EXHIBIT GLE-012

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

Paul S. Ryerson, Chairman
Dr. James F. Jackson
Dr. Michael O. Garcia

In the Matter of	)	Docket No. 70-7016-ML
GE-HITACHI GLOBAL LASER ENRICHMENT LLC	)	ASLB No. 10-901-03-ML-BD01
(GLE Commercial Facility)	)	June 19, 2012

GE-HITACHI GLOBAL LASER ENRICHMENT'S PREFILED TESTIMONY ON TOPIC 5 (NEED/ALTERNATIVES/ ENVIRONMENTAL COST-BENEFIT ANALYSIS)

I. INTRODUCTION

Q1. Please state your name, your employer, and your current job title.

A1. My name is Julie Anne Olivier [JO]. I am Licensing and Regulatory Affairs Manager for Global Laser Enrichment (GLE) in Wilmington, North Carolina.

My name is Michael Schwartz [MS]. I am Chairman of the Board for Energy Resources International, Inc. (ERI) in Washington, D.C.

My name is Katherine Heller [KH]. I am a Senior Economist at RTI International in Research Triangle Park, North Carolina.

My name is Kimberly Matthews [KM]. I am Research Environmental Scientist at RTI International in Research Triangle Park, North Carolina.

Q2. Please briefly describe your professional qualifications.

A2. **[JO]** I have a B.S. degree in Chemistry from the University of New Orleans and a Masters Degree in Environmental Science and Engineering from Virginia Polytechnic Institute and State University (Virginia Tech). In addition, I have completed post-graduate doctoral courses in Environmental Systems Engineering at Clemson University.

During my career in the nuclear industry, I have held various technical, project management, and licensing positions. I was employed by the U.S. Nuclear Regulatory Commission (NRC) for over eight years (1999 to 2007). During my NRC tenure, I was a project manager for various fuel fabrication, enrichment, and other facilities, with duties ranging from the lead technical reviewer for licensing actions involving chemical safety, to the lead environmental reviewer responsible for ensuring compliance with the National Environmental Policy Act (NEPA). My responsibilities included reviewing and inspecting various commitment tracking systems at commercial power reactors, fuel fabrication facilities, and uranium enrichment facilities. Since 2007, I have worked at GE-Hitachi (GEH), holding positions within the GLE project as the Senior Licensing Professional and the Licensing and Regulatory Affairs Manager, which is my current position.

[MS] I hold B.S. and M.S. degrees in Nuclear Engineering from the University of Michigan. I also have completed graduate-level courses in finance, economics, and management. I am a registered Professional Engineer in the State of California. I have been a consultant on issues related to the nuclear fuel cycle for over 35 years. As Chairman of the Board, I oversee all consulting services provided by ERI, a consulting firm established in 1989 that provides energy and resource consulting services to electric power companies, private industry, institutions and associations, and government agencies in the United States (including the Department of Energy (DOE)) and abroad. Among ERI's products is an annual nuclear fuel market projection that addresses all nuclear fuel market elements, including a chapter dedicated to the international market for uranium enrichment services. I have provided testimony in both state and federal regulatory proceedings, including testimony on the need for new uranium enrichment facilities in the U.S. in contested and uncontested proceedings before several NRC

Atomic Safety and Licensing Boards. I also have provided expert testimony in litigation related to pricing of uranium enrichment services by the U.S. Government.

[KH] I hold B.A. and M.S. degrees in Economics from The College of William and Mary and the University of North Carolina, Chapel Hill, respectively. I have been employed as an economist at RTI International since 1985, first as a Research Economist and later as a Senior Economist (since 2006). During my career, I have performed or assisted in performing numerous economic, socioeconomic, and water resource availability analyses for both private and governmental entities, including the U.S. Environmental Protection Agency (EPA) and the North Carolina Department of Environment and Natural Resources (NCDENR).

For example, I have led a multi-disciplinary assessment of the potential impacts of developing and operating a uranium mine and mill in southern Virginia; analyzed the potential flood damages associated with alternative release schedules for the Roanoke Rapids dam on the Roanoke River for the NCDENR; assisted a private client with long-term natural resource availability planning by projecting water use by user category for several river basins in the Southeastern United States over a 50-year period; and provided economic analytical support to the EPA's Climate Change Division in developing a regulation requiring facilities to report releases of greenhouse gases.

[KM] I hold a B.A. degree in Biology from Wittenberg University and an M.S. degree in Natural Resources (concentration in Watershed Hydrology) from North Carolina State University. I have been employed as a Research Scientist at RTI International since 2006. Prior to that time, I was employed as a Biologist at Arcadis Geraghty & Miller of North Carolina, Inc. in Raleigh, North Carolina (from 2002 to 2006) and as a Water Quality Monitoring Technician for the City of Greensboro, North Carolina (from 1996-2000). I have provided technical support to numerous water quality and ecological projects administered by private entities as well as local, state, and federal agencies, including the EPA. Those projects have involved investigations of streams, wetlands, and terrestrial resources; water quality assessments; and preparation of environmental impact assessment reports. I also have technical expertise relating to stormwater quality, protected species, monitoring and research methods for natural resources assessment, and on-site stormwater best management practices.

[**All**] Full copies of our *curriculum vitae* are attached hereto as Appendices A-D.

Q3. Please briefly describe your role or responsibilities relative to the GLE Facility project.

A3. **[JO]** I have been involved in the GLE Facility project since its early phases. Initially, I served as the technical lead for preparing and submitting the GLE Facility License Application to the NRC. I authored sections of the License Application related to chemical safety, environmental protection, decommissioning, management measures, and project administration. I also served as the interface between the design and safety analysis teams. In my current capacity as Licensing and Regulatory Affairs Manager, I manage project-related interactions with federal, state, and local governmental agencies; oversee matters related to the NRC's ongoing review of the GLE License Application; and serve as technical lead on environmental issues, as discussed in the GLE Environmental Report (ER) and NUREG-1938, Vol. 1, Final Report, *Environmental Impact Statement for the Proposed GE-Hitachi Global Laser Enrichment, LLC Facility in Wilmington, North Carolina* (Feb. 2012) (FEIS).

[MS] I was recently retained by GLE as a consultant on issues related to domestic and global uranium enrichment supply and requirements. In this capacity, I have reviewed portions of the ER and FEIS related to the need for the proposed GLE Facility as analyzed under NEPA, taking into account enriched uranium supply and demand and other considerations, such as the fuel procurement objectives of U.S. nuclear power plant operators and the energy security policy objectives of the U.S. Government.

[KH] I served as the project lead in analyzing the socioeconomic impacts of the proposed GLE Facility. That evaluation included, among other things, profiling the existing and projected future demographic and economic conditions in the affected region, and analyzing the potential changes in those conditions as a result of construction and operation of the proposed facility. In addition, I was principally responsible for performing and documenting the cost-benefit analysis described in Chapter 7 and Appendix U (proprietary) of the ER. I also have reviewed the corresponding sections of the NRC Staff's FEIS.

[KM] I led the field investigations related to GLE's assessment of ecological resources, wetlands, and surface waters. I was the primary author of the corresponding chapters in the ER that describe existing resource conditions and estimate the potential impacts from the proposed GLE Facility. In addition, I contributed to the mitigation and monitoring chapters of the ER. I have coordinated with the North Division of Coastal Management for compliance with the Coastal Area Management Act, the North Carolina Division of Water Quality for compliance with Section 401 of the Clean Water Act, the U.S. Army Corps of Engineers for compliance with Section 404 of the Clean Water Act, and the U.S. Fish and Wildlife Service for compliance with Section 8 of the Endangered Species Act.

Q4. What is the purpose of your testimony?

A4. **[All]** Our testimony responds to Topic 5, "Need/Alternatives/Environmental Cost-Benefit Analysis," one of six prefiled testimony areas identified by the Atomic Safety and Licensing Board (Licensing Board) in its May 16, 2012 Memorandum and Order (Identifying Areas for Prefiled Testimony). In accordance with that Licensing Board issuance, our testimony:

1. Provides a detailed review of the need for future enrichment capability that considers the impact of the March 2011 Fukushima event and uncertainties associated with two proposed U.S.-based commercial enrichment facilities that have been licensed by the NRC but not yet built. [Topic 5.A]

2. Briefly reviews the alternatives analysis described in Chapter 2 of the ER, with a focus on the No-Action Alternative. [Topic 5.B]

3. Reviews the key elements of the cost-benefit analysis described in Chapter 7 and Appendix U (proprietary) of the ER. [Topic 5.C]

4. Discusses the implications of GLE's decision to delay preconstruction activities, as relevant to GLE's environmental impacts analysis. [Topic 5.E]

5. Discusses communications between GLE and Progress Energy concerning the latter's capacity to meet the proposed GLE Facility's expected electrical energy demands [Topic 5.F]

6. Describes GLE's plans regarding implementation of the specific mitigation measures listed in Table 5-1 and Table 5-2 of the FEIS. [Topic 5.G]

We do not address topic 5.D in this testimony. Testimony on that topic is being provided exclusively by the NRC Staff witnesses.

Q5. Please describe how your testimony is organized.

A5. **[All]** Section II provides some regulatory background as context for our subsequent testimony. Sections III through VIII address Topics 5.A, 5.B, 5.C, 5.E, 5.F, and 5.G sequentially. Section IX summarizes key points and conclusions.

II. APPLICABLE NEPA REQUIREMENTS

Q6. Please briefly describe the applicable requirements of NEPA and 10 CFR Part 51, as they pertain to an applicant's preparation of an Environmental Report and the issues discussed in this testimony.

A6. **[All]** NEPA and the NRC's related regulations in 10 CFR Part 51 require the NRC Staff to consider the potential environmental effects of any proposed "major Federal action significantly affecting the quality of the human environment," as defined by NEPA. 10 CFR § 51.20(a)(1); 42 U.S.C. 4321 et seq. (2012). The proposed issuance of a license for a uranium enrichment facility is such an action. Thus, NRC regulations require an enrichment facility applicant to file with its application an Environmental Report (ER) pursuant to the relevant portions of 10 CFR Part 51.

The ER must contain "a description of the proposed action, a statement of its purposes, [and] a description of the environment affected." 10 CFR § 51.45(b). NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs - Final Report" (Aug. 2003) (ML032450279) provides additional guidance regarding the format and technical content of an ER (as well as the Staff's FEIS). It states that the ER should describe "the underlying need for the proposed action," and that "the need describes what will be accomplished as a result of the proposed action." NUREG-1748 at 6-1.

Generally, an ER also must discuss, among other things: (1) the impact of the proposed action on the environment, with impacts "discussed in proportion to their significance" (10 CFR § 51.45(b)(1)); and (2) reasonable alternatives to the proposed action, with that discussion being "sufficiently complete to aid the Commission in developing and exploring, pursuant to section 102(2)(E) of NEPA, 'appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources.'" *Id.* § 51.45(b)(3); NUREG-1748 at 6-2, 6-4. Reasonable alternatives are "[t]hose alternatives that are practical or feasible from the technical and economic standpoint and using common sense." NUREG-1748, App. F at F-7. The analysis in the ER must consider and balance the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and alternatives available for reducing or avoiding adverse environmental effects (*i.e.*, mitigation measures or alternatives). 10 CFR § 51.45(c).

Q7. With respect to this mandatory hearing, please identify the NEPA-related findings to be made by the Licensing Board.

A7. **[All]** The Licensing Board is tasked with making findings on the following three "NEPA baseline" issues:

1. Determine whether the requirements of sections 102(2)(A), (C) and (E) of NEPA and Subpart A of 10 CFR Part 51 have been complied with in the proceeding.
2. Independently consider the final balance among conflicting factors contained in the record of the proceeding with a view to determining the appropriate action to be taken.

3. Determine, after weighing the environmental, economic, technical, and other benefits against the environmental and other costs, and considering reasonable alternatives, whether a license should be issued, denied, or appropriately conditioned to protect environmental values.

Third Revised Scheduling Order, Att. A at 1 (citing GE-Hitachi Global Laser Enrichment LLC; (GLE Commercial Facility); Notice of Receipt of Application for License; Notice of Consideration of Issuance of License; Notice of Hearing and Commission Order; and Order Imposing Procedures for Access to Sensitive Unclassified Non-Safeguards Information and Safeguards Information for Contention Preparation, 75 Fed. Reg. 1819, 1821 (Jan. 13, 2010)). Our testimony, in conjunction with that of the NRC Staff, is intended to assist the Licensing Board in making its required findings.

III. DISCUSSION OF TOPIC 5.A: NEED FOR THE PROPOSED FACILITY

Q8. What portion of the ER addresses the need for the Proposed Action, *i.e.*, construction and operation of the proposed GLE Facility?

A8. **[JO]** ER Section 1.2, "Purpose and Need for the Proposed Action," addresses the need for the proposed GLE Facility. As stated therein, the need for the Proposed Action manifests itself in three primary respects: (1) the need for enriched uranium to fulfill nuclear electrical-generation requirements, (2) the need for domestic uranium enrichment capacity for national energy security, and (3) the need for advanced uranium enrichment technology in the United States. ER at 1-4. Sections 1.2.1, 1.2.2, and 1.2.3 of the ER discuss each of these needs, respectively, and how the Proposed Action serves to meet those needs. Consistent with NRC guidance in NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility" (Mar. 2002) (ML020930033), ER Section 1.2.1 discusses the quantities of enriched uranium used for domestic benefit, the projections of domestic and foreign requirements for the services, and the alternative sources of supply for the proposed GLE Facility's services. NUREG-1520 at 9-5. That discussion is based on information that was available to GLE when it prepared the ER for submittal in January 2009.

Q9. The Licensing Board requested a detailed, updated review of the need for future enrichment capability that accounts for developments that have occurred since GLE submitted its ER. Have you prepared such an assessment?

A9. **[MS]** Yes. In response to the Licensing Board's request, ERI has prepared a comprehensive report entitled "A Detailed Review of the Need for Future Enrichment Capability -Response to ASLB 5A" (June 2012) (hereinafter, ERI Report). I am the principal author of the ERI Report, which is appended in full to this testimony as Exhibit GLE-014. The ERI Report contains a detailed supply and requirements analysis of world installed nuclear generating capacity and global enrichment services for the period 2012 through 2035. The analysis is based on currently-available data and information concerning future uranium enrichment requirements and supply, conservative assumptions, and accepted forecasting methodologies. The ERI Report considers scenarios that assume the deployment and the non-deployment of several proposed new uranium enrichment facilities in the United States. It also considers the near-term and potential long-term effects of the March 2011 event at the Fukushima Daiichi Nuclear Power Plant in Japan on global uranium enrichment requirements and supply.

Q10. What types of information did ERI use in developing its current forecasts of nuclear generating capacity, enrichment requirements, and enrichment supply?

A10. **[MS]** ERI obtained the data and information underlying its forecasts from an array of publicly available sources, as well as from direct communications with market participants. Examples include the NRC's website, various Department of Energy/Energy Information Administration reports and databases, World Nuclear Association publications, nuclear trade press articles and reports (*e.g.*, *Nuclear Fuel*, *Nukem Market Report*, *The Ux Weekly*), newspaper articles, meeting presentation materials prepared by industry participants and analysts, industry press releases, and financial filings (*e.g.*, annual and 10-K reports). To the extent possible, ERI evaluated these materials, which are commonly used by industry analysts for forecasts of this type, for reliability and accuracy.

Q11. You indicated that the first component of ERI's supply and requirements analysis involved forecasting world installed nuclear power generating capacity for the period 2012-2035. Please describe the manner in which ERI prepared that forecast.

A11. **[MS]** Enriched uranium from the proposed GLE Facility would be used in fuel for commercial nuclear power plants. Most nuclear reactors are fueled by low-enriched uranium (LEU), which is obtained by mining, converting, and enriching uranium ore and then fabricating it into fuel assemblies. Furthermore, the enrichment services market is a global one. That is, U.S. purchasers presently purchase enrichment services or enriched uranium from domestic (*i.e.*, USEC, Urenco USA) and foreign suppliers (*e.g.*, Urenco, Eurodif), and the majority of U.S.-purchased enrichment services are of foreign origin. Conversely, USEC exports much of its ongoing Paducah plant production to Far East countries. Thus, the demand for enriched uranium is a function of worldwide nuclear power generating capacity.

ERI's forecast of installed nuclear power generating capacity is based on its country-by-country and unit-by-unit review of current nuclear power programs and planned programs. In particular, in evaluating current and future generation capacity, ERI took into account the following considerations: (1) nuclear generating units currently in operation as of January 2012 and retirements among these units that occur during the forecast period (assuming no license renewal); (2) capacity which is created by uprates or by restarting units that have been placed in extended outages of several years or more; (3) capacity which is created by extending the operating lifetimes of units currently in operation beyond initial expectations through license renewal; (4) units under construction, already ordered, or firmly planned with likely near-term site approval as of May 2012; and (5) additional new capacity that will require site approval and which is expected to be ordered in the future. ERI Report at 3 (Exhibit GLE-014).

Q12. What countries did ERI consider in its country-by-country review of nuclear power programs?

A12. **[MS]** ERI has prepared Reference, High and Low Nuclear Power Growth forecasts of installed nuclear power generating capacity by country. The generating capacity in each forecast is categorized 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." ERI Report at 2 (Exhibit GLE-014).

The C.I.S. is an association of former Soviet republics that was established in December 1991 by Russia, Ukraine, and Belarus following the dissolution of the Soviet Union. Other members include Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Turkmenistan, and Uzbekistan. Of the C.I.S. countries that were part of the former Soviet Union, the three with nuclear power plants still operating are Armenia, Russia and Ukraine. In addition, Belarus and Kazakhstan, which previously had operating nuclear power plants, may revive their nuclear programs in the future.

The countries categorized as Eastern Europe that have operating nuclear power plants are Bulgaria, the Czech Republic, Hungary, Romania and Slovakia. Within this category, Lithuania has expressed interest in reviving its program, and Poland has initiated efforts to establish a nuclear power program.

Countries in Western Europe with active nuclear power programs include: Belgium, Finland, France, Germany, Netherlands, Slovenia, Spain, Sweden, Switzerland and the United Kingdom (U.K.). Italy has expressed interest in reestablishing its program, but, if so, not for many years to come.

East Asia includes Japan, the People's Republic of China (China), the Republic of Korea (South Korea), and Taiwan. Each of those countries has an active commercial nuclear power program. Vietnam is in the early stages of developing a program.

Among the countries categorized as "Other", those with active nuclear power programs include: Argentina, Brazil, Canada, India, Mexico, Pakistan, and South Africa. In addition, a number of other countries have expressed interest in developing commercial programs in the future. Among those countries are Bangladesh, Chile, Egypt, Iran, Indonesia, Jordan, Malaysia, Saudi Arabia, Thailand, Turkey, and the United Arab Emirates (U.A.E.).

Q13. You referred to ERI's preparation of (1) Reference, (2) High and (3) Low Nuclear Power Growth forecasts. Please explain.

A13. **[MS]** The specific assumptions underlying each of these forecasts are presented in the ERI Report. ERI Report at 4-8 (Exhibit GLE-014). In addition, a summary comparison of ERI's Reference, High and Low Nuclear Power Growth forecasts is provided in Table 1 of the ERI Report. *Id.* at 7. In brief, the ERI *Reference* Nuclear Power Growth forecast represents ERI's best estimate of installed nuclear generating capacity during the 2012-2035 forecast period. It is consistent with present trends and is considered by ERI to be the most likely scenario at the present time. On a world basis, the Reference forecast is consistent with a steady average annual nuclear generating capacity growth rate of 1.9% through the year 2035. Aggressive expansion plans in Asia, particularly in China, are assumed to translate into real growth. Worldwide, plant operating lifetimes extending beyond 40 years are expected to be the rule rather than the exception. Almost all U.S. plants are expected to undergo license renewal, and several Gigawatts in capacity additions are expected to be made through plant power uprates. The Reference forecast also recognizes Russia's progress on an ambitious expansion of its nuclear power program, and the addition of new units by several other countries in the C.I.S./Eastern Europe category.

The ERI *High* Nuclear Power Growth forecast is considered to be an upper bound scenario, with a comparatively low probability of occurrence. In the High forecast, most countries decide to extend the operating licenses of existing nuclear power plants to 50 years or more or to replace units retiring in order to maintain their portfolio of nuclear plants. Persistent high coal and natural gas prices, broad agreement regarding the need for new base load generation capacity, and more stringent environmental controls and costs imposed on fossil fired capacity (including limits on carbon emissions) will support the post-2012 level of nuclear plant orders that is assumed in the High forecast.

Conversely, the ERI *Low* Nuclear Power Growth forecast is considered to be a lower bound scenario, with a comparatively low probability of occurrence. It represents a lack of support for the nuclear option in most countries, resulting in minimal growth in nuclear generating capacity on a world basis due to the confluence of a number of inauspicious factors. Such factors may include persistent low natural gas prices, the lack of any carbon-based taxes on fossil-fueled generation or other incentives for non-carbon emitting technology, difficulties raising capital for new construction, persistently high construction costs, lower than expected growth in electric power demand, declining market prices for electricity, difficulties in plant site selection, and growing anti-nuclear sentiments—as exacerbated by the Fukushima Daiichi event.

Q14. What effect has the Fukushima Daiichi event had on world installed nuclear generating capacity to date?

A14. **[MS]** The adverse sociopolitical reaction to nuclear power in Germany following Fukushima was very strong, and the seven oldest nuclear units in that country were shut down permanently, along with another unit that had been in a long-term outage. If the six units at the Fukushima Daiichi station are included, then 14 units totaling approximately 13 GWe (equivalent to 3.5% of existing world capacity) were effectively retired as a result of the Fukushima event. (The 0.2 GWe Oldbury-2 in the U.K. also retired as scheduled). Overall, net generation capacity decreased by 8.6 GWe during 2011. This is due largely to the permanent shutdown of units as a direct result of the Fukushima Daiichi event. The long-term impact is estimated by ERI to be a 4.6% reduction in installed nuclear generation by 2020, growing to a

7.9% reduction by 2030. This is equivalent to a two to three-year slippage in the projected installed nuclear generation capacity from pre-Fukushima numbers in 2020, and as much as a four-year slippage by 2030. ERI Report at 2 (Exhibit GLE-014).

Q15. Does ERI's Reference forecast take into account the present and potential future effects of the Fukushima event on installed nuclear generating capacity?

A15. **[MS]** Yes. As explained in the ERI Report, not all of the Reference forecast's expectations are positive. In Japan, the last operating unit went into a refueling outage in May 2012 and, as of yet, no units have been authorized to return to operation. It is ERI's expectation that twelve units, including the six at Fukushima Daiichi, will retire without restarting. The restart of other units is projected to be spread out over the next 30 months, with just four restarts expected in the second half of 2012. Only the two Japanese units currently under construction (for which construction is presently suspended) are assumed to be completed. All of the Japanese projects firmly planned, but not initiated prior to Fukushima, are expected to be abandoned. ERI Report at 5 (Exhibit GLE-014).

Q16. Please summarize the results of ERI's *Reference* forecast of world installed nuclear generating capacity for the forecast period as well as the key developments or trends underlying those results.

A16. **[MS]** World installed nuclear power capacity is forecast to increase 32% to 485 GWe by 2025, and to rise an additional 19% to 580 GWe by 2035 for a total (cumulative) increase of 58% over the Reference forecast period. In the Reference Nuclear Power Growth forecast, world nuclear capacity is dominated by plants currently in operation and license renewals for those units whose licenses otherwise would expire during the forecast period. The contribution of plants currently in operation, but with no license renewal, steadily decreases from 72% of the total in 2015 to just 7% by 2035. A small contribution (1.5% between 2015 and 2035) is obtained from capacity uprates of these units and plant restarts. The contribution of license renewal of existing units rises from 17% in 2015 to 42% of total capacity by 2028, before gradually declining to 30% in 2035. As a result, plants currently in operation still account for 65% of total operating capacity in 2025 and 38% in 2035. ERI Report at 4 (Exhibit GLE-014).

Plants currently under construction or firmly planned will account for 9% of total operable capacity in 2015 and will average 23% between 2020 and 2035. Additional new capacity first appears in 2017 (0.2%) and steadily rises to 38% in 2035. Cumulative retirements of currently operating units will amount to 3% of total operable capacity in the year 2015, slowly rising to 14% by 2030 and then doubling to 28% by 2035. Projected growth in the U.S. is modest but steady, as a total of 11 new units are projected to be added by 2030. Although an additional 17 units are expected by 2035, they do not result in net capacity expansion since a number of existing units will reach the end of their extended operating lives between 2030 and 2035. ERI Report at 5 (Exhibit GLE-014). Figure 1 shows the changing contribution to world nuclear generation capacity between now and 2035, as reflected in ERI's Reference forecast.

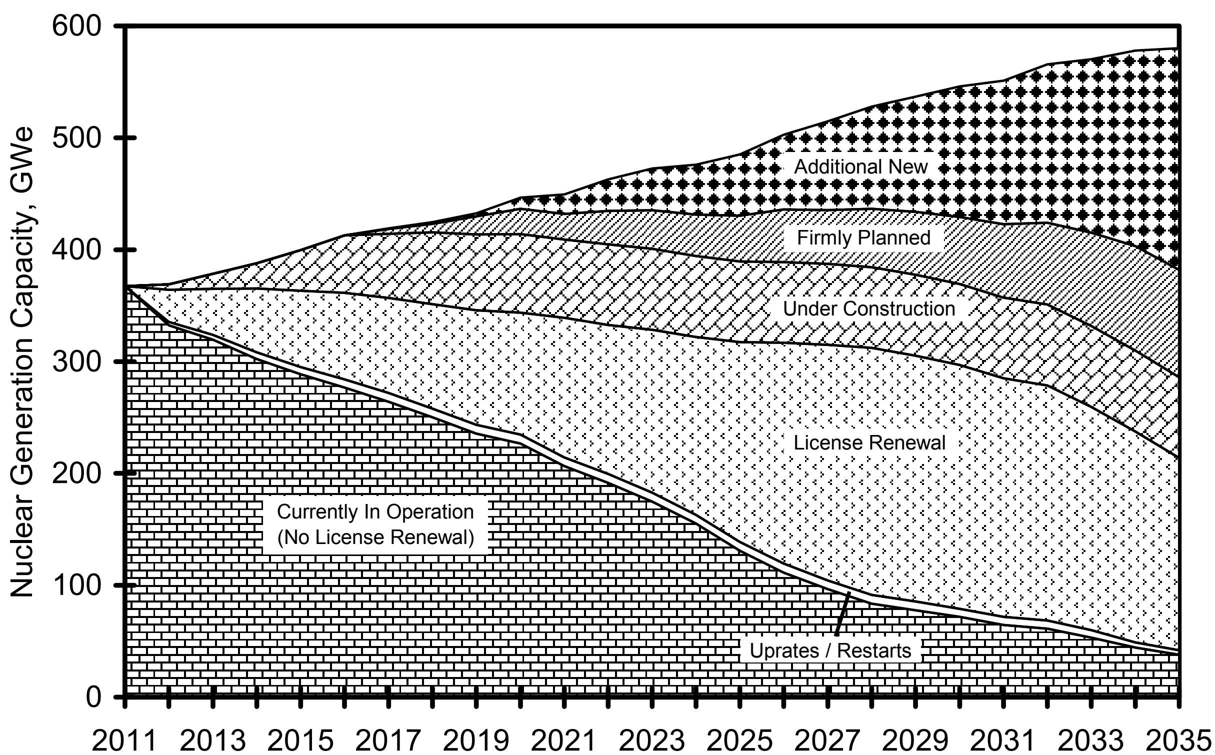

Figure 1. Composition of World Nuclear Capacity for the Reference Forecast

Q17. Please explain why you believe that ERI's Reference forecast of installed nuclear generating capacity is reasonable, particularly for purposes of a NEPA assessment.

A17. **[MS]** ERI has been monitoring and assessing nuclear fuel markets for more than 20 years as part of its regular consulting activities. While there are uncertainties inherent in all forecasts, including those related to nuclear power generation and the nuclear fuel cycle, ERI's experience in this area gives it confidence in the reasonableness of its forecasts. Furthermore, as discussed in the ERI Report, the forecasts of world and U.S. installed generating capacity prepared by ERI generally are consistent with (and, in fact, generally more conservative than) those forecasts prepared by other entities experienced in generating such forecasts. Those entities include the International Energy Agency (IEA), International Atomic Energy Agency (IAEA), the World Nuclear Association (WNA), the DOE's Energy Information Administration (EIA), and Ux Consulting Company (UXC).

Q18. Please discuss how ERI's forecasts compare to those of the other entities identified above.

A18. **[MS]** On a world basis, the full range of these forecasts indicates a variation of ±16% (*i.e.*, ±76 GWe) in 2020. The variation in forecasts then expands noticeably and is ±41% (*i.e.*, ±241 GWe) by 2030. The Low forecasts that are made by WEO , UXC and IAEA are significantly higher than the Low forecasts made by the WNA and ERI by 2030. The High forecasts of world nuclear capacity made by all the organizations are in general agreement.

Importantly, the differences among the published "Mid/Reference" forecasts are small at ±4% (*i.e.*, ±18 GWe) in the year 2015, and increase slowly with time to ±7% (*i.e.*, ±37 GWe) in the year 2025, and to ±9% (*i.e.*, ±55 GWe) by the year 2035. Between 2020 and 2030, the EIA, IAEA, UXC and WNA forecasts are grouped in a range that is between 2% and 4% above the group average. The IEA's WEO Mid forecast is 4% below the group average, while the ERI Reference forecast is almost 9% below the group average during the period between 2020 and

2030. ERI Report at 7-8. The Mid/Reference forecasts for installed world nuclear generation capacity by the various organizations are shown in Figure 2.

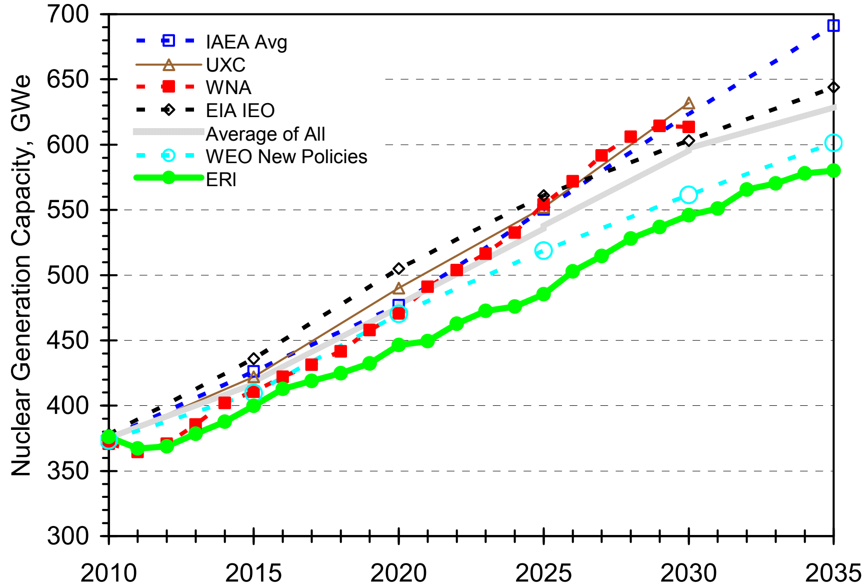

Figure 2. Comparison of World Nuclear Generation Capacity Reference Forecasts

Q19. Why, in your view, is ERI's Reference forecast more conservative (*i.e.*, it projects lesser installed nuclear generating capacity) than the other forecasts?

A19. **[MS]** The other forecasts assume accelerating growth of installed nuclear generation capacity after 2020, while the ERI Reference forecast assumes a growth rate that is more consistent with that assumed prior to 2020. The other forecasts also appear to assume a much stronger recovery for commercial nuclear power in Japan, while ERI has assumed that Japan will gradually reduce its commitment to nuclear power as a result of the Fukushima event.

Q20. How does ERI's Reference forecast compare to other forecasts relative to *U.S.* installed nuclear generation capacity in particular?

A20. **[MS]** With regard to the U.S., only ERI, EIA and WNA publish separate forecasts of U.S. installed nuclear generation capacity. The ERI and EIA forecasts extend through 2035 and the WNA forecast extends through 2030. Overall, these three forecasts are in very close agreement. The differences among the forecasts are only ±3% to 5% (*i.e.*, ±3 to 5

GWe) during the period 2020 through 2030. For the year 2035, the ERI and EIA forecasts are identical. ERI Report at 8 (Exhibit GLE-014).

Q21. You indicated that the second component of the ERI supply and requirements analysis entailed the development of forecasts of uranium enrichment *requirements* in the United States and abroad. Is that correct?

A21. **[MS]** Yes.

Q22. Are these forecasts based on the ERI forecasts of U.S. and world installed nuclear generating capacity discussed above?

A22. **[MS]** Yes. ERI's forecasts of enrichment services requirements take into account, and are consistent with, the installed generating capacity projections discussed above. Thus, ERI prepared world annual enrichment services requirements for the Reference, High and Low Nuclear Power Growth forecasts. Understandably, increased nuclear generation generally will result in increased use of nuclear fuel. Thus, one would expect an increase in nuclear generation to be accompanied by an increase in the demand for uranium enrichment services. In forecasting enrichment services requirements, however, certain nuclear fuel design and management parameters also must be considered and established, either by ascertaining specific values for those parameters or by assuming reasonable values based on available information.

Q23. Please identify the relevant fuel design and management parameters, as discussed in the ERI Report.

A23. **[MS]** In developing its enrichment services requirements forecasts, ERI took into account the following considerations: (1) country-by-country average capacity factors; (2) individual plant enriched product assays, in terms of weight-percent of uranium-235, based on plant design, energy production, design burnup, and fuel type; (3) enrichment tails assays, in terms of weight percent uranium-235; (4) current plant-specific fuel discharge burnup rates for U.S. plants, and country and reactor-type-specific fuel burnup rates for foreign facilities; (5) country or plant-specific fuel cycle lengths; and (6) typical delivery lead times for enrichment services (calculated from the start of the refueling outage). These parameters are discussed in greater detail in the ERI Report. ERI Report at 9-10 (Exhibit GLE-014).

Q24. What are an "enriched product assay" and a "tails assay"?

A24. **[MS]** Various uranium enrichment processes can be used to enrich natural uranium hexafluoride (UF_6) to obtain the desired concentration or assay of the fissile uranium-235 isotope (U^{235}) for light water reactor (LWR) fuel (*i.e.*, "product assay"), which usually is in the range of 3.0 to 5.0 weight percent (w/o) U^{235} from the 0.711 w/o U^{235} that exists naturally. The enrichment process also generates a byproduct stream in which the concentration of U^{235} is reduced (*i.e.*, "depleted tails"). The concentration (assay) of U^{235} in the tails (*i.e.*, "tails assay") generally falls in a range between 0.2 w/o and 0.3 w/o, although Russian enrichment tails may have assays as low as 0.11 w/o. The most economic tails assay, known as the "optimum tails", is that tails assay that yields the minimum cost for the resulting enriched uranium product (EUP), given the costs of uranium concentrates, conversion services, and enrichment services. The EUP is occasionally referred to as low-enriched uranium, or LEU. The enrichment process is measured in separative work units (SWU). ERI Report at 9 (Exhibit GLE-014).

Q25. Please describe the results of ERI's current uranium enrichment requirements forecasts.

A25. **[MS]** Table 1 below provides ERI's forecasts of average annual enrichment services requirements by world region over successive five-year periods for the Reference, High, and Low Nuclear Power Growth scenarios.

Period	Forecast	Average Annual Enrichment Requirements (Million SWU)					
		U.S.	Western Europe	C.I.S. & E. Europe	East Asia	Other	World
2011	Actual	12.2	12.1	5.8	10.0	0.8	40.9
2016-2020	Low	14.8	12.5	6.6	12.7	1.1	47.7
	Reference	15.6	13.0	7.0	14.7	1.5	51.8
	High	15.8	13.8	7.8	18.5	2.7	58.6
2021-2025	Low	14.6	11.2	6.5	16.4	1.4	50.1
	Reference	16.0	13.2	7.8	19.6	2.7	59.3
	High	17.3	16.1	9.2	25.5	6.1	74.2
2026-2030	Low	14.2	9.4	5.9	18.4	1.8	49.7
	Reference	16.8	12.2	8.4	24.3	4.2	65.9
	High	19.2	17.0	10.8	33.1	10.6	90.7
2031-2035	Low	11.4	7.4	4.6	21.0	2.1	46.5
	Reference	16.7	12.1	9.0	28.5	5.8	72.1
	High	19.4	17.3	12.2	40.7	13.6	103.2

Table 1. World Average Annual Enrichment Requirements Forecasts

As shown in Table 1, during the 2021 to 2025 period, *world* annual enrichment services requirements are forecast to average 59.3, 74.2 and 50.1 million SWU per year for the Reference, High and Low Nuclear Power Growth forecasts, respectively. This reflects a 45%, 81% and 22% increase over the estimated 2011 value of 40.9 million SWU for the Reference, High and Low forecasts, respectively. During the 2031 to 2035 period, *world* annual enrichment services requirements are forecast to average 72.1, 103.2 and 46.5 million SWU per year for the Reference, High and Low Nuclear Power Growth forecasts, respectively. This reflects a 76%, 152% and 14% increase over the estimated 2011 value for the Reference, High and Low forecasts, respectively. ERI Report at 11 (Exhibit GLE-014).

As also shown in Table 1, during the 2021 to 2025 period, *U.S.* annual enrichment services requirements are forecast to average 16.0, 17.3 and 14.6 million SWU per year for the Reference, High and Low Nuclear Power Growth forecasts, respectively. This reflects a 31%, 42% and 20% increase over the estimated 2011 value of 12.2 million SWU for the Reference, High and Low forecasts, respectively. During the 2031 to 2035 period, *U.S.* annual enrichment services requirements are forecast to average 16.7, 19.4 and 11.4 million SWU per year for the Reference, High and Low Nuclear Power Growth forecasts, respectively. This reflects a 37%

increase, 59% increase, and a 7% decrease over the estimated 2011 value for the Reference, High and Low forecasts, respectively. ERI Report at 11-12 (Exhibit GLE-014).

Q26. How do ERI's forecasts of world and U.S. average annual uranium enrichment requirements compare to other available forecasts?

A26. **[MS]** The only publicly available forecasts of enrichment requirements that were available for comparison are those published by WNA. ERI Report at 12 (Exhibit GLE-014) (citing The World Nuclear Association, "The Global Nuclear Fuel Market Supply and Demand 2011-2030", Tables IV.1, IV.2 and IV.3 (Sept. 2011)). Figures 3 and 4 compare ERI's forecasts with WNA's forecasts for world and U.S. requirements, respectively, for the Reference, High and Low Nuclear Power Growth forecasts.

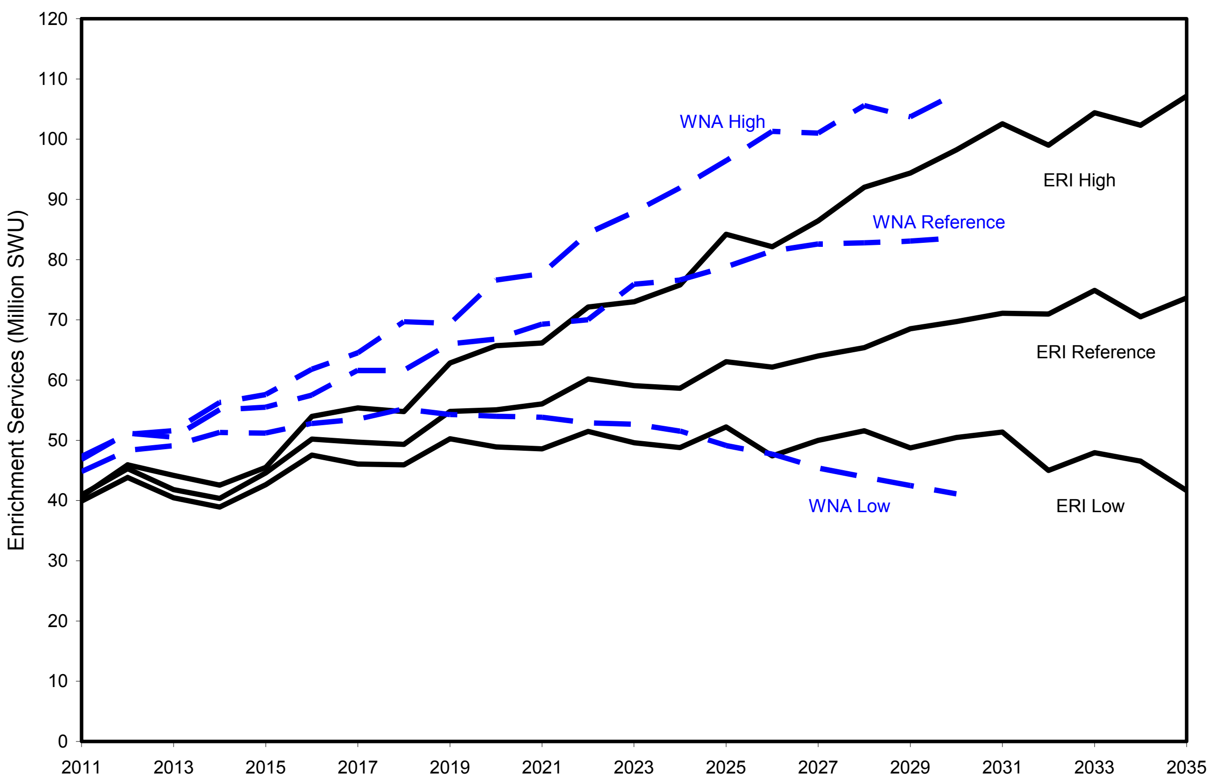

Figure 3. Comparison of World Annual Enrichment Requirements Forecasts

As shown in Figure 3, over the period 2016 through 2030, the ERI Reference forecast for the world is 16% lower than the WNA Reference World Nuclear Power Growth forecast.

For the High forecasts, the ERI forecast is 7.7% lower than the WNA High Nuclear Power Growth forecast. For the Low forecasts, the ERI forecast is 1% lower than the WNA Low Nuclear Power Growth forecast. However, by 2030, the WNA Low forecast is lower than the ERI Low forecast. ERI Report at 12 (Exhibit GLE-014).

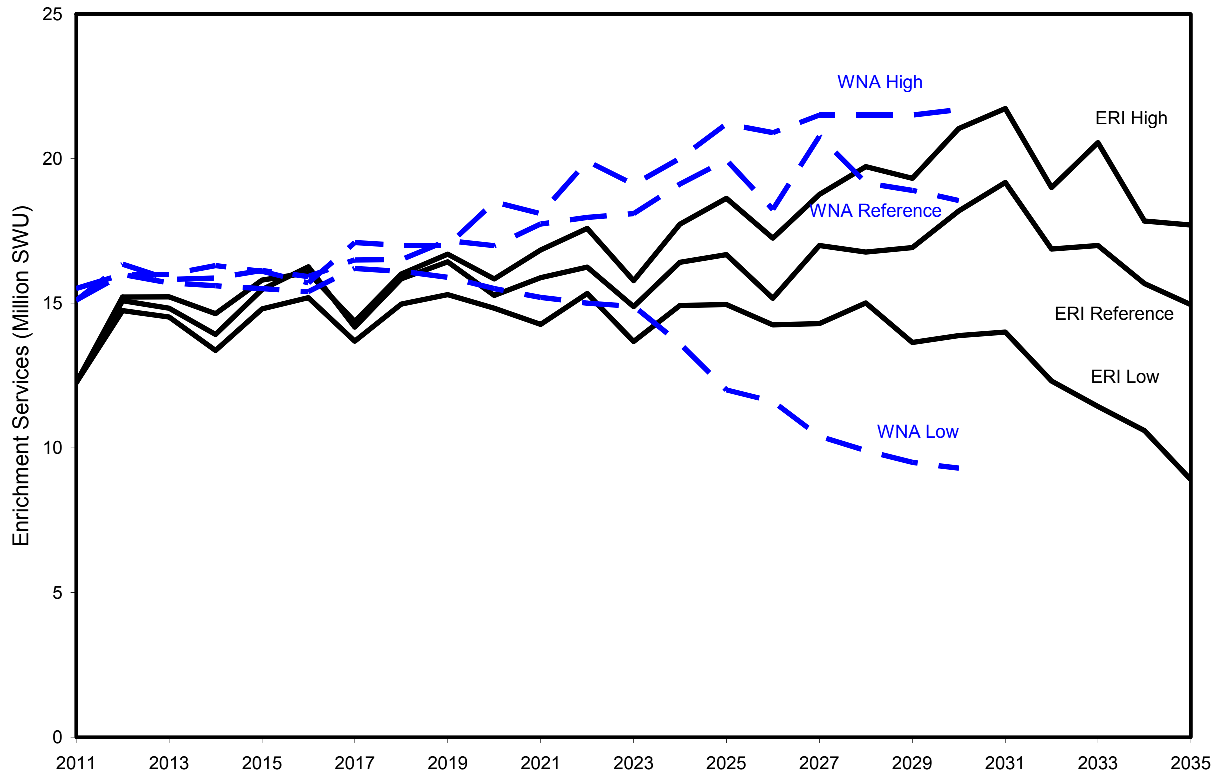

Figure 4. Comparison of U.S. Annual Enrichment Requirements Forecasts

As shown in Figure 4, over the period 2016 through 2030, the ERI Reference forecast for the U.S. is 11% lower than the WNA Reference U.S. Nuclear Power Growth forecast. For the High forecasts, the ERI forecast is 10.3% lower than the WNA High U.S. Nuclear Power Growth forecast; and for the Low forecasts, the ERI forecast is 8.2% greater than the WNA Low U.S. Nuclear Power Growth forecast. ERI Report at 13 (Exhibit GLE-014).

Q27. To what do you attribute the differences in the ERI and WNA forecasts?

A27. **[MS]** The differences in the ERI and WNA enrichment requirements forecasts are due to several factors, including WNA's higher forecasts of installed nuclear generation capacity (which includes the requirements for more first cores for new nuclear power plants); WNA's higher long-term average plant capacity factors; WNA's use of slightly lower tails assays; and WNA's assumptions regarding nuclear fuel requirements. *If the higher WNA forecasts for uranium enrichment requirements were used by ERI in its analysis, then the projected need for new uranium enrichment capability would be larger.* ERI Report at 13.

Q28. The third major component of ERI's detailed analysis involved assessing current and proposed future supplies or sources of enrichment services, correct?

A28. **[MS]** Yes. Towards that end, Section 4.1 of the ERI Report discusses "Base" sources and quantities of uranium enrichment services. Section 4.2 of the ERI Report discusses three proposed sources of enrichment services that have each made a substantial financial commitment to establishing U.S.-based, commercial-scale enrichment facilities, but which have either discontinued or not begun construction of the proposed facilities for reasons discussed below. ERI Report at 16-21 (Exhibit GLE-014).

Q29. As discussed in Section 4.1 of the ERI Report, what sources constitute the Base supply of enrichment services?

A29. **[MS]** Table 2, below, summarizes current and potential future Base sources and quantities of uranium enrichment services. As available, these Base sources include: (1) existing inventories of low-enriched uranium (LEU), (2) production from existing uranium enrichment plants, (3) enrichment services obtained by blending down Russian weapons-grade high-enriched uranium (HEU), (4) the base capacity for enrichment plants presently under construction, (5) capacity expansions at existing facilities, and (6) enrichment services that are presently being obtained by blending down U.S. HEU.

Item		Technology	Base Economically Competitive and Usable Supply Capability (Million SWU)					
			2012	2015	2020	2025	2030	2035
1	Inventory (a)	Misc.	1.5	1.3	0.0	0.0	0.0	0.0
2	Urenco (Existing and Planned Expansions)	Centrifuge	13.5	13.7	13.6	13.6	13.6	13.6
3	AREVA GB I (Existing)	Diffusion	1.3	0.0	0.0	0.0	0.0	0.0
4	AREVA GB II (New)	Centrifuge	1.6	6.3	7.0	7.0	7.0	7.0
5	USEC Paducah (Existing)	Diffusion	2.3	0.5	0.3	0.0	0.0	0.0
6	Rosatom (Internal - C.I.S. & Eastern Europe - Ref. Case)	Centrifuge	5.8	6.5	7.2	7.4	8.5	8.0
7	Rosatom (Exports, excluding for U.S.)	Centrifuge	4.9	8.3	9.3	9.2	10.3	10.7
8	Russian HEU-derived LEU	Inventory, down blending required	6.7	0.4	0.2	0.0	0.0	0.0
9	U.S. HEU	Inventory, down blending required	1.0	0.6	0.2	0.2	0.2	0.2
10	China and Other (Existing/New)	Centrifuge	2.4	4.8	8.7	12.0	15.2	18.3
11	Urenco USA (Exisitng and Expansion)	Centrifuge	0.9	4.6	5.3	5.3	5.3	5.3
12	Rosatom (Exports to U.S.)	Centrifuge	0.2	2.6	3.0	4.5	4.8	4.2
13	Recycle	Commercial Reprocessing; Weapons Pu Inv.	1.4	1.5	2.1	2.1	2.1	2.1
	Total		43.4	51.2	56.8	61.3	67.0	69.4

(a) Includes preproduction by an enrichment facility prior to its being shut down.

(b) A portion of an enrichment facility's production capacity may be dedicated to underfeeding to produce uranium. Where appropriate, some of the numbers in this table have been adjusted to reflect this.

Table 2. Base Sources of Uranium Enrichment Services

Each of the sources of supply identified in Table 2 above is discussed in Section 4.2 of the ERI Report. As reflected in Table 2, the principal existing uranium *enrichment plants* include Urenco's three gas centrifuge plants in Gronau, Germany; Almelo, Netherlands; and Capenhurst, England; the partially-completed but operational Urenco USA facility in Lea County, New Mexico; Eurodif's Georges Besse I gaseous diffusion plant (GDP) (which was permanently shut down on June 7, 2012) in Pierrelatte, France; Eurodif's partially completed but operational gas centrifuge enrichment plant (George Besse II) in Pierrelatte, France; the United States Enrichment Corporation's (USEC) GDP at Paducah, Kentucky, which is owned by the U.S. government; and the Rosatom centrifuge plants in Russia.[1] Enrichment plants with more limited SWU capacities also exist in China and several other countries (which enrich uranium mainly for indigenous use). LEU derived from the downblending of HEU (principally Russian HEU) is another source of enriched uranium product. Russian-origin sources and related U.S. trade restrictions are discussed in detail in the ERI Report. ERI Report at 2 (Exhibit GLE-014).

Q30. Please describe, in quantitative terms, ERI's current and projected *Base* supplies of enrichment services.

A30. **[MS]** As shown in Table 2, above, current Base annual supply capability that is economically competitive and not constrained by international trade restrictions equals 43.4 million SWU for the Reference Nuclear Power Growth forecast. This is comparable in magnitude to the estimated 2012 total world requirement of 41.5 million SWU. Base annual supply capability is forecast to increase to 61.3 million SWU per year by 2025 and 69.4 million SWU per year by 2035. ERI Report at 18 (Exhibit GLE-014).

Q31. What are the three *proposed* sources of enrichment services identified in Section 4.2 of the ERI Report?

A31. **[MS]** The three proposed sources are three enrichment plants that, if built, would all be located in the United States. Two out of the three facilities already have received NRC licenses but have either discontinued or not begun construction. The third—the proposed GLE Facility—is seeking its license and is the subject of this proceeding. ERI Report at 21 (Exhibit GLE-014).

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). As discussed further below,

[1] Rosatom is a state corporation in Russia with responsibility for nuclear energy-related activities.

USEC received a license from the NRC in 2007, but has not built the facility, as it continues to experience difficulties in obtaining financing and cannot fully fund the project on its own. *Id.* at 22-23.

AREVA received a license from the NRC in 2011 that authorizes it to build and operate a 6.6 million SWU per year centrifuge enrichment plant—the Eagle Rock Enrichment Facility (EREF) in Idaho. The EREF would use the same gas centrifuge technology being deployed in George Besse II and Urenco USA. *Id.* at 22.

The proposed GLE Facility planned maximum target annual production is six million SWU. If an NRC license is granted and GLE opts to proceed with construction of a commercial facility, then the earliest that such facility might be expected to begin operation, according to GLE, is 2014. GLE anticipates that it will reach an enrichment capacity of one million SWU by the end of the first year, with annual production increasing by one million SWU per year until the facility achieves its full capacity of six million SWU per year in 2020. *Id.*

The enrichment services that might reasonably be expected from these proposed sources (including the anticipated availability of such services) are summarized in Table 3 below.

Item		**Technology**	**Potential Economically Competitive and Usable Capability (Million SWU)**					
			2012	2015	2020	2025	2030	2035
14	GLE	Laser	0.0	1.5	6.0	6.0	6.0	6.0
15	USEC ACP	Centrifuge	0.0	0.0	3.8	3.8	3.8	3.8
16	AREVA EREF	Centrifuge	0.0	0.0	1.9	4.5	6.0	6.0
	Total		0.0	1.5	11.7	14.3	15.8	15.8

(a) A portion of an enrichment facility's production capacity may be dedicated to underfeeding to produce uranium. Where appropriate, some of the numbers in this table have been adjusted to reflect this.

Table 3. Proposed New Sources of U.S.-Based Uranium Enrichment Services

Q32. The Board requested that GLE and the NRC Staff also address "uncertainties associated with two proposed U.S.-based commercial enrichment facilities that have been licensed by the NRC but not yet built" (*i.e.*, the ACP and the EREF). Can you please do so?

A32. **[MS]** Yes. Although USEC received a license from the NRC five years ago, it continues to experience delays in obtaining project financing, and has acknowledged that it cannot continue to fund the ACP project without substantial financial assistance from the U.S. Government. Further, DOE has raised additional concerns about aspects of the project that USEC was not able to address to DOE's satisfaction. As a result, instead of issuing the conditional loan guarantee sought by USEC, DOE proposed a two-year cost sharing research, development and demonstration (RD&D) program for the project "to enhance the technical and financial readiness of the centrifuge technology for commercialization." However, the source of the full funding for this RD&D program remains uncertain. ERI Report at 14, 22-23 (Exhibit GLE-014).

Marking progress in this regard, on June 13, 2012, USEC and the DOE executed an agreement to move forward on a cooperative RD&D program with a total investment of up to $350 million to confirm the technical readiness of the American Centrifuge. The agreement calls for DOE to provide 80% ($280 million) and USEC to provide 20% ($70 million) of the total. This RD&D program will support building, installing, operating and testing commercial plant support systems and a 120-machine cascade that would be incorporated into the full-scale commercial ACP. According to USEC's announcement, USEC and DOE will initially provide $110 million in cost-shared funding that is intended to last through the end of November 2012. DOE's portion of the funding will be derived from its assumption of the disposal obligation for a quantity of depleted uranium tails from USEC, releasing $87.7 million in cash for use in the RD&D program. DOE and USEC used a similar approach in March 2012 to provide $44 million in interim funding. USEC will continue to work with Congress and DOE to pursue opportunities for funding the balance of the RD&D program. Appropriation bills providing Fiscal Year 2013 funding have been approved by the House of Representatives and the Senate Appropriations Committee, but have not yet been finalized. ERI Report at 14.

With respect to AREVA's proposed Eagle Rock Enrichment Facility, initial production originally had been expected to occur in 2014, with full capacity being reached in 2019. However, on December 13, 2011, AREVA announced that it was cutting jobs and suspending projects around the world, including the EREF in the U.S., as part of a five year strategic action plan that would allow it to recover from massive losses in 2011 and return to profit. It was reported in January 2012 that AREVA was planning to begin construction on the EREF in 2013, instead of 2012 as originally planned; or possibly as late as 2014 if it could not secure a suitable investment partner for the project. However, in February 2012, URS Nuclear LLC, the Procurement and Construction Manager for the EREF notified all of its subcontractors that the "project has been placed on indefinite suspension until further notice."

Q33. Based on ERI's forecasts, and considering the effects of the Fukushima event and the status of other enrichment projects, what do you conclude with respect to the need for future enrichment services, including those to be provided by the GLE Facility?

A33. **[MS]** As illustrated by Figure 5, in the absence of the enrichment services that would be produced by the still-proposed U.S.-based plants (the ACP, EREF, and GLE Facility), supply is shown not to be adequate to meet projected world requirements beginning as early as 2017. During the 10-year period from 2016 through 2025, without these three proposed sources of enrichment supply under the *Reference* Nuclear Power Growth forecast, world supply is an average of 1.3 million SWU per year (2.2%) short of meeting world average annual requirements. During the subsequent 10-year period 2026 through 2035, supply is an average of 3.8 million SWU per year (5.4%) short of meeting world average annual requirements. ERI Report at 25 (Exhibit GLE-014).

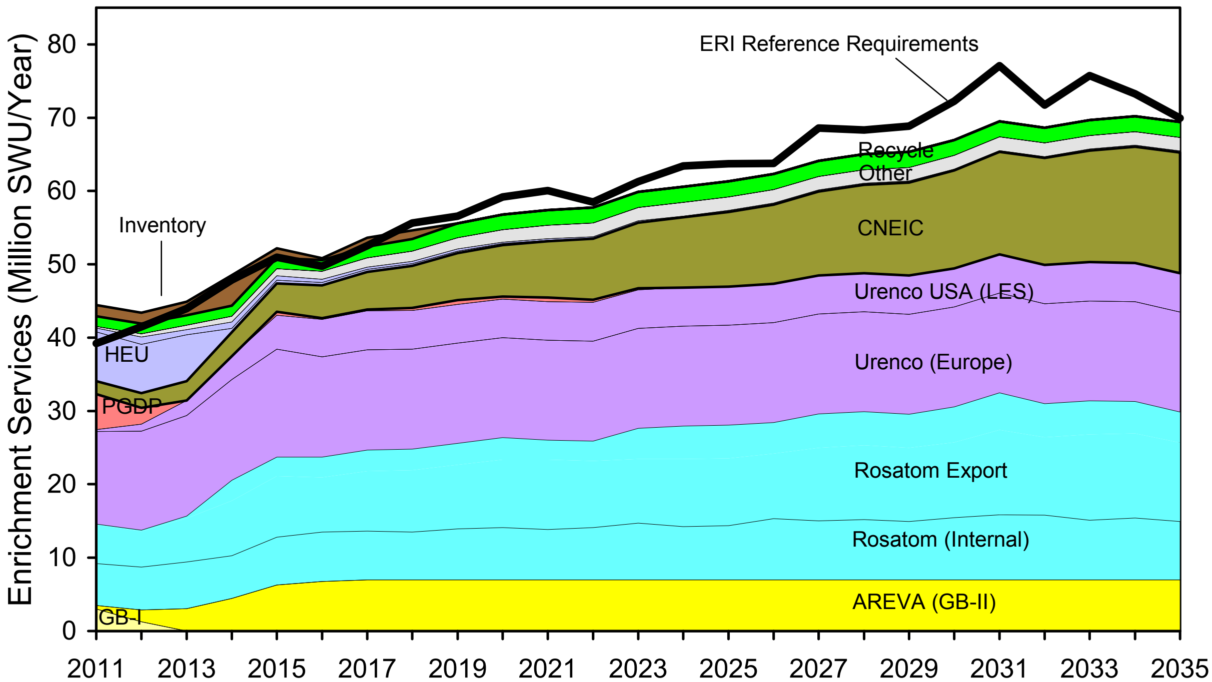

Figure 5. Base Supply and Reference Nuclear Power Growth Requirements (assumes that the proposed American Centrifuge Plant, Eagle Rock Enrichment Facility, and GLE Facility are not constructed)

If one of these three proposed sources of enrichment supply are assumed to be operating, then it is estimated that there will be adequate world supply, but with an average annual supply margin that, depending upon which one of the proposed enrichment plants is assumed to be operating, is between 0.8 and 3.9 million SWU per year (between 1.4% and 6.7% of average annual requirements) during the period 2016 through 2025; and not more than 2.2 million SWU per year (not more than 3.1% of average annual requirements) during the period 2026 through 2035. Thus, even with the addition of enrichment capacity from a new facility, enrichment services requirements and supply would be in very close balance. ERI Report at 25. As discussed below, such a small margin is not optimal in terms of diversity and security of supply.

Q34. Assuming that increasing domestic enrichment capability (thereby lessening dependence on foreign supplies) remains an important U.S. energy and national security policy objective, what do you conclude with respect to the need for future enrichment services in the U.S.?

A34. **[MS]** ERI's Reference Nuclear Power Growth forecast indicates that all three proposed facilities (ACP, EREF, and GLE) are needed to avoid a shortage of U.S.-based enrichment supply relative to U.S. requirements at some point during the period 2016 through 2035. With only two of the three proposed sources of enrichment supply operating, the average shortage in supply during the period 2016 through 2025 is between 1.6 and 4.7 million SWU per year (between 10.1% and 29.7% of average annual requirements). During the period 2026 through 2035, without both the EREF and GLE facilities operating, the shortage is estimated to be about of 1.7 million SWU per year (about 10.1% of average annual requirements). If the smaller ACP is not operating, but both the EREF and GLE plant are operating, then average annual supply exceeds U.S. average annual requirements by 0.5 million SWU per year (3.0% of average annual requirements). Thus, even in that situation, supply and requirements are in close balance, but with very little margin. ERI Report at 25 (Exhibit GLE-014).

Q35. Did ERI evaluate the need for future enrichment services on a worldwide and U.S. basis for all three of its forecasts (Reference, High, and Low) and, if so, what were the results?

A35. **[MS]** Yes. Table 4 summarizes supply and requirements scenarios for the world and U.S. under each of the three nuclear power growth forecasts described above. Results are presented as average annual values for each of two 10-year periods of interest (2016 through 2025 and 2026 through 2035). The highlighted scenarios in Table 4 are those for which the average annual supply of enrichment services is *not* adequate to meet requirements.

Time Period	Forecast Million SWU per Year (Percent of Requirements) 2016-2025	Forecast 2026-2035	High Nuclear Power Growth Forecast Million SWU per Year (Percent of Requirements) 2016-2025	High 2026-2035	Low Nuclear Power Growth Forecast Million SWU per Year (Percent of Requirements) 2016-2025	Low 2026-2035
World						
Potential Supply - None	-1.3 (-2.2%)	-3.8 (-5.4%)	-8.1 (-11.3%)	-17.5 (-17.3%)	+3.7 (+7.5%)	+4.7 (+9.8%)
Potential Supply - 1 of 3	+0.8 to +3.9 (+1.4% to +6.7%)	+0.0 to +2.2 (+0.0% to +3.1%)	-6.0 to -2.9 (-8.4% to -4.0%)	-13.7 to -11.5 (-13.6% to 11.4%)	+5.8 to +8.9 (+11.8% to +18.1%)	+8.5 to +10.7 (+17.6% to +22.2%)
Potential Supply - 2 of 3	+4.1 to +7.2 (+7.1% to +12.4%)	+5.8 to +8.0 (+8.2% to 11.3%)	-2.7 to +0.4 (-3.8% to +0.6%)	-7.9 to -5.7 (-7.8% to -5.6%)	+9.1 to 12.2 (+18.5% to 24.7%)	+14.3 to +16.5 (+29.7% to 34.2%)
Potential Supply - All	+9.3 (+16.0%)	+11.8 (16.6%)	+2.5 (+3.5%)	-1.9 (-1.9%)	+14.2 (+29.0%)	+20.3 (+42.1%)
U.S.						
Potential Supply - None	-10.0 (-63.3%)	-11.3 (-67.3%)	-10.8 (-65.1%)	-13.8 (-71.5%)	-8.9 (-60.5%)	-7.3 (-57.0%)
Potential Supply - 1 of 3	-6.1 to -4.8 (-38.6% to -30.4%)	-5.3 to -2.5 (-31.5% to -14.9%)	-6.6 to -5.5 (-39.8% to -33.1%)	-7.8 to -4.4 (-40.4% to -22.8%)	-5.1 to -3.7 (-34.7% to -25.2%)	-1.3 to +0.8 (-10.2% to +6.2%)
Potential Supply - 2 of 3	-4.7 to -1.6 (-29.7% to -10.1%)	-1.7 to +0.5 (-10.1% to +3.0%)	-5.5 to -2.4 (-33.1% to -14.5%)	-4.2 to -2.0 (-21.8% to -10.4%)	-3.6 to -0.5 (-24.5% to -3.4%)	+2.3 to +4.5 (+18.0% to +35.2%)
Potential Supply - All	+0.5 (+3.2%)	+4.3 (+25.6%)	-0.3 (-1.8%)	+1.8 (+9.3%)	+1.6 (+10.9%)	+8.3 (+64.8%)

Base Supply is included in all cases.

Potential Supply includes AREVA/EREF, GEH/GLE, USEC/ACP.

Table 4. Summary of Supply and Requirements for Representative Scenarios (blue shading indicates that forecasted requirements exceeded forecasted supply)

As shown in Table 4, the Base supply alone is sufficient to meet world requirements through 2035 *only* under the Low Nuclear Power Growth forecast. Under the Reference Nuclear Power Growth forecast, Base supply plus at least one of the three proposed new U.S. sources of enrichment services is necessary to meet world requirements during each of the 10-year periods. Under the High Nuclear Power Growth forecast, all three proposed sources of enrichment services are necessary to just meet world requirements during the first 10-year period. However, even with all three proposed sources of enrichment services operational, supply is not adequate to meet forecast requirements during the second 10-year period.

With regard to the U.S., it is apparent from Table 4 and my testimony above that all three of the proposed U.S.-based enrichment facilities are needed if the U.S. is to achieve a domestic enrichment capability that significantly reduces reliance on foreign suppliers of enrichment services. There is only one exception; it is the 2026-2035 period under the Low Nuclear Power

Growth forecast, when only two of the three proposed sources of enrichment services are necessary to meet projected U.S. requirements. ERI Report at 28-29 (Exhibit GLE-014).

Notably, with an enrichment capacity of 6 million SWU per year when fully operational, the GLE Facility would have a capacity equal to approximately 8% of world requirements during the period 2026 through 2035 and about 36% of U.S. requirements during the same period.

Q36. You previously stated [A27] that "If the higher WNA forecasts for uranium enrichment requirements were used by ERI in its analysis, then the projected need for new uranium enrichment would be higher." Did you make any effort to quantify this, and if so, what were the results?

A36. **[MS]** Yes. The WNA Reference forecast for uranium enrichment requirements is higher than the ERI Reference Nuclear Power Growth forecast, as discussed above and illustrated in Figures 3 and 4. If the WNA Reference forecast is taken as the basis for future world requirements for enrichment services, then all three of the proposed U.S. sources of enrichment services would have to be operational to avoid a shortage of world supply during the 2016 through 2030 time period. However, if any one of these three proposed sources of enrichment services is not built and operated as currently planned, then there would be a shortage of enrichment services during the 2016 through 2030 time period that averages between 0.9 and 3.0 million SWU per year (between -1.2% and -4.1% of average annual requirements). These results are similar to those associated with the ERI High Reference Nuclear Power Growth requirements forecast over the same period (between -2.5% and -5.3% of average annual requirements). ERI Report at 29 (Exhibit GLE-014).

In the U.S., assuming the WNA Reference forecast of requirements for enrichment services, even with two out of three of the proposed sources of enrichment supply available, there would still be a shortage of U.S.-based enrichment supply relative to U.S. requirements during the 2016 through 2030 time period of between 3.5 and 5.7 million SWU per year (between -19.3% and -31.5% of average annual requirements). *Id.*

Q37. What conclusion did the NRC Staff reach in FEIS Section 1.3.1 ("Need for Enriched Uranium to Fulfill Electricity Requirements")? Do you agree with it?

A37. **[MS]** The NRC Staff concludes that, even if operation of the GLE Facility were to result in enrichment capacity that exceeds projected annual requirements, there are uncertainties associated with other proposed projects, and that "extra capacity would provide needed assurance that enriched uranium would be reliably available when needed for domestic nuclear power production." FEIS, Vol. 1 at 1-8. This is a reasonable conclusion.

In short, owners and operators of nuclear power plants have two primary objectives in purchasing nuclear fuel, including uranium enrichment services. The first objective is security of supply—*i.e.*, adequacy of supply in the market that is sufficient to: (1) mitigate against unanticipated disruptions from one or more sources, and (2) assure the purchaser that it can rely on its suppliers to deliver nuclear fuel materials and services on schedule, within technical specifications, and according to the terms of the parties' contracts. The second objective is to ensure a competitive procurement process—*i.e.*, the purchaser's ability to choose from among multiple suppliers through a process that fosters reasonable prices for the nuclear fuel materials and services that are purchased. Operation of the GLE Facility would increase the likelihood that these important objectives are met in the future. ERI Report at 29-30.

IV. DISCUSSION OF TOPIC 5.B: SUMMARY OF ALTERNATIVES ANALYSIS

Q38. Please briefly describe the types of alternatives that GLE considered in Chapter 2 of its Environmental Report (ER).

A38. **[JO]** GLE considered a reasonable range of alternatives, including the No-Action Alternative, in its Environmental Report. As described in ER Section 2.2, GLE evaluated alternatives to the Proposed Action (*i.e.*, construction and operation of a 6.0 million SWU enrichment facility in Wilmington, North Carolina deploying laser enrichment technology) with respect to (1) enrichment technology, (2) facility design, (3) site location, and (4) facility location within the preferred site.

The other enrichment technologies evaluated (*e.g.*, gaseous diffusion, gas centrifuge, other laser-based technologies) were not found to constitute reasonable alternatives to the Proposed Action for the economic, commercial, technological, and environmental reasons set forth in ER Section 2.2.1.

Through a facility design optimization process, several design alternatives were considered but eliminated based on evaluation of potential environmental impacts, contamination of the facility, ease of decommissioning, waste minimization, emergency response, and uranium-separation efficiency. *See* ER Section 2.2.2.

GLE also evaluated alternative site locations for the GLE Facility, but those alternative sites were eliminated after the conduct of a detailed, multi-step site-selection process described in ER Section 2.2.3. No site was found to be obviously superior to the Wilmington Site.

Finally, GLE also considered alternative locations for the proposed GLE Facility within the boundaries of the Wilmington Site, but excluded those alternatives from further evaluation because of the significant degree of additional mitigation necessitated by their implementation. *See* ER Section 2.2.4.

Q39. What is the No-Action Alternative, particularly at it applies to the Proposed Action in this case?

A39. **[JO]** As described in NRC guidance, the No-Action Alternative is the status quo. NUREG-1748 at 6-3. It is considered in order to provide a baseline to compare the proposed action and reasonable alternatives. Under the No-Action Alternative, in this case, the proposed GLE Facility would not be constructed. Enrichment services would continue to be provided by existing domestic (USEC, Urenco USA) and foreign uranium enrichment suppliers. No further alterations to the Wilmington site would occur, and no further benefits or costs would accrue to the region or the Nation as a result of the construction and operation of the proposed GLE Facility.

Q40. What benefits of the Proposed Action would not be realized under the No-Action Alternative?

A40. **[JO]** Under the No-Action Alternative, positive socioeconomic impacts (with the possible exception of those impacts stemming from preconstruction activities) related to employment, economic activity, population, housing, and community resources during the construction, operations, and decommissioning phases would not occur. For example, there would be no increase in local or regional employment as a result of facility construction, operation and maintenance. There also would be no additional tax revenue from such activities or the local industries that arise or evolve to support them. Furthermore, on a national scale, there would be no increase in domestic enrichment capacity for LEU production; no advancement in U.S. isotopic enrichment capabilities via deployment of a next-generation, first-of-its-kind enrichment technology; and a less diverse pool of potential suppliers of enrichment services.

The negative effects of these forgone national benefits would manifest themselves in several ways. If the GLE Facility is not deployed, then owners and operators of U.S. nuclear power plants will have a less diverse and secure supply of enrichment services and continue to rely heavily on foreign suppliers. Currently, more than 80% of domestic LEU used by U.S. reactors is foreign in origin. The No-Action Alternative, therefore, would not enhance national energy security by allowing the U.S. to become less dependent on foreign suppliers.

Finally, the No-Action Alternative would not contribute to the deployment of more advanced enrichment technology in the United States. The U.S. Congress, the DOE, and other federal agencies have emphasized the need to deploy state-of-the-art enrichment technology in the United States in the near term, both for national energy security and commercial reasons. For example, as recently as February 2012, the DOE described the benefits of an advanced domestic enrichment capability as follows:

- Allowing the U.S. to discourage the unnecessary spread of enrichment technology by contributing directly to sustained confidence in the international commercial enrichment market.
- Providing the U.S. an unencumbered source of enriched uranium, critical in the near-term for the national security tritium production mission.
- Providing a U.S. capability to enrich uranium to make fuel, critical in the long term for meeting demand for defense-related research reactors and for naval nuclear propulsion reactors.
- Allowing the U.S. to better detect, deter, and assess potential proliferation of new uranium enrichment programs around the world.
- Helping to preserve the technical knowledge base and the supply chain needed to support uranium enrichment capabilities in the United States..

Department of Energy, National Nuclear Security Administration, Office of Chief Financial Officer, *FY 2013 Congressional Budget Request: Office of the Administrator, Weapons Activities, Defense Nuclear Nonproliferation, Naval Reactors* (DOE/CF-0071),Vol. 1 at 376 (Feb. 2012), http://www.cfo.doe.gov/budget/13budget/content/volume1.pdf.

The industry also has emphasized the importance of having multiple domestic enrichment facilities—owned by different entities and deploying different enrichment technologies—to provide diversity and assurance of the fuel supply. *See* Ameren Corporation, Florida Power and Light Company, Nuclear Management Company, and Progress Energy. *Supporting NRC's Action to License an Additional Uranium Enrichment Facility in the U.S.* Comments from Ameren Corporation, Florida Power and Light Company, Nuclear Management Company, and Progress Energy (Nov. 2002) (Exhibit GLE-015).

Additionally, gaseous diffusion technology (in use at Paducah GDP) and gas centrifuge technology (in use at Urenco USA, and proposed for the ACP and EREF) are the two enrichment technologies currently in commercial use in the United States. Gas centrifuge technology is known to be more efficient and substantially less energy-intensive than gaseous diffusion technology. The GLE laser-based technology that would be deployed at the proposed GLE Facility is newer than gas centrifuge technology. GLE expects it to offer certain advantages over both the gaseous diffusion and gas centrifuge processes. For example, because centrifugation relies upon exploiting small mass differences between isotopes (a mechanical process), it is anticipated to be less efficient than laser technology (an optical process), thereby potentially resulting in greater costs, a larger environmental footprint, and a larger amount of depleted tails produced per unit output. Thus, relative to the No-Action Alternative, the Proposed Action could have small to moderate beneficial impacts.

Q41. What environmental costs of the Proposed Action would be averted under the No-Action Alternative?

A41. **[JO]** Potential local environmental impacts (with the possible exception of impacts associated with preconstruction activities) would be avoided by the No-Action Alternative. Such impacts are those related to water use, land use, potential groundwater contamination, ecology, air emissions, human health and occupational safety, waste storage and disposal, disposition of depleted uranium, and decommissioning projected to occur during the construction, operations, and decommissioning phases. Specific examples of avoided environmental impacts include:

- No increase in motor vehicle traffic arising from GLE Facility construction, operation and maintenance.
- No soil disturbance or road improvement over 146 acres of the GLE site.
- No additional effluents, trace radiological constituents, or change in runoff quality/quantity.
- No use of surface waters and no change in surface and/or groundwater elevation brought about by facility water usage.
- No stream crossings built for new roads.
- No direct impact on 0.42 acres of wetland or indirect impact upon up to 660 acres of wetland.
- No alteration of overall flora, fauna, wildlife populations or forested biotic communities.
- No addition of UF_6, uranyl fluoride, hydrogen fluoride (HF), particulate or other radioactive species to the air.
- No short duration noise level increases during construction and decommissioning.

- No visual impact from the erection of buildings.
- No effect on the socioeconomics of the area and no change in baseline demographics.
- No increase in occupational exposure of area workers due to chemicals and radiation.
- No storage of UF_6 tails on site.

With the exception of community effects brought about by motor vehicle traffic, flora and fauna, noise during construction/decommissioning, and UF_6 waste management, all of these forgone costs are expected to be SMALL in magnitude, as discussed in the GLE ER. The noted exceptions were forecast to have potential MODERATE impacts. Cumulative effects arising from these items are discussed in greater detail in the ER.

Q42. What conclusions did the NRC Staff reach in its FEIS in comparing the Proposed Action and the No-Action Alternative?

A42. **[JO]** Based on consideration of local and national socioeconomic benefits, and the potential effects of construction, operation, and decommissioning of the proposed GLE Facility on a range of environmental resources as well as public and occupational health, the Staff concluded that the Proposed Action is preferable to the No-Action Alternative in the following major respects:

- The Proposed Action would contribute to meeting future demand for enrichment services from domestic nuclear power plants and increase national energy security. It also would introduce a newer technology with the potential to have smaller resource requirements and environmental impacts in the U.S. relative to other, existing enrichment technologies.

- The proposed action would have positive impacts in the region of interest on employment, income, and tax revenues during the construction, operations, and decommissioning phases, and on state and federal income tax revenues.

Q43. Please briefly summarize the process by which GLE evaluated alternative sites for the proposed GLE Facility.

A43. **[JO]** As summarized in ER Section 2.2.3.1 (p. 2-15) and FEIS Section 2.3.1 (p. 2-43), the GLE site-selection process involved multiple steps. Broadly speaking, those steps included: (1) identification of candidate sites, (2) initial screening, (3) coarse screening, (4) site reconnaissance visits, (5) fine screening, and (6) qualitative cost-benefit analysis. These steps are summarized in ER Figure 2.2-1 and FEIS Figure 2-4.

The process began with the identification of candidate sites for the GLE project, which were subjected to an initial screening step that eliminated those sites located in areas of significant seismic, tectonic, and flood hazards. Sites that passed the initial screening step entered the coarse-screening step, which considered criteria related to property size requirements or potential impediments to the transfer of property ownership. Sites that failed one or more of these criteria were eliminated from further consideration. At that point, reconnaissance visits to the remaining sites were conducted to identify potential issues beyond the initial and coarse screening. Sites that passed the reconnaissance step entered a fine-screening step, in which GLE considered a number of detailed criteria for each lifecycle phase of the project (*i.e.*, preconstruction, construction, operation-production, and decommissioning), as applicable. *See* ER Section 2.2.3.1.1 (p. 2-15).

A total of 22 potential sites were screened using the multi-stage evaluation process outlined above. Of the 22 potential sites, three were eliminated due to elevated seismic risk, and 16 others were eliminated because they were too small, government-owned, at significant risk for litigation or some other form of public opposition, subject to RCRA Corrective Action or designated as CERCLA National Priority List sites.[2] Of the three sites that passed the coarse screen, one had insufficient uncommitted land and was therefore eliminated. The remaining two sites (Morris, Illinois and Wilmington, North Carolina) were compared using the detailed fine-screening criteria.

As discussed in greater detail in response to the Licensing Board's FEIS Question No. 14, the development of the weighting factors for each criterion used in the alternative sites analysis

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[2] RCRA refers to the Resource Conservation and Recovery Act. CERCLA refers to the Comprehensive Environmental Response, Compensation, and Liability Act, commonly known as "Superfund."

was performed as part of the fine-screening step. Specifically, the determination of weights was part of a multi-criteria decision analysis methodology referred to as the Analytic Hierarchy Process (AHP). The Wilmington, North Carolina site scored higher than the Morris, Illinois site on three of the four criteria clusters, and a qualitative cost-benefit analysis indicated that the net benefits would likely be slightly higher at the Wilmington Site. Based on the results of the site-selection process summarized above, GLE concluded that the Wilmington Site is the preferred site for the GLE Facility. Key factors differentiating the two sites included the existing nuclear infrastructure and greater cost savings associated with Wilmington Site, and smaller adverse impacts to the quality and quantity of surface water and groundwater resources, air quality, sensitive ecological species and habitat, and socioeconomic conditions at the Wilmington Site.

V. DISCUSSION OF TOPIC 5.C: KEY ELEMENTS OF THE GLE COST-BENEFIT ANALYSIS

Q44. Please briefly explain the purpose and nature of a cost-benefit analysis, particularly one performed for purposes of compliance with NEPA.

A44. **[KH]** As described in NUREG-1748, a cost-benefit analysis should be part of both the Environmental Report and the Environmental Impact Statement. NUREG-1748 at 5-30, 6-32. The cost-benefit analysis (CBA) estimates the overall impact of the Proposed Action on society's well-being, including both private benefits and costs accruing to the Facility's owners and external benefits and costs experienced by other members of society. Benefits and costs of the Proposed Action result from changes in conditions, relative to baseline conditions. Baseline conditions are defined as conditions expected to exist throughout the lifetime of the proposed GLE Facility, in the absence of the impacts that would result from the Facility.

CBA refers to the comparison of social benefits and costs arising from a specific project or program. It is a tool used to systematically catalogue, quantify, and value in monetary terms (where possible) the effect of the project or program on society's well-being. The effect on society's well-being is measured in terms of the project's net benefit, defined as benefits minus costs. Typically, CBA is used to assess the societal impact of public expenditures or regulations; however, it also can be used (as in this situation) to assess the total social impact of a project undertaken with Federal oversight.

In situations where a project gives rise to externalities, the social net benefits are computed as the sum of private net benefits and external net benefits. Impacts (benefits or costs) that accrue to someone other than the Applicant, its customers, and its suppliers are referred to as externalities, comprising external costs and external benefits. The private net benefits and external net benefits are both streams of impacts that occur over time. Economists use discounting to reflect the fact that benefits and costs occurring in the future are worth less today than current ones. Following Office of Management and Budget (OMB) guidance in *OMB Circular A-4,*[3] analysts discount the future streams of net benefits using a 7% discount rate to reflect the private cost of capital and using a 3% discount rate to reflect society's estimated rate of time preference.

Q45. Did GLE perform a CBA for the proposed GLE Facility and, if so, where is it documented?

A45. **[KH]** Yes. The CBA for the GLE Facility project compares the Proposed Action to the No-Action Alternative. The overall CBA assessment, which treats many of the external costs and benefits in a qualitative manner, is presented in Chapter 7 of the ER. Monetary costs and benefits are presented in 2007 dollars. It is important to note that this response is based on data and results presented in the ER. Recognizing that several underlying market factors have changed since the ER and FEIS were prepared, our testimony below discusses how these market changes would affect the estimated costs and benefits, in qualitative terms. The private benefits and costs to GLE are assessed quantitatively as described in proprietary Appendix U of the ER.

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3 http://www.whitehouse.gov/omb/circulars_a004_a-4. NUREG-1748 references OMB's 1996 guidance, "Economic Analysis of Federal Regulations Under Executive Order 12866", which has been superseded by OMB Circular A-4.

Q46. Please summarize the benefits and costs of the GLE Facility project.

A46. **[KH]** As discussed in Chapter 7 of the ER, in addition to GLE's private benefits and costs, the Proposed Action would be expected to result in external benefits and costs, which would be experienced by others in society. The sum of the private net benefits and the external net benefits provides an estimate of the overall impact of the Proposed Action on the well-being of society as a whole. Table 5, below, lists expected external benefits and costs of the Proposed Action, together with their estimated significance level (SMALL, MODERATE, or LARGE). In addition to these external benefits and costs, the Proposed Action is expected to yield private net benefits for the Applicant in the form of a stream of profits over the life of the project.

Cost-Benefit Category	Description	Scale of Impacts
Benefits		
Energy Security	Increases availability of domestically-produced nuclear fuel, reducing reliance on foreign sources of enriched uranium; establishes an advanced uranium-enrichment technology in the United States.	LARGE
Enriched Uranium Produced	Estimated 6 million Separative Work Units (SWU) helps address projected SWU shortfall in United States after 2014.	LARGE
Reduced Emissions	By allowing increased nuclear power generation, may encourage reduced emissions of criteria pollutants and greenhouse gases by fossil-fuel fired electric utility power plants.	MODERATE
Energy Efficiency	SILEX (Separation of Isotopes by Laser Excitation) technology produces enriched uranium using less electric power than existing uranium enrichment technologies.	MODERATE
Economic Impacts	Employment of up to 1040 during construction and start-up and 350 during operation; increases in regional income due to employee payroll and local GE-Hitachi Global Laser Enrichment LLC (GLE) purchases of goods and services.	MODERATE
Tax Receipts	Sales and income taxes due to GLE and employee spending; corporate income tax on GLE profits.	SMALL
Costs		
Land Use	Proposed GLE Facility will be built on land already owned by one of the owning companies, already zoned I-2 for Heavy Industrial use, and adjacent to an existing nuclear fuel fabrication plant and other industrial manufacturing operations; no impact on surrounding land uses expected.	SMALL
Transportation	Up to 815 average daily traffic (ADT) counts during construction and 740 to 1,560 ADT during operation. Congestion may occur in the immediate area between Wilmington Site entrances and the U.S. Interstate Highway I-140 (I-140) interchange.	SMALL regionally, MODERATE locally
Water Resources	Groundwater quality for nearby wells unaffected; no significant adverse impacts on nearby wells anticipated from relatively small changes in groundwater withdrawals.	SMALL

Cost-Benefit Category	Description	Scale of Impacts
	After mitigation, no significant impacts to surface water quality or quantity due to construction of Proposed GLE Facility.	SMALL
	Small increase in surface water runoff and sanitary wastewater discharges during operation.	SMALL
	Short-term increase in soil erosion during GLE Facility site preparation would be mitigated by following proper construction best management practices, thus minimizing the potential impact of sediment on surface water bodies.	SMALL
	Modification to the stream crossing for the proposed South access road would occur within the floodplain but would not impede floodwaters. Increases in floodwaters due to runoff during extreme storm events will be slight (3% to 5%).	SMALL
	Less than 1 acre of wetlands affected; impacts would be mitigated.	SMALL
Soils	Terrain changes induced during site preparation would be minimal because the area is very gently sloping. Shallow soils would be disturbed for the construction of building footings and the excavation of stormwater detention ponds. The construction of the proposed North access road would require excavation, backfilling, compaction, grading, and paving. Shallow soils disturbed during construction would either be reused within the GLE construction site (*i.e.*, GLE Facility site) or stockpiled for potential use in other areas of the Wilmington Site, and no off-site disposal of soil is expected.	SMALL
Air Quality	The construction, operation, and decommissioning of the Proposed GLE Facility would result in SMALL impacts from air emissions to the atmosphere and would not substantially change the ambient air quality in the vicinity of the Proposed GLE Facility.	SMALL
Ecological Resources	Of nine federally-listed Threatened and Endangered Species that are listed as potentially occurring in New Hanover County, only one species may be affected, but would not likely be adversely affected.	SMALL to MODERATE
Social Services	Small increases in regional population will not burden housing, schools, police and fire services, or healthcare.	SMALL
Noise	Except for short duration, temporary construction noise impacts associated with building the proposed North access road portion of the Proposed GLE Facility (MODERATE), noise modeling indicates impacts from construction, operations, and decommissioning will be SMALL	SMALL
Public and Occupational Health	Some increase in work-related injuries due to construction; no adverse health impacts projected for either employees or residents due to radiological or non-radiological releases.	SMALL
Environmental Justice	Environmental impacts are expected to be SMALL and not to fall disproportionately on low-income or minority residents.	SMALL
Wastewater	Process waste and sanitary waste will be treated prior to release to existing effluent channel. Quantities are within maximum allowable under existing National Pollutant Discharge Elimination System (NPDES) permit for the Wilmington Site. Stormwater will be routed to a stormwater wet detention basin prior to release.	SMALL
Solid Waste	Generated municipal, industrial non-hazardous, hazardous, and low-level radioactive waste (LLRW) would be collected and transported off-site for appropriate recycling, treatment, and/or disposal. Uranium hexafluoride (UF_6) tails would be temporarily stored at the Proposed GLE Facility before being shipped to a licensed depleted-uranium conversion facility.	SMALL to MODERATE

Table 5. Summary of Projected External Benefits and Costs of the Proposed Action

Q47. Please summarize the results of GLE's Comparison of the Proposed Action to the No-Action Alternative.

A47. **[KH]** Under the No Action alternative, the GLE facility would not be constructed or operated. Impacts associated with the Proposed Action related to water use, land use, potential groundwater contamination, ecology, air emissions, human and occupational health, waste storage and disposal, disposition of depleted uranium, and decommissioning would not occur. Similarly, the socioeconomic impacts of the Proposed Action would not occur. Enrichment services would continue to be provided by existing domestic and foreign uranium enrichment suppliers.

As stated above, the Proposed Action was found by GLE and the NRC Staff to be preferable to the No-Action Alternative, because:

- The Proposed Action would contribute to meeting future demand for enrichment services from domestic customers and increase national energy security. It also would introduce a newer enrichment technology that is reasonably expected to have smaller resource requirements and smaller environmental impacts in the United States.
- The Proposed Action would have positive socioeconomic impacts in the region of influence and on state and federal income taxes.

Q48. Please briefly discuss how changes in underlying market conditions related to the Fukushima event and present uncertainties related to the ACP and EREF projects could affect the potential costs or benefits of the Proposed Action.

A48. **[KH, MS]** As noted above and in the ERI Report, the international economic downturn, the Fukushima earthquake and tsunami, and decisions by other suppliers of enrichment services (domestic and international) are likely to have an impact on the market for enriched uranium that is not reflected in the responses immediately above. The global economic downturn would be expected to reduce demand for energy, and thus demand for uranium enrichment services, for several years; however, the downturn is expected to be temporary. As the world's economies recover, the demand for LEU also is expected to recover, as reflected in the forecasts of ERI and other organizations identified above.

The earthquake and tsunami at Fukushima is projected to have a more lasting impact on installed nuclear generation and thus the demand for LEU. Although nuclear generating capacities in the U.S. and worldwide still are projected to increase between the 2012 and 2030, the projected growth is somewhat smaller than was expected prior to the Fukushima event. For example, ERI estimates that U.S. annual requirements for enrichment services will grow from 14.0 million SWU in 2012 to 18.1 million SWU per year by 2030, an increase of 29%. ERI Report at 11. Thus, while the overall growth in demand for LEU is now projected to be somewhat lower than prior to the economic downturn and events at Fukushima, demand is projected to grow substantially over the next 20 or so years, as reflected in the ERI and other forecasts discussed above. In fact, even after accounting for the effects of the Fukushima event, ERI's forecast of world enrichment requirements is slightly higher than that reflected in GLE's 2008 Environmental Report.

Meanwhile, domestic projects that would supply some additional enrichment services, if completed, have encountered delays. The Urenco USA facility reached 400,000 SWU as of the end of 2011, but is approximately a year behind schedule. ERI Report at 15 (Exhibit GLE-014) (citing Phil Chaffee, "Urenco USA Production A Year Behind Schedule", *Nuclear Intelligence Weekly*, January 30, 2012). The American Centrifuge project has experienced substantial delays and uncertainties in obtaining financing, and AREVA has announced that it is cutting jobs and suspending projects, possibly including the Eagle Rock Enrichment Facility. *Id.* at 14-15, 22. Thus, competing domestic supplies of enrichment services may be somewhat less likely than anticipated, at least in the short run.

In summary, the overall growth in demand for enrichment requirements is now projected to be somewhat lower than before the Fukushima event and global economic downturn.

However, the demand is still projected to grow substantially over the next two decades. Further, the net impact of delays and uncertainties associated with the other proposed U.S. projects (ACP and EREF) on the quantity of domestic enrichment services clearly is negative, which reinforces the need for the GLE Facility. As explained by Mr. Schwartz in Section III above, even under ERI's Reference forecast, there is strong support for the conclusion that the additional domestic enrichment capacity to be provided by the GLE Facility is needed. This is especially the case when the clear national policy-related and commercial benefits of having diverse, reliable sources of domestic enrichment services are included in the cost-benefit analysis.

VI. DISCUSSION OF TOPIC 5.E: IMPACT OF DELAY IN PRECONSTRUCTION ACTIVITIES

Q49. In light of GLE's not yet having begun preconstruction activities, will the schedule for completing construction be compressed and, if so, will the environmental impact of construction activities therefore increase on an annual basis?

A49. **[JO]** As stated in GLE's May 2, 2012, response to the Licensing Board's FEIS Question No. 12, the 2014 operations start-up date listed in the ER was GLE's best estimate at the time it prepared the ER. That date is subject to reevaluation and adjustments, as necessary. At present, no alternative start-up operations date has been established.

Despite delays in preconstruction activities (and, thus, likely commensurate delays in facility construction and start-up), GLE does not intend to expedite or compress the schedule to complete construction. Therefore, the environmental impacts of construction activities will not increase on an annual basis. The impacts of construction activities will remain as they are described in GLE's ER and the NRC Staff's FEIS.

VII. DISCUSSION OF TOPIC 5.F: FACILITY ELECTRICAL REQUIREMENTS

Q50. Per the Board's question in Topic 5.F., has GLE taken any steps to ensure that existing electrical utility lines would support the electrical energy demands of the proposed GLE Facility? And, if so, has Progress Energy provided written confirmation?

A50. **[JO]** Yes. GLE has confirmed with Progress Energy ("Progress") that sufficient capacity exists at the Sutton Electrical Plant (SEP) to supply the expected electrical energy demands (approximately 120MW) of the proposed GLE Facility. To meet the estimated demand, Progress has informed GLE that certain upgrades to the existing 115kV feeder line and terminals will be required. The upgrades are:

- Increase Sutton Plant-Wilmington Global Nuclear Fuels (GNF) 115kV Feeder line rating to full conductor capacity;
- Increase SEP line terminal rating to serve additional GLE load;
- Remove and reconfigure a section of the 115kV line on the GEH/GNF/GLE property;
- Install 115kV tap and point of distribution with metering on the GEH/GNF/GLE site.

In February 2009, GLE and Progress entered into a written agreement to perform the planning and preliminary design necessary to support the additional electricity demand. Letter from Tammy Orr, GLE to John Jackson, Carolina Power & Light Company, d/b/a Progress Energy Carolinas, Inc. (Feb. 20, 2009) (Exhibit GLE-016). By agreement of the parties, such planning and preliminary design work was put on hold as a result of GLE Facility project delays.

In September of 2011, GLE met with a representative of Progress and discussed, among other items, its intention to resume planning and preliminary design when a decision is made to proceed with construction of the proposed GLE Facility. The representative reaffirmed in writing Progress Energy's ability and willingness to provide the requested services, pending a similar written agreement. E-mail from E. Sholar Powell, Jr., Progress Energy Carolinas, Inc. to Peter Mancini, GE Capital, "Subject: GLE - Response to Change in Scope of Work" (Sept. 13, 2011) (Exhibit GLE-017).

VIII. DISCUSSION OF TOPIC 5.G: IMPLEMENTATION OF MITIGATION MEASURES

Q51. Per the Licensing Board's question in Topic 5.G., if presently known, what specific mitigation measures does GLE plan to implement from Table 5-1 and from Table 5-2 of the FEIS? If not presently known, when will GLE make those decisions?

A51. **[JO, KM]** GLE will implement the mitigation measures listed in Table 5-1 of the FEIS that are required by federal, state, and local regulations. GLE also will implement those mitigation measures that were factored into the ER's analysis of environmental impacts (*e.g.*, GLE's fugitive dust modeling considered water spraying for dust suppression).

To the extent practicable, GLE will implement additional mitigation measures from Table 5-1 of the EIS as well as those identified by the NRC Staff in Table 5-2 of the FEIS. GLE will consider the following factors in determining which mitigation measures will be implemented:

- Regulations or ordinances that require implementation (*e.g.*, construction best management practices (BMPs) per New Hanover County Erosion and Sedimentation Control Ordinance)
- Availability (*e.g.*, low-sulfur fuel oil and ultra-low sulfur diesel fuel)
- The potential for conflicts among mitigation measures (*e.g.*, conducting soil-disturbing activities during favorable meteorological conditions versus timing activities in consideration of noise and traffic impacts)
- Safety and security considerations
- Overall feasibility with respect to project schedule
- Cost-benefit analysis.

GLE's present implementation plans regarding the mitigation measures listed in FEIS Tables 5-1 and 5-2, including the relevant project phase(s) (*i.e.*, Preconstruction, Construction, Operation, and Decommissioning) during which such measures will or might be implemented, are provided in Tables 5G-1 and 5G-2, below, which are amended versions of the FEIS tables that we prepared for purposes of this testimony. Specifically, we have reproduced FEIS Tables 5-1 and 5-2 and added two additional columns—"GLE to Implement" and "Phase."

Table 5G-1. Summary of Mitigation Measures Proposed by GLE

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
Land Use	Land disturbance	Use existing service road routes and utility rights-of-way (ROWs) to the extent practicable to minimize the need for clearing additional wooded areas.	Yes, to the extent practicable.	Pre-construction and Construction
		Use existing wastewater treatment and solid waste management infrastructure to the extent practicable to reduce the total area needed for construction and operation of the proposed facility.	Yes, to the extent practicable.	Construction and Operation
Historic and Cultural Resources	Disturbance of prehistoric archaeological sites eligible for listing on the *National Register of Historic Places*	To prevent disturbance of site 31NH801, maintain conditions of the bank at the side of the existing gravel road unchanged from its current graded and vegetated state.	Yes, to the extent practicable.	Construction
		Signs are posted to prevent unauthorized excavation.	Yes.	Construction, Operation, and Decommissioning
Visual and Scenic Resources	Potential visual intrusions in the existing landscape character	Locate the proposed facility in a sector of the Wilmington Site away from site boundaries bordering existing development along NC 133 and I-140.	Yes, to the extent practicable. However, security protocols will also be considered.	Construction
		To the width practicable, maintain the existing tree buffer along the northeast Wilmington Site boundary to limit visibility of the proposed facility structures and access road traffic from offsite viewpoints in nearby residential neighborhoods.	Yes, to the extent practicable. However, security protocols will also be considered.	Construction
		Use exterior building colors and landscaping that would soften the visual impact of the proposed facility	Yes, to the extent practicable.	Construction and Operation
Air Quality	Fugitive dust, construction equipment, and facility operation emissions	Water the facility site and unpaved roads to reduce dust.	Yes.	Pre-construction and Construction
		Remove dirt from truck tires by driving over a gravel pad prior to leaving the facility site or unpaved access road to avoid spreading sediments on paved roads.	Yes.	Pre-construction and Construction
		Cover trucks carrying soil and debris to reduce dust emissions from the back of trucks driving on roadways.	Yes.	Pre-construction and Construction

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
		Pave access road and parking lots as soon as practicable.	Yes.	Pre-construction and Construction
		Conduct uranium-enrichment operations inside an enclosed building using a closed-system process with no routine venting of process gases.	Yes, in accordance with GLE's License Application commitments.	Operation
		Install and operate leak-detection monitors for process equipment. In the event a leak is detected due to an equipment component malfunction or other reason, safety interlocks will isolate the section of the process where the leak is detected, limiting the potential quantity of gaseous material that could be released inside the proposed facility operations building.	Yes, in accordance with GLE's Waste Minimization Plan.	Operation
		Maintain process areas inside the operations building under continuous negative pressure relative to atmospheric pressure. In the event of a gaseous release in one of these process areas, the negative pressure conditions would prevent outflow of the air from the process areas, effectively containing the released gaseous material to the affected process area.	Yes, in accordance with GLE's ISA commitments	Operation
		Ventilate the operations building with a high-efficiency, multi-stage air emissions control system. Components of the air emissions control system planned for the operations building consist of high-efficiency particulate arresting (HEPA) filters for removal of solid particulate matter and activated carbon beds for adsorption of hydrogen fluoride (HF). Exhaust gases from this emission-control system would be vented to the atmosphere through a single stack.	Yes, in accordance to emission limits and other conditions specified in the site-specific state air permit for the facility to be issued by the North Carolina Division of Air Quality (NC DAQ).	Operation
		Implement a periodic inspection and maintenance program for uranium hexafluoride (UF_6) cylinders stored in outdoor areas.	Yes, in accordance with GLE's License Application commitments.	Operation

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
		Burn low-sulfur fuel oil in the auxiliary diesel generators.	Yes, Federal EPA rule requires sulfur level for nonroad diesel fuel be ≤15 ppm/gal.	Operation
		Store organic solvents, paints, and other volatile organic compound–containing liquids in containers covered with tightly fitting lids.	Yes, in accordance with OSHA requirements and Best Management Practices.	Construction and Operation
Geology and Soil Resources	Soil disturbance and contamination	Minimize the construction footprint to the extent possible.	Yes.	Pre-construction
		Engineer design plans that minimize soil disturbance during construction activities.	Yes. Implemented in compliance with approved erosion and sedimentation control plan and permit.	Pre-construction and Construction
		If additional soil is necessary for construction purposes, use soils from onsite borrow pits that are accessible via existing roadbeds, to minimize disturbance to other areas of the Wilmington Site outside of the GLE study area.	Yes, to the extent practicable.	Construction
		Manage construction activities so that only designated areas within the GLE study area are disturbed and so that no heavy equipment or construction operations are allowed to affect areas outside the study area unless specifically designated, such as potential use of existing onsite borrow areas.	Yes, to the extent practicable.	Construction
		Use adequate containment methods during excavation and/or similar operations.	Yes. Implemented in compliance with approved erosion and sedimentation control plan and permit.	Construction
		Use site-stabilization practices (i.e., placing crushed stone on top of disturbed soil in areas of concentrated runoff).	Yes. Implemented in compliance with approved erosion and sedimentation control plan and permit.	Construction
		Use silt berms, dikes, and sediment fences.	Yes. Implemented in compliance with approved erosion and sedimentation control plan and permit.	Construction
		Stabilize drainage culverts and ditches by lining surface with rock aggregate/rip-rap to	Yes. Implemented in compliance with approved	Construction

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
		reduce flow velocity and prohibit scouring.	erosion and sedimentation control plan and permit.	
		Reuse and/or appropriately place excavated materials to decrease exposed soil piles.	Yes. Implemented in compliance with approved erosion and sedimentation control plan and permit.	Construction
		Place gravel construction pads at the entrances/exits of construction acres.	Yes. Implemented in compliance with approved erosion and sedimentation control plan and permit.	Construction
		Stabilize site with low-maintenance landscaping and pavement.	Yes, to the extent practicable.	Construction and Operation
Surface Water Resources	Runoff	Follow proper construction Best Management Practices (BMPs) as specified by the New Hanover County Erosion and Sedimentation Control Ordinance (New Hanover County, 2007).	Yes in accordance with New Hanover County ordinances.	Construction
		Construct an access road perpendicular to Unnamed Tributary #1 to minimize the area impacted.	Yes, to the extent practicable.	Pre-construction and Construction
		Design and construct the upgrade of the crossing over Unnamed Tributary #1 following procedures required by the New Hanover County Flood Damage Prevention Ordinance (New Hanover County, 2006).	Yes, in accordance with New Hanover County ordinances.	Pre-construction and Construction
		Construct a stormwater wet detention basin and implement a Wilmington Site stormwater management plan to mitigate a portion of the increased floodwaters from extreme storm events and all stormwater from smaller storm events.	Yes, in accordance with New Hanover County ordinances.	Pre-construction and Construction
		Limit cut/fill slopes to a horizontal-vertical ratio of 3:1 or less.	Yes. Implemented in compliance with approved erosion and sedimentation control plan and permit.	Pre-construction and Construction
		Use silt fencing and covering of soil stockpiles to prevent sediment runoff.	Yes. Implemented in compliance with approved	Pre-construction and Construction

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
			erosion and sedimentation control plan and permit.	
		Suspend general construction activities during storms and impending precipitation.	Yes, to the extent practicable.	Construction
		Construct stream crossings (i.e., installation of culverts) following at least 48 hours of dry weather.	Yes. Implemented in compliance with approved erosion and sedimentation control plan and permit.	Construction
		Divert stream flow during stream-crossing construction to minimize excavation in flowing water.	Yes. Implemented in compliance with approved erosion and sedimentation control plan and permit.	Construction
		Maintain construction equipment so that equipment is in good repair and without visible leaks of oil, greases, or hydraulic fluids.	Yes, to the extent practicable.	Construction
		Restore disturbed areas to original surface elevations, where possible.	Yes. Implemented in compliance with approved erosion and sedimentation control plan and permit.	Construction
		Comply with all National Pollutant Discharge Elimination System (NPDES) stormwater and wastewater permit requirements.	Yes, as required by applicable laws and regulations.	Construction; Operation; Decontamination and Decommissioning
		Route stormwater from the proposed facility to a new stormwater wet detention basin, designed in accordance with the North Carolina Department of Environment and Natural Resources (NCDENR) Stormwater Best Management Practices Manual (NCDENR, 2007).	Yes, as required by applicable laws and regulations.	Pre-construction/construction
		Perform onsite treatment of process and sanitary wastewaters to NPDES-permit limits before discharge to receiving waters.	Yes, as required by applicable laws and regulations.	Operation
		Routinely monitor and inspect onsite liquid waste storage tanks and containers to detect any leaks or releases to the environment due to equipment malfunctions to ensure that actions according to the Spill Prevention	Yes, as required by applicable laws and regulations.	Operation

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
		Control and Countermeasure (SPCC) plan or other appropriate corrective action can be taken promptly.		
		Discharge stormwater runoff from UF6 storage pads area to a holding pond for monitoring prior to discharge to the stormwater wet detention basin.	Yes, in accordance with GLE License Application commitments.	Operation
		Perform periodic visual inspections of the stormwater wet detention basin to verify proper function, at a frequency sufficient to allow for identification of basin high-water-level conditions and implementation of corrective actions to restore the water level prior to overflow.	Yes, as required by applicable laws and regulations.	Operation
		Ensure easy access to the stormwater wet detention basin to allow the prompt, systematic sampling of runoff.	Yes, to the extent practicable.	Operation
Floodplains	Floodplain disturbance	Select a non-wetland, non-floodplain area for the proposed facility.	Yes, to the extent practicable.	Pre-Construction
Groundwater Resources	Infiltration	Implement hazardous material and waste-handling procedures and secondary containment, as required by applicable laws and regulations.	Yes, as required by applicable laws and regulations.	Construction; Operation; Decontamination and Decommissioning
	Water Use	Provide water necessary during construction via tanker truck from off-site potable water sources.	Yes.	Construction
		Reuse treated sanitary wastewater effluent as makeup water in Wilmington Site cooling towers.	Yes, but dependent on cooling tower demand.	Operation; Decontamination and Decommissioning
		Routinely monitor sitewide groundwater levels, and continue to analyze the groundwater monitoring-well and pumping-well networks to confirm that changes in groundwater levels associated with the proposed action are minimal.	Yes, in accordance with GLE License Application commitments.	Operation; Decontamination and Decommissioning
		Readjust pumping well rates and/or perform well maintenance or rehabilitation, as appropriate, in the event of unexpected	Yes, in accordance with GLE License Application commitments.	Operation; Decontamination and Decommissioning

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
		changes in groundwater levels.		
		Use low-water-consumption landscaping. Install low-flow toilets, sinks, and showers.	Yes, to the extent practicable.	Operation; Decontamination and Decommissioning
		Perform localized floor washing using mops and self-contained cleaning machines to reduce water usage compared to conventional washing techniques.	Yes, to the extent practicable.	Operation; Decontamination and Decommissioning
Ecological Resources	Disturbance of habitats	Minimize the construction footprint to the extent possible and limit habitat disruption.	Yes.	Pre-Construction
		Perform surveys of trees greater than 61 centimeters (24 inches) in diameter before beginning preconstruction and construction activities, and plant one 61-centimeter (24-inch) diameter tree, two 30.5-centimeter (12-inch) diameter trees, or three 20.3-centimeter (8-inch) diameter trees elsewhere on the Wilmington Site.	Yes, as required by New Hanover County ordinance.	Pre-Construction and Construction
		Restrict preconstruction activities and the harvesting of trees to periods when the ground is dry.	Yes, to the extent practicable.	Construction
		If trenches are necessary, ensure that they are closed overnight; inspect trenches left open overnight and remove animals prior to backfilling.	Yes, to the extent practicable.	Construction
		Place escape ramps in trenches at less than 45-degree angles to provide exit strategies for animals.	Yes, to the extent practicable.	Construction
		Sod, seed, and/or landscape disturbed areas of the study area in accordance with the Sediment and Erosion Control Permit.	Yes. Implemented in compliance with approved erosion and sedimentation control plan and permit.	Construction
		Install animal-friendly fencing around the proposed facility site so that wildlife cannot be injured by or entangled in the site's security fence.	Yes, to the extent practicable.	Construction
		Plant native plant species (i.e., not invasive species) to revegetate disturbed areas and for landscaping.	Yes, to the extent practicable.	Construction and Operation

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
		Use nectar- and berry-producing plants for landscaping plants.	Yes, to the extent practicable.	Construction and Operation
		Conduct site-stabilization practices to reduce the potential for erosion and sedimentation.	Yes, to the extent practicable.	Construction and Operation
		Place bluebird boxes throughout the study area.	Yes, to the extent practicable.	Construction and Operation
		Establish food plots along roadways and under power lines.	No food plots will be established along roads as this increases risk of mortality from vehicle strikes.	Construction and Operation
		Consider the recommendations of appropriate State and Federal agencies, including the U.S. Fish and Wildlife Service (FWS) and NCDENR.	Yes.	Pre-construction and Construction
	Wetland disturbance	Select a non-wetland, non-floodplain area for the proposed facility.	Yes, to the extent practicable.	Pre-construction and Construction
		Use existing service road routes and utility ROWs to the extent practicable to minimize the need for additional wetlands crossings.	Yes, to the extent practicable.	Pre-construction and Construction
		Construct access road perpendicular to wetland to minimize the area impacted.	Yes, to the extent practicable.	Pre-construction and Construction
		Limit cut/fill slopes to a horizontal-vertical ratio of 3:1 or less.	Yes, to the extent practicable.	Construction
		Avoid temporary storage of materials in wetlands during construction.	Yes.	Construction
		Maintain the hydrological connectivity of wetlands to surface waters.	Yes.	Construction
		Place fencing/barriers and use signs around wetland areas.	Yes.	Construction
		Use silt fencing and cover soil stockpiles to prevent sediment runoff.	Yes. Implemented in compliance with approved erosion and sedimentation control plan and permit.	Construction

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
		Restore disturbed areas to original surface elevations.	Yes.	Construction
		Revegetate disturbed areas with native plant species.	Yes. Implemented in compliance with approved erosion and sedimentation control plan and permit.	Construction
Noise	Exposure of workers and the public to noise	Prohibit heavy truck and earth-moving equipment usage after twilight and during early morning hours.	Yes, as required by New Hanover County permitting. Note: Delivery trucks will operate at night during operation.	Construction and Decommissioning
		Equip construction equipment with the manufacturer's noise-control devices, and maintain these devices in effective operating condition.	Yes, to the extent practicable.	Construction; Operation; Decommissioning
		When possible, use quiet equipment or methods to minimize noise emissions.	Yes, to the extent practicable.	Construction; Operation; Decommissioning
		For equipment with internal combustion engines, operate equipment at the lowest operating speed to minimize noise emissions, when possible and practical.	Yes, to the extent practicable.	Construction; Operation; Decommissioning
		Close engine-housing doors during operation of equipment to reduce noise emissions from the engine.	Yes, to the extent practicable.	Construction; Operation; Decommissioning
		Avoid equipment engine idling.	Yes, to the extent practicable.	Construction; Operation; Decommissioning
		Use quieter, less-tonal devices that comply with all applicable safety restrictions (e.g., Occupational Safety and Health Administration [OSHA] standards) on back-up alarms for construction equipment.	Yes, to the extent practicable.	Construction and Decommissioning
		Use a quieter, high-efficiency transformer to mitigate noise from the proposed electrical substation.	Yes, to the extent practicable.	Operation
Transportation	Traffic volume	Locate the proposed facility near an interstate highway interchange to minimize the distance that truck traffic must travel on local surface streets and to facilitate	Yes.	Pre-construction and Construction

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
		employee commuter traffic.		
		Increase the number of entry gates onto the Wilmington Site from NC 133 (Castle Hayne Road), including one dedicated to worker entrance/exit.	Yes, will consult with NCDOT to minimize local traffic impacts.	Pre-construction and Construction
		Add roadway improvements (e.g., a turn lane) to NC 133 as required by the North Carolina Department of Transportation (NCDOT) for issuance of a driveway permit for connections of the new entrance.	Yes, as required by NCDOT.	Pre-construction and Construction
		Work with NCDOT to evaluate driveway- and roadway-improvement options to minimize impacts.	Yes, will consult with NCDOT to minimize local traffic impacts.	Pre-construction and Construction
		Schedule worker shift intervals so that shift start and end times are staggered from peak periods of worker-commuting traffic for existing site facilities and other planned operations.	Yes, to the extent practicable.	Operation
		Promote carpooling among construction and operations workers to help reduce congestion by minimizing the additional number of vehicle trips necessary during peak commuting periods.	Yes, to the extent practicable.	Operation
		Route truck shipments of radioactive materials around cities by using a U.S. Interstate Highway System bypass or beltway (when available).	Yes, to the extent practicable.	Operation
		Schedule truck deliveries and shipments for off-peak traffic periods to reduce potential congestion on local roadways during peak worker commuting periods.	Yes, to the extent practicable.	Operation
Public and Occupational Health	Facility operation	Install a building ventilation system to maintain the majority of the interior of the process building under sub-atmospheric pressure. Install alarms in the Emergency Control Center to detect, alarm, and/or activate the automatic safe shutdown of process equipment in the event of operational problems.	Yes, in accordance with GLE License Application and Emergency Preparedness commitments.	Operation

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
		Isolate leaks and shut down process lines to prevent damage to equipment	Yes.	Operation
		Vent exhaust gases from the emission control system to the atmosphere through a single rooftop stack.	Yes.	Operation
		Install radiation monitors in effluent stacks to detect, alarm, and activate the automatic safe shutdown of process equipment, should contaminants be detected in the system exhaust.	Yes, in accordance with GLE License Application commitments.	Operation
		Comply with all applicable State, NRC, and OSHA regulations concerning worker health and safety, as well as the existing Wilmington Site Nuclear Safety Program and the Industrial Safety Program. Comply with the Site Radiation Protection Program, the SPCC plan, and the GLE Environmental, Health, and Safety Program. Conduct routine radiological surveys to characterize and minimize potential radiological exposure.	Yes, in accordance with GLE License Application commitments.	Operation
		Monitor all radiation workers via the use of dosimeters and area air sampling to ensure that radiological doses remain within regulatory limits and As Low As Reasonably Achievable (ALARA).	Yes, as required by applicable laws and regulations	Operation
		Conduct operations activities involving hazardous respirable effluents with ventilation control and/or respiratory protection, as required.	Yes, as required by applicable laws and regulations.	Operation
		Use personal protective equipment based on the nature of the work and chemical and/or radiological hazards present.	Yes, as required by applicable laws and regulations.	Operation
		Perform environmental monitoring and sampling to ensure compliance with regulatory discharge limits.	Yes, in accordance with GLE License Application commitments.	Operation
		Route treated process wastewater effluents to the existing final process lagoon facility for additional treatment.	Yes, in accordance with GLE License Application commitments.	Operation
Waste	Generation of industrial,	Select the laser enrichment process to reduce	Yes, to the extent	Pre-construction and

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
Management	hazardous, radiological, and mixed wastes (air emissions are addressed under Air Quality and liquid emissions are addressed under Groundwater and Surface Water Resources)	the amount of waste generated for production of the same amount of enriched product.	practicable.	Construction
		Minimize the quantities of waste generated by the proposed facility by implementing the Waste Minimization Plan.	Yes, in accordance with GLE License Application commitments.	Operation
		Perform an integrated safety analysis (ISA) for each onsite waste storage area to identify and prevent accidental releases to the environment.	Yes, in accordance with 10 CFR Part 70 requirements.	Operation
		Monitor and inspect onsite liquid waste storage tanks and containers on a periodic schedule to detect leaks or releases to the environment due to equipment malfunctions so that actions identified in the SPCC plan or other appropriate corrective action can be taken promptly.	Yes, in accordance with GLE License Application commitments.	Operation
		Use the existing Wilmington Site onsite wastewater treatment facilities within current regulatory permit limits to avoid the need to add new onsite waste treatment and disposal facilities for the proposed facility.	Yes, to the extent practicable.	Operation
		Pre-treat radioactive liquid wastewaters in a treatment system planned for the proposed facility before the wastewater effluent is pumped to the existing NPDES-permitted final process lagoon facility for further treatment.	Yes, in accordance with GLE License Application commitments.	Operation
		Ship each waste generated by the proposed facility that requires offsite storage, treatment, or disposal to a licensed facility (as appropriate for the waste type) in compliance with U.S. Environmental Protection Agency (EPA) and NRC requirements.	Yes, as required by applicable laws and regulations.	Operation
		Minimize onsite storage volumes and times and ship waste destined for offsite treatment and disposal facilities as soon as practicable.	Yes, to the extent practicable.	
		Conduct onsite treatment of process and	Yes, as required by	Operation

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
		sanitary wastewaters to NPDES permit limits before discharge to receiving waters.	applicable laws and regulations.	
		Avoid and minimize potential hazardous and radiological waste impacts from the UF6 storage pads by implementing design elements and safety procedures during operation, including: Use of a storage array that permits easy visual inspection (stacked no more than two cylinders high); Segregation of storage pad areas from the rest of the enrichment facility by barriers (e.g., vehicle guardrails); Inspection of cylinders for external contamination (i.e., a "wipe test") prior to placing on the storage pads or transporting them offsite; Ensuring that UF6 cylinders are not equipped with defective valves; Allowing only designated vehicles with a limited amount of fuel in the storage pad area; Allowing only trained and qualified personnel to operate vehicles in the storage pad area; and Monitoring the holding pond that collects stormwater from the cylinder pads.	Yes, in accordance with GLE License Application commitments.	Operation
		Inspect cylinders of UF6 initially prior to placing a filled cylinder on a storage pad and, thereafter, inspect periodically for damage or surface coating defects. Inspection criteria would include ensuring that: Lifting points are free from distortion and cracking; Cylinder skirts and stiffener rings are free from distortion and cracking; Cylinder surfaces are free from bulges, dents, gouges, cracks, or significant corrosion;	Yes, in accordance with GLE License Application commitments.	Operation

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
		Cylinder valves are fitted with the correct protector and cap; Cylinder valves are straight and not distorted, two to six threads are visible, and the square head of the valve stem is undamaged; and Cylinder plugs are undamaged and not leaking.		
		If inspections of a cylinder reveal significant deterioration or other conditions that may affect its safe use, transfer the contents of the cylinder to another cylinder and discard the defective cylinder. Investigate the cause of any significant deterioration, and if necessary, perform additional inspection of cylinders.	Yes, in accordance with GLE License Application commitments.	Operation
		Conduct continuous or periodic monitoring of waste management processes and storage facilities for the detection of non-intentional releases to the environment, so that corrective actions would be taken to minimize adverse impacts on the environment. For example, directing stormwater runoff from the UF6 storage pads to a holding pond, where it would be monitored to ensure that unexpected radioactive material releases to the wet detention basin did not occur.	Yes, in accordance with GLE License Application commitments.	Operation
Accidents	Accident prevention and consequence management	Incorporate the following features into facility design to mitigate fire and explosion accidents: Fire alarm and detection systems, including suppression capability; Fire barriers to prevent propagation of fire in and out of areas containing uranic material; System and component design features that isolate combustible material and/or shut down affected systems; Continuous detection of a flammable gas in the laser systems, for automatic isolation	Yes, in accordance with GLE License Application commitments.	Operation

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
		in the event of high readings; Structural design features that ensure peak explosive blast loads and eliminate or minimize propagation of structural material into a UF6 process or handling area; and Limit combustibles in outside areas where cylinders are stored.		
		Incorporate the following features into facility design and operating procedures to mitigate criticality accidents, and to contain UF6 gas within specified building areas and attenuate any release to the environment: Maintain safe geometry of all vessels, containers, and equipment containing fissile material and ensure that the concentration and/or mass of fissile material is limited to a specified amount; Install radiation detection and criticality monitoring systems to quickly alert personnel and isolate systems when parameters exceed expected limits; Physically separate areas within the facility to prevent or reduce exposure; Control positive or negative air pressures within designated areas to prevent or maintain leakage between facility areas; Install carbon absorbers, HEPA filters, and, where necessary, automatic trips for ventilation systems to help minimize the potential for a release outside the affected area; and Implement appropriate door and building design features to limit leakage paths to the outside environment.	Yes, in accordance with GLE License Application commitments.	Operation

Table 5G-2. Summary of Potential Mitigation Measures Identified by NRC

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
Land Use	Land disturbance	Construction BMPs required under the New Hanover County Soil Erosion and Sedimentation Ordinance are listed under Geology and Soil. Following those measures would help moderate the short-term land use effects associated with preconstruction and construction activities.	Yes, as required by applicable laws and regulations.	Construction
		Use BMPs to control waste disposal, erosion, and runoff to help restrict the effect of facility operation on surrounding land use.	Yes, as required by applicable laws and regulations.	Operation
Historic and Cultural Resources	Disturbance of prehistoric archaeological sites and sites eligible for listing on the *National Register of Historic Places*	Follow internal procedural guidance for unexpected archaeological discoveries, including the unexpected discovery of human remains. The procedures include notification of certain local and State agency representatives, including the State Archaeologist. Consider the effect of facility activities on historic and cultural resources, as required by the license condition (which would be applicable if the license is granted).	Yes, in accordance with GLE License Application commitments.	Construction; Operation; Decommissioning
Visual and Scenic Resources	Potential visual intrusions in the existing landscape character	Plant additional vegetation on the perimeter of the facility site to help screen the study area.	Yes, to the extent practicable. However, security protocols will also be considered.	Construction; Operation
Air Quality	Fugitive dust, construction equipment, and facility operation emissions	Post speed limits (e.g., 10 mph) visibly within the construction site, and enforce them to minimize airborne fugitive dust.	Yes.	Construction
		Limit access to the construction site and staging areas to authorized vehicles only, through the designated treated roads.	Yes, to the extent practicable.	Construction
		Stage construction to limit the exposed/disturbed area at any given time, when practical.	Yes, to the extent practicable.	Construction
		Train workers to comply with the speed limit, use good engineering practices, minimize drop height of materials, minimize disturbed areas, and employ other BMPs as appropriate.	Yes.	Construction

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
		To the extent practicable, conduct soil-disturbing activities and travel on unpaved roads during periods of favorable meteorological conditions, as conducting these activities during periods of unfavorable meteorological conditions may result in exceedances of air quality standards. Unfavorable meteorological conditions are infrequent and include (1) periods of low winds, stable, and relatively low mixing height conditions (primarily encountered around sunrise in colder months from late fall to early spring) and (2) periods of high winds.	Yes, to the extent practicable.	Construction
		All heavy equipment should meet emission standards specified in the State Code of Regulations, and routine preventive maintenance, including tune-up to the manufacturer's specification, should be implemented to ensure efficient combustion and minimum emissions.	Yes, to the extent practicable.	Construction [Operations; and Decommissioning]
		Fuel all diesel engines used in the facility and auxiliary diesel generator units with ultra-low sulfur diesel with a sulfur content of 15 parts per million or less.	Yes, to the extent practicable.	Construction [Operations; and Decommissioning]
		Limit idling of diesel equipment to no more than 10 minutes, unless idling must be maintained for proper operation; for example, drilling, hoisting, and trenching.	Yes, to the extent practicable.	Construction [Operations; and Decommissioning]
		Implement more aggressive dust control measures during road construction and land clearing, such as more frequent water spraying and the application of an appropriate dust suppressant.	Yes, to the extent practicable.	Construction
Geology and Soil	Soil disturbance and contamination	Implement erosion control BMPs by following the New Hanover County Erosion and Sedimentation Control Ordinance.	Yes, as required by applicable laws and regulations.	Construction; Decommissioning
		Implement BMPs for storage, handling, spill prevention, and spill response to reduce the impact of soil contamination associated with fuels, oils, and grease from equipment used	Yes, as required by applicable laws and regulations.	Construction; Operation; Decontamination and Decommissioning

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
		onsite or from other chemicals or wastes managed onsite.		
Surface Water Resources	Runoff	Implement BMPs for storage, handling, spill prevention, and spill response to reduce the impact of surface water contamination associated with the runoff of fuels, oils, and grease from equipment used onsite or from other chemicals or wastes managed onsite.	Yes, as required by applicable laws and regulations.	Operation
Groundwater Resources	Infiltration	Implement BMPs for storage, handling, spill prevention, and spill response to reduce the impact of groundwater contamination associated with the accidental release of fuels, oils, and grease from equipment used onsite or from other chemicals or wastes managed onsite.	Yes, as required by applicable laws and regulations (e.g., SPCC rules).	Construction; Operation; Decontamination and Decommissioning
	Water Use	If the proposed action results in measurable onsite changes in groundwater levels, expand groundwater level monitoring to appropriate offsite areas.	Need and access to offsite measurement locations to be evaluated if necessary.	Operation; Decontamination and Decommissioning
Ecological Resources	Disturbance of habitats	Reduce or prevent the collection, harassment, or disturbance of plants, wildlife, and their habitats (particularly threatened, endangered, and sensitive species) through employee and contractor education on applicable State and Federal laws. Additionally, instruct all personnel to avoid harassment and disturbance of local plants and wildlife; make personnel aware of the potential for wildlife interactions around facility structures; and ensure that food refuse and other garbage is not available to scavengers.	Yes, to the extent practicable.	Construction; Operation; Decontamination and Decommissioning Decommissioning
		Establish a trash abatement program that focuses on containing trash and food in closed containers and removing them periodically to reduce their attractiveness to opportunistic species, such as bears, coyotes, and feral dogs.	Yes, to the extent practicable.	Construction; Operation; Decontamination and Decommissioning
		Avoid known locations of listed plant species and habitats of listed wildlife species and establish a setback distance (minimum 60	Yes, in accordance with FWS requirements.	Construction; Operation; Decontamination and Decommissioning

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
		meters [200 feet]) to prevent any destructive impacts associated with construction and decommissioning activities.		Construction; Operation; Decontamination and Decommissioning
		Minimize the number of areas where wildlife could hide or be trapped (e.g., open sheds, pits, uncovered basins, and laydown areas).	Yes, to the extent practicable.	
		If any Federally threatened or endangered species such as the roughleaf loosestrife or the red-cockaded woodpecker are encountered, consult with FWS (as required by Section 7 of the Endangered Species Act [ESA]) and determine an appropriate course of action to avoid or mitigate impacts.	Yes, in accordance with FWS requirements.	Pre-Construction
		Observe all trees >61 centimeters (24 inches) identified during GLE's surveys for potential compensatory tree plantings for the potential presence of red-cockaded woodpecker cavities. If any cavity trees are observed, consult the FWS (as required by Section 7 of the ESA) and determine an appropriate course of action to avoid or mitigate impacts.	Yes, to the extent practicable trees will be survey. Yes, if cavity trees are observed, the FWS will be consulted in accordance with the ESA.	Pre-construction and Construction
		Develop an integrated vegetation management plan for the control of noxious weeds and invasive plant species.	Yes, to the extent practicable.	Pre-construction and Construction
		Minimize the area disturbed by preconstruction activities and the installation of facilities (pipelines, transmission towers, pump stations, substations, laydown areas, assembly areas) to retain native vegetation and minimize soil disturbance.	Yes, to the extent practicable.	Construction
		Backfill open trenches as quickly as is reasonable.	Yes, to the extent practicable.	Construction
		To the extent practicable, avoid the use of guy wires, which pose a collision hazard for birds.	Yes, to the extent practicable.	Construction; Operation
		Maintain areas left in a natural condition during construction (e.g., wildlife crossings) in as natural a condition as possible within safety and operational constraints.	Yes, to the extent practicable.	Construction

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
		To minimize habitat loss and fragmentation, reestablish as much habitat as possible after construction is complete by maximizing the area reclaimed or re-vegetated during operations	Yes, to the extent practicable.	Construction
		Prevent the establishment and spread of invasive species and noxious weeds within the transmission line ROW, along the access road, and in associated areas of ground surface disturbance or vegetation cutting. Monitor the area regularly and eradicate invasive species immediately.	Yes, to the extent practicable.	Operation
Noise	Exposure of workers and the public to noise	When possible, schedule different noisy activities to occur at the same time. Less-frequent but noisy activities would generally minimize overall noise disturbance compared to lower-level noise occurring more frequently.	Yes, GLE Industrial Health and Safety will monitor noise levels during construction, and take corrective actions when appropriate.	Construction, operation and decommissioning
		Implement noise control measures (e.g., erection of temporary wooden noise barriers) if noisy activities would be expected near sensitive receptors.	Unlikely (such barriers are unlikely to provide noise control benefits during these phases).	Construction and decommissioning
		Operate all vehicles traveling within and around the project area in accordance with posted speed limits.	Yes.	Construction; Operation; and Decommissioning
		Post warning signs in high noise areas and implement a hearing protection program for work areas in excess of 85 dBA.	Yes, in accordance with GLE's Industrial Health and Safety program, and applicable OSHA requirements.	Construction, operation and decommissioning
		Because complaints about noise may occur even when noise levels from the facility do not exceed regulatory or guideline levels, implement a noise complaint process and hotline for the surrounding communities, including documentation, investigation, evaluation, and resolution of all legitimate project-related noise complaints.	Yes, GE already maintains a Communications Program for community concerns.	Construction, operation and decommissioning
Public and Occupational	Effects from facility	Move UF6 cylinders only when cool and when UF6 is in solid form, to minimize the risk of	Yes, in accordance with GLE	Operation

Impact Area	Activity	Proposed Mitigation Measures	GLE to Implement	Phase
Health	operation	inadvertent release due to mishandling.	ISA commitments.	
		Direct process off-gas from UF6 purification and other operations through cold traps to solidify and reclaim as much UF6 as possible. Pass remaining gases through high-efficiency filters and chemical absorbers to remove hydrogen fluoride and uranic compounds.	Yes, in accordance with GLE ISA commitments.	Operation
		Separate uranic compounds and various other heavy metals in waste material generated by decontamination of equipment and systems	Yes, in accordance with GLE ISA commitments.	Operation

IX. SUMMARY AND CONCLUSIONS

Q52. Please summarize the key points and conclusions from your testimony above.

A52. **[JO]** The Proposed Action's purpose and need are described in ER Section 1.2 in accordance with NRC regulations and guidance. As described in the ER, the purpose of the proposed action is to license GLE to construct and operate the GLE Facility at the Wilmington Site in New Hanover County, North Carolina. GLE would employ a laser-based enrichment process to enrich uranium to up to 8 percent uranium-235 by weight, with an initial planned maximum target production of 6 million separative work units (SWU) per year.

If an NRC license is granted this year and GLE opts to proceed with construction of a commercial facility, then GLE anticipates that the earliest that such facility might be expected to begin operation is 2014. Since GLE will not expedite or compress the schedule to complete construction to offset delays in preconstruction activities, the environmental impacts of construction activities will not increase on an annual basis relative to those impacts described in the ER and FEIS. GLE anticipates that it will reach an enrichment capacity of one million SWU by the end of the first year, with annual production increasing by one million SWU per year until the facility achieves its full capacity of six million SWU per year in 2020.

As stated in the ER and discussed above, the proposed GLE Facility will, among other things, satisfy the need for: (1) enriched uranium to fulfill nuclear electrical-generation requirements, (2) additional domestic uranium enrichment capacity for national energy security, and (3) a more advanced uranium enrichment technology in the United States. As required by NEPA and NRC regulations, GLE considered a range of alternatives to the Proposed Action, including: (1) the No-Action Alternative; (2) alternative sites for the GLE Facility; (3) alternative locations at the preferred Wilmington Site; and (4) alternative technologies that are available for uranium enrichment. All of the site, location, and technology alternatives were appropriately eliminated from further consideration in the ER before comparison of the Proposed Action and the No-Action Alternative.

[JO, KM] GLE also identified mitigation measures in its ER that would reduce the environmental impacts associated with preconstruction activities and the Proposed Action. GLE will implement the mitigation measures listed in Table 5G-1, provided above, that are required by federal, state, and local regulations. GLE also will implement those mitigation measures that were factored into the ER's analysis of environmental impacts. In accordance with the criteria specified above (see A51), and to the extent practicable, GLE will implement additional mitigation measures identified in Table 5-G1 above as well as those recommended by the NRC Staff and identified in Table 5G-2 above.

[KH] In accordance with 10 CFR § 51.45 and NRC guidance, GLE performed a cost-benefit analysis of construction and operation of the GLE Facility, and compared the incremental costs of the Proposed Action to the increase in benefits over the No-Action Alternative. The results are summarized in Chapter 7 and Appendix U (proprietary) of the ER and provide a rationale for deciding the likelihood of a net positive economic impact resulting from the project; compare alternatives for achieving the stated purpose and needs of the proposed action; and provide an objective rationale for choosing between competing alternatives.

In its analysis, GLE compared the costs of the proposed GLE Facility to the projected economic and energy-related benefits, and qualitatively concluded that the benefits of the Proposed Action outweigh its costs. In particular, GLE concluded that the Proposed Action is preferable to the No-Action Alternative because it would contribute to meeting future U.S. enrichment requirements through domestic supply sources and increase national energy security by increasing the diversity and reliability of domestic enrichment services (thereby lessening U.S. dependence on foreign suppliers of enrichment services). If successfully deployed, it also would introduce a newer, more advanced enrichment technology that would be exclusive to the United States and potentially offer environmental and economic benefits relative to other enrichment technologies. The Proposed Action also would have positive socioeconomic impacts in the region of influence and on state and federal income taxes.

[MS, KH] As discussed above, the Fukushima event has precipitated a near-term decrease in world nuclear generating capacity and is expected to lessen the commitment of Japan and certain other nations to nuclear power in the long term. However, steady growth in nuclear power generation is expected in many other countries, notwithstanding current conditions. Forecasts developed by ERI and other entities (private and governmental) based on currently-available information indicate that the GLE Facility, along with other new enrichment facilities, are needed to avoid a shortage of U.S.-based enrichment supply relative to U.S. requirements at some point during the period 2016 through 2035. The current delays and uncertainties associated with the ACP and EREF projects underscore this possibility. In short, there is strong support for the conclusion that the additional domestic enrichment capacity to be provided by the GLE Facility is needed, especially when the national policy and commercial benefits of having diverse, reliable sources of domestic enrichment services are appropriately taken into account.

Q53. Does this conclude your testimony?

A53. **[All]** Yes.

Q54. In accordance with 28 U.S.C. § 1746, do you state under penalty of perjury that the foregoing testimony is true and correct?

A54. **[All]** Yes.

<u>*Executed in accord with 10 C.F.R. § 2.304(d)*</u>
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June 19, 2012

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EDUCATION

1992, BS Chemistry, University of New Orleans
1993, MS Environmental Science and Engineering, Virginia Tech
Post-Graduate Doctoral Courses, Environmental Systems Engineering, Clemson University

PROFESSIONAL EXPERIENCE

Global Laser Enrichment, Wilmington NC

Licensing and Regulatory Affairs Manager (4/10 to Present)

- Responsible for managing the Federal, State, and Local government interactions
- Responsible for obtaining a license from the Nuclear Regulatory Commission to construct and operate the commercial laser enrichment facility
- Technical lead for environmental issues

Senior Licensing Professional (10/07 to 4/10)

- Technical lead for preparing and submitting the Global Laser Enrichment License Application to the Nuclear Regulatory Commission
- Author of chemical safety, environmental protection, decommissioning, management measures, and administration chapters of the License Application
- Interface between design and safety analysis teams

Nuclear Regulatory Commission, Rockville, MD

Senior Project Manager (10/6 to 10/07)

- Project Manager for Category I fuel fabrication facility
- Project Manager for gas centrifuge facility
- Acted as the Section Chief from 08/01/05 to 10/14/05

- Senior environmental reviewer, which includes preparation of documentation (e.g., Environmental Assessments, Categorical Exclusions) to ensure compliance with the National Environmental Policy Act (NEPA)
- Senior analyst for evaluations involving decommissioning of fuel conversion and fabrication facilities
- Senior technical reviewer for licensing actions involving chemical safety
- Prepared budget for the branch to be used in strategic planning

Special Assistant to the Chairman for Materials and Security (10/05 to 10/06)

- Reviewed and evaluated Commission papers, and provided recommendations to the Chairman regarding technical and policy decisions
- Prepared Congressional correspondence from the Chairman regarding security and nuclear materials issues.
- Represented the Chairman in meetings with staff and industry

Project Manager (5/99 to 10/05)

- Project manager for four fuel fabrication facilities
- Lead environmental reviewer for the fuel manufacturing section, which included preparation of documentation (Environmental Assessments, Categorical Exclusions) to ensure compliance with the National Environmental Policy Act (NEPA)
- Lead analyst for evaluations involving decommissioning of fuel conversion and fabrication facilities
- Technical reviewer for licensing actions involving chemical safety

Dames and Moore, Orchard Park, NY

Engineering Specialist (4/97 to 4/99)

- Technical lead for field laboratory chemical analyses performed on soil and water samples for a chemical landfill remediation project at the U.S. Department of Energy's Brookhaven National Laboratory
- Project manager and lead author of the multi-volume West Valley Safety Analysis Reports, the primary document required by the Department of Energy to ensure safe operation and deactivation of nuclear facilities
- Lead analyst for all safety evaluations involving chemical reactions including the use of acids to clean out underground radioactive waste tanks, and the generation of oxides of nitrogen gases in process test facilities

- Authored extensive documentation including hazards assessments, facility deactivation plans, process safety requirements, procedural checklists, and position papers to demonstrate compliance with Department of Energy regulations and to ensure the safety of client activities
- Provided engineering calculations and technical guidance for Department of Energy contractors to ensure compliance with state emissions laws and reportable quantities of hazardous chemicals

Michael H. Schwartz

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EDUCATION

1971, BSE, Nuclear Engineering, University of Michigan
1972, MSE, Nuclear Engineering, University of Michigan

PROFESSIONAL REGISTRATION

Professional Engineer, State of California, No. 0618

PROFESSIONAL SOCIETIES

American Nuclear Society (ANS)
American Society of Mechanical Engineers (ASME)

PROFESSIONAL EXPERIENCE

<u>Energy Resources International, Inc.</u>

Chairman of the Board (1/1989 – Present)

- Oversees all consulting services provided to ERI clients, which include electric power companies, private industry, institutions and associations, and government agencies in the United States (U.S.) and abroad.
- Consults with clients regarding market analyses for all components of the nuclear fuel cycle, including uranium supply, conversion services, uranium enrichment services, fuel fabrication, and spent fuel storage and disposal.
- Provides assistance to clients pertaining to strategic planning, and commercial and economic evaluations. In the course of these activities performs viability assessments and due diligence reviews of major fuel supply companies, develops and supports the implementation of fuel procurement strategies, reviews commercial, economic and technical aspects of vendor proposals, and assists clients in contract negotiations; and performs impact assessments of government actions on the commercial industry.

- Prepares assessments of nuclear non-proliferation issues, plutonium disposition options, and utilization in the commercial nuclear fuel cycle of low enriched uranium (LEU) derived from high enriched uranium (HEU) originally produced as part of Former Soviet Union and U.S. nuclear weapons programs.
- Has supported applicants in both federal and state regulatory proceedings associated with matters such as the need for new uranium enrichment facilities in the U.S., as well as providing expert testimony in litigation related to pricing of uranium enrichment services by the U.S. government.

<u>Pickard, Lowe and Garrick, Inc</u>

Senior Consultant (7/1976 – 1/1989)

- Performed economic analyses and optimization of fuel cycle designs and fuel procurement plans; technical and commercial evaluations of vendor proposals for fuel materials and services; technical, strategic, and policy support for utilities and utility-sponsored organizations in the areas of nuclear fuel and high-level nuclear waste.
- Provided supervision and direction for an in-depth evaluation of the basic causes for the cost increases that occurred during the construction of a commercial nuclear power plant.
- Participated in a multifaceted consequence analysis of the postulated release of radionuclides from an operating nuclear power plant through the liquid pathway.
- Involved in a broad range of power plant technical, managerial, licensing, and risk analysis activities.

<u>General Atomic International</u>

Senior Fuel Application Engineer, 7/1975 – 7/1976

- Responsibilities included guidance of General Atomic's high temperature gas cooled reactor (HTGR) core physics design and fuel management activities in support of international ventures; international development of the direct cycle and process heat HTGR; development of fuel cycle strategies for countries considering introduction of the HTGR; and evaluation of the use of alternative thorium fuel cycles.

<u>General Atomic Company</u>

Engineer, 7/1972 – 7/1975

- Responsibilities included the Peach Bottom end-of-life core physics analysis; a broad range of HTGR physics design activities; evaluation of safety criteria for the HTGR fuel with respect to nuclear criticality; and preparation of the licensing topical report describing technical basis for models used to analyze fission product release from HTGR cores during transient temperature excursions.

Consumers Power Company

Assistant Engineer, Summers 1971 – 1972

- Performed core design and plutonium recycle studies for the Palisades and Big Rock Point nuclear power plants. Expanded capabilities of fuel accountability program and performed a variety of fuel cycle economic studies.

Katherine B. Heller

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Education

MS, Economics, University of North Carolina, Chapel Hill, North Carolina, 1989.
BA, Economics, The College of William and Mary, Williamsburg, Virginia, 1973.

Professional Experience

RTI International, Research Triangle Park, NC (1985 to present)

Senior Economist (2006 to present)

- Led a multi-disciplinary assessment of the potential impacts of developing and operating a uranium mine and mill in southern Virginia. Led the analysis of socioeconomic impacts of the project.
- For North Carolina's Department of Environment and Natural Resources, analyzed the potential flood damages associated with alternative release schedules for the Roanoke Rapids dam on the Roanoke River.
- Led analysis of socioeconomic impacts of proposed nuclear fuel cycle facility. Profiled existing demographic and economic conditions in the effected region, and analyzed the changes in those conditions as a result of construction and operation of the proposed facility.
- As part of a multidisciplinary team assisting a private client with long-term natural resource availability planning, projected water use by user category for several river basins in the Southeastern United States over the period 2010 to 2060. Analyzed and projected water use rates by category. Obtained underlying projections of population and economic activity, and projected water use by combining the water use rate projections with the underlying projections. Evaluated several scenarios representing alternative futures.
- Part of a large multidisciplinary team providing engineering and economic analytical support to EPA's Climate Change Division in developing a regulation requiring facilities to report releases of greenhouse gases. Conducted economic impact analyses of parts of the regulation, prepared draft and final documents, directed subcontractors in preparation of information collection requests and supporting statements, and analyzed impacts of the rules to comply with various Executive Orders and statutes.
- Worked with multidisciplinary team to characterize baseline, estimate compliance costs, and estimate economic impacts of proposed new source review for minor sources and modified major sources in Indian Country. Combined existing data from Census and Bureau of Indian Affairs with data from EPA databases to estimate numbers and types of

existing minor sources in Indian Country, and to project new sources and modifications over a 6-year period. For the final rule, worked with input gathered from public comments and information from EPA Region experts to better characterize existing sources in Indian Country and reestimated the impacts of the rule.

- Led a project to develop proposed metrics based on existing publicly available data for measuring Tribal hardship, in response to a request from EPA's American Indian Environmental Office. The hardship measure would be used to assess Tribal eligibility for cost share waivers on EPA grants. Developed two recommended metrics: per capita income and a multivariate hardship index using Census data, and prepared documentation for AIEO project manager to use in soliciting comment from EPA Tribal experts and Tribes indicating how tribes would be characterized using each metric.

Research Economist 3 (2000 to 2006)

- For EPA's Office of Water, led a project to analyze the employment impacts of water infrastructure spending using several macroeconomic modeling methods. Led a team that performed input/output analysis and computable general equilibrium analyses in-house, and coordinated with another contractor who conducted an analysis using a macroeconomic model. Prepared a report compiling, comparing, and synthesizing the results of the three approaches.
- For Alcoa Power Generating, Inc. (APGI), led a project to analyze the economic and property value impacts of reservoirs associated with the four hydroelectric dams operated by APGI as part of stakeholder involvement for dam relicensing under FERC. Conducted interviews of stakeholders to gather information on impacts on businesses of reservoir operations. Conducted a hedonic price analysis to assess the impact on property value of proximity to the reservoirs and reservoir operations.
- Analyzed the economic impacts of limiting withdrawals from two Cretaceous Aquifers in the Central Coastal Plain of North Carolina. Identified alternative water sources and estimated the impacts of developing them on business and communities in the region. After determining that the major impact was upon affected communities' ability to finance development of alternative water supplies, presented findings at public meetings and before concerned North Carolina legislators.
- Led a team that analyzed the economic impacts of several redevelopment scenarios for the Garner Road Industrial Area, under a Brownfields Redevelopment Grant to the City of Raleigh, North Carolina. Engaged stakeholder working group in developing and refining several alternative visions for the site, including a mix of industrial, park, and mixed-use alternatives.

Research Economist 2 (1993 to 2000)

- With an Environmental Technology Initiative grant, conducted research into the economic impacts of facility-wide permitting. Combined qualitative data collection with a simulation model of a petroleum refinery to examine potential cost savings and incentives for pollution prevention and energy efficiency, as a result of moving from a source-specific permitting system to a facility-wide permitting system.

- Researched policies to promote environmental quality and economic prosperity in industrial communities. Using qualitative data collection and analysis, identified policies that improve environmental quality while not adversely affected the region's economy. Used three counties in northeastern New Jersey as case study area.
- Led a project, for EPA's Office of Water, to develop questionnaires, gather data, and prepare a regulatory impact analysis for proposed effluent limitations guidelines and standards for the Centralized Waste Treatment industry. Developed and implemented a simulation model for regional imperfectly competitive markets for waste management services. Project included providing support for EPA during development of proposed rule, re-proposal, and final rule, and lasted more than 10 years.
- For EPA's Office of Air Quality Planning and Standards, analyzed the economic impacts of air emissions standards for coke ovens. Developed a multi-market model, simulating impacts on the market for Coke and the market for Iron and Steel.
- For EPA's Office of Water, conducted an analysis of the economic achievability of Nonpoint Source Pollution Control guidance to limit polluted runoff in coastal areas.

Research Economist 1 (1987 to 1993)

- For EPA's Office of Solid Waste, gathered data and conducted analyses to provide information for a Report to Congress on Hazardous Waste Reduction.
- Led a project to analyze the economic impacts of an EPA regulation limiting air emissions from municipal waste combustors.
- Led a project to analyze the economic impacts of an EPA regulation limiting air emissions from Solvent Recycling facilities.
- Conducted analyses to evaluate the effectiveness of various methods for communicating the risks of radon exposure, including helping to develop public service announcements, conducting focus groups, and performing statistical analyses to identify which brochure formats and public service announcements are most effective in informing the public and motivating them to change behaviors.
- Analyzed pollution prevention and waste minimization actions by hazardous waste generators and TSDR facilities, based on EPA's Survey of Hazardous Waste Generators and Survey of Hazardous Waste Treatment, Storage, and Disposal Facilities.

Economist 2 (1985 to 1987)

- Prepared projections of water demand by region and user type for the state of New Mexico, based on population and economic projections.
- Gathered data to analyze property value impacts associated with a residential set-back restriction surrounding the Chesapeake Bay in Maryland.

North Carolina State University, Department of Economics and Business, Raleigh, NC

Economics Instructor (1979 to 1981)

- Taught individual sections of introductory microeconomics, introductory macroeconomics, regional and urban economics, and statistics for business and economics

The College of William and Mary, Department of Economics, Williamsburg, VA

Visiting Assistant Professor (1977 to 1978)

- Taught individual sections of introductory microeconomics, introductory macroeconomics, and regional and urban economics.

Kimberly Y. Matthews

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Education

MS, Natural Resources (concentration in Watershed Hydrology), North Carolina State University (2003)
BA, Biology, Wittenberg University (1996)

Professional Experience

RTI International, Research Triangle Park, NC (2006 to present)

Research Environmental Scientist 2 (2008 to present)

- Provides technical oversight on the development of the data management system created for DoD-funded research program and provides quality control on uploaded data. Conducted a literature review to assess the impacts of military training on the various ecosystems and in combination with real-time use data and spatial data determined an index of military training impacts.
- Coordinated project to predict the geographic location of isolated wetlands in the coastal plain of North and South Carolina. Evaluated existing geodata and remote sensing imagery to develop the initial population frame and provided expertise on the ranking candidate wetlands. Provided quality assurance on field data collection efforts and made recommendations for model improvements.
- Managed project that created a workgroup for state wetland scientist for in EPA Region 4 (Southeast US). Designed and maintained website, facilitated web-based training opportunities, provided field-based training, and promoted communication among participants.
- Managed various projects for EPA to conduct sampling of impaired for water quality, habitat, and macroinvertebrate conditions and determine cause of impairment to streams and wetlands.

Research Environmental Scientist 1 (2006 to 2008)

- Provides support for water quality and ecological projects involving investigations of streams, wetlands, and terrestrial resources, conducting water quality assessments, and preparing environmental impact reports.
- Provides technical over site for multi-year DoD-funded research program at Camp Lejeune including reviewing research results, submitting quarterly and annual reports, and organizing meetings. Facilitated preparation of Strategic Plan, Monitoring Plan, and Research Plan.
- Conduct literature review and assessment of military training impacts as well as ecosystem indicators of nitrogen and sulfur oxide deposition.
- Provide technical knowledge relating to the stormwater quality, protected species, and monitoring and research methods for natural resources assessment.

Arcadis Geraghty & Miller of North Carolina, Raleigh, NC. (2002-2006)

Biologist

- Conducted wetland and stream delineations, surveyed for federally and state listed protected species and performed natural community classifications for federal, state, and local agencies throughout North Carolina.
- Prepared natural resource technical reports, NEPA documents, and CWA Section 401/404 permits.
- Analyzed hydrologic, benthic, and water quality data for various projects and conducted feasibility studies and monitoring of stream and wetland mitigation projects.
- Managed projects, including client negotiations, scoping, budgeting, and invoicing. Participated in concurrence and public involvement meetings for transportation projects.

City of Greensboro, Greensboro, NC. (1996-2000)

Water Quality Monitoring Technician

- Sampled and analyzed water from stormwater runoff, streams, and lakes during varying weather conditions to determine ambient water quality and pollutant loading.

- Implemented benthic invertebrate sampling program to assess instream water quality across the City.
- Assisted in developing a Water Quality Index to visually display and interpret water quality data for public use and developed a biological monitoring program.
- Conducted maintenance inspections of on-site stormwater best management practices (BMPs) and conducted comparative studies for the removal efficiencies of selected BMPs.