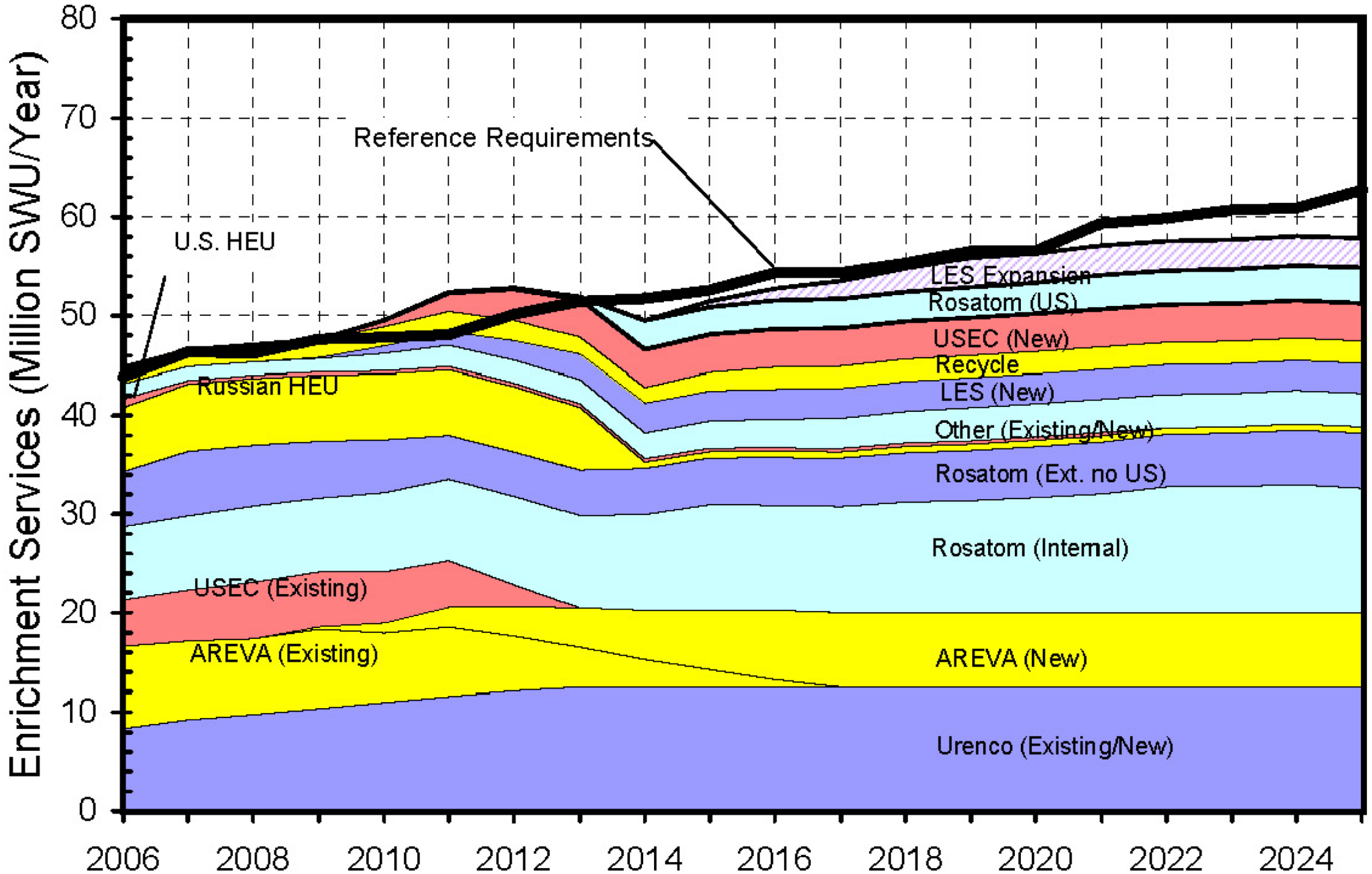

FIGURE 1.1-13 **Rev. 0**

Scenario C - Base Supply and Reference Nuclear Power Growth Requirements Without AREVA's U.S. Plant; Plus LES Expansion of NEF

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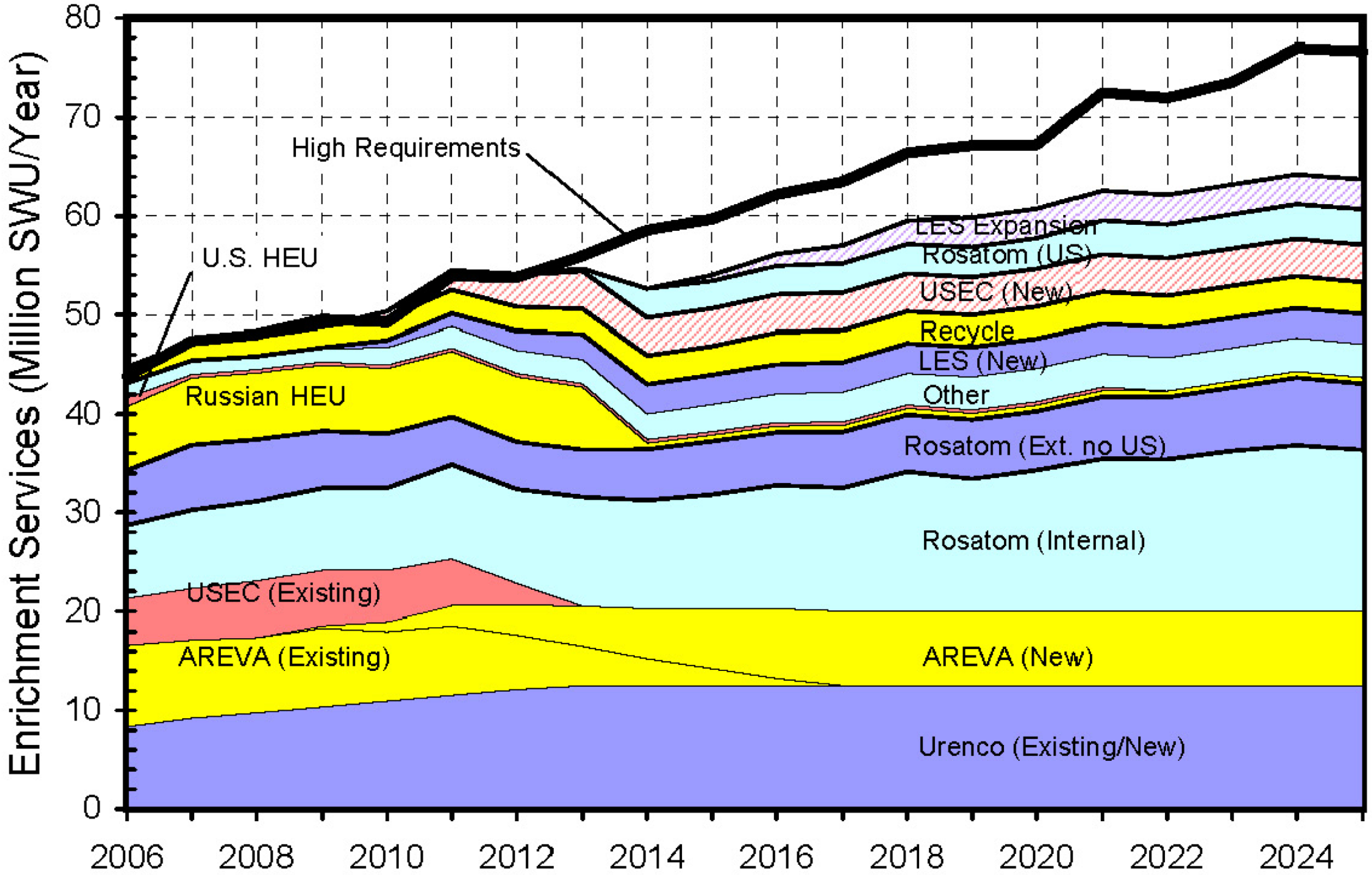

FIGURE 1.1-14 **Rev. 0**

Scenario C - Base Supply and High Nuclear Power Growth Requirements Without AREVA's U.S. Plant; Plus LES Expansion of NEF

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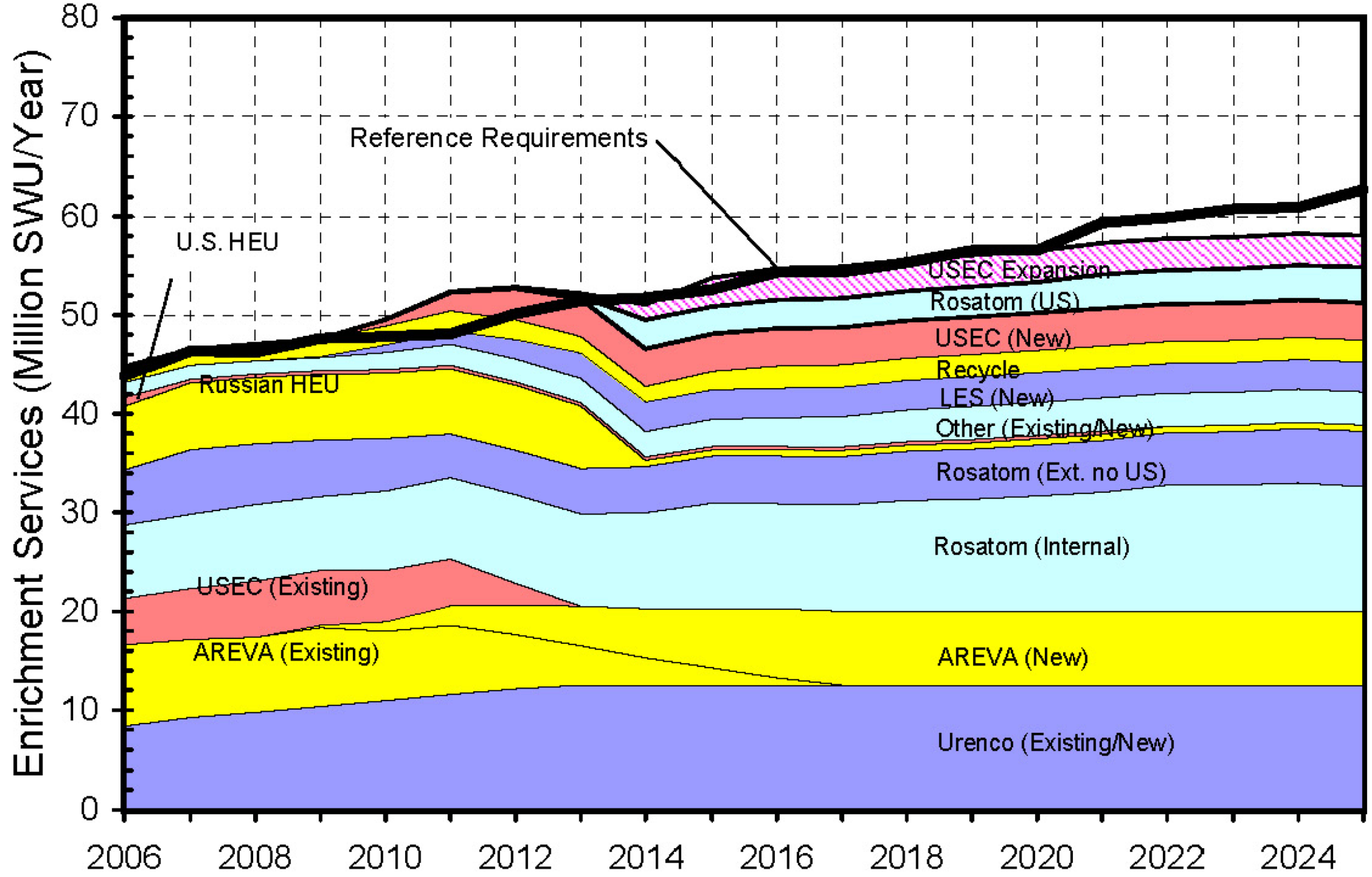

FIGURE 1.1-15 **Rev. 0**

Scenario D - Base Supply and Reference Nuclear Power Growth Requirements Without AREVA's U.S. Plant; Plus USEC Expansion of ACP

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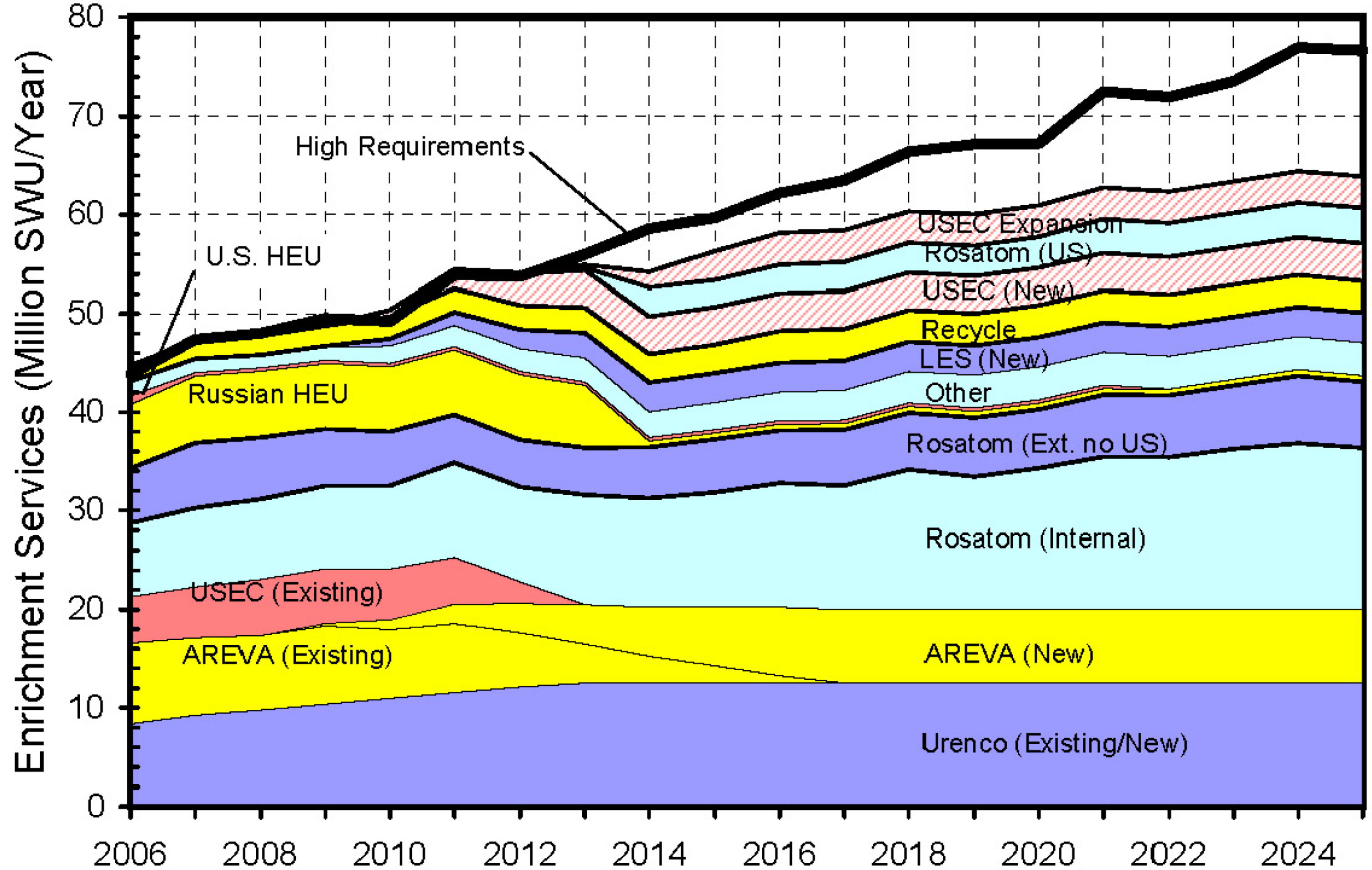

FIGURE 1.1-16 **Rev. 0**

Scenario D - Base Supply and High Nuclear Power Growth Requirements Without AREVA's U.S. Plant; Plus USEC Expansion of ACP

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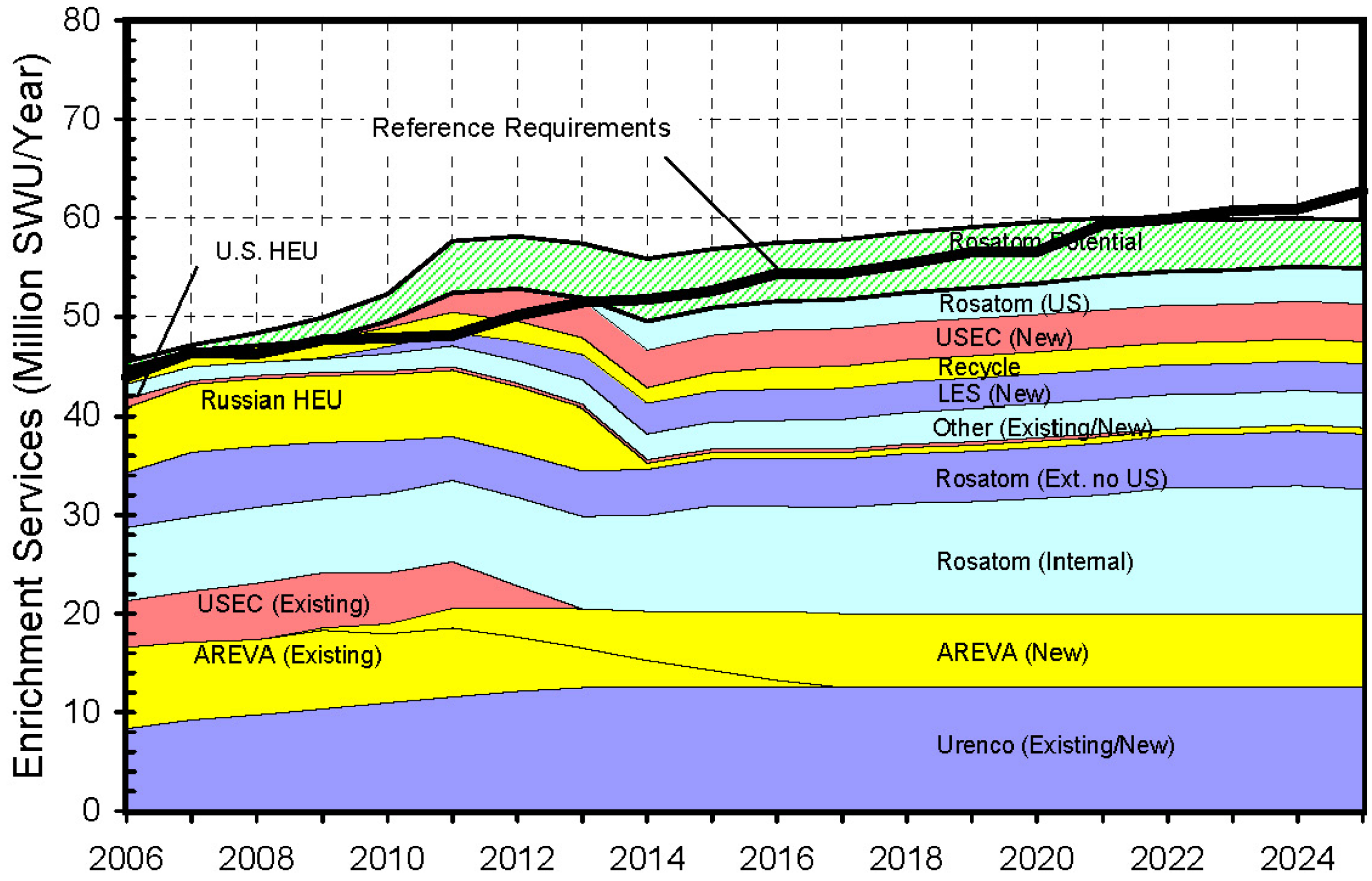

FIGURE 1.1-17 **Rev. 0**

Scenario E - Base Supply and Reference Nuclear Power Growth Requirements Without AREVA's U.S. Plant; Plus Potential Rosatom Expansion Capability

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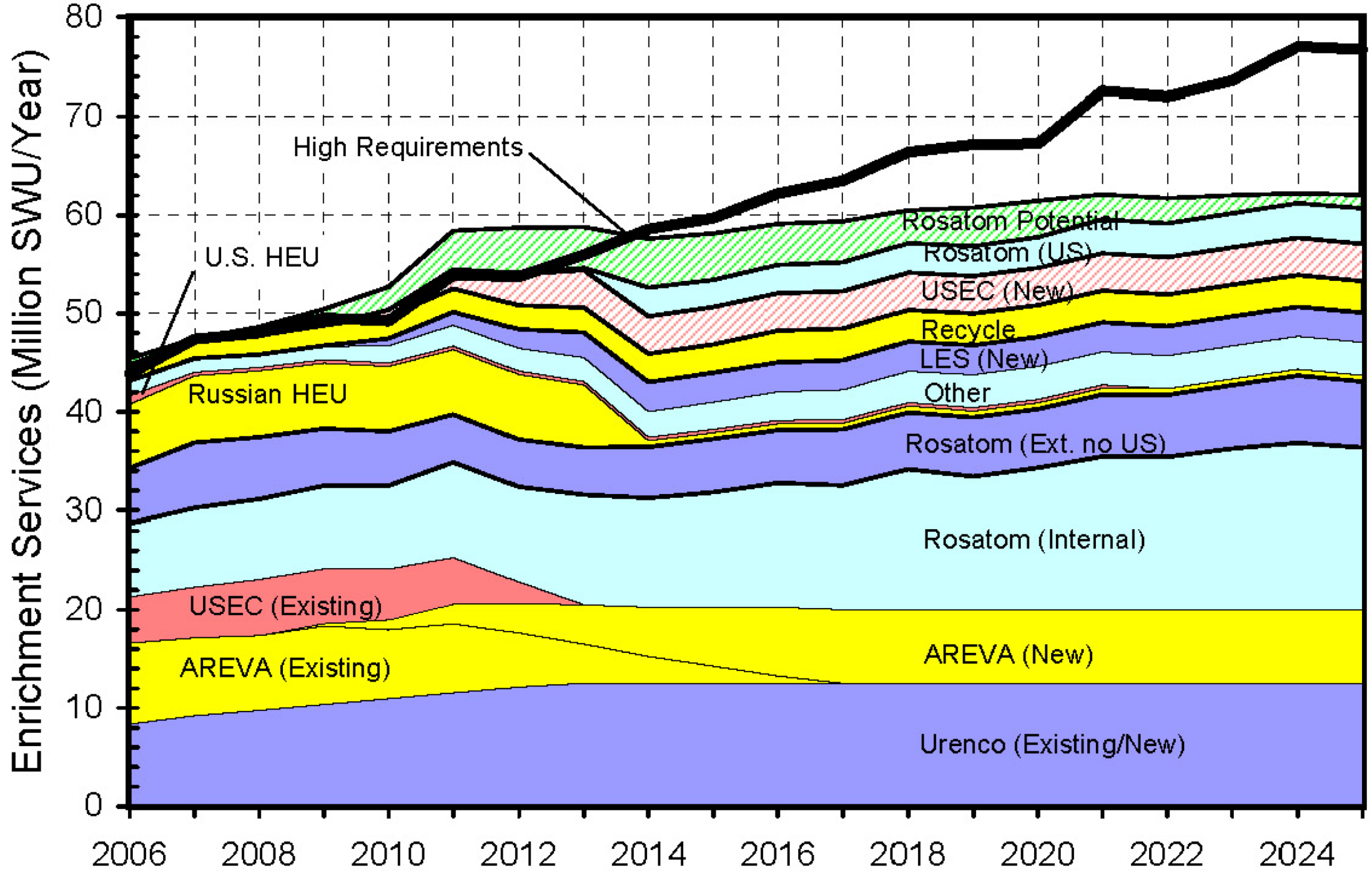

FIGURE 1.1-18 **Rev. 0**

Scenario E - Base Supply and High Nuclear Power Growth Requirements Without AREVA's U.S. Plant; Plus Potential Rosatom Expansion Capability

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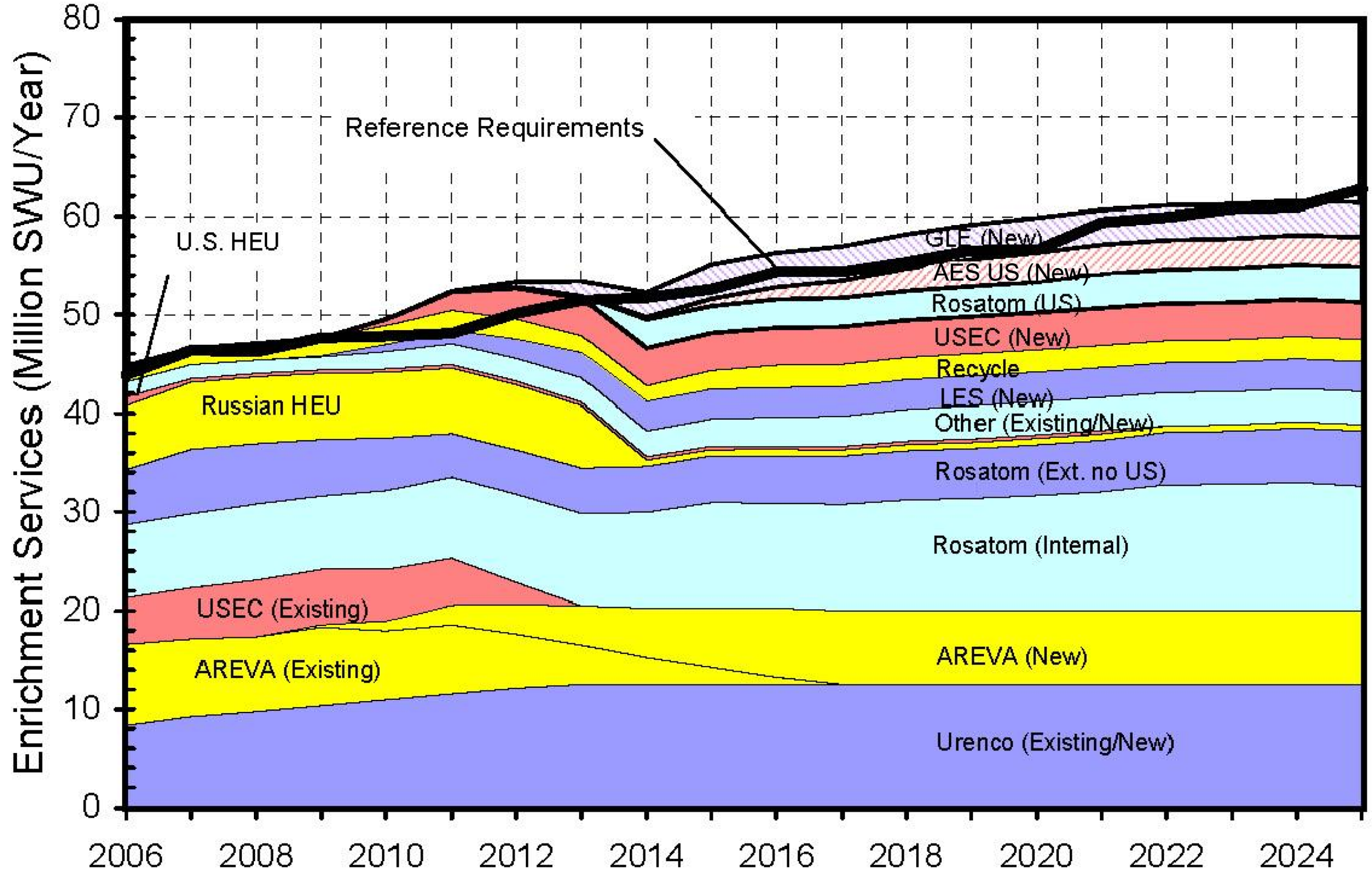

FIGURE 1.1-19 **Rev. 0**

Scenario H - Base Supply and Reference Nuclear Power Growth Requirements; Plus GEH Deployment of GLE

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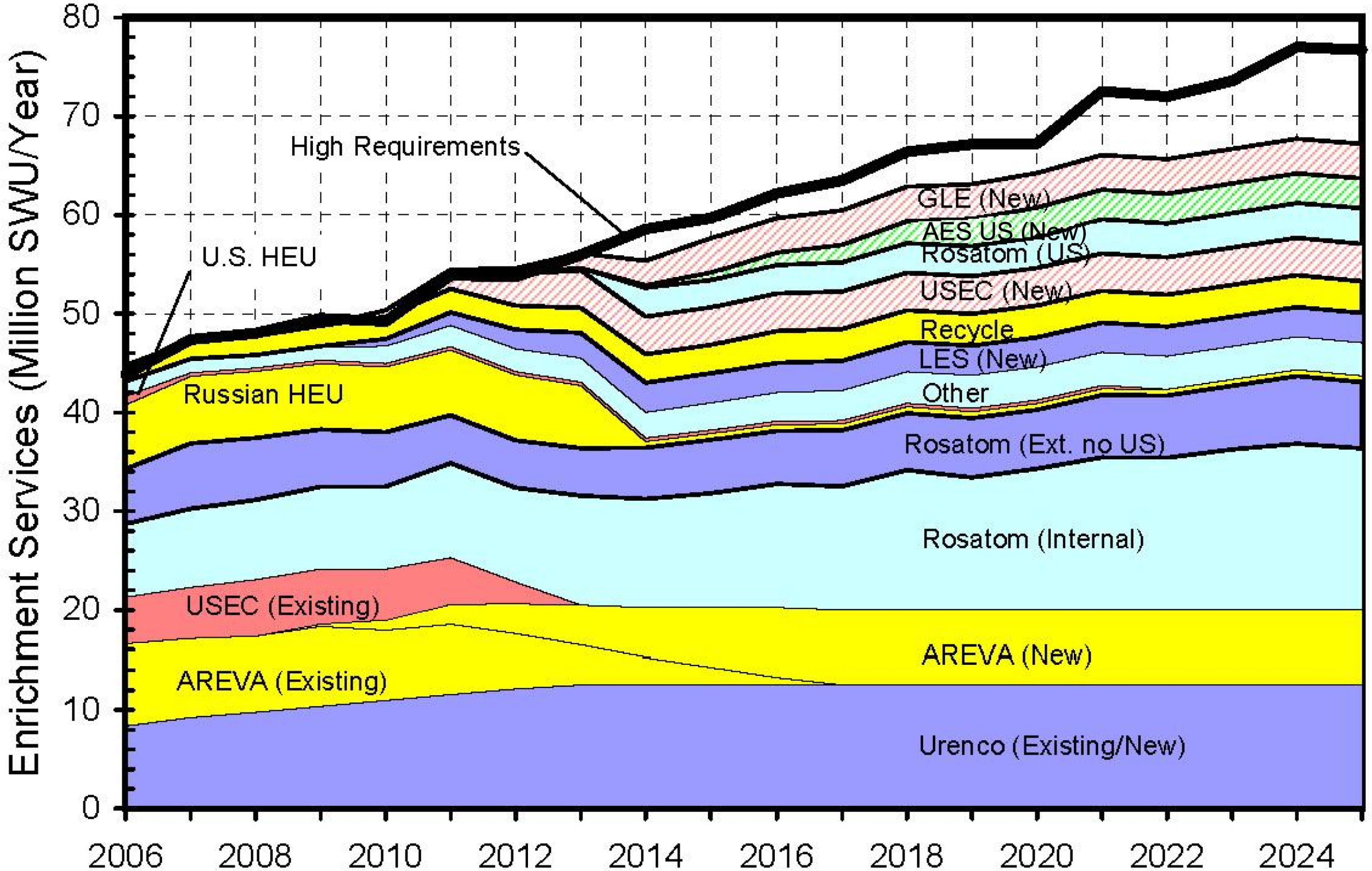

FIGURE 1.1-20 **Rev. 0**

Scenario H - Base Supply and High Nuclear Power Growth Requirements; Plus GEH Deployment of GLE

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1.2 PROPOSED ACTION

The proposed action is the issuance of an NRC license under 10 CFR 70 (CFR, 2008b) for the construction and operation of a uranium enrichment facility at a site located In Bonneville County, Idaho. The Eagle Rock Enrichment Facility (EREF) will use the gas centrifuge process to separate natural uranium hexafluoride feed material containing approximately 0.71 Uranium-235 (^{235}U) into a product stream enriched up to 5.0 $^{w}/_{o}$ ^{235}U and a depleted UF_6 stream containing approximately 0.15 to 0.30 $^{w}/_{o}$ ^{235}U. Production capacity at design throughput is approximately a nominal 3.0 million Separative Work Units (SWU) per year. Facility construction is expected to require seven (7) years. Construction will be conducted in four phases associated with each of the four Cascade Halls. Operation will commence after the completion of the first cascade in the first Cascade Hall. The facility is licensed for 30 years of operation. Decommissioning and Decontamination (D&D) is projected to take nine (9) years. AREVA Enrichment Services, LLC (AES) estimates the cost of the plant to be approximately [Proprietary Commercial Information withheld in accordance with 10 CFR 2.390] (in 2007 dollars) excluding escalation, contingency, interest, tails disposition, decommissioning, and any replacement equipment required during the operational life of the facility.

1.2.1 The Proposed Site

The proposed site is situated in Bonneville County, Idaho, on the north side of U.S. Highway 20, about 113 km (70 mi) west of the Idaho/Wyoming state line. Portions of Bonneville, Jefferson, and Bingham counties are within 8 km (5 mi) of the proposed site. The approximately 1,700 ha (4,200 ac) property is currently under private ownership by a single landowner. There is a 16-ha (40-ac) parcel within the proposed site, which is administered by the U. S. Bureau of Land Management (BLM). There are two, 16-ha (40-ac) parcels located within the proposed site for which the Federal government has uranium land patents. The land patents are not subject to the 1872 Mining Law (USC, 2008f) and, therefore, are not available to mining claims. The privately held land will be purchased by AES. The approximate center of the EREF is located at latitude 43 degrees, 35 minutes, 7.37 seconds North and longitude 112 degrees, 25 minutes, 28.71 seconds West. Refer to Figure 1.2-1, Location of Proposed Site, and Figure 1.2-2, EREF Location Relative to Population Centers Within 80 Kilometers (50 Miles).

There are no right-of-ways on the property with the exception of the right-of-way for U.S. Highway 20, which forms part of the southern boundary of the proposed site. A dirt road provides site access from U.S. Highway 20, while other dirt roads provide access throughout the proposed site. The proposed site is comprised mostly of relatively flat and gently sloping surfaces with small ridges and areas of rock outcrop. Most of the site is semi-arid steppe covered by eolian soils of variable thickness that incompletely cover broad areas of volcanic lava flows. Elevations at the site range from about 1,556 m (5,106 ft) to about 1,600 m (5,250 ft). Many of the areas with thickest soils and gentle slopes with a minimum of rock outcrop are currently used for crops.

The proposed site is in native rangeland, non-irrigated seeded pasture, and irrigated cropland. The proposed site is seasonally grazed. Wheat, barley, and potatoes are grown on 389 ha (962 ac) of irrigated land on the proposed site. One potato storage facility is located at the south end of the site.

Grazing and cropping are the main land uses within 8 km (5 mi) of the proposed site. State land immediately west of the proposed site and BLM land immediately east of the site are grazed. The nearest off-site croplands are within 0.8 km (0.5 mi) of the southeast corner of the proposed site. The nearest feedlot and dairy operations are approximately 16 km (10 mi) east of the proposed site. The Department of Energy's Idaho National Laboratory (INL) eastern boundary is 1.6 km (1 mi) west of the proposed site. The INL property near the site is undeveloped rangeland. The closest facility on the INL property is the Materials and Fuels Complex (MFC), located approximately 16 km (10 mi) west of the proposed site boundary. The lands north, east, and south of the site are a mixture of private-, State-, and Federal-owned parcels.

The city of Idaho Falls, the nearest large population center, is located approximately 32 km (20 mi) east southeast of the site. Idaho Falls has the closest commercial airport. The towns of Rigby and Rexburg are located approximately 23 km (14 mi) and 42 km (26 mi) north of Idaho Falls, respectively. Atomic City is approximately 32 km (20 mi) west of the site. The towns of Blackfoot , Fort Hall, and Pocatello are located approximately 40 km (25 mi), 60 km (37 mi), and 76 km (47 mi) south of the proposed site, respectively. The Fort Hall Indian Reservation comprises approximately 220,150 ha (544,000 ac) and also lies to the south. The nearest boundary of the Fort Hall Indian Reservation is about 44 km (27 mi) from the proposed site.

The nearest residence is approximately 7.7 km (4.8 mi) east of the proposed site. Temporarily occupied structures in the 8 km (5 mi) radius include a transformer station adjacent to the proposed site to the east, and potato storage facilities, one approximately 3.2 km (2 mi) west of the proposed site, and one approximately 7.7 km (4.8 mi) to the east. Public use areas include a hiking trail south of the proposed site in Hell's Half Acre Wilderness Study Area (WSA) and a small lava tube cave located approximately 8 km (5 mi) east and south. The Wasden Complex, consisting of caves formed by collapsed lava tubes, is located approximately 3.2 km (2 mi) northeast from the footprint of the EREF.

Refer to Figure 1.2-3, EREF Location Relative to Transportation Routes, for the site location relative to other important landmarks, transportation routes, including active railroad lines.

1.2.2 Description of EREF Operations and Systems

The EREF is designed to separate a feed stream containing the naturally occurring proportions of uranium isotopes into a product stream enriched in ^{235}U and a stream depleted in the ^{235}U isotope. The feed material for the enrichment process is uranium hexafluoride (UF_6) with a natural composition of isotopes ^{234}U, ^{235}U, and ^{238}U. The enrichment process involves the mechanical separation of isotopes using a fast-rotating cylinder (centrifuge) which is based on a difference in centrifugal forces due to differences in molecular weight of the uranic isotopes. No chemical or nuclear reactions take place. The feed, product, and depleted UF_6 streams are all in the form of UF_6.

The UF_6 is delivered to the plant in standard Type 48Y international transit cylinders, which are connected to the plant in feed stations joined to a common manifold. Heat is then applied electrically to sublime UF_6 from solid to vapor. The gas is flow controlled through a pressure control system for distribution to individual cascades at sub-atmospheric pressure.

Individual centrifuges are not able to produce the desired product and depleted UF_6 concentration in a single step. They are therefore grouped together in series and parallel to form arrays known as cascades. A typical cascade hall comprises many hundreds of centrifuges. A cascade hall is made up of twelve cascades. UF_6 is drawn through cascades with vacuum pumps and moved to the transport cylinders located in product and tails take-off stations where it can desublime. Highly reliable UF_6 resistant pumps have been developed for transferring the process gas.

Depleted uranium material is desublimed at the Tails Low-Temperature Take-Off Station into chilled Type 48Y cylinders. The product is desublimed into Type 30B cylinders for shipping or Type 48Y cylinders for internal use.

The entire plant process gas system operates at sub-atmospheric pressure. This provides a high degree of safety but also means that the system is susceptible to in-leakage of air. Any in-leakage of air passes through the cascades and is preferentially directed into the product stream. A vent system is provided to remove hazardous contaminants from low levels of light gas (any gas lighter than UF_6) that arise on a regular basis from background in-leakage, routine venting of UF_6 cylinders, and purging of UF_6 lines.

Each Plant Module - consisting of two Cascade Halls - is provided with a cooling water system to remove excess heat at key positions on the centrifuges in order to maintain optimum temperatures within the centrifuges.

The centrifuges are driven by a medium frequency Alternating Current (AC) supply system. A converter produces the medium frequency supply from the AC main supply using high efficiency switching devices for both run-up and continuous operation.

1.2.3 Comparison of the EREF Design to the LES Claiborne Enrichment Center Design and the LES National Enrichment Facility Design

While the design of the EREF is fundamentally the same as the Claiborne Enrichment Center design reviewed and approved by the NRC staff in the 1990s (NRC, 1994), a number of improvements or enhancements have been made in the current design from an environmental and safety perspective. In addition to these changes is the increase from seven cascades per Assay Unit to twelve cascades per Assay Unit. Maximum Assay Unit capacity has been increased from 280,000 SWU/yr to 832,500 SWU/yr.

There are two important differences in the UF_6 Feed System for the EREF as compared to the Claiborne Enrichment Center. First, the liquid UF_6 phase above atmospheric pressure has been eliminated. Sublimation from the solid phase directly to the gaseous phase below atmospheric pressure is the process to be used in the EREF. A sealed autoclave is replaced with a Solid Feed Station enclosure for heating the feed cylinder. A second major difference is the use of chilled air, rather than chilled water, to cool the feed purification cylinder. The EREF UF_6 Feed System is the same as used at the NEF.

In addition to operating the process at sub-atmospheric pressure, the other primary difference between the Louisiana Energy Services, Claiborne Enrichment Center, and the EREF cascade systems is that all assay units are now identical, whereas in the Claiborne Enrichment Center, one assay unit was designed to produce low assays - in the region of 2.5%. An additional change is the increase from seven cascades per Cascade Hall to twelve cascades per Cascade Hall. Maximum Cascade Hall capacity has been increased to 832,500 SWU/yr. Louisiana Energy Services' National Enrichment Facility (NEF) has eight cascades per Cascade Hall with a Cascade Hall capacity of 545,000 SWU/yr.

The EREF "Product Take-Off System" uses a process similar to the Claiborne Enrichment Center, but there are certain differences. In the current system proposed for the EREF, there is only one product pumping stage, whereas the proposed Claiborne Enrichment Center system used two pumping stages to transport the product for desublimation. In the EREF system, pressures are controlled such that desublimation cannot occur in the piping, eliminating the need for heat tracing and valve hot boxes. In the Claiborne Enrichment Center, the product cylinder stations relied on common chillers to cool the stations, the current system; however, the EREF uses a dedicated chiller for each station. The cold traps used to desublime any UF_6 in the vent gases are smaller than those of the Claiborne Enrichment Center design and each is situated on load cells to allow continuous monitoring of accumulation (LES, 1991). The EREF UF_6 product Take-Off System is essentially the same as the one used at the NEF.

The EREF “Product Liquid Sampling System” uses a process very similar to the Claiborne Enrichment Center, but will have the following differences and enhancements from the Claiborne Enrichment Center design:

- The Process Vent System is a permanent vent system rather than a mobile unit as used at the Claiborne Enrichment Center (LES, 1991).
- The Liquid Product Sampling Autoclaves (autoclaves) will consist of five autoclaves to process 30B cylinders and two combined autoclaves that may be used to sample either 30B or 48Y cylinders. The Claiborne Enrichment Center design uses only the five autoclaves to process 30B cylinders.
- Each autoclave uses an internal heat exchanger to cool the autoclave rather than external cooling coils which cool the autoclave walls for the Claiborne Enrichment Center design.
- The internal autoclave circulation fan’s motor is located outside the autoclave rather than being internal for the Claiborne Enrichment Center design.
- The sampling manifold inside the autoclave is normally not removed after each liquid sample but goes through a cleaning process using liquid UF_6 which is removed through the Process Vent System as part of the autoclave liquid process. For the Claiborne Enrichment Center design, the sampling manifold is replaced each time a liquid sample is taken and cleaned in the Decontamination System.

A more detailed discussion of the EREF Product Liquid Sampling System that can be compared to the NEF Product Liquid Sampling System is provided in the Integrated Safety Analysis Summary, Section 3.4, “Process Descriptions.”

The EREF "Product Blending System," like the NEF, uses a process similar to the proposed Claiborne Enrichment Center. One major difference, however, is the use of Solid Feed Stations to heat the donor cylinders in the EREF. The Claiborne Enrichment Center design required the use of autoclaves to heat the donor cylinders in the Claiborne Enrichment Center. Other differences between the two designs include the use of only two receiver stations in the EREF process versus five in the Claiborne Enrichment Center and the use of a dedicated vacuum pump/trap set in the EREF design versus a mobile set in the Claiborne Enrichment Center (LES, 1991). The NEF design was based on four receiver stations (LES, 2005). Other than this difference, the EREF and NEF designs are the same.

The EREF "Tails Take-Off System," like the NEF, uses a process similar to that proposed for the Claiborne Enrichment Center, but there are certain differences. In the EREF system there is only one tails pumping stage, whereas the Claiborne Enrichment Center would have used two pumping stages to transport the tails for desublimation. UF_6 tails are desublimed in cylinders cooled with chilled air in the current system, whereas the Claiborne Enrichment Center would have used chilled water to cool the cylinders. The Claiborne Enrichment Center design called for a total of ten tails cylinders in five double cooling stations for each Separation Plant Module (two Cascade Halls), but the EREF system uses eleven cylinders in single cooling stations for each Cascade Hall. Finally, the EREF system has a dedicated vacuum pump/trap set for venting and does not use the Feed Purification System like the Claiborne Enrichment Center (LES, 1991). The NEF design uses ten cylinders in single cooling stations (LES, 2005). Other than this difference, the EREF and NEF designs are the same.

The EREF “Cylinder Preparation System” uses a process similar to the Claiborne Enrichment Center design in conditioning empty, clean or used (i.e., with heel) 30B or 48Y cylinders except the EREF has six conditioning stations rather than the four the Claiborne Enrichment Center design has. The EREF also has a Cylinder Evacuation System which is used to reduce the heel in used 30B and 48Y cylinders and the Claiborne Enrichment Center and NEF designs does not. This system uses three donor stations, one receiver station and one large capacity cold trap.

The major structures and areas of the EREF are described below and shown in Figure 1.2-4, EREF Buildings. A more detailed discussion of these structures and areas, which are different than the corresponding structures and areas for the CEC and the NEF, is provided in the Integrated Safety Analysis Summary, Section 3.3, "Facility Description."

The Guard House serves as the primary access control point for the facility. It also contains the necessary space and provisions for an alternate Emergency Operations Center (EOC) should the primary facility become unusable.

The Separations Building Modules (SBM) house two, essentially identical, plant process units. Each SBM is comprised of a UF_6 Handling Area, two Cascade Halls, and a Process Services Corridor. The EREF has two SBMs. UF_6 is fed into the Cascade Halls and enriched UF_6 and depleted UF_6 are removed.

The Centrifuge Assembly Building (CAB) is used to assemble centrifuges before the centrifuges are moved to the Separations Building Modules and installed in the cascades.

The Technical Support Building (TSB) contains various laboratories and maintenance facilities necessary to safely operate and maintain the facility. The Operation Support Building (OSB) contains a Medical Room and the Control Room. In an emergency, the Control Room serves as the primary Emergency Operations Center (EOC) for the facility. Most site infrastructure facilities (i.e., laboratories for sample analysis) are located in the TSB and the OSB.

The Electrical Services Building (ESB) houses two standby diesel generators (DGs) that provide power to protect selected equipment in the unlikely event of loss of off-site supplied power. The ESB also contains electrical equipment. The Mechanical Services Building (MSB) houses air compressors, the demineralized water system and portions of the centrifuge cooling water system.

The Cylinder Receipt and Shipping Building (CRSB) is used to receive, inspect, and weigh cylinders of natural UF_6 sent to the facility and ship cylinders of enriched UF_6 to customers.

The Cylinder Storage Pads are a series of concrete pads designed to temporarily store empty and full feed, product, and tails cylinders. The Full Tails Cylinder Storage Pad would need to accommodate a total of 15,330 cylinders generated over the lifetime of the facility. A single-lined Cylinder Storage Pads Stormwater Retention Basin will be used specifically to retain runoff from the Cylinder Storage Pads during heavy rainfalls. This basin will also receive treated effluent from the packaged domestic sanitary sewage treatment plant. The unlined Site Stormwater Detention Basin will receive rainfall runoff from the balance of the developed plant site. No other liquid effluent will be discharged from the facility.

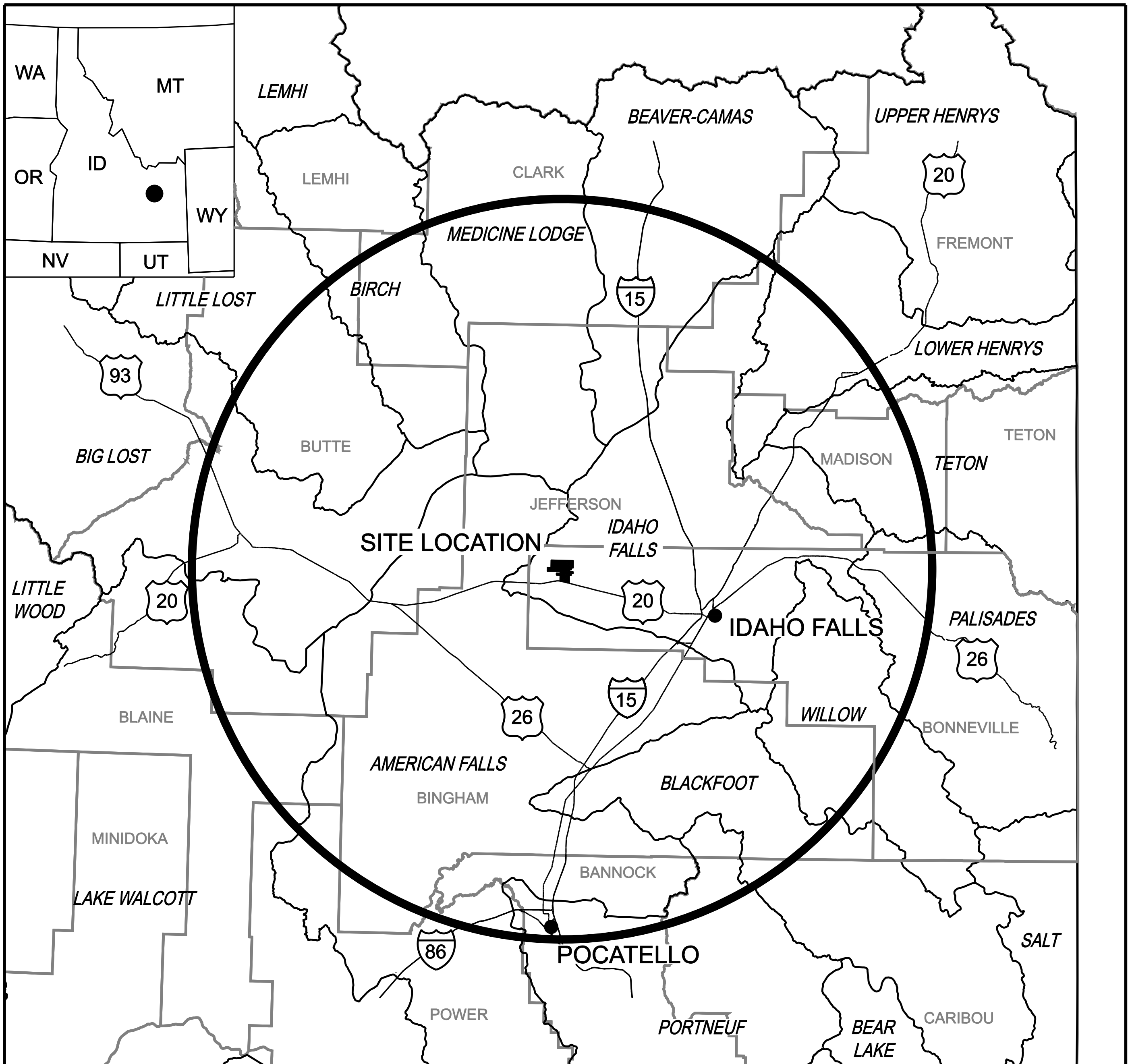
1.2.4 Schedule of Major Steps Associated with the Proposed Action

The EREF will be constructed in four phases corresponding to the successive completion of four centrifuge Cascade Halls. All construction will be completed in 2018. Each phase will result in an additional 832,500 SWU, with the first unit beginning operation prior to the completion of the remaining phases. Like the Claiborne Enrichment Center (LES, 1991) and the NEF (LES, 2005), the EREF is designed for at least 30 years of operation. A review of the centrifuge replacement options will be conducted late in the second decade of 2000. Decommissioning is expected to take approximately nine (9) years.

The anticipated schedule for licensing, construction, operation and decommissioning is as follows:

Milestone	Estimated Date
Submit Facility License Application	December 2008
Initiate Facility Construction	February 2011
Start First Cascade	February 2014
Achieve Full Nominal Production Output	March 2018
Submit License Termination Plan to NRC	February 2030
Complete Construction of D&D Facility	February 2032
D&D Completed	February 2041

FIGURES



LEGEND:

80 km (50 mi) RADIUS

SCALE

0 30 60 km

SCALE

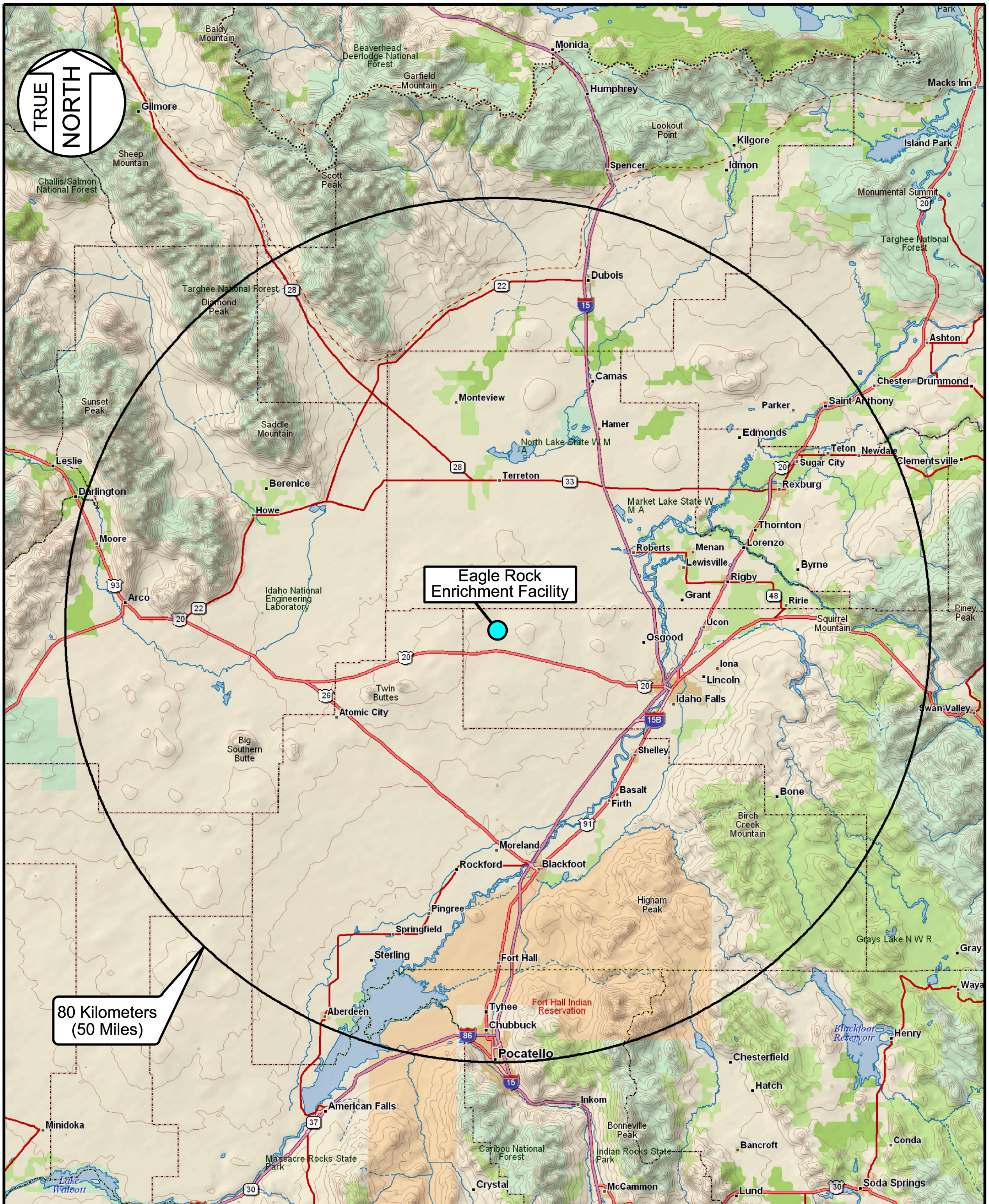
0 20 40 miles

N

Figure 1.2-1 **Rev. 0**

Location of Proposed Site

EAGLE ROCK ENRICHMENT FACILITY
ENVIRONMENTAL REPORT



0 5 10 15 20 25
SCALE: MILES

0 5 10 15 20 25 30 35 40
SCALE: KILOMETERS

Figure 1.2-2 **Rev. 0**

EREF Location Relative to Population Centers Within 80-Kilometers (50-Miles)

EAGLE ROCK ENRICHMENT FACILITY ENVIRONMENTAL REPORT

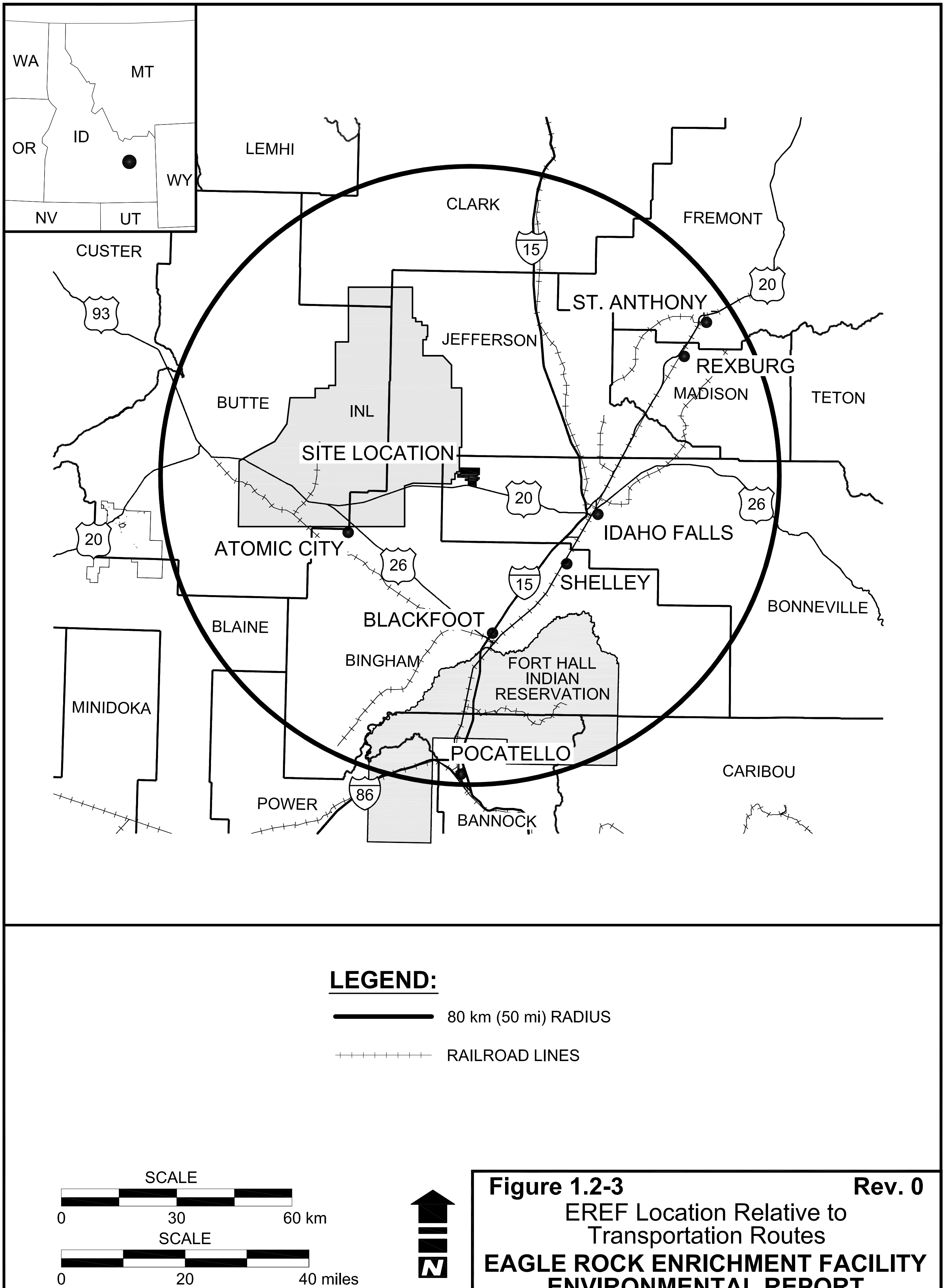


Figure 1.2-3 **Rev. 0**

EREF Location Relative to Transportation Routes

EAGLE ROCK ENRICHMENT FACILITY ENVIRONMENTAL REPORT

Figure 1.2-4, EREF Buildings, contains Security-Related Information Withheld from Disclosure under 10 CFR 2.390

1.3 APPLICABLE REGULATORY REQUIREMENTS, PERMITS AND REQUIRED CONSULTATIONS

In addition to the Nuclear Regulatory Commission (NRC) licensing and regulatory requirements, a variety of environmental regulations apply to the Eagle Rock Enrichment Facility (EREF) during the site characterization, construction, and operation phases. Some of these regulations require permits from, consultations with, or approvals by other governing or regulatory agencies. Some apply only during certain phases of the plant development, rather than over the entire life of the facility. Federal, state and local statutes and regulations (non-nuclear) have been reviewed to determine their applicability to the site characterization, construction, and operation phases of the proposed site.

Following is a list of federal, state, and local agencies with whom consultations have been or will be conducted. Table 1.3-1, Regulatory Compliance Status, summarizes the status of the permits and approvals required to construct and operate the proposed facility.

1.3.1 Federal Agencies

Nuclear Regulatory Commission

The Atomic Energy Act of 1954, as amended, gives the NRC regulatory jurisdiction over the design, construction, operation, and decommissioning of the proposed facility specifically with regard to assurance of public health and safety in 10 CFR 70, 40, and 30 (CFR, 2008b) (CFR, 2008d) (CFR, 2008c) which are applicable to uranium enrichment facilities. The NRC performs periodic inspections of construction, operation, and maintenance of the facility. The NRC, in accordance with 10 CFR 51 (CFR, 2008a), also assesses the potential environmental impacts of the proposed facility.

The NRC establishes standards for protection against radiation hazards arising out of licensed activities. NRC licenses are issued pursuant to the Atomic Energy Act of 1954, as amended, and the Energy Organization Act of 1974. The regulations apply to all persons who receive, possess, use, or transfer licensed materials.

Domestic Licensing of Special Nuclear Material (10 CFR 70) (CFR, 2008b) establishes the procedures and criteria for the issuance of licenses to receive title to, own, acquire, deliver, receive, possess, use, and transfer special nuclear material; and establishes and provides for the terms and conditions upon which the Commission will issue such licenses.

Domestic Licensing of Source Material (10 CFR 40) (CFR, 2008d) establishes the procedures and criteria for the issuance of licenses to receive, possess, use, transfer, or deliver source material.

Rule of General Applicability to Domestic Licensing of Byproduct Material (10 CFR 30) (CFR, 2008c) establishes the procedure and criteria for the issuance of licenses to receive, possess, use, transfer, or deliver byproduct material.

Packaging and Transportation of Radioactive Material (10 CFR 71) (CFR, 2008e) regulates shipping containers and the safe packaging and transportation of radioactive materials under authority of the NRC and the U.S. Department of Transportation (DOT).

U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) has primary authority relating to compliance with the Clean Air Act (CAA) (USC, 2008b), Clean Water Act (CWA) (USC, 2008c), Safe Drinking Water Act (SDWA) (USC, 2008d), and Resource Conservation and Recovery Act

(RCRA) (USC, 2008e). EPA Region 10 has not delegated regulatory jurisdiction to the State of Idaho for CWA and SDWA enforcement permitting, monitoring, and reporting activities relating to these statutes and associated programs. However, the State of Idaho has water quality requirements that are required to be met. EPA Region 10 has delegated regulatory jurisdiction to the state of Idaho for CAA and RCRA enforcement permitting, monitoring, and reporting activities relating to these statutes and associated programs. Applicable state requirements, permits, and approvals are described in Section 1.3.2, State Agencies.

Environmental Standards for the Uranium Fuel Cycle (40 CFR 190 Subpart B) (CFR, 2008f) establishes the maximum doses to the body organs resulting from operational normal releases and received by members of the public.

The CAA (USC 2008b) establishes regulations to ensure air quality and authorizes individual states to manage permits. The CAA requires (1) the EPA to establish National Ambient Air Quality Standards as necessary to protect the public health, with an adequate margin of safety, from any known or anticipated adverse effects of a regulated pollutant; (2) establishment of national standards of performance for new or modified stationary sources of atmospheric pollutants; (3) specific emission increases to be evaluated to prevent a significant deterioration in air quality; and (4) specific standards for releases of hazardous air pollutants (including radionuclides). These standards are implemented through plans developed by each state with EPA approval. The CAA requires sources to meet air-quality standards and obtain permits to satisfy those standards.

The SDWA was enacted in 1974 to establish minimum national standards for public water supply systems (USC, 2008d). The SDWA requires protection of sole source aquifers (SSA). The proposed EREP will use site groundwater for potable water. The Eastern Snake River Plain (ESRP) SSA map was reviewed to determine the spatial relationship between the proposed site and the SSA.

The SDWA authorizes EPA to set national health-based standards for drinking water to protect against both naturally occurring and man-made contaminants that may be found in drinking water. EPA and states then work together to make sure that these standards are met (EPA, 2004). Idaho has been authorized by the EPA to implement the SDWA requirements in Idaho. EPA sets national standards for drinking water; provides guidance, assistance, and public information about drinking water; collects drinking water data; and oversees state drinking water programs. Primary drinking water regulations and regulations applicable to drinking water systems are promulgated in 40 CFR 141 through 143 (CFR 2008q) (CFR 2008r) (CFR 2008s). 40 CFR 141 specifies siting requirements for construction of a new drinking water system at a site that is subject to significant risk from earthquakes, floods, fires, or other disasters or that is within the floodplain of a 100-year flood. In addition, regulations pertaining to the maximum permissible level of a contaminant in water and monitoring and analytical requirements are published in 40 CFR 141 and are implemented and enforced in 40 CFR 142. The National Secondary Drinking Water Regulations control contaminants in drinking water primarily affected by aesthetic qualities relating to the public acceptance of drinking water and are promulgated in 40 CFR 143.

The SDWA applies to every public drinking water system in the U.S. (EPA, 2004). A public drinking water system is defined as one that has 15 or more service connections or serves 25 or more persons per day for at least 60 days per year. Therefore, drinking water provided at the proposed facility will be governed by the SDWA as a public drinking water system. Rules governing quality and safety of drinking water in Idaho have been promulgated in Idaho Administrative Code (IDAPA) 58.01.08 (IDAPA, 2008b).

In 1987, Congress amended the CWA (USC, 2008c) and added Section 402(p). This section requires a comprehensive program for addressing stormwater discharges through the National Pollutant Discharge Elimination System (NPDES) program. The CWA requires states to set water quality standards for all bodies of water within their boundaries and directs EPA and the states to regulate and issue permits for point-source discharges as part of the NPDES permitting program. Under the CWA, EPA has established a program whereby the EPA or individual states can issue permits for stormwater discharges related to industrial activity, including construction activities that could disturb 20,500 or more square meters (220,660 or more square feet) (CFR, 2008p) (IDEQ, 2008c). The CWA recognizes but does not regulate problems posed by nonpoint source pollution.

As authorized by the CWA, the EPA NPDES permit program controls water pollution by regulating point sources that discharge pollutants into surface waters of the United States. In Idaho, the NPDES permit program is administered by the EPA, Region 10. An applicant may apply for either an individual or a general NPDES permit. An individual permit is specifically tailored to an individual facility, and a general permit covers multiple facilities with a specific category, such as stormwater discharges (IDEQ, 2008a). Permits specify the control technology applicable to each pollutant, the effluent limitations a discharger must meet, and the deadline for compliance. The permit incorporates numerical effluent limitations issued by the EPA. Permittees are required to maintain records and carry out effluent monitoring activities. Permits are issued for 5-year periods and must be renewed thereafter to allow continued discharge (CFR, 2008p).

Wastewater is spent or used water that contains enough harmful material, such as oil, dirt, human waste, and chemicals, to damage the water’s quality. Any structure or facility that generates wastewater must dispose of it through a wastewater treatment and disposal system (IDEQ, 2008d). Some industries may discharge their wastewater directly to a sanitary sewer, where it is conveyed to a wastewater treatment plant. This wastewater may be subject to pretreatment requirements under the wastewater treatment plant’s NPDES permit (IDEQ, 2008c). Sites not served by public sewer systems depend on decentralized, on-site septic systems to treat and dispose of wastewater (IDEQ, 2008d). Industrial point sources of pollution that discharge wastewater directly to surface waters are required to obtain NPDES permits that limit the amount of pollution that may be discharged into surface waters (IDEQ, 2008c).

The NPDES permit program includes an industrial stormwater permitting component adopted under Section 402 of the CWA (USC, 2008c). The NPDES Stormwater Program regulates discharges of stormwater from construction and industrial activities to waters of the United States. Since construction of the proposed EREF would be greater than 0.4 ha (1.0 ac), AES will obtain a NPDES Construction General Permit to establish the provisions for meeting stormwater regulations at the EREF. In addition, during operations, AES will obtain a NPDES Multi-Sector General Permit for storm water discharges. Design, construction, and operational details of facility stormwater systems and stormwater pollution prevention plans will be provided to EPA and IDEQ for review and issuance of the permits for construction and operation of the EREF.

The RCRA (USC, 2008e) requires the EPA to define and identify hazardous waste; establish standards for its transportation, treatment, storage, and disposal; and require permits for persons engaged in hazardous waste activities. Section 3006 of the RCRA allows states to establish and administer these permit programs with EPA approval. EPA Region 10 has delegated regulatory jurisdiction to the Idaho Department of Environment Quality (Waste Management and Remediation Division) for nearly all aspects of permitting as required by the Hazardous Waste Management Act of 1983 (IDAPA, 2008f). The EPA regulations implementing the RCRA are found in 40 CFR Parts 260 through 282 (CFR, 2008t). Regulations imposed on a generator or on a treatment, storage, and/or disposal facility vary according to the type and quantity of material or waste generated, treated, stored, and/or disposed. The method of treatment, storage, and/or disposal also impacts the extent and complexity of the requirements. The proposed EREF would generate small quantities of hazardous waste that are expected to be not greater than 1,000 kg (2,200 lb) per month. There would be no plans to store these wastes in excess of 180 days; thus, the proposed EREF would qualify as a small quantity hazardous waste generator in accordance with Section 006.01 of the Idaho Rules and Standards for Hazardous Waste (IDAPA, 2008f) and RCRA requirements.

The Emergency Planning and Community Right-to-Know Act of 1986 (42 U.S. Code 116) (USC, 2008g) establishes the requirements for federal, state and local governments, Indian Tribes, and industry regarding emergency planning and "Community Right-to-Know" reporting on hazardous and toxic chemicals. The Community Right-to-Know provisions help increase the public's knowledge and access to information on chemicals at individual facilities, their uses, and releases into the environment. States and communities, working with facilities, can use the information to improve chemical safety and protect public health and the environment. AES will provide the State Emergency Planning Committee and the local fire department information on the storage and use of chemicals that meet the threshold quantity reporting thresholds required by the Community Right to Know provisions of the Act. In addition, to the extent the EREF exceeds thresholds for chemical emissions reporting, AES will submit the required annual toxic chemical release inventory information. Should EREF experience an inadvertent release of a Reportable Quantity (RQ) of a chemical listed as hazardous under provisions of the Emergency Release Notification requirements, AES will provide immediate notification to local and state emergency planning committees.

U.S. Department of Transportation (DOT)

Transport of the proposed facility UF_6 cylinders, radioactive waste, and hazardous waste requires compliance with the following DOT enabling regulations:

- 49 CFR 107, Hazardous Materials Program Procedures, Subpart G: Registration and Fee to DOT as a Person Who Offers or Transports Hazardous Materials (CFR, 2008i).
- 49 CFR 171, General Information, Regulations and Definitions (CFR, 2008j).
- 49 CFR 173, Shippers - General Requirements for Shipments and Packages, Subpart I: Radioactive Materials (CFR, 2008k).
- 49 CFR 177, Carriage by Public Highway (CFR, 2008l).
- 49 CFR 178, Specification for Packagings (CFR, 2008m).

All provisions of these enabling regulations will be met prior to the transport of UF_6 cylinders, radioactive waste, and hazardous waste. AES may be transporting UF_6 cylinders and wastes from the proposed facility on interstate highways.

U.S. Department of Agriculture

The U.S. Natural Resources Conservation Service (NRCS) branch of the U.S. Department of Agriculture (USDA) is responsible for the preservation of prime or unique farmlands as outlined in the Farmland Protection Policy Act (FPPA) (USC, 2008l). Although the proposed site occupies land designated as Prime Farmland, FPPA does not apply because the action is on private land and the Federal action is a licensing action. Federal licensing and permitting actions are not required to follow FPPA. Therefore, no NRCS formal land evaluation and site assessment will be required for the proposed facility.

The Noise Control Act of 1972 (42 USC 4901) (USC, 2008h)

The Noise Control Act transfers the responsibility of noise control to state and local governments. Commercial facilities are required to comply with federal, state, interstate, and local requirements regarding noise control. The proposed facility is located in a county (Bonneville) that does not have a noise control ordinance.

National Historic Preservation Act of 1966 (16 USC 470) (USC, 2008i)

The National Historic Preservation Act (NHPA) requires federal agencies to consider the effects of their actions (including permits) on historic properties. Historic properties are defined as “Any district, site, building, structure or object included in or eligible for inclusion in the National Register of Historic Places.” Such consideration includes but is not limited to the identification and management of historic properties under an agency’s responsibility and taking into account the effects of their actions on historic properties. The Advisory Council on Historic Preservation (ACHP) Regulations, 36 CFR Part 800 (CFR, 2008u), Protection of Historic Properties, are the implementing regulations for Section 106 of NHPA which identify the roles and functions of federal and state agencies as well as describing the process by which historic properties are identified, evaluated, and effects assessed.

An archaeological survey of the proposed site resulted in the recording of 11 sites and 17 isolated occurrences (finds). The sites include three prehistoric, four historic, and four multi-component sites. The prehistoric components at three sites (MW002, MW012, and MW015) required further investigation to determine their National Register of Historic Places (NRHP) eligibility. Subsequent testing of these sites resulted in a recommendation of not eligible. The historic component of one site (MW004) is recommended as eligible. The remaining seven sites (MW003, MW006, MW007, MW009, MW011, MW013, and MW014) are recommended not eligible for inclusion in the NRHP. The potentially eligible site is within the proposed plant footprint. A treatment/mitigation plan for MW004 will be developed by AES in consultation with the Idaho SHPO to recover significant information.

Hazardous Materials Transportation Act (49 USC 1801, Title 49 CFR 106-179) (USC, 2008j)

The Hazardous Materials Transportation Act (HMTA) regulates transportation of hazardous material (including radioactive material) in and between states. According to HMTA, states may regulate the transport of hazardous material as long as they are consistent with HMTA or the DOT regulations in Title 49 CFR 171-177 (CFR, 2008g). Other regulations regarding packaging for transportation of radionuclides are contained in Title 49 CFR 173 (CFR, 2008k), Subpart I. AES will be transporting UF_6 cylinders, radioactive waste, and hazardous waste from the proposed facility on interstate highways.

U.S. Army Corps of Engineers

The Clean Water Act (USC, 2008c) established a permit program under Section 404 to be administered by the U.S. Army Corps of Engineers (USACE) to regulate the discharge of dredged or fill material into "the waters of the U.S." The USACE also evaluates wetlands, floodplains, dam inspections, and dredging of waterways. The proposed facility will not impact or involve any wetlands, surface waters, dams, or other waterways. By letter dated October 10, 2008, the USACE notified AES of its determination that there are no Department of the Army jurisdictional waters at the proposed site (USACE, 2008). Therefore, a Section 404 permit will not be required.

Occupational Safety and Health Administration

The Occupational Safety and Health Act of 1970 (OSHA) is designed to increase the safety of workers in the workplace. It provides that the Department of Labor is expected to recognize the dangers that may exist in workplaces and establish employee safety and health standards. The identification, classification, and regulation of potential occupational carcinogens are found at 29 CFR 1910.101 (CFR, 2008n), while the standards pertaining to hazardous materials are listed in 29 CFR 1910.120 (CFR, 2008n). OSHA regulates mitigation requirements and mandates proper training and equipment for workers. Facility employees and management are subject to the requirements of 29 CFR 1910 (CFR, 2008n).

U.S. Department of Interior

The U.S. Fish and Wildlife Service (USFWS) is responsible for the protection and recovery of threatened and endangered species under the Endangered Species Act (USC, 2008n).

AES conducted a rare, threatened and endangered species survey for both plants and animals. No threatened or endangered species or habitat is present on the proposed site. The site provides potential habitat for the pygmy rabbit and greater sage grouse. USFWS initiated status reviews in January 2008 for the pygmy rabbit (FR, 2008b) and in February 2008 for the greater sage grouse (FR, 2008c) (FR, 2008d) to determine if listing of either species is warranted. However, neither species is listed as a candidate, threatened, or endangered species as of September 2008. By letter dated June 30, 2008, the USFWS notified AES of its determination that Endangered Species Act consultation is not needed (USFWS, 2008a).

The USFWS is responsible for the protection of migratory bird species under the Migratory Bird Treaty Act of 1918 (MBTA) (USC, 2008k). Although the facility occupies land that is potential habitat for several migratory species protected under the MBTA, the proposed action will not impact such species on-site.

1.3.2 State Agencies

Several state agencies are responsible for the protection and management of the environment and public health in the state of Idaho. State departments include divisions of the Idaho Department of Environmental Quality (IDEQ), Idaho Department of Water Resources (IDWR), Idaho Department of Lands, Idaho Department of Fish and Game (IDFG), Idaho Department of Health and Welfare (IDHW), Idaho State Historic Preservation Office (IDSHPO), Idaho Transportation Department (ITD), and the Division of Building Safety. AES has consulted with these State agencies regarding permit and consultation requirements. The general and specific consultations, permits and requirements are discussed below by the agency that has responsibility for consultations and permitting actions.

Idaho Air Quality Division

The Air Quality Division (AQD) Permitting Section processes permit applications for any business or industry (source) in Idaho that emits, or has the potential to emit, pollutants into the air. Permits are issued when new sources begin operation and when existing sources modify their facilities.

The AQD issues several different types of permits based on the emissions from the facility and/or emitting source. Permits require sources to comply with all health- and technology-based standards established by the EPA and Idaho’s Rules for Control of Air Pollution in Idaho (IDAPA, 2008i).

Construction Permits are required for constructing or modifying a stationary source which has a potential emission rate equal to 91 MT per year (100 tons per year) of any regulated air contaminant for which there is an Idaho Air Quality Standard. If the specified threshold is exceeded for any one regulated air contaminant, all regulated air contaminants emitted are subject to permit review. The threshold emission rate for nitrogen dioxide shall be based on total oxides of nitrogen.

Operating Permits (under Title V) are required for major sources that have a potential to emit more than 4.5 kg (10 lbs) per hour or 91 MT (100 tons) per year for criteria pollutants, or for landfills greater than 2.5 million m^3 (88 million ft^3). In addition, major sources also include facilities that have the potential to emit greater than 9.1 MT (10 tons) per year of a single Hazardous Air Pollutant, or 22.7 MT (25 tons) per year of any combination of Hazardous Air Pollutants. Air emissions for the proposed EREF during operations will be less than the limits identified by the standards; therefore, a permit is not required. Similarly, the proposed EREF would not require a National Emissions Standards for Hazardous Air Pollutants (NESHAPS) permit since it would not be a major source of criteria air pollutants and would not be a source of hazardous air pollutants.

For this facility, the potential applicable state permit is the permit to construct (PTC) which is issued by the IDEQ. Specifically, an air quality PTC is required prior to construction or modification of stationary sources, such as buildings, structures, and other installations that emit, or may emit, pollutants into the air. A PTC is also required for certain portable equipment such as generators. The State of Idaho uses a self-exemption process for air quality permits (IDAPA, 2008i). The Rules for Control of Air Pollution in Idaho provide for exemptions to the PTC. These conditions are as follows:

1. Idaho Administrative Code (IDAPA) 58.01.01.220 (IDAPA, 2008i) states the general exemption criteria to be used by owners or operators to exempt certain sources from the requirement to obtain a permit to construct. No permit to construct is required for a source that satisfies the following criteria in subparts (01.a and 01.b):

    a. (01.a) Maximum capacity of a source to emit an air pollutant under its physical and operational design without consideration of limitations on emissions such as air pollutant control equipment, restriction on hours of operation and restrictions on the type and amount of material combusted, stored or processed would not (i.) equal or exceed one hundred (100) tons per year of any regulated air pollutant and (ii.) cause an increase in the emissions of a major facility that equals or exceeds the significant emission rates set out in the definition of significant at Section 006.

    b. (01.b) The source is not part of a proposed new major facility or part of a proposed major modification.

2. IDAPA 58.01.01.222.01(d) (IDAPA, 2008i) states that a source is exempt if it satisfies the criteria set forth in section 220 and if stationary internal combustion engines are used exclusively for emergency purposes, which are operated less than or equal to aggregate of five hundred (500) hours total per year and are fueled by natural gas, propane gas, liquefied petroleum gas, distillate fuel oils, residual fuel oils, and diesel fuel.

    The other exemption in IDAPA 58.01.01.222.02(c) (IDAPA, 2008i) is for fuel burning equipment used for indirect heating and for reheating furnaces using natural gas, propane gas, liquefied petroleum gas, or biogas (gas produced by the anaerobic decomposition of organic material through a controlled process) with hydrogen sulfide concentrations less than two hundred (200) parts per million by volume (ppmv) exclusively with a capacity of less than (50) million (British thermal units) BTUs per hour input.

3. Record Retention (IDAPA 58.01.01.220.02) (IDAPA, 2008i) states that the owner or operator shall maintain documentation on-site which shall identify the exemption determined to apply to the source and verify that the source qualifies for the identified exemption. The records and documentation shall be kept for a period of time not less than five (5) years

from the date of when the exemption determination has been made or for the life of the source for which the exemption has been determined to apply, which ever is greater, or until such time as a permit to construct or an operating permit is issued which covers the operation of the source. The owner or operator shall submit the documentation to the Department upon request.

The proposed facility qualifies for these exemptions and, therefore, a permit is not required for the following reasons:

1. The four diesel generators (standby (2), security, and fire pump), will be used exclusively for emergency purposes and for the purpose of testing these generators, the generators will be meet the hours of operation for testing specified in the IDAPA 58.01.01.222.01(d) (IDAPA, 2008i). Records will be maintained to document the hours of operation for each diesel generator.
2. The four (4) diesel generators have the potential to emit less than 25 tons per year of critical air pollutants (oxides of nitrogen (NOx), carbon monoxide (CO), oxides of sulfur dioxide (SO_2), particulate matter (PM_{10}), and volatile organic compounds (VOC)).

Idaho Water Quality Division

To implement the Safe Drinking Water Act (SDWA) requirements on a state level, the Idaho Environmental Protection and Health Act (Idaho Code Chapter 1, Title 39) (IDAHO Code, 2008c) gives the Idaho Department of Environmental Quality (IDEQ) the authority to promulgate rules governing quality and safety of drinking water (IDAPA, 2008b). The Water Quality Division (WQD) is delegated responsibility to implement the SDWA. The state 1) ensures that water systems are tested for contaminants, 2) reviews plans for water system improvements, 3) conducts on-site inspections and sanitary surveys, 4) provides training and technical assistance, and 5) takes action against water systems not meeting standards (EPA, 2004). In addition, a state has primary enforcement responsibility for drinking water systems in the state (CFR, 2008q).

Therefore, drinking water provided at the proposed facility will be governed by the SDWA as a public drinking water system. Rules governing quality and safety of drinking water in Idaho have been promulgated in IDAPA 58.01.08 (IDAPA, 2008b). No person may construct a drinking water system until it is demonstrated to the WQD that the water system will have adequate technical, financial, and managerial capacity (IDAPA, 2008b). Although there is not a permit required for a drinking water system, AES must have a drinking water facility plan that includes sufficient detail to demonstrate that the proposed project meets applicable criteria. The facility plan generally addresses the overall system-wide plan. The facility plan shall identify and evaluate problems related to the drinking water system, assemble basic information, present criteria and assumptions, examine alternative solutions with preliminary layouts and cost estimates, describe financing methods, set forth anticipated charges for users, and review organizational and staffing requirements.

The WQD requires facility owners of drinking water systems to place the direct supervision and operation of their systems under a properly licensed operator. All drinking water systems are also required to have a licensed backup or substitute operator. Operators are licensed by the Idaho State Board of Drinking Water and Wastewater Professionals.

Water systems serving fewer than 10,000 persons are considered to be small systems. IDAPA 58.01.08.005(02)(b) (IDAPA, 2008b) and 40 CFR 142 (CFR, 2008r) provide authorization for obtaining variances from the requirement to comply with Maximum Contaminant Level (MCL) or treatment techniques to systems serving fewer than 10,000 persons. Although a permit is not required for a drinking system serving fewer than 10,000 persons, the IDEQ requires a comprehensive treatment plan and licensed plant operator. The drinking water plan for the proposed EREF will include sufficient detail to demonstrate that the proposed project meets applicable criteria.

An on-site domestic sanitary sewage treatment plant will treat sanitary sewage. Liquid effluents would be discharged into the lined Cylinder Storage Pads Stormwater Retention Basin. Because this basin is lined, the system is considered a zero-discharge system. Therefore, a sanitary sewage system permit is not required.

As previously stated, industrial point sources of pollution that discharge wastewater directly to surface waters are required to obtain NPDES permits that limit the amount of pollution that may be discharged into surface waters (IDEQ, 2008c).

In Idaho, the NPDES permit program is administered by the EPA, which means that EPA is responsible for issuing and enforcing all NPDES permits in Idaho. The state of Idaho's role in this process is to certify that NPDES-permitted projects comply with state water quality standards (IDEQ, 2008b) in accordance with Section 401 of the CWA (USC, 2008c), which is implemented in 40 CFR 121 (CFR, 2008o). IDEQ is the state agency responsible for implementing the Section 401 certification process (IDEQ, 2008b).

Section 401 of the Clean Water Act certification is required for any permit or license issued by a federal agency for any activity that may result in a discharge into waters of the state to ensure that the proposed project will not violate state water quality standards. IDEQ is responsible for issuing Section 401 certifications in Idaho.

After the EPA issues a draft permit and provides public notice, the agency provides the proposed final permit to the IDEQ for certification. The IDEQ must grant, deny, or waive Section 401 certification for a project before a federal permit or license can be issued. AES will apply for the NPDES permits with the EPA, and the EPA would request the Section 401 certification from IDEQ. IDEQ must act on a request for certification within a reasonable period of time, which cannot exceed one year, after which the certification requirement will be waived. IDEQ can waive certification (either expressly or by taking no action), deny the certification, grant the certification, or grant the certification with conditions.

Since construction of the proposed EREF would be greater than 0.4 ha (1.0 ac), AES will obtain a NPDES General Permit for Storm Water Discharges Associated with Construction Activities. In addition, during operations, AES will obtain a NPDES Multi-Sector General Permit for Storm Water Discharges Associated With Industrial Activities. Design, construction, and operational details of facility stormwater systems and stormwater pollution prevention plans are required to be provided to EPA as part of the Notice of Intent to obtain both permits.

<u>Idaho Waste Management & Remediation Division</u>

The Idaho Waste Management & Remediation Division (WMRD) mission is to provide regulatory oversight and technical guidance to Idaho hazardous waste generators and treatment, storage, and disposal facilities as required by the Idaho Hazardous Waste Management Act (HWMA; Chapter 44, Title 39 1983) (IDAHO Code, 2008d) and regulations promulgated under the Act. The bureau issues hazardous waste permits for all phases, quantities, and degrees of hazardous waste management, including treating, storing and disposing of listed or hazardous materials.

Hazardous waste permits are required for the treating, storing or disposing of hazardous wastes. The level of permit and associated monitoring requirements depend on the volume and type of waste generated and whether or not the waste is treated or just stored for off-site disposal. Any person owning or operating a new or existing facility that treats, stores, or disposes of hazardous waste must obtain a hazardous waste permit from the Idaho Waste Management & Remediation Division. It is anticipated that small volumes of hazardous waste will be temporarily stored at the facility for eventual off-site disposal. The facility will generate small quantities of hazardous waste that are not expected to be greater than 1,000 kg (2,200 lbs) per month and is not planning to store these wastes in excess of 180 days (see ER Section 3.12, Waste Management). As a result, the facility will not require a hazardous waste Treatment, Storage, and Disposal Permit (40 CFR Part 262) (CFR, 2008h), but will file for a US EPA Hazardous Waste Identification Number as a Small Quantity Generator with the Idaho Department of Environmental Quality under Administrative Code 58.01.05 (IDAPA, 2008f).

The facility is committed to pollution prevention and waste minimization practices and will incorporate RCRA pollution prevention goals, as identified in 40 CFR 261 (CFR, 2008v). A Pollution Prevention Waste Minimization Plan will be developed to meet the waste minimization criteria of NCR, EPA, and state regulations. The Pollution Prevention Waste Minimization Plan will describe how the facility design procedures for operation will minimize (to the extent practicable) the generation of radioactive, mixed, hazardous, and non-hazardous solid waste.

Idaho Department of Water Resources

The Idaho Department of Water Resources (IDWR) is responsible for guiding, controlling, and planning the use and conservation of Idaho's water and energy resources. It is responsible for water allocation, water rights adjudication, surface water protection, and groundwater protection. IDWR also is responsible for water well permitting

The use of groundwater will be covered by a 1961 water right appropriation that will be transferred to the property for use as industrial water. The water transfer will occur concurrently with the purchase of the property by AES and will change the original water use from agriculture to industrial use. The primary point of diversion is expected to be from the existing agricultural well, Lava Well 3, near the center of Section 13, or a replacement well. The water will be assigned to other points of diversion to allow for the use of water from another well if the primary well should happen to fail. The original 1961 appropriation will decrease to approximately 1,713 m^3/d (452,500 gal/d) for industrial use and 147 m^3/d (38,800 gal/d) for seasonal irrigation use.

The predicted daily water consumption of the EREF is anticipated to be approximately 51,500 L/d (13,600 gal/d) and the peak water consumption rate is anticipated to be 43 L/s (689.0 gal/min) (i.e., equivalent to the normal and peak water usage rates given in m^3/min (gal/min) in Table 3.4-2, Anticipated Normal Plant Water Consumption, and Table 3.4-3, Anticipated Peak Plant Water Consumption. The peak water usage is developed based on the conservative assumption that all water users are operating at maximum demand simultaneously. This peak water usage is used to size the piping system and pumps. The normal annual water usage rate will be 18,790,000 L/y (4,970,000 gal/yr), which is a small fraction (i.e., about 3%) of the water appropriation value of 625,000,000 L/yr (165,000,000 gal/yr) for industrial use. Given that the normal annual water usage rate for the EREF is a small fraction of the appropriation value, momentary usages of water beyond the expected normal water usage rate is expected to be well within the water appropriation value for the EREF.

The IDWR has statutory responsibility for all water wells. A drilling permit must be obtained from the IDWR before the construction of any well greater than 5.5 m (18 ft) in depth. The drilling permit is valid for two months from the approval date for the start of construction. The well is required to be constructed by a driller currently licensed in the State of Idaho, who must maintain a copy of the drilling permit at the drilling site. Wells must also comply with Idaho's well construction standards found at IDAPA 37.03.09 (IDAPA, 2008h). AES will apply for drilling permits for a proposed water production well and for additional groundwater monitoring wells.

The State Board of Land Commissioners and the Idaho Department of Lands

The Idaho Department of Lands manages endowment trust lands to maximize long-term financial returns and provide protection to Idaho's natural resources (Idaho Code, 2008a). Article IX of the Idaho Constitution established the State Board of Land Commissioners to act in the capacity of trustees to manage endowment lands, given in trust by the Federal government in 1890 (endowment lands). Idaho Code 57-715 (Idaho Code, 2008b) created the Endowment Fund Investment Board, which formulates policy for, and manages the investment of, the financial assets (IDL, 2008a). The Department of Lands was created in 1895 to manage these lands under the Land Board's direction. Land immediately to the west of the proposed site is managed by the Department of Lands. However, no access or easement is needed, and therefore no permits or approvals are required (IDAPA, 2008j).

Idaho Department of Fish and Game

The Idaho Department of Fish and Game (IDFG) mission is to preserve, protect, perpetuate, and manage all species with in the state of Idaho. Although the primary responsibility for species classified as federally endangered or threatened (Endangered Species Act (ESA)) (USC, 2008n) rests with the USFWS, the Secretary of the Interior does negotiate cooperative agreements to provide financial assistance to states for the conservation of endangered and threatened species. Idaho administrative codes also identify and afford protection to species listed by the state as threatened or endangered (IDAPA, 2008g). AES conducted a rare, threatened and endangered (RTE) species survey for both plants and animals. No listed RTE species or habitat were observed on the proposed site. However, USFWS initiated status reviews in January 2008 for the pygmy rabbit (FR, 2008b) and in February 2008 for the greater sage grouse (FR, 2008c) (FR, 2008d) to determine if listing of either species is warranted. However, neither species are listed as a candidate, threatened, or endangered species as of September 2008. Habitat is present on the proposed site for both species and is isolated to the northwestern one-third of the proposed site. By letter dated June 30, 2008, the USFWS notified AES of its determination that Endangered Species Act consultation is not needed (USFWS, 2008a).

Idaho Department of Health and Welfare

The Radiation Control Agency of the Idaho Department of Health and Welfare (IDHW) regulates the radiation machines and their usage in accordance with the requirements of the Idaho Radiation Control Rules (IDAPA, 2008a). A radiation machine is defined by the Idaho Administrative Codes as any device capable of producing radiation except those which produce radiation only from radioactive material. Examples include medical x-ray machines, particle accelerators, and x-ray radiography machines used for non-destructive testing of materials. The Radiation Control Agency of the IDHW regulates the machines and their usage in accordance with the requirements of the Idaho Radiation Control Rules (IDAPA, 2008a). AES plans to use non-destructive (x-ray) inspection systems for package security requirements. AES has notified the IDHW and will submit a permit request to register the facility x-ray equipment prior to use when the equipment specifications become available.

Idaho State Historic Preservation Office

The Idaho State Historic Preservation Office (IDSHPO) participates with federal agencies in the consultation process during the planning of federal actions which may affect historic properties. The IDSHPO requires that cultural resource studies within the state use the various guidance and documentation forms. The NHPA Section 106 Review Process Guidance (USC, 2008m) establishes standards for cultural resource fieldwork and reporting as well as protocols for the actual Section 106 consultation process.

The State Historical Society code (Idaho Statutes, 2008a) provides for the designation of historic sites and penalties for damage to archaeological or historical sites, requires permits for excavation, establishes requirements for and duties of Board of Trustees for Historical Society, specifies powers and duties of Board and Director, establishes historical society account, and designates Pioneer Relic Hall.

The Preservation of Historic Sites code (Idaho Statutes, 2008b) authorizes city and county governments to enact local historic preservation ordinances and establish preservation commissions, outlines duties of commissions, allows for design review authority in locally designated historic districts, provides for historic easements and designation as historic property, provides for penalties, and provides exemption from health or building codes.

The Protection of Graves code (Idaho Statutes, 2008c) prohibits the willful disturbance or destruction of human burials, prohibits possession of artifacts or human remains taken from a grave other than as authorized, and provides for professional archaeological excavation.

Trespass and Malicious Injuries to Property code (Idaho Statutes, 2008d) specifies that damaging caves or caverns is unlawful and prohibits willful damage to archaeological sites associated with caves or caverns.

AES retained a subcontractor who obtained a permit to conduct an archaeological survey. A Cultural Resource Inventory was conducted on the site from April through July, 2008. The survey for the cultural resources (archaeological and historical) consisted of: (1) file search and records check; (2) field inventory; and (3) inventory report for the project. The tasks described in this scope are those necessary to complete SHPO standards for a cultural resource inventory which includes NRHP evaluations of all cultural resources within the project area and subsequent review and acceptance by federal and state agencies. Results of the survey are provided in ER Section 3.8, Historic and Cultural Resources, and Section 4.8, Historic and Cultural Resource Impacts.

<u>Idaho Transportation Department</u>

The Idaho Transportation Department (ITD) is responsible for design, construction, and maintenance of the state transportation system. The state transportation system includes a road network, bridges, rail lines, and public airports. ITD has jurisdictional responsibility for almost 8,046 km (5,000 mi) of highway, more than 1,700 bridges, and 30 recreational and emergency airstrips. ITD also oversees federal grants to 15 rural and urban public transportation systems, provides state rail planning and rail-project development, and supports bicycle and pedestrian projects. They are responsible for reviewing and permitting new access to state highways, including U.S. Highway 20. AES has initiated discussions with ITD on design and construction of access points on to U.S. Highway 20 (IDAPA, 2008k). AES will submit a permit application and receive a permit prior to construction.

<u>Division of Building Safety</u>

Construction permits will need to be obtained and inspections performed for electrical, plumbing, and HVAC systems for the proposed plant (IDAPA, 2008c) (IDAPA, 2008d) (IDAPA, 2008e).

Bonneville County has the authority to inspect and permit new buildings (Phillmore, 2008). County inspections and permits will be needed for the structure (including fire and safety permits) and mechanical systems. The county follows the 2006 International Building Code (ICC, 2006).

1.3.3 Local Agencies

Plans for construction and operation of the proposed facility are being communicated to and coordinated with local organizations. Officials in Bonneville County have been contacted regarding the project and county requirements. The county does not have any noise ordinances or visual resource protection requirements.

Emergency support services have been coordinated with the state and local agencies. When contacted, the Central Dispatch in the Idaho Falls Police Department will dispatch fire, Emergency Medical Services (EMS) and local law enforcement personnel. Mutual aid agreements exist between the Idaho Falls Police Department, Bonneville County Sheriff's Department, and Idaho State Police, which are activated if additional police support is needed. Mutual aid agreements also exist between other counties and cities (e.g., Atomic City, Fort Hall) for additional fire and medical services. If emergency fire and medical services personnel in Bonneville County are not available, the mutual aid agreements are activated; and the Idaho Falls Central Dispatch will contact the appropriate agencies for the services requested at the facility.

AES is in discussions with local, county, and State agencies and parties to develop agreements for emergency services cooperation.

1.3.4 Permit and Approval Status

Several permits associated with construction activities have been drafted and will be formally submitted to the appropriate agency prior to the commencement of construction. Construction and operational permit applications will be prepared and submitted, and regulator approval and/or permits will be received prior to construction or facility operation as appropriate.

Initial consultations have been made with the cognizant agencies. Some permits (including notices of intent) have been submitted to the state of Idaho. More specific discussions will be held, as appropriate, as the project progresses. See Table 1.3-1, Regulatory Compliance Status, for a summary listing of the required federal, state and local permits and their current status.

TABLES

Table 1.3-1 Regulatory Compliance Status
(Page 1 of 2)

Requirement	Agency	Status	Comments
Federal			
10 CFR 70, 10 CFR 71, 10 CFR 40, 10 CFR 30	NRC	Application (or parts) submitted	Facility License
NPDES Industrial Stormwater Permit	EPA Region 10	Application to be submitted	IDEQ/WQD has authority to promulgate rules governing quality and safety of drinking water.
NPDES Construction General Permit	EPA Region 10	Application to be submitted	IDEQ/WQD has authority to promulgate rules governing quality and safety of drinking water.
Section 404 permit	USACE	Not Required	
Endangered Species Act consultation	USFWS	Not required (Discussions ongoing)	No currently listed species or habitat on-site.
State			
Air Construction Permit	IDEQ/AQD	Not required	
Air Operating Permit	IDEQ/AQD	Not required	
NESHAPS Permit	IDEQ/AQD	Not required	
Hazardous Waste Permit	IDEQ/WMRD	Not required	
NPDES Permit Certification	IDEQ/WQD	Application to be submitted	See NPDES Permits under Federal Requirement of this Table 1.3-1
Well drilling permit	IDWR	Application to be submitted	

Table 1.3-1 Regulatory Compliance Status
(Page 2 of 2)

Requirement	Agency	Status	Comments
Easement on State Owned Land	Department of Lands	Not required	
SDWA Drinking Water System	IDEQ/WQD	Prepare comprehensive treatment plan	AES will place operations under a licensed operator
Sanitary system permit	IDEQ/WQD	Not required	No permit required for a zero discharge system.
Section 401 Certification	IDEQ	Not required	
Access permit	ITD	Application to be submitted.	
Construction Permits (structural and mechanical	Bonneville County	Application to be submitted	
Construction Permits (electrical, plumbing, HVAC)	ID Division of Building Safety	Application to be submitted	
Machine-Produced Radiation-Registration	IDHW/RCB	Application to be submitted	