LBP-12-21

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

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	ASLBP No. 10-901-03-ML-BD01
LLC	September 19, 2012
(GLE Commercial Facility)	

INITIAL DECISION

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LIST OF ACRONYMS AND ABBREVIATIONS[1]

ADAMS	Agencywide Documents Access and Management System
ALARA	as low as is reasonably achievable
ASLB(P)	Atomic Safety and Licensing Board (Panel)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DPO	differing professional opinion
ER	environmental report
ERI Report	A Detailed Review of the Need for Future Enrichment Capability - Response to ASLB 5A (Energy Resources International, Inc.)
°F	degrees Fahrenheit
FEIS	final environmental impact statement
GLE	GE-Hitachi Global Laser Enrichment, LLC
GNF-A	Global Nuclear Fuels - Americas
GWe	gigawatt-electric
HF	hydrogen fluoride
IROFS	items relied on for safety
ISA/ISA Summary	integrated safety analysis/integrated safety analysis summary
k_{eff}	effective neutron multiplication factor
MOX	mixed oxide
mph	miles per hour
NaF	sodium fluoride
NEPA	National Environmental Policy Act
NRC	U.S. Nuclear Regulatory Commission
NUREG-1520	NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility"
pH	measure of the molar concentration of hydrogen ions
rem	roentgen equivalent man
SER	safety evaluation report
SWU	separative work unit
^{235}U/U-235	uranium-235
UF_6/UF-6	uranium hexafluoride
UO_2F_2	uranyl fluoride
USEC	United States Enrichment Corporation
USGS	U.S. Geological Survey

[1] In an effort to comply with the Plain Language Act of 2010 and in recognition of the Court of Appeals for the D.C. Circuit's admonition against "abbreviating every conceivable agency and statute involved, familiar or not," we have attempted to limit our use of acronyms and abbreviations and have strived to use only those likely to be familiar to our readers. See Nat'l Assoc. of Regulatory Util. Comm'rs v. DOE, 680 F.3d 819, 820, n.1 (D.C. Cir. 2012).

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Before the Atomic Safety and Licensing Board (the Board) is an application from GE-Hitachi Global Laser Enrichment LLC (GLE or the Applicant) for a license to possess and use source, byproduct, and special nuclear material and to enrich natural uranium to a maximum of 8 percent ^{235}U by a laser-based enrichment process at a facility that would be located near the City of Wilmington in New Hanover County, North Carolina.[1] GLE's proposed facility would occupy approximately 100 acres on a 1,621 acre site owned by GLE's affiliate General Electric Company.[2] The Wilmington site, which is zoned for heavy industrial use, is currently the location of other General Electric manufacturing facilities, including a nuclear fuel fabrication

[1] 75 Fed. Reg. 1819, 1820 (Jan. 13, 2010).

[2] Ex. NRC003A at 2-2.

facility.[3] Using a first-of-a-kind laser process, the proposed GLE facility would enrich uranium for use in commercial power reactors.

Pursuant to Section 193(b)(1) of the Atomic Energy Act, this Board was constituted to conduct a mandatory hearing concerning GLE's proposed facility.[4] As explained infra,[5] licensing boards have an "important but limited role" in such proceedings.[6] The Commission expects "licensing boards conducting mandatory hearings on uncontested issues to take an independent 'hard look' at NRC Staff safety and environmental findings."[7] However, licensing boards are "not to replicate NRC Staff work."[8] The Commission has directed that licensing boards "should conduct a simple 'sufficiency' review of uncontested issues, not a de novo review."[9]

Likewise, as directed by the Commission, our review is limited to safety and environmental issues that are specific to the proposed facility. This Board's review does not broadly extend to other issues, such as national and international nuclear nonproliferation policy, that are unrelated to the NRC's licensing criteria.

After reviewing the Final Environmental Impact Statement (FEIS) and Safety Evaluation Report (SER) prepared by the NRC Staff (including the license conditions imposed by the Staff), the prefiled testimony and exhibits filed by the Staff and the Applicant, the oral testimony heard

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[3] Id. at xxviii, 2-2.

[4] Establishment of Atomic Safety and Licensing Board (Apr. 20, 2010); see also 75 Fed. Reg. 21,660 (Apr. 26, 2010).

[5] See infra Section II.A.

[6] La. Energy Servs., L.P. (National Enrichment Facility), et al., CLI-05-17, 62 NRC 5, 41 (2005).

[7] Id. at 34.

[8] Id.

[9] Id. at 39.

over the course of a two-day evidentiary hearing, and the complete record of this proceeding, the Board finds that the application and record of this proceeding contain sufficient information to support issuance of GLE's requested license and that the Staff's review of the application has been adequate to support its independent safety and environmental findings. We have also independently considered the final balance among conflicting environmental and other factors with a view to determining the appropriate action to be taken. Therefore, pursuant to 10 C.F.R. § 2.340(k), we authorize the Directors of the Office of Nuclear Materials Safety and Safeguards and of the Office of Federal and State Materials and Environmental Management Programs to license construction and operation of GLE's proposed facility when each has made all findings necessary for license issuance that are not within the scope of this Initial Decision.[10]

I. BACKGROUND

GLE, in which both Japanese and Canadian corporations hold indirect minority interests, is an indirect subsidiary of American corporation General Electric Company.[11] On January 30, 2009, pursuant to an exemption allowing it to file its environmental report (ER) in advance of its

[10] For example, we received testimony at the evidentiary hearing that GLE was missing a consistency determination from the State of North Carolina concerning GLE's compliance with the Coastal Zone Management Act, and that the NRC could not issue a license until that (and all other) permitting issues had been resolved. Tr. at 37-38 (7/12/12 Hearing). See also 10 C.F.R. § 2.340(k)(1). Subsequently, the Board was informed that GLE had received the consistency determination from the North Carolina Department of Environment and Natural Resources. Letter from Marcia J. Simon, Counsel for the NRC Staff, to the Licensing Board (Aug. 21, 2012).

[11] Specifically, GLE is a Delaware limited liability company and is a subsidiary of majority owner and Delaware limited liability company GE-Hitachi Nuclear Energy Americas LLC, which is a wholly-owned subsidiary of GE-Hitachi Nuclear Energy Holdings LLC. GE-Hitachi Nuclear Energy Holdings LLC is a subsidiary of majority owner GENE Holding LLC and minority owner Hitachi America, Ltd. GENE Holding LLC, also a Delaware limited liability company, is wholly-owned by General Electric Company, a United States corporation incorporated in New York. Hitachi America is a wholly-owned subsidiary of Hitachi Ltd., a Japanese corporation. GLE also has two minority owners, GENE Holding LLC and Cameco Enrichment Holdings, LLC, a Delaware limited liability company wholly owned by Cameco US Holdings, Inc., a Nevada corporation, which is in turn wholly-owned by Cameco Corporation, a Canadian corporation. General Electric Company, through its wholly-owned and majority-owned subsidiaries, has a 51 percent indirect interest in GLE. GLE's minority owners Hitachi Ltd. and Cameco Corporation have indirect interests of 25 percent and 24 percent respectively. 75 Fed. Reg. at 1820.

license application, GLE submitted its ER to the NRC.[12] On June 26, 2009, GLE submitted the remainder of its application.[13]

The Commission published a Notice of Hearing in the Federal Register on January 13, 2010.[14] No petitions to intervene under 10 C.F.R. § 2.309, petitions to participate as an interested governmental entity under 10 C.F.R. § 2.309(d)(2), or requests to make a limited appearance pursuant to 10 C.F.R § 2.315(a) were submitted.[15] On April 15, 2010, the Commission referred this matter to the Atomic Safety and Licensing Board Panel for an uncontested, mandatory hearing,[16] and on April 20, 2010, this Board was established.[17]

A. Hearing Schedule and NRC Staff Delays

The Commission's Notice of Hearing stated that "[t]he Licensing Board's initial decision with respect to either a contested adjudicatory hearing or an uncontested, mandatory hearing should be issued no later than 28 ½ months from the date of this Order [Jan. 7, 2010]."[18] Because of a series of delays by the Staff of the expected issuance dates for the SER and FEIS, however, meeting that milestone was not possible. Collectively, the Staff's delays extended issuance of these documents by more than a year.

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[12] See Ex. GLE0006A-H; Ex. NRC075; Ex. NRC076. GLE submitted a supplement to its ER on July 13, 2009. See Exs. GLE008, GLE009.

[13] See Exs. GLE004A-D & GLE005.

[14] See 75 Fed. Reg. at 1819.

[15] Id. at 1821.

[16] Memorandum from Annette L. Vietti-Cook to E. Roy Hawkens, Chief Administrative Judge, Atomic Safety and Licensing Board Panel (Apr. 15, 2010) (referring this matter to the Atomic Safety and Licensing Board Panel for hearing).

[17] Establishment of Atomic Safety and Licensing Board (Apr. 20, 2010).

[18] 75 Fed. Reg. at 1824.

On May 11, 2010, we asked the Staff to notify the Board of its best estimates of the Staff's projected schedule for issuing its FEIS and SER.[19] On May 27, 2010, the Staff replied, estimating that "it will issue the final environmental impact statement (FEIS) in February 2011, and the final safety evaluation report (SER) in December 2010."[20]

Based on suggestions from the parties,[21] on September 13, 2010 the Board issued an initial scheduling order.[22] The Board contemplated an evidentiary hearing in early August 2011 and issuance of an initial decision on October 31, 2011 – well within the deadline set by the Commission.[23] In November 2010, however, the Staff submitted the first of several notifications that its license review schedule had been delayed – notifying the Board that the SER would now be issued in February 2011.[24] On January 14, 2011, the Board received another such notification – this time stating that both the SER and the FEIS would be issued in April 2011.[25]

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[19] Licensing Board Order (Concerning Scheduling) (May 11, 2010) at 1 (unpublished).

[20] Letter from Carrie M. Safford, Counsel for the NRC Staff, to the Licensing Board (May 27, 2010).

[21] The Applicant proposed a schedule that called for an initial decision by October 18, 2011. Applicant's Proposed Hearing Schedule (Aug. 24, 2010) at 4. The Staff did not object. NRC Staff's Comments on Applicant's Proposed Hearing Schedule (Sept. 2, 2010) at 1 (commenting that the Staff's proposed schedule only diverged with the Applicant in that the Staff was in favor of the parties having the opportunity to file Proposed Findings of Fact and Conclusions of Law).

[22] Licensing Board Initial Scheduling Order (Sept. 13, 2010) at 6 (unpublished) [hereinafter Initial Scheduling Order].

[23] Id.

[24] Letter from Carrie M. Safford, Counsel for the NRC Staff, to the Licensing Board (Nov. 23, 2010).

[25] Letter from Molly Barkman Marsh, Counsel for the NRC Staff, to the Licensing Board (Jan. 14, 2011). In a January 2011 teleconference, the Staff told the Board that the April 2011 release dates were "reasonably firm." Tr. at 5 (1/20/11 Teleconference).

After consulting the parties,[26] the Board issued a First Revised Scheduling Order that contemplated a hearing to be held in November 2011 and the Board's Initial Decision to be issued on January 31, 2012.[27] On April 14, 2011, the Staff again notified the Board of a delay – both the SER and FEIS would now be issued in June 2011.[28] In response, the Board issued a Second Revised Scheduling Order, delaying the schedule set forth in the First Revised Scheduling Order by approximately two months, and observing that this adjustment "should still allow the Board to issue its Initial Decision more than a month in advance of the deadline set by the Commission."[29] On May 31, 2011, the Staff notified the Board of another delay – this time extending the date of issuance for the SER and FEIS to September 7, 2011.[30] In light of this notification, the Board again revised the schedule – reducing the time periods for several interim milestones in order to ensure compliance with the Commission's 28½ month deadline for an Initial Decision.[31]

On September 6, 2011, one day before the Staff's environmental and safety documents were promised, the Board received another notification from the Staff – announcing that the

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[26] Tr. at 8-13 (1/20/11 Teleconference); Applicant's Revised Proposed Hearing Schedule (Jan. 26, 2010); NRC Staff's Comments on Applicant's Revised Proposed Hearing Schedule (Feb. 2, 2011).

[27] Licensing Board First Revised Scheduling Order (Feb. 9, 2011) at 7 (unpublished) [hereinafter First Revised Scheduling Order].

[28] Letter from Marcia J. Simon, Counsel for the NRC Staff, to the Licensing Board (Apr. 14, 2011).

[29] Licensing Board Order (Second Revised Scheduling Order) (May 4, 2011) at 1 (unpublished) [hereinafter Second Revised Scheduling Order].

[30] Letter from Marcia J. Simon, Counsel for the NRC Staff, to the Licensing Board (May 31, 2011).

[31] Licensing Board Third Revised Scheduling Order (June 6, 2011) at 3 (unpublished) [hereinafter Third Revised Scheduling Order]. This schedule proposed a hearing in February 2012, and an Initial Decision to be issued by the Board by May 10, 2012. Id. at 7.

SER and FEIS issuance would be delayed until February 29, 2012.[32] In light of this fifth announced of delay, by which the Staff had extended expected issuance of the SER by fourteen months and of the FEIS by twelve months from the Staff's initial estimates, the Board issued a Notice to the Commission, stating that "the Board's initial decision with respect to this uncontested, mandatory hearing will likely not be issued within 28 ½ months from the date of [the Notice of Hearing]."[33] As the Board explained in its Notice, because of the NRC Staff's repeated delays, compliance with the Commission's original deadline "would require the Board to review the SER and FEIS, conduct a mandatory hearing, and issue our initial decision approximately ten weeks after the Staff documents first become available."[34] In the Board's view, such an abbreviated schedule would make it impossible to comply with the Commission's direction to take "an independent 'hard look' at NRC Staff safety and environmental findings,"[35] and thereby undertake "the kind of 'truly independent review' that Congress anticipated when it established the mandatory hearing requirement."[36]

On October 5, 2011, the Board issued a Fourth Revised Scheduling Order, which further compressed the schedule initially agreed upon by the parties and established an aggressive schedule that now contemplated an evidentiary hearing in mid-July 2012 and an Initial Decision by August 31, 2012.[37]

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[32] Letter from Carrie M. Safford, Counsel for the NRC Staff, to the Licensing Board (Sept. 6, 2011).

[33] Licensing Board Notice to the Commission (Expected Date for Initial Decision) (Sept. 9, 2011) at 1 (unpublished).

[34] Id. at 2.

[35] La. Energy Servs, L.P., CLI-05-17, 62 NRC at 34.

[36] Id. at 40 (internal citation omitted).

[37] Licensing Board Fourth Revised Scheduling Order (Oct. 5, 2011) at 4, 8 (unpublished) [hereinafter Fourth Revised Scheduling Order].

On February 28, 2012, the Staff finally issued both the SER and the FEIS.[38] In the SER, the NRC Staff determined that, subject to certain license conditions identified by the Staff, the application provided an adequate basis for concluding that operation of the proposed facility would not pose an undue risk to worker and public health and safety.[39] In the FEIS, the NRC Staff concluded that the overall benefits of the proposed facility outweigh the environmental disadvantages and costs, and recommended (unless safety issues mandate otherwise) that the proposed license be issued to GLE.[40]

B. Other Events Prior to Issuance of the SER and FEIS

Meanwhile, the Board was aware of the importance of properly handling the classified information and other non-public information involved in this proceeding. On August 25, 2010, the Board asked the Commission to designate a representative to advise and assist the Board "with respect to security classification of information and safeguards to be observed,"[41] and on September 10, 2010, the Commission did so.[42]

At the suggestion of the Applicant,[43] the Board arranged to visit the site of the proposed Wilmington facility. The purpose of the visit, which took place on September 28, 2011,[44] was "to

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[38] See Ex. NRC001 [Public SER] & Ex. NRC003A-B. The Staff also released a non-public SER, which the Board reviewed. See Ex. NRC002.

[39] Ex. NRC001 at iii, xvii.

[40] Ex. NRC003A at 2-65.

[41] Licensing Board Request to Commission (Seeking Designation of Representative to Advise and Assist Licensing Board with Respect to Classification of Information and Safeguards to Be Observed) (Aug. 25, 2010) at 1-2 (unpublished).

[42] Commission Order (Sept. 10, 2010) (unpublished).

[43] Tr. at 21 (8/19/10 Teleconference).

[44] The site visit was first scheduled for May 24, 2011, but was delayed twice in light of the repeated delays to the scheduled issuance of the FEIS and SER, which the Board initially hoped to review prior to the visit. Licensing Board Order (Scheduling Site Visit) (Mar. 30, 2011) at 1 (unpublished) [hereinafter Initial Site Visit Order]. See also First Revised Scheduling Order

allow the Board to view the technology, the test loop, and the site area set aside for the commercial facility" and was "conducted in accordance with General Electric-Hitachi's normal site security and safety procedures."[45] The NRC Staff also participated.[46]

C. Events Subsequent to Issuance of the FEIS and SER

Upon receipt of the FEIS and SER, the Board began its review of both documents in March 2012. On April 4, 2012, the Board issued its Board Initial Questions Order, which asked of the parties seventy-four questions that were raised by the Staff documents.[47] The Board also indicated its expectation that the Board would address the issues of "criticality, radiological and chemical safety in some detail" at the evidentiary hearing.[48] On May 2, 2012, in accordance with the Board's Initial Questions Order, the parties responded to the Board's initial written questions.[49]

After reviewing the parties' answers to the Board's initial written questions, the Board concluded that many of the parties' answers resolved its concerns on a given issue and

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at 4; Second Revised Scheduling Order at 2; Third Revised Scheduling Order at 5; Tr. at 17-18 (9/22/11 Teleconference).

[45] Initial Site Visit Order at 1.

[46] Fourth Revised Scheduling Order at 6.

[47] Licensing Board Memorandum and Order (Initial Board Questions and Associated Administrative Directives) (Apr. 4, 2012) at Attach. A & B (unpublished) [hereinafter Board Initial Questions Order]. The Staff later requested clarification of several of the Board's questions. See NRC Staff's Request for Clarification Regarding Initial Board Questions (Apr. 11, 2012). The Board granted that request. See Licensing Board Order (Granting the NRC Staff's Request for Clarification) (Apr. 13, 2012) (unpublished).

[48] Board Initial Questions Order at 2.

[49] NRC Staff Response to the Licensing Board's Initial Questions (May 2, 2012) [hereinafter Staff Initial Question Responses – Public]; NRC Staff Non-Publicly Available Response to Licensing Board's Questions Regarding the SER (May 2, 2012) [hereinafter Staff Initial Question Responses – Non-public]; GE-Hitachi Global Laser Enrichment Responses to Initial Board Questions (Public Version) (May 2, 2012) [hereinafter GLE Initial Question Responses – Public]; GE-Hitachi Global Laser Enrichment Responses to Initial Board Questions (Non-Public Version) (May 2, 2012) [hereinafter GLE Initial Question Responses – Non-public].

established an adequate record.[50] As contemplated by the Fourth Revised Scheduling Order,[51] the Board identified issues on which it still had questions and wished to review "more detailed and integrated prefiled testimony and exhibits."[52] The six major topics identified by the Board were: (1) Criticality Safety and Chemical/Radiological Hazard Evaluation; (2) Licensing an Evolving Design; (3) Safety Impact of External Hazards; (4) Tracking and Implementation of Applicant Commitments; (5) Need/Alternatives/Environmental Cost-Benefit Analysis; and (6) Environmental Monitoring Program.[53] The Board also encouraged the parties to supplement their formal prefiled written testimony with brief summaries to provide the Board with broad overviews of areas of remaining concern.[54]

Between June 19 and June 25, 2012, the Staff and Applicant filed their prefiled written testimony, exhibits, and summaries as directed by the Board's Prefiled Testimony Order.[55] On June 28, 2012, the Board conducted a prehearing teleconference (for which "listen only" lines

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[50] Licensing Board Memorandum and Order (Identifying Areas for Prefiled Testimony) (May 16, 2012) at 2 (unpublished) [hereinafter Prefiled Testimony Order].

[51] Fourth Revised Scheduling Order at 6-7.

[52] Prefiled Testimony Order at 2.

[53] Id. at 2-6 (highlighting sub-questions on which the parties should focus their testimony for each topic heading).

[54] Id. at 7. On May 21, 2012, GLE filed a motion for extension of time to file written testimony, exhibits, and proposed findings. GE-Hitachi Global Laser Enrichment's Motion for Extension of Time to File Written Testimony, Exhibits and Proposed Findings (May 21, 2012). The Board granted the request as to the extension of the prefiled written testimony and supporting exhibits, which extended the filing date by one week to June 25, 2012. This change did not affect the hearing dates. Licensing Board Order (Granting in Part and Denying in Part Motion for Extension of Time) (May 22, 2012) at 1-2 (unpublished).

[55] Prefiled Testimony Order at 6-8.

were made available to members of the public and to the press) to discuss administrative details concerning the evidentiary hearing, including security protocols and logistics.[56]

An especially important issue addressed at the prehearing conference was whether to allow the public to attend the evidentiary hearing. Throughout the proceeding, the Board has handled all classified and other non-public information in accordance with 10 C.F.R. Part 2, Subpart I and other applicable provisions.[57] Additionally, the Board entertained suggestions from the parties on how best to navigate the complexities of the classified and non-public information in the context of a public proceeding.[58] Despite a desire to hold at least part of the hearing in North Carolina (and open to the public) and after discussions with the parties on how that might have been feasible,[59] the Board had nonetheless previously concluded that the hearing should be held in the Atomic Safety and Licensing Board Panel's Hearing Room in NRC's headquarters in Rockville, Maryland due to the need to thoroughly examine the safety issues presented by this first-of-a-kind facility.[60] After receiving testimony and exhibits that contained classified information, in accordance with the wishes of both the Applicant and the NRC Staff, the Board determined, pursuant to 10 C.F.R. § 2.328 and §§ 2.900 to 2.913, that the oral portion of the proceeding should be closed to the public to allow for the free-ranging and

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[56] Licensing Board Order (Setting Prehearing Teleconference) at 1-2 (June 15, 2012) (unpublished).

[57] First Revised Scheduling Order at 3.

[58] Id. at 4. See also Proposed Procedures for Hearing Involving Classified Information (Apr. 11, 2012); Licensing Board Order (Concerning GLE's Proposed Procedures for Hearing) (Apr. 17, 2012) (unpublished); Proposed Procedures for Submitting Documents Containing Export Controlled Information (Apr. 26, 2012); Licensing Board Order (Concerning the NRC Staff's Proposed Procedures for Submitting Documents) (Apr. 27, 2012) (unpublished).

[59] See Initial Scheduling Order at 5; First Revised Scheduling Order at 5-6; Third Revised Scheduling Order at 6; Tr. at 10-11 (9/22/11 Teleconference); Fourth Revised Scheduling Order at 7.

[60] Licensing Board Fifth Revised Scheduling Order (Apr. 4, 2012) at 1 (unpublished).

thorough examination of witnesses and to ensure the effective safeguard and prevention from disclosure of Restricted Data as mandated by Section 181 of the Atomic Energy Act.[61]

During the prehearing conference, the Board also asked the parties to submit legal briefs concerning the significance to this proceeding, if any, of the recent decision of the United States Court of Appeals for the District of Columbia Circuit in New York v. NRC.[62] In response, the parties submitted briefs on July 10 and 11, 2012.[63]

On July 6, 2012, a request was submitted to the Board by e-mail, on behalf of the Alliance for Nuclear Accountability in Columbia, South Carolina, to open portions of the oral evidentiary hearing to the public.[64] For reasons explained infra,[65] the Board denied the request at the outset of the evidentiary hearing.[66]

The Board conducted the evidentiary hearing on July 11 and 12, 2012. All twenty-four witnesses who had submitted prefiled testimony were present and available to answer the

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[61] 42 U.S.C. § 223.

[62] New York v. NRC, 681 F.3d 471 (D.C. Cir. 2012). See infra Section II.D.

[63] GE-Hitachi Global Laser Enrichment, LLC's Brief on the Applicability to the Above Captioned Proceeding of the D.C. Circuit's Decision in New York v. NRC, No. 11 1045 (D.C. Cir. June 8, 2012) (July 10, 2012) [hereinafter GLE WCD Brief]; NRC Staff Response to Board Question Regarding the Recent D.C. Circuit Order Vacating the 2010 Waste Confidence Rule (July 11, 2012) [hereinafter Staff WCD Brief].

[64] E-mail from Tom Clements, Nonproliferation Policy Director, Alliance for Nuclear Accountability to Judge Paul S. Ryerson, Chair, Judge James F. Jackson, and Judge Michael O. Garcia, Atomic Safety and Licensing Board (July 6, 2012, 15:04 EST) (copied to the service list and posted on the Electronic Hearing Docket).

[65] See infra Section III (explaining the Board's reasons for closing the evidentiary hearing to the public).

[66] In addition to having sound reasons for closing the evidentiary hearing in its entirety, which are more fully explained infra, the Board also notes that the request to open the hearing was submitted three business days before the hearing was scheduled to begin, on behalf of a party that had never previously elected to participate in this proceeding in any capacity, despite ample opportunity to do so. 75 Fed. Reg. at 1821-22.

Board's questions. As confirmed in a subsequent order,[67] the Board admitted in substance and without objection all prefiled exhibits submitted by either party.

Thereafter, on July 27, 2012, the Applicant submitted follow-up responses to certain Board questions at the hearing,[68] and the Applicant and the NRC Staff submitted a joint motion for proposed transcript corrections.[69] On July 30, 2012, the Board accepted the proposed transcript corrections and closed the evidentiary record.[70] On August 27, 2012, the Board provided notice that its Initial Decision would issue in September 2012.[71]

II. LEGAL STANDARDS

As amended in 1990, Section 193(b)(1) of the Atomic Energy Act states that "[t]he Commission shall conduct a single adjudicatory hearing on the record with regard to the licensing of the construction and operation of a uranium enrichment facility. . . ."[72] NRC regulations have implemented this provision through 10 C.F.R. §§ 70.23a and 70.31(e). Section 70.23a reads:

> The Commission will hold a hearing under 10 CFR part 2, subparts A, C, G, and I, on each application for issuance of a license for construction and operation of a

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[67] Licensing Board Order (Concerning Evidence Admitted During Hearing) (July 18, 2012) at 1-2 (unpublished). See also Licensing Board Order (Admitting Revised Board Exhibit) (July 30, 2012) at 1 (unpublished).

[68] GE-Hitachi Global Laser Enrichment's Follow-Up Responses to Board Inquiries (July 27, 2012) [hereinafter GLE Follow-Up].

[69] Joint GE-Hitachi Global Laser Enrichment and NRC Staff Motion for Proposed Transcript Corrections (July 27, 2012).

[70] Licensing Board Order (Granting Joint Motion for Proposed Transcript Corrections) (July 30, 2012) at 1 (unpublished).

[71] Licensing Board Notice of Expected Date of Initial Decision (Aug. 27, 2012) (unpublished).

[72] 42 U.S.C. § 2243(b)(1). Specifically, the 1990 Amendments provide that enrichment facilities are to be licensed pursuant to Sections 53 and 63 of the AEA, 42 U.S.C. §§ 2073, 2093. For a more extensive history, see La. Energy Servs., L.P. (Claiborne Enrichment Center), CLI-97-15, 46 NRC 294, 296-97 (1997).

> uranium enrichment facility. The Commission will publish public notice of the hearing in the Federal Register at least thirty (30) days before the hearing.[73]

Section 70.31(e) states that "[n]o license to construct and operate a uranium enrichment facility may be issued until a hearing pursuant to 10 CFR part 2, subparts G and I, is completed and decision issued on the application."[74]

While Part 70 of title 10 of the Code of Federal Regulation establishes the general regulatory framework applicable to the licensing, construction, and operation of a uranium enrichment facility, the Commission noted that many regulations in 10 C.F.R. Chapter I are applicable to the proposed GLE license, including "10 C.F.R. parts 19, 20, 21, 25, 30, 40, 51, 70, 71, 73, 74, 95, 140, 170, and 171 for the licensing and regulation of byproduct, source, and special nuclear material, including requirements for notices to workers, reporting of defects, radiation protection, waste disposal, decommissioning funding, and insurance."[75] The Commission also noted that this is the fifth proceeding involving the licensing of an enrichment facility, and several of those prior decisions resolve relevant issues and may be relied upon as precedent.[76] As a result of those decisions, the recent licensing board mandatory review of the proposed AREVA Eagle Rock Enrichment Facility,[77] and mandatory hearings conducted by

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[73] 10 C.F.R. § 70.23a.

[74] 10 C.F.R. § 70.31(e).

[75] 75 Fed. Reg. at 1824.

[76] Id. See also La. Energy Servs., L.P. (Claiborne Enrichment Center), CLI-92-7, 35 NRC 93 (1992); La. Energy Servs., L.P. (Claiborne Enrichment Center), CLI-97-15, 46 NRC at 294; La. Energy Servs., L.P. (Claiborne Enrichment Center), CLI-98-3, 47 NRC 77 (1998); La. Energy Servs., L.P. (National Enrichment Facility), CLI-05-05, 61 NRC 22, 36 (2005); La. Energy Servs., L.P. (National Enrichment Facility), et al., CLI-05-17, 62 NRC at 5; USEC, Inc. (American Centrifuge Plant), CLI-07-05, 65 NRC 109 (2007).

[77] AREVA Enrichment Servs., LLC (Eagle Rock Enrichment Facility), LBP-11-11, 73 NRC 455 (2011); AREVA Enrichment Servs., LLC (Eagle Rock Enrichment Facility), LBP-11-26, 74 NRC __ (Oct. 7, 2011), Commission review declined, Memorandum from Annette L. Vietti-Cook, NRC Secretary, to Board and Parties (Nov. 17, 2011) (ADAMS Accession No. ML11321A227).

licensing boards in four 10 C.F.R. Part 52 early site permit proceedings,[78] there is considerable recent guidance on the role of licensing boards in mandatory proceedings such as this.

A. The Role of the Board and Issues for Determination

Because this is a mandatory, uncontested hearing, this Board's review is a limited one.[79] The Applicant and the NRC Staff agree that the Commission has directed this Board to determine five issues:[80]

> 1. General Issue 1: "[T]he Licensing Board will determine the following without conducting a de novo evaluation of the application: (1) Whether the application and record of the proceeding contain sufficient information to support license issuance and whether the NRC staff's review of the application has been adequate to support findings to be made by the Director of the Office of Nuclear Materials Safety and Safeguards with respect to the matters set forth in paragraph C of this section."[81]
>
> 2. General Issue 2: "[T]he Licensing Board will determine the following without conducting a de novo evaluation of the application . . . (2) whether the review conducted by the NRC staff pursuant to 10 CFR part 51 has been adequate."
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> 3. NEPA Baseline Issue 1: "[T]he Licensing Board will, in the initial decision, in accordance with Subpart A of 10 CFR part 51: Determine whether the

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[78] See S. Nuclear Operating Co. (Early Site Permit for Vogtle ESP Site), LBP-09-19, 70 NRC 433 (2009), Commission review declined, Memorandum from Annette L. Vietti-Cook, NRC Secretary, to Board and Parties (Jan. 4, 2010) (ADAMS Accession No. ML100040233); Dominion Nuclear N. Anna, LLC (Early Site Permit for North Anna ESP Site), LBP-07-9, 65 NRC 539 (2007), permit issuance authorized, CLI-07-27, 66 NRC 215 (2007); Sys. Energy Res., Inc. (Early Site Permit for Grand Gulf ESP Site), LBP-07-1, 65 NRC 27 (2007), permit issuance authorized, CLI-07-14, 65 NRC 216 (2007); Exelon Generation Co., LLC (Early Site Permit for Clinton ESP Site), LBP-06-28, 64 NRC 460 (2006), permit issuance authorized, CLI-07-12, 65 NRC 203 (2007).

[79] The hearing's uncontested status is defined indirectly by 10 C.F.R. § 2.4, which defines a "contested proceeding."

[80] Tr. at 14-15 (8/19/10 Teleconference).

[81] Subpart C states: "The matters of fact and law to be considered are whether the application satisfies the standards set forth in this Notice and Commission Order and the applicable standards in 10 CFR parts 30, 40, and 70, and whether the requirements of NEPA and the NRC's implementing regulations in 10 CFR part 51 have been met." Licensing Board Order (Scheduling Initial Scheduling Conference) at Attach. A (July 12, 2010) (unpublished) (citing 75 Fed. Reg. at 1821).

> 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."
>
> 4. NEPA Baseline Issue 2: "[T]he Licensing Board will, in the initial decision, in accordance with Subpart A of 10 CFR part 51: . . . 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."
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> 5. NEPA Baseline Issue 3: "[T]he Licensing Board will, in the initial decision, in accordance with Subpart A of 10 CFR part 51: . . . 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."[82]

When addressing these questions, licensing boards are not expected to conduct a de novo review of safety or environmental issues, but rather "a simple 'sufficiency' review of uncontested issues."[83] Licensing boards must "take an independent 'hard look' at NRC Staff safety and environmental findings, but not . . . replicate NRC Staff work. Giving appropriate deference to NRC Staff technical expertise, boards are to probe the logic and evidence supporting NRC Staff findings and decide whether those findings are sufficient to support license issuance."[84]

While our review under General Issues 1 and 2 calls for us to examine whether the Staff's review is "adequate" or "sufficient," our responsibility in addressing the three NEPA Baseline Issues calls for a somewhat more active role. As the United States Court of Appeals for the District of Columbia Circuit has explained, the National Environmental Policy Act (NEPA):

> requires that agencies consider the environmental impact of their actions "to the fullest extent possible." . . . Compliance to the "*fullest*" possible extent would seem to demand that environmental issues be considered at every important stage in the decision making process concerning a particular action – at every stage where an overall balancing of environmental and nonenvironmental factors is appropriate and where alterations might be made in the proposed action to

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[82] Id. (citing 75 Fed. Reg. at 1821).

[83] La. Energy Servs., L.P., CLI-05-17, 62 NRC at 39.

[84] Id. at 34.

> minimize environmental costs. Of course, consideration which is entirely duplicative is not necessarily required. But independent review of staff proposals by hearing boards is hardly a duplicative function. A truly independent review provides a crucial check on the staff's recommendations. The Commission's hearing boards automatically consider nonenvironmental factors, even though they have been previously studied by the staff. Clearly, the review process is an appropriate stage at which to balance conflicting factors against one another. And, just as clearly, it provides an important opportunity to reject or significantly modify the staff's recommended action.[85]

The court emphasized that, after a licensing board in an uncontested proceeding determines the Staff's NEPA review is adequate, it must then "independently consider the final balance among conflicting factors that is struck in the staff's recommendation."[86]

In reaching our independent judgment on the NEPA Baseline Issues, licensing boards walk a fine line – our role is not to "second-guess underlying technical or factual findings by the NRC Staff"[87] but to ensure that the demands of NEPA and our regulations are met through "independent environmental judgments by NRC licensing boards."[88] Even a licensing board's NEPA review "must not be so intrusive or detailed as to involve the board in 'independent basic research' or a 'duplicat[ion of] the analysis previously performed by the staff.'"[89]

For these reasons, although we summarize in detail in Section IV infra the hearing evidence upon which we rely, this Board does not make detailed factual findings of its own.

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[85] Calvert Cliffs' Coordinating Comm., Inc. v. AEC, 449 F.2d 1109, 1118 (D.C. Cir. 1971) (citations omitted, emphasis in the original). The Commission has directed "boards to follow the approach spelled out in the D.C. Circuit's seminal Calvert Cliffs decision." La. Energy Servs., L.P., CLI-05-17, 62 NRC at 44.

[86] Calvert Cliffs' Coordinating Comm., Inc., 449 F.2d at 1118.

[87] La. Energy Servs., L.P., CLI-05-17, 62 NRC at 45 (stating "[t]he only exceptions to this would be if the reviewing board found the Staff review to be incomplete or the Staff findings to be insufficiently explained in the record.").

[88] Id. at 44.

[89] Id. at 45 (footnote omitted).

Rather, our role is to examine the sufficiency of the Staff's findings and to confirm that those findings have "reasonable support in logic and fact."[90]

B. Adequacy of Facility Design Detail

The level of design completeness and detail required for the NRC Staff to conduct its review, and for the Board to evaluate the Staff's work, was of particular concern to the Board. Because the proposed GLE uranium enrichment plant would be a first-of-its-kind facility, there is no direct full-scale operational experience to inform many of the risks involved.

Part 70 of the NRC's regulations outlines the regulatory requirements associated with facility design and the level of detail required in the license application and related documents. For example, 10 C.F.R. § 70.22(a) sets forth the requirements for license applications, including that the application must contain "the place at which the activity is to be performed and the general plan for carrying out the activity" as well as "[a] description of equipment and facilities which will be used by the applicant to protect health and minimize danger to life or property."[91] Sections 70.61 and 70.62 describe the requirements of the integrated safety analysis (ISA), including that the ISA "is of appropriate detail for the complexity of the process" and "identifies (i) radiological hazards . . . ; (ii) chemical hazards . . . ; (iii) facility hazards that could affect the safety of licensed materials and thus present an increased radiological risk; (iv) [p]otential accident sequences caused by process deviations or other events internal to the facility and credible external events . . . ; (v) [t]he consequence and likelihood occurrence of each potential accident sequence . . . ; and (vi) [e]ach item relied on for safety."[92] Section 70.65 requires, inter alia, that an ISA Summary accompany the license application and contain a general description of the site and the facility with emphasis on those factors that could affect safety, as well as a

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[90] Id. at 39-40.

[91] 10 C.F.R. § 70.22(a)(2),(7).

[92] Id. § 70.62(c).

description of each process analyzed in the ISA "in sufficient detail to understand the theory of operation; and, for each process, the hazards that were identified in the integrated safety analysis."[93] Section 70.64 outlines the requirements for new facilities, including that the "design must provide for adequate protection against" natural phenomena, fires and explosions, "chemical risks produced from licensed material, facility conditions . . . , and hazardous chemicals produced from licensed material."[94] It also requires that the design provide for emergency planning, continued operation of essential utility services, the inspection, testing, and maintenance of items relied on for safety (IROFS), and criticality control including adherence to the double contingency principle.[95]

NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility" (NUREG-1520) expands upon these regulatory requirements and is used by applicants and by the NRC Staff to guide the preparation and review of applications for fuel cycle facilities so as to meet the requirements of the regulations and provide an adequate level of design for the Staff to conduct its review.[96] While we recognize that guidance documents do not have the force of law,[97] NUREG-1520 has benefited from extensive consideration within the agency, with which the Commission has never expressed disagreement.

Specifically, in 2006, the NRC Staff grappled with the question of whether NUREG-1520 correctly specified the level of design detail required by the Part 70 regulations when reviewing United States Enrichment Corporation's (USEC's) application for its American Centrifuge Plant. On August 4, 2006, Robert Pierson, then the Director of the Division of Fuel Cycle Safety and

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[93] Id. § 70.65(b).

[94] Id. § 70.64(a).

[95] Id.

[96] Ex. NRC005.

[97] See Natural Res. Def. Council v. EPA, 643 F.3d 311 (D.C. Cir. 2011).

Safeguards in the Office of Nuclear Material Safety and Safeguards, issued a memorandum (the Pierson Memorandum) that discussed how the Staff should review license applications for level of design detail.[98] The Pierson Memorandum discussed the procedures in place to ensure that a finalized facility meets all regulatory requirements, despite the fact that "changes to the plant are to be expected."[99] Citing NUREG-1520 as reflective of the regulations, an enclosure to the Pierson Memorandum entitled "Level of Information Needed for 10 CFR Part 70 Licensing" stated:

> [T]he licensing review needs to focus on the applicant's programmatic commitments and, consequently, the licensing decision is ultimately based on a sufficient level of detail to understand process system functions and functionally how items relied on for safety can perform their intended function and be reliable. The reasonable assurance standard is applied such that the staff decision pertains to a reasonable assurance that the integrated safety analysis summary is complete and the licensee will follow its integrated safety analysis approach and maintain it consistent with the regulations. The level of detail required for a licensing decision, therefore, does not require a final facility design or an absolutely complete identification of all items relied on for safety and accident sequences, but instead sufficient information has to be provided to understand the process and functions of items relied on for safety and reasonable assurance that the integrated safety analysis summary is complete.[100]

Highlighting the 10 C.F.R. § 70.72 change process, the enclosure stated that "it was anticipated that, in the future, changes will be made to the facility design and processes and, therefore, a process for addressing these changes is described in 10 CFR 70.72."[101]

In November 2006, four members of the NRC Staff issued a Differing Professional Opinion (DPO) concerning the guidance set forth in the Pierson Memorandum.[102] The four individuals asserted that the current "level of design is not sufficient to meet the regulatory

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[98] Ex. NRC021.

[99] Id. at 1-2.

[100] Id. Enclosure at 2.

[101] Id.

[102] Ex. NRC022.

requirements for issuing a license" and that the Pierson Memorandum "does not consider all the applicable portions of the regulation [10 C.F.R. Part 70], and as a result draws an erroneous regulatory conclusion."[103] The DPO stated that "[d]uring the USEC [American Centrifuge Plant] licensing review, only roughly 15% of the instrumentation and control design was completed. It is our position that this represents a design that is not sufficiently complete and was not enough to determine that the instrumentation and control design was adequate to protect health and minimize danger to life or property."[104] Concerning the ISA Summary, the four Staff members stated that, based on NRC regulations, "the applicant must have performed a complete ISA Summary" and concluded that "reasonable assurance cannot be achieved without a sufficiently complete facility design."[105]

The USEC American Centrifuge Plant hearing board (the USEC Board) was notified of the dispute and questioned witnesses on the level of detail utilized by the Staff in its review of the proposed plant's safety.[106] The USEC Board determined that the prevailing Staff view that there was reasonable assurance that all credible accident sequences were identified and that all IROFS and necessary safety controls were identified in the ISA Summary was credible.[107] The Board agreed with the Staff that the DPO did "not preclude the agency from conducting licensing reviews or making licensing decisions" and issued a decision prior to a resolution of the DPO by the NRC Staff.[108]

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[103] Id. at 1.

[104] Id. at 4.

[105] Id. at 5.

[106] USEC Inc. (American Centrifuge Plant), LBP-07-6, 65 NRC 429, 464 (2007) (publicly available version).

[107] Id. at 465-66.

[108] Id. at 466.

The DPO was reviewed through the normal course by a DPO Ad Hoc Review Panel and by Michael Weber, the then-new Director of the Office of Nuclear Material Safety and Safeguards.[109] Mr. Weber and the Ad Hoc Review Panel agreed "that a programmatic review . . . is consistent with the requirements of Part 70."[110] However, both the Ad Hoc Review Panel and Mr. Weber agreed that NUREG-1520 should be revised to "address, among other aspects, what constitutes the licensing basis for fuel cycle facilities."[111] The four Staff members then appealed to the Executive Director of Operations, who supported the determination of the DPO Ad Hoc Review Panel in his final determination.[112] He stated that the intent of the regulation "was to create a performance based rule to allow flexibility and lessen the burden on affected internal and external stakeholders by providing the necessary design and ISA information commensurate with the risk of the facility."[113] He added that in the case of USEC's American Centrifuge Plant, the USEC Board "thoughtfully considered [the] DPO" and "the Commission, the final arbiter in the decision when called upon, was cognizant of and considered [the] DPO during ASLBP deliberations and did not interject or object to the ASLBP's ruling on the matter."[114]

NUREG-1520, Revision 1, was issued in May 2010 to address the level-of-detail issue more effectively.[115] Because GLE's application was submitted prior to the Revision's adoption, the Staff applied NUREG-1520, Revision 0 to its review, but the reviewers "had knowledge of

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[109] Ex. NRC023.

[110] Id. at 2.

[111] Id.

[112] Ex. NRC024.

[113] Id. at 5.

[114] Id.

[115] Ex. NRC120 at 5.

the proposed guidance in Revision 1 and the review of the GLE application was informed by this information."[116]

In light of this history, the Board accepted as reasonable the NRC Staff's determination that the level of design detail necessary for a licensing decision does not require a final facility design. Additionally, even where compliance with our regulations cannot be determined without more complete information, in a limited number of appropriate circumstances the Staff may exempt an applicant from regulatory requirements subject to license conditions that will ensure compliance before a facility becomes operational.[117]

For example, GLE's application described a program for precluding and detecting unauthorized production of enriched uranium, including monitoring of the enrichment within the process system and monitoring of material quantities against possession limits.[118] Because the design of the facility is not final, however, GLE has not yet analyzed potentially credible diversion scenarios by which unauthorized enrichment activities could take place.[119] Accordingly, the Staff granted – reasonably in the Board's view – an exemption from applicable regulatory requirements,[120] subject to license conditions that require GLE to submit, for the Staff's prior review and approval, detailed analyses of such potentially credible diversion scenarios and the processes and management measures best suited to address them.[121]

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[116] Id.

[117] See 10 C.F.R. § 70.17(a) (stating that "[t]he Commission may, upon application of any interested person or upon its own initiative, grant such exemptions from the requirements of the regulations in this part as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest.").

[118] Ex. NRC001 at 12-1.

[119] Id. at 12-1 to 12-2.

[120] See 10 C.F.R. § 74.33(c)(5).

[121] Ex. NRC001 at 12-2. The Staff approved a similar exemption regarding criticality alarm systems, for which there is not yet sufficient design detail. See id. at 1-22. When contentions in

Application of the pertinent legal standards to particular safety concerns is further discussed in Section V infra.

C. Nuclear Proliferation and Terrorism

Nuclear proliferation and terrorism are addressed in very specific ways by the NRC and thus by this Board. The Atomic Energy Act grants the NRC broad regulatory authority to address issues of defense, security, unauthorized disclosure of protected information, diversion of nuclear materials, and materials control as part of its delegation of licensing authority.[122] Although the Act does not grant express nonproliferation authority, key NRC regulations, such as 10 C.F.R. Parts 73, 74, and 95, clearly have nonproliferation, security, and terrorism objectives.[123] The Staff examined many of those objectives in its SER as mandated by the Atomic Energy Act.[124]

Nuclear proliferation and hypothetical terrorist attacks, however, are not analyzed by the Staff as part of its environmental review.[125] The Supreme Court has held that "NEPA requires a reasonably close causal relationship between the environmental effect and the alleged cause."[126] The Commission has determined that there is no such relationship between NRC licensing actions and terrorism.[127] Likewise, the Commission has determined that nuclear

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contested hearings are purportedly resolved by license conditions, the Commission has stated that such conditions must be drawn very precisely. See Private Fuel Storage, L.L.C. (Independent Spent Fuel Storage Installation), CLI-00-13, 52 NRC 23, 34-35 (2000). Here, we review the Staff's approach for adequacy.

[122] Ex. NRC003A at 1-14.

[123] See id. at 1-14 to 1-15.

[124] See, e.g., Ex. NRC001 at 11.A-12, 12-1 to 12-3, 13-1, 14-1, 16-1 to 16-2.

[125] Ex. NRC003A at 1-15.

[126] Dep't of Transp. v. Pub. Citizen, 54 U.S. 752, 767 (2004) (internal quotations omitted).

[127] Amergen Energy Co., LLC (License Renewal for Oyster Creek Nuclear Generating Station), CLI-07-08, 65 NRC 124 (2007); La. Energy Servs., L.P. (National Enrichment Facility), CLI-05-

nonproliferation issues "span a host of factors far removed from" and "far afield from" the NRC's decision whether to license a uranium enrichment facility.[128] Rather, such issues are depend "upon the actions and decisions of the President, Congress, international organizations, and officials of other nations," and constitute "issues of international policy unrelated to the NRC's licensing criteria."[129] Thus, the Staff was not required to analyze proliferation or terrorism issues as part of its environmental review in this case.

D. Inapplicability of the Waste Confidence Rule

On June 8, 2012, the United States Court of Appeals for the District of Columbia Circuit issued a decision in New York v. NRC.[130] In that decision, the court vacated the Commission's current rule concerning the storage and disposal of high-level waste (the Waste Confidence Rule) and remanded the issue to the Commission to generate either a generic analysis that is "forward looking" and has "enough breadth to support the Commission's conclusions"[131] or site specific environmental impact statements in all relevant proceedings.[132] Because the NRC Staff had indicated before other boards that a license could not issue in nuclear reactor cases until

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28), 62 NRC 721, 724-25 (2005). With regard to facilities located in the Ninth Circuit the NRC is required to analyze potential terrorist attacks as part of its NEPA review. See San Luis Obispo Mothers for Peace v. NRC, 449 F.3d 1016 (9th Cir. 2006). One former Commissioner expressed concern that terrorism would not be addressed in the NEPA context by the Staff in this case. 75 Fed. Reg. at 1828 ("I believe that the Commission should have a consistent, nationwide approach to NEPA and should discontinue the practice of addressing terrorism only for facilities within the jurisdiction of the Ninth Circuit. This practice creates a disparity in the public information we provide concerning the potential impacts of a terrorist attack on our nuclear facilities based on the arbitrary criteria of geographic location.") (separate statement of Jaczko, Chairman).

[128] La. Energy Servs., L.P., CLI-05-28, 62 NRC at 724.

[129] USEC, Inc. (American Centrifuge Plant), CLI-06-9, 63 NRC 433, 463 (2006).

[130] New York v. NRC, 681 F.3d 471 (D.C. Cir. 2012).

[131] Id. at 483.

[132] Id.

the Commission resolved the issues in New York v. NRC, the Board asked the parties to comment on what, if any, impact the court's decision has on this proceeding, recognizing that an enrichment facility is "two steps removed in the fuel cycle" from power reactors that produce high-level waste.[133] (The Commission has subsequently confirmed that it will not, in fact, issue final licenses dependent upon the Waste Confidence Rule until the court's remand is appropriately addressed.[134])

Responding on July 10 and 11, 2012, respectively, GLE and the Staff submitted briefs addressing the Board's concerns.[135] Both parties contend that the court's decision has no impact on this case because the waste produced at the GLE facility will be considered low-level waste, which has designated long term storage, and because the Waste Confidence Rule focused solely on spent nuclear fuel and high-level waste generated by nuclear reactors and on independent spent fuel storage installations.[136]

The Board agrees. The Waste Confidence Rule facially does not apply to uranium enrichment facilities, as it refers directly to waste "generated in any reactor."[137] Although the parties cite the FEIS as evidence that only low-level waste would be generated by the proposed facility,[138] the Commission itself addressed waste production at a uranium enrichment facility in a 2005 decision cited in the hearing notice for this proceeding.[139] As the Commission explained,

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[133] Tr. at 27-29 (6/28/12 Teleconference).

[134] Calvert Cliffs Nuclear Project, LLC (Calvert Cliffs Nuclear Power Plant, Unit 3), et al., CLI-12-16, 76 NRC __, __ (slip op. at 4) (Aug. 7, 2012).

[135] GLE WCD Brief; Staff WCD Brief.

[136] GE WCD Brief at 4, 5; Staff WCD Brief at 2.

[137] Waste Confidence Decision Update, 75 Fed. Reg. 81,037, 81,060-76 (Dec. 23, 2010).

[138] GLE WCD Brief at 4, n.17; Staff WCD Brief at 4, n.12.

[139] 75 Fed. Reg. at 1824-25.

"[l]ow-level waste traditionally has been defined by what it is not."[140] Because depleted uranium and the other waste generated by uranium enrichment facilities are not "spent fuel, transuranic waste, or 11e(2) byproduct material" or "specific kinds of wastes such as irradiated fuel and the liquid and solid wastes resulting from the processing of irradiated fuel," those wastes are necessarily classified as low-level waste.[141]

The Board's primary concern was therefore not with the waste that will be generated by GLE, but rather with potential, less direct impacts. For example, did the Staff's acknowledgement that nuclear plant licenses could not issue prior to resolution of this issue impact GLE's and the Staff's needs assessment? While the parties did not address this question, the written and oral testimony of Mr. Schwartz, discussed in Section IV infra, illustrated a clear need for the facility despite multiple future uncertainties. The Board also was concerned with GLE's potential role of placing a product into commerce that becomes high-level waste. However, the Board agrees with the Staff's assessment that the relationship between the GLE product and the production of high-level waste is too attenuated to show the "requirement of a reasonably close causal relationship" required by NEPA.[142] Therefore, the Board is satisfied that the court's recent decision in New York v. NRC should not affect the outcome of this proceeding.

III. APPROACH TO EVIDENTIARY HEARING

The Atomic Energy Act does not prescribe a specific structure for the mandatory hearing requirement, and the Commission has granted licensing boards considerable flexibility to select

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[140] La. Energy Servs. (National Enrichment Facility), CLI-05-05, 61 NRC at 34.

[141] Id. at 34-35.

[142] Staff WCD Brief at 3-4 (citing Metro. Edison Co. v. People Against Nuclear Energy, 460 U.S. 766, 774 (1983)).

the most appropriate approach in the circumstances of each individual case.[143] As the Commission has explained:

> As for the actual procedure to be followed at mandatory hearings, licensing boards have considerable flexibility. The AEA's mandatory hearing requirements in sections 189a and 193(b)(1) are phrased generally. "[T]he Act itself nowhere prescribes the content of a hearing or prescribes the manner in which this 'hearing' is to be run." The word "hearing" can refer to any of a number of events, including trial-type evidentiary hearings, "paper hearings," paper hearings accompanied by oral arguments, hearings employing a mixture of procedural rules, and legislative hearings. The AEA's hearing requirement does not demand a "one size fits all" approach. Thus, we do not dictate any particular procedure in the current cases, but we would expect the boards to select the most appropriate and expeditious approach given the specific circumstances of a case.[144]

In determining what structure may best serve the needs of this hearing, the Board heeded the Commission's advice to sharpen our focus by narrowing it:

> A "mandatory hearing" board must narrow its inquiry to those topics or sections in Staff documents that it deems most important and should concentrate on portions of the documents that do not on their face adequately explain the logic, underlying facts, and applicable regulations and guidance. It serves no purpose for the Staff to produce volumes of documents and information supporting facts and conclusions that are of small importance and are beyond dispute. It likewise serves no purpose for the Staff to produce copies of every document used in its review when the Board cannot possibly read through every one, let alone scrutinize them.[145]

Therefore, rather than undertake a comparatively shallow analysis of all possible issues, the Board focused on a relatively thorough examination of selected issues of concern by instituting a multi-step process that narrowed as the Staff and Applicant responded to the questions and concerns of the Board.

First, the Board members reviewed the SER and the FEIS. In themselves, these lengthy analyses satisfied the Board that the Staff's consideration of many issues had been

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[143] See La. Energy Servs., L.P., CLI-05-17, 62 NRC at 42-43.

[144] Id. (footnotes omitted).

[145] Exelon Generation Co., LLC (Early Site Permit for Clinton ESP Site), CLI-06-20, 64 NRC 15, 21-22 (2006).

appropriately thorough. For example, in the SER, the Staff identified a number of license conditions that it determined would provide enhanced assurance of safe operation in areas where the applicant's design or procedures should be supplemented.[146] In the FEIS, among other things, the Staff carefully examined numerous potential impacts and concluded that they would generally be small and, taken in combination with the Applicant's environmental monitoring program and proposed mitigation measures, would eliminate or substantially lessen any potential adverse environmental impacts associated with the proposed facility.[147]

Second, on April 4, 2012, the Board set forth seventy-four detailed written questions arising from the SER and the FEIS, to which it directed the parties to respond.[148] More specifically, we directed that "[t]he parties' written answers shall, for each question, identify the responding subject matter expert(s) or individuals(s), and shall be submitted in exhibit form, under oath, so that they are suitable for receipt into evidence without the necessity of the personal appearance of each expert or individual."[149] In other words, we directed the parties to respond under oath to our initial written questions, so that the Board could accord the responses as much weight as we would give sworn testimony presented in person at an evidentiary hearing.

The parties responded to the Board's initial written questions on May 2, 2012.[150] Collectively, the parties' public and non-public sworn responses totaled some 175 pages,

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[146] For example, GLE must provide at least sixty days notice to the NRC before initial product withdrawal of licensed material exceeding 5 percent by weight ^{235}U. Ex. NRC001 at 1-9.

[147] See Ex. NRC003A at 8-1 to 8-6.

[148] Board Initial Questions Order Attachs. A & B.

[149] Id. at 1 (citing Fourth Revised Scheduling Order at 6).

[150] Staff Initial Question Responses – Public; Staff Initial Question Responses – Non-public; GLE Initial Question Responses – Public; GLE Initial Question Responses – Non-public.

exclusive of the supporting affidavits and resumes of the forty-one responding individuals.[151] Because the parties provided substantial and, for the most part, directly responsive answers to the Board's initial questions, the need for written or oral testimony at the evidentiary hearing was reduced to the extent that the parties' sworn answers resolved many of the Board's concerns.

For example, the following illustrate a few of the numerous instances in which the Board's preliminary concerns were adequately addressed by the parties' responses to the Board's initial written questions:[152]

1. Because the use of lasers in the GLE separations process is unique for a fuel cycle facility, the Board was interested in how laser safety had been addressed. We posed two written questions in this area. The first asked whether the facility's Industrial Safety Manager would be required to have specific laser safety training and experience.[153] The second asked whether the guidance in NUREG-1520 covered laser safety and, if not, whether the NRC Staff used any additionally guidance in reviewing the Applicant's laser safety program.[154] In response, the Staff pointed out that laser safety is under the jurisdiction of the North Carolina Department of Labor, as part of the Department's enforcement activities regarding the Occupational Safety and Health Act of North Carolina. Because regulatory jurisdiction lies with the State of North Carolina, the NRC Staff neither reviewed the Applicant's program for laser safety nor required the Industrial Safety Manager to have specific training and experience in

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[151] Staff Initial Question Responses – Public; Staff Initial Question Responses – Non-public; GLE Initial Question Responses – Public; GLE Initial Question Responses – Non-public.

[152] Additionally, as discussed in Section V. infra, in other instances the parties' initial written responses – while not necessarily fully satisfactory by themselves – were adequate when considered together with subsequent prefiled and oral testimony that the Board received on related topics.

[153] Board Initial Questions Order Attach. A at 2.

[154] Id.

laser safety.[155] On this basis, the Board did not pursue further the adequacy of the NRC Staff's consideration of laser safety.

2. Fire safety was another area where the Board was able to resolve its concerns at the outset. The Board's primary concern arose from the fact that the fire protection review in the SER did not specify the Cascade/Gas Handling area as one for which fire events had been postulated in the ISA Summary.[156] The Board inquired whether the Cascade/Gas Handling area had in fact been evaluated and, if so, what the results of that evaluation were.[157] Both the NRC Staff and the Applicant submitted non-public responses to this question.[158] Based on its review of these responses and related referenced material, the Board was satisfied that this area had been adequately reviewed and appropriate IROFS had been identified.

3. The Board had another fire protection-related question that arose from its review of criticality safety. We asked how the Applicant would ensure that off-site fire departments would not employ water-based fire suppression in areas where that would not be appropriate from the standpoint of criticality safety.[159] Based on the responses from both the Applicant and the NRC Staff,[160] the Board was assured that adequate plans and controls would be in place, and the Board's concerns in this area were thereby resolved.

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[155] Staff Initial Question Responses – Public Attach. A at 20-22.

[156] Ex. NRC001 at 3-40, 7-8.

[157] Board Initial Questions Order Attach. A at 3.

[158] Staff Initial Question Responses – Non-public Attach. A at 5; GLE Initial Question Responses – Non-public at 13.

[159] Board Initial Questions Order Attach. A at 4.

[160] Staff Initial Question Responses – Public Attach. A at 36; GLE Initial Question Responses – Non-public at 18-19.

4. Because the FEIS discusses noise level impacts only in terms of decibels above ambient levels,[161] the Board was concerned whether machinery to be used during construction or operation of the proposed facility might produce sound at frequencies outside the range of human hearing that could cause discomfort to wildlife.[162] On the basis of the Staff's response,[163] the Board was satisfied that would not be the case.

5. The Board wondered why wind speed data used in the FEIS to calculate potential radiation dosages was no more recent than 1992.[164] Through the Staff's response, the Board learned that the Staff used the most recent data available from the Wilmington airport in a format that could be used in the applicable modeling program, thereby resolving that concern.[165]

Third, after reviewing the parties' responses to its initial questions, the Board nonetheless determined that it still wished to receive more detailed and integrated sworn prefiled testimony and exhibits concerning six key topics: (1) evaluation of criticality safety, focusing in particular on whether unique design features of the proposed facility pose potential safety hazards that differ from those in other uranium enrichment facilities, as well as evaluation of chemical and radiological hazards; (2) the NRC Staff's regulatory approach to reviewing a facility design that has not yet been finalized; (3) evaluation of external hazards related to flooding (including hurricanes and tsunamis), high winds and tornados, and earthquakes; (4) the process for implementing and tracking the Applicant's commitments (both mandatory and voluntary); (5) the need for the proposed facility and the related environmental cost-benefit

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[161] See Ex. NRC003A at 4-57 to 4-62.

[162] Board Initial Questions Order Attach. B at 3.

[163] Staff Initial Question Responses – Public Attach. B at 48-49.

[164] See Ex. NRC003A at 4-82; Board Initial Questions Order at Attach. B. at 4.

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[165] Staff Initial Question Responses – Public Attach. B at 53-56.

analysis; and (6) the Applicant's environmental monitoring program.[166] Again, we directed the parties to provide written testimony under oath, so that the Board could accord sworn prefiled testimony as much weight as we would give sworn testimony presented in person at the evidentiary hearing, without having to engage in the formality of asking witnesses at the hearing to "adopt" their prior written testimony.[167]

In response, collectively the parties submitted several hundred pages of prefiled written testimony from twenty-four witnesses, as well as 136 exhibits.[168]

Fourth, at a two-day evidentiary hearing, the Board members heard presentations from many of the witnesses and had the opportunity to question in person each of the twenty-four witnesses who submitted prefiled written testimony. All prefiled testimony and exhibits were admitted into evidence without objection. The Board also received supplemental sworn written responses to some of the questions posed at the hearing after the oral portion of the evidentiary hearing had concluded.[169]

In other words, the Board's process was a continuing one, which allowed consideration of various kinds of information at various times. The sworn oral testimony at the evidentiary hearing constituted only a portion of the sworn testimony available to the Board – which included both prefiled testimony and responses under oath to the Board's initial written questions – and addressed only a portion of all the information (including the application itself) that we began to examine as soon as the Board was constituted. Also, absent objection in an uncontested case such as this, the Board saw no purpose in applying formal rules of evidence

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[166] Prefiled Testimony Order at 2-6.

[167] Id. at 6.

[168] See Ex. BRD001-R; Ex. BRD002; Ex. GLE001; Ex. GLE012; Ex.GLE019; Ex. GLE021-R; Ex. GLE023; Ex. NRC118; Ex. NRC119; Ex. NRC120; Ex. NRC121; Ex. NRC122; Ex. NRC123-R; Ex. NRC124.

[169] See GLE Follow-Up.

to exclude opinion testimony or other evidence that might be objectionable in a court of law.[170] Rather, in addressing the issues before it, the Board considered all available facts – recognizing that some sources of information may be more reliable than others.

Therefore, despite our desire to be as transparent as possible, the Board was satisfied that the proper course was to conduct the oral portion of this proceeding in a closed session, which the public was not able to observe. In practice, classified and other non-public information was closely intertwined with the unique aspects of the proposed facility that were of the greatest interest. Not only was the Board concerned that it might not be possible in real

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[170] Although somewhat different considerations may apply in contested cases, formal rules of evidence rarely have a useful role in licensing board proceedings. Our rules state that "strict rules of evidence do not apply to written submissions." 10 C.F.R. § 2.319(d). Otherwise, they merely set forth the broad admonition (in language that has remained unchanged since the era of the Atomic Energy Commission and before enactment of the Federal Rules of Evidence) that "[o]nly relevant, material, and reliable evidence which is not unduly repetitious will be admitted." Id. § 2.337(a). In practice, while the Federal Rules of Evidence are not directly applicable to NRC proceedings, NRC adjudicatory boards often look to those rules for guidance. S. Cal. Edison Co. (San Onofre Nuclear Generating Station, Units 2 & 3), ALAB-717, 17 NRC 346, 365 n.32 (1983). The bedrock principle that underlies much of the modern law of evidence is set forth in Fed. R. Evid. 403: "The court may exclude relevant evidence if its probative value is substantially outweighed by a danger of one or more of the following: unfair prejudice, confusing the issues, misleading the jury, undue delay, wasting time, or needlessly presenting cumulative evidence." In licensing board cases, however, excluding evidence will seldom achieve these objectives. Written prefiled testimony and exhibits are typically submitted well in advance of the evidentiary hearing, and in our most common types of hearings, the licensing boards themselves – not the parties – orally examine the witnesses. 10 C.F.R. § 2.1207. Therefore, rulings excluding evidence have, as a practical matter, little effect in eliminating delay, waste of time, or the needless presentation of cumulative evidence in the record. On the contrary, briefing and consideration of motions to exclude evidence may result in considerable delay and wasted time. If a licensing board deems prefiled evidence to be of little or no value, it simply need not ask about it at the evidentiary hearing, and is free to accord such evidence little or no weight. Likewise, because the members of the licensing boards themselves must read challenged testimony to determine whether its probative value is substantially outweighed by the danger of unfair prejudice or confusion of the issues, excluding evidence on this ground also seems to have little practical effect. In a jury trial, the presiding judge reviews the evidence to determine whether the ultimate fact finder – the jury – should see it at all. A similar process in NRC proceedings would require creating one licensing board to review the evidence for purposes of admissibility and a second licensing board to weigh the admitted evidence for the purpose of ruling on the merits. No such elaborate protocol, it is well-recognized, is necessary in administrative proceedings. See 2 Robert J. Pierce Jr., Administrative Law Treatise § 10.1 at 910 (5th ed. 2010).

time to separate public and non-public responses to the Board's questions, but doing so would necessitate constantly directing members of the public in and out of the hearing room in an unmanageable way. At the same time, nearly the entirety of the written factual material on which the Board relies – the application, the NRC Staff's SER and FEIS, the bulk of the parties' sworn responses to the Board's initial written questions, and most of the prefiled testimony and exhibits – has been and remains publicly available through the Agencywide Documents Access and Management System (ADAMS), accessible through the NRC's public website. Subject to necessary redactions, the Board's decision is also publicly available (except for the classified appendix), as are every one of the Board's previous orders. Moreover, in due course a full transcript of the evidentiary hearing (with classified and other non-public information removed or redacted) will be publicly available as well.[171]

The Board chose to exclude witnesses from the hearing room during the testimony of other witnesses testifying on the same issues. In part the Board's objective was to minimize the number of witnesses who might hear classified testimony, and to restrict such testimony solely to properly cleared personnel with the requisite need to know. Additionally, however, the Board was mindful of the policies underlying Rule 615 of the Federal Rules of Evidence.

Rule 615 provides (subject to limited exceptions) that at the request of any party a court "must" order witnesses excluded so that they cannot hear other witnesses' testimony.[172] Or, Rule 615 provides, "the court may do so on its own."[173] In contrast to the practices followed by

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[171] Other Boards, concerned with less restrictive (i.e., non-public but unclassified) types of information, have not only closed their hearings, but also did not release redacted versions of their transcript and orders. See Shaw Areva MOX Servs. (Mixed Oxide Fuel Fabrication Facility), LBP-12-02, 75 NRC __ (2012) (marked "SUNSI – withhold from public disclosure"); Shaw Areva MOX Servs. (Mixed Oxide Fuel Fabrication Facility) Licensing Board Memorandum and Order (Requesting Further Information from the Applicant) (June 29, 2012) (unpublished) (marked "SUNSI – withhold from public disclosure").

[172] Fed. R. Evid. 615.

[173] Id.

some licensing boards, courts therefore routinely exclude witnesses prior to their testimony. They do so, as the Supreme Court has recognized, not only to discourage or expose outright fabrication (which we hope should rarely be an issue in NRC proceedings), but also to exercise a restraint on the natural tendency of witnesses to "tailor" their testimony to that of earlier witnesses.[174] Indeed, although in many respects the Federal Rules of Evidence liberalized prior practice, Rule 615 departs from the common law in that, whenever a party requests it, exclusion of witnesses is now mandatory rather than a matter of discretion.[175] Clearly, the drafters of the Federal Rules of Evidence thought exclusion of witnesses to be useful, and in conducting the evidentiary hearing in this proceeding, we found that the practice encouraged exceptionally candid responses from the witnesses.

IV. SUMMARY OF TESTIMONY

A. Topic 1: Criticality Safety and Chemical/Radiological Hazard Evaluation

1. GLE Witness

Steven M. Painter. Mr. Painter is currently employed by Nuclear Safety Associates, LLC, as a Senior Nuclear Safety Engineer, and as the ISA Lead for implementation of GLE's safety program.[176] He has a B.S. in Physics and a B.S. in Applied Mathematics from California State Polytechnic University, Pomona.[177] Upon entering the U.S. Navy, he completed training at the Nuclear Power School and a Nuclear Reactor Prototype in preparation for his role as a Navy Nuclear Propulsion Officer.[178] He has also taken Master's level courses on relevant topics,

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[174] Geders v. United States, 425 U.S. 80, 87 (1976).

[175] See 29 Charles Alan Wright & Victor James Gold, Federal Practice and Procedure: Evidence § 6241 (1st ed. 1997).

[176] Ex. GLE001 at 2.

[177] Id. at 1.

[178] Id. at 1-2.

including Basic and Advanced Nuclear Criticality Safety.[179] He previously worked as a Nuclear Criticality Safety Engineer at the Y-12 National Security Complex, a peer reviewer for Safety Analysis at the Waste Isolation Pilot Plant, a Nuclear Criticality Safety Engineer at the former Oak Ridge, the Paducah, and the Portsmouth Gaseous Diffusion uranium enrichment facilities, and a Navy Nuclear Propulsion Engineering Officer of the Watch and Engineering Duty Officer during the new construction and testing of a Naval Nuclear Submarine Propulsion Plant.[180]

Mr. Painter's written and oral testimony is summarized in the classified appendix.

2. NRC Staff Witnesses

Christopher S. Tripp. Dr. Tripp is a Senior Nuclear Process Engineer (Criticality) in the NRC's Office of Nuclear Material Safety and Safeguards, Division of Fuel Cycle Safety and Safeguards.[181] He received his B.S., M.S. and Ph.D. in Physics from Rensselaer Polytechnic Institute.[182] Dr. Tripp has NRC qualifications as a Nuclear Criticality Safety Inspector and a Nuclear Criticality Safety Technical Reviewer and has specialized in nuclear criticality safety.[183] In his more than sixteen years with the NRC, his inspection experience has included routine and reactive inspections at both low-enriched and high-enriched fuel fabrication facilities and enrichment facilities.[184] His licensing experience includes a range of new enrichment facilities.[185] Dr. Tripp has also participated on teams that have reviewed and written regulatory

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[179] Id. at 2.

[180] Id.

[181] Ex. NRC118 at 1.

[182] Id. Attach. (Christopher S. Tripp Statement of Professional Qualifications).

[183] Id.

[184] Id.

[185] Id.

guidance, and he has independently authored or co-authored numerous papers presented at national and international meetings.[186]

Dr. Tripp's written and oral testimony is summarized in the classified appendix.

Blake A. Purnell. Mr. Purnell is a Project Manager in the NRC's Office of Nuclear Reactor Regulation, Division of Policy and Rulemaking.[187] He has his B.S. in Physics and Chemistry from Western Washington University and his M.A. in Physics from the University of California, Santa Barbara.[188] Mr. Purnell has worked at the NRC for seven years, including five years as a nuclear criticality safety specialist in the Division of Fuel Cycle Safety and Safeguards in the Office of Nuclear Material Safety and Safeguards.[189] He has three NRC qualifications, including as a Nuclear Criticality Safety Reviewer and Nuclear Criticality Safety Inspector, and has participated in the Nuclear Safety Professional Development Program.[190] His inspection experience includes routine and supplemental inspections, including all currently operating low- and high-enrichment fuel fabrication facilities and the Paducah Gaseous Diffusion Plant.[191] He also assisted the lead inspector for the operational readiness review of the National Enrichment Facility.[192] His experience in licensing has included nuclear criticality safety reviews of applications for new enrichment facilities, license renewals, and new

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[186] Id.

[187] Id. at 1.

[188] Id. Attach. (Blake A. Purnell Statement of Professional Qualifications).

[189] Id.

[190] Id.

[191] Id.

[192] Id.

processes.[193] Mr. Purnell has assisted in developing NRC and American Nuclear Society guidance documents.[194]

Mr. Purnell's written and oral testimony is summarized in the classified appendix.

Merritt N. Baker. Mr. Baker is a Senior Project Manager in the NRC's Office of Nuclear Material Safety and Safeguards, Division of Fuel Cycle Safety and Safeguards.[195] He received his B.S. in Mechanical Engineering from Clarkson College of Technology and is a Professional Engineer in Pennsylvania.[196] Mr. Baker has over thirty-five years of experience in various private and government facilities and has been working in fuel facility licensing and inspection since 1997.[197] In his current position, Mr. Baker is the NRC's point of contact for virtually all actions related to applicants or licensees within his cognizance, beginning with the initial submittal of an application or request for amendment, and he has served as the lead or backup project manager for fuel manufacturing facilities.[198] As a licensed reviewer, Mr. Baker is also responsible for reviewing fuel cycle applications and amendment requests, primarily in the areas of Chemical Safety and ISA methods.[199] As a certified fuel cycle safety inspector, Mr. Baker has been responsible for execution of inspection modules, primarily in Chemical Safety and Fire Protection.[200] Prior to his role at the NRC, Mr. Baker was a Senior Engineer and managing

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[193] Id.

[194] Id.

[195] Ex. NRC119 at 1.

[196] Id. Attach. (Merritt N. Baker Statement of Professional Qualifications).

[197] Id.

[198] Id.

[199] Id.

[200] Id.

contractor in the private sector.[201] Mr. Baker has written numerous technical papers and presentations, and currently is a presenter at a multi-agency course on nuclear awareness and technical response to nuclear threats.[202]

Mr. Baker's written and oral testimony is summarized in the classified appendix.

B. Topic 2: Licensing an Evolving Design

1. GLE Witness

Julie Anne Olivier. Ms. Olivier has a B.S. in Chemistry from the University of New Orleans and an M.S. in Environmental Science and Engineering from Virginia Polytechnic Institute and State University.[203] In addition, she has taken post-graduate doctoral courses in Environmental Systems Engineering at Clemson University.[204] From 1999 to 2007, Ms. Olivier was employed by the NRC, where she served as a project manager in connection with licensing various fuel fabrication, uranium enrichment and other facilities.[205] Ms. Olivier also served as a Special Assistant to the Chairman for Materials and Security from 2005 to 2006.[206] Since 2007, she has worked for GLE, currently serving as GLE's Licensing and Regulatory Affairs Manager.[207]

In her written testimony on Topic 2, Ms. Olivier testified as follows:

Ms. Olivier addressed the extent to which GLE's design for the proposed facility is likely to change, and how GLE will determine whether any such design changes could impact

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[201] Id.

[202] Id.

[203] Ex. GLE019 at 1.

[204] Id.

[205] Id.

[206] Id. App. A.

[207] Id. at 2.

safety.[208] In summary, aspects of the design are still evolving, but Ms. Olivier does not believe these will impact the safety of the facility.[209] Changes to the design will be evaluated, implemented, and tracked based on GLE's Configuration Management system and applicable change management processes.[210] Changes within the existing safety basis will not affect the safety of the facility.[211] Other changes will require NRC approval before the change can be made.[212]

Specifically, a level of design detail for the facility was established that was sufficient to enable GLE to perform an effective safety review and to create the ISA.[213] The design used for that purpose was based on conservative and anticipated bounding assumptions, including system descriptions, system interfaces, materials of construction, environmental conditions, handling devices, working area descriptions, measuring and monitoring instruments, devices for disposal of radioactive effluents and wastes, storage facilities, criticality accident alarm systems, fire safety systems, and maximum amounts of material-at-risk.[214] In addition to being sufficient to perform an ISA, the level of design was sufficient to develop a safety basis for the facility that includes, among other things, analysis of accident sequences, identification of IROFS, implementation of Management Measures to ensure the IROFS are available and reliable when

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[208] Id.

[209] Id.

[210] Id. at 6.

[211] Id.

[212] Id.

[213] Id. at 2-3.

[214] Id. at 3.

needed, application of defense-in-depth measures, and commitment to codes and standards to support ongoing design and construction to satisfy 10 C.F.R. § 70.62.[215]

In accordance with 10 C.F.R. § 70.72(a), GLE has established and maintains a Configuration Management system to evaluate, implement and track changes to the site, structures, processes, systems, equipment, components, computer programs and activities of personnel.[216] The Configuration Management program ensures that, before implementing any change, the following matters, among others, are addressed: (1) impact of the change on safety and health or control of licensed material; (2) authorization requirements for the change; and (3) impacts of the change on the ISA, ISA Summary, or other safety program developed in accordance with 10 C.F.R. § 70.62.[217] Before implementing a change, including design changes, a Change Request is prepared.[218] Every Change Request is reviewed against the criteria in Section 1.2.5.5 of the license application and the criteria in 10 C.F.R. § 70.72 to determine whether NRC approval is required prior to implementing the change.[219] When a Change Request is submitted, the ISA Manager conducts an ISA review against the approved ISA safety basis to determine if there are any impacts requiring prior NRC approval.[220] In addition, the Licensing Manager reviews the changes against the license application, in accordance with Section 1.2.5.5, to determine whether the changes "decrease the effectiveness of the license commitments."[221] If the changes trigger the criteria in either 10 C.F.R. § 70.72 or

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[215] Id. at 4.

[216] Id.

[217] Id.

[218] Id.

[219] Id.

[220] Id. at 4-5.

[221] Id. at 5.

Section 1.2.5.5, GLE will submit to the NRC, for review and approval, an application to amend the license, which will include, as required, supporting documentation and revisions to the ISA Summary.[222] Such changes will not be implemented until NRC approval is granted.[223]

GLE also may make changes in the facility or process as described in the license application, or conduct tests or activities not discussed in the license application, without prior NRC approval, but only subject to the following conditions: (1) there is no degradation in the safety commitments in the license; (2) the change, test, or activity does not conflict with any condition specifically stated in the license application; and (3) the change does not meet the criteria for a license amendment set forth in 10 C.F.R. § 70.72.[224] Records of such changes must be maintained at the facility, including technical justification and management approval to enable NRC inspection upon request.[225] Any changes to the ISA not requiring NRC approval are submitted to the NRC on an annual basis.[226] Additionally, GLE performs periodic and independent assessments of the Configuration Management system's effectiveness, conducted by individuals not involved in the area being assessed.[227]

In her oral testimony on Topic 2, Ms. Olivier testified as follows:

The level of design submitted to the NRC was consistent with the guidance in NUREG-1520, "which meant that the design was sufficient to perform the safety basis, develop the

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[222] Id.

[223] Id.

[224] Id.

[225] Id.

[226] Id.

[227] Id. at 6.

integrated safety analysis, and provide a definition of a safety basis for the facility."[228] The design "was at the component level for safety systems, and at the process level for non-safety systems."[229] Changes can only be implemented without NRC approval if there are no safety implications; however, if the change alters the safety basis, prior to implementation, GLE must get NRC approval.[230]

A design needs to be complete enough to establish the safety basis and ensure that all accident sequences are identified.[231] According to Ms. Olivier, the design submitted by GLE with the license application in 2009 has not evolved; "today the design that we intend to build is the design that is described in our commercial facility license application."[232] However, GLE is "looking at some optimization of the process," including improvement of the lasers and optimization of the separation technology, but it has not been determined whether or not those will be incorporated into the design.[233]

Ms. Olivier could not "quantify what level the design is at" but in looking toward other facilities that have been recently licensed, Ms. Olivier stated that "the level of design that we've submitted is about the equivalent to what USEC submitted in their ACP [American Centrifuge Plant] application."[234] This design is considered a "baseline design" and there are several steps

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[228] Tr. at 158 (7/11/12 Hearing). The slides associated with Ms. Olivier's presentation to the Board can be viewed at Ex. GLE020.

[229] Tr. at 158 (7/11/12 Hearing).

[230] See id. at 160.

[231] Id. at 162.

[232] Id. at 163.

[233] Id. at 164.

[234] Id. at 164-65.

before a final design can be created.[235] GLE still needs a conceptual and then a final design before the facility is constructed.[236] GLE is looking at what other facilities are experiencing and is trying to incorporate those lessons into its facility.[237] Ms. Olivier stated she "would be surprised if it was fewer than ten" changes that were required, but "surprised if we had over 100 changes."[238] Changes that require NRC approval must be made through license amendment.[239] The license amendment process requires notice and an opportunity to request a hearing by members of the public.[240]

2. NRC Staff Witnesses

Timothy C. Johnson. Mr. Johnson is a Senior Project Manager in the NRC's Office of Nuclear Material Safety and Safeguards, Division of Fuel Cycle Safety and Safeguards.[241] Mr. Johnson has a B.S. in Mechanical Engineering from Worcester Polytechnic Institute and an M.S. in Nuclear Engineering from Ohio State University.[242] He is a nuclear engineer with over thirty-nine years of work experience in industry and in the federal government.[243] He is a member of the American Nuclear Society, the American Society of Mechanical Engineers, and the American Society for Testing and Materials.[244] Mr. Johnson has been with the NRC since

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[235] Id. at 165.

[236] Id.

[237] Id. at 167.

[238] Id. at 168.

[239] Id.

[240] Id. at 169 (as supplemented by Mr. Silverman on Ms. Olivier's behalf).

[241] Ex. NRC120 at 1.

[242] Id. Attach. (Timothy C. Johnson Statement of Professional Qualifications).

[243] Id.

[244] Id.

1977, where he has held various roles, including Section Leader of the Materials Engineering Section in the Division of Waste Management, Section Leader of the Special Projects Section in the Division of Waste Management, and Section Chief of Decommissioning Sections in the Division of Waste Management, before joining the Division of Fuel Cycle Safety and Safeguards where he holds his current position.[245]

In his written testimony on Topic 2, Mr. Johnson testified as follows:

Mr. Johnson has been the licensing Project Manager for the proposed GLE facility since October 2006.[246] As the Project Manager for the GLE project, he oversaw the Staff's review of the license application and the preparation of the SER.[247] Mr. Johnson explained the Staff's approach to its review of the design of the proposed GLE facility and the regulatory basis for that approach, focusing on (1) how the Staff determined the level of design detail and finality needed to conduct a safety review and make a licensing decision; (2) significant aspects of the design of the proposed GLE facility that are still evolving and that could impact the safety of the facility; and (3) if a license is granted, how the Staff will ensure that any future changes to the design of the proposed GLE facility will fall within the parameters of a license issued on the basis of the current design.[248]

To evaluate the design of the proposed GLE facility, the NRC Staff primarily used NUREG-1520.[249] NUREG-1520 provides generic guidance for reviewing and evaluating the health, safety, and environmental protection aspects of applications for licenses to possess and

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[245] Id.

[246] Id. at 1.

[247] Id. at 2 (citing Ex. NRC001).

[248] Id.

[249] Id. at 5. NUREG-1520 can be viewed at Ex. NRC005.

use special nuclear material in nuclear fuel cycle facilities.[250] The principal purpose of NUREG-1520 is to ensure the quality and uniformity of reviews conducted by the Staff.[251] NUREG-1520, which describes the scope, level of detail, and acceptance criteria for reviews, was developed to ensure that all necessary safety and environmental issues are addressed.[252]

NUREG-1520 was developed as a generic document for licensing fuel cycle facilities under 10 C.F.R. Part 70, including fuel fabrication facilities and uranium enrichment facilities.[253] Although there are differences among fuel cycle facilities, hazards that would exist at the proposed GLE facility are similar to the types of hazards at other fuel cycle facilities for which NUREG-1520 was prepared.[254] These hazards include handling of uranium hexafluoride ($UF_{6)}$ cylinders, processing of UF_6 as a gas and sometimes as a liquid, use of autoclaves for feeding and sampling uranium, nuclear criticality, equipment decontamination operations, and laboratory activities.[255]

The Staff adapts the prescriptions of NUREG-1520 to different types of 10 C.F.R. Part 70 facilities on the basis of relative risk and the specific types of hazards associated with the particular technology.[256] Based on the processes performed at each type of facility, the proposed GLE facility has the lowest level of potential hazards, fuel fabrication facilities have the

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[250] Ex. NRC120 at 5.

[251] Id.

[252] Id. at 5-6.

[253] Id. at 6.

[254] Id.

[255] Id.

[256] Id. at 7.

next level of hazard, and the Mixed Oxide (MOX) fabrication facility has the highest level of hazard of all 10 C.F.R. Part 70 fuel cycle facilities.[257]

Excluding a spent fuel reprocessing plant or a MOX facility that processes weapons-grade plutonium, the main hazard in other fuel cycle facilities is chemical exposure associated with a loss of material confinement.[258] The primary chemical hazards include soluble uranium compounds, which present a heavy metal toxicity concern, and hydrogen fluoride (HF), which is a product of the chemical reaction between UF_6 and water (moisture from the air).[259] Qualitatively, the chemical risks posed by these enrichment facilities are far below those found at a typical chemical plant.[260] The external radiological dose rates are minimal, and the chemical toxicological effects on individuals constitute the predominant hazard until about 18 percent by weight ^{235}U enrichment, at which point internal radiation dose becomes the primary hazard.[261]

In 10 C.F.R. Part 70 licensing, the Staff uses a reasonable assurance standard and focuses on the programmatic provisions of the applicant's proposed activities.[262] The level of detail required for a licensing decision, therefore, does not require a final detailed facility design, an absolutely complete identification of all supporting IROFS and accident sequences, or a review of the detailed implementing procedures.[263] Rather, applicants must provide sufficient

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[257] Id.

[258] Id.

[259] Id.

[260] Id.

[261] Id.

[262] Id. at 8.

[263] Id. at 9.

information to understand the process and functions of IROFS and to provide reasonable assurance that the ISA Summary is complete.[264]

There are no significant differences between the proposed GLE facility and gas centrifuge facilities that would warrant a different level of design detail for the proposed GLE facility because the hazards at the GLE facility and the gas centrifuge plants are similar.[265] At both facility types, the only significant chemical hazard is from UF_6.[266] In contrast, fuel fabrication facilities use other hazardous chemicals in their processes that may present exposure hazards to workers and to the public.[267]

The NRC Staff recognizes that GLE is continuing to conduct design testing and studies on the laser-based enrichment process.[268] The primary developmental area that could affect safety is the final design of the separators, where GLE efforts are focused on optimizing uranium separation and material handling.[269] GLE is also furthering the designs of the remainder of the facility, including the feed, withdrawal, blending, and sampling systems.[270] However, the baseline designs for the remainder of the plant, as described in the ISA Summary, are not expected to undergo significant changes.[271]

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[264] Id.

[265] Id. at 13.

[266] Id.

[267] Id.

[268] Id. at 15.

[269] Id.

[270] Id.

[271] Id. The ISA Summary can be viewed at Ex. GLE010.

The NRC Staff expects that the principal hazards in the facility will be the same as in other licensed uranium enrichment plants.[272] That is, the most important facility hazard is in the liquid sampling system, where product cylinders are heated to conditions that cause the UF_6 to become a liquid so that it is possible to obtain representative samples of the product.[273] The Staff does not expect that GLE will make significant changes to the design of the liquid sampling system.[274] Although the design of the separators is expected to change the most, the changes are not expected to impact safety, because the separator operating conditions and absence of moderation will remain constant.[275]

As GLE completes its design, any deviations from the original design would have to be evaluated against the criteria in 10 C.F.R. § 70.72 to determine if a license amendment is required or if GLE could make the change without NRC approval.[276] Additionally, before the proposed GLE facility can begin operations, pursuant to 10 C.F.R. §§ 40.41(g) and 70.32(k) the NRC would be required to verify through inspection that the facility has been constructed in accordance with the requirements of the license.[277]

In his oral testimony on Topic 2, Mr. Johnson testified as follows:

The ISA "was never intended to be a static document, but [] over the course of construction and operating period, there would likely be changes based on new technology, for

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[272] Ex. NRC120 at 15.

[273] Id.

[274] Id.

[275] Id.

[276] Id. at 16.

[277] Id. at 17.

example, or new information that becomes known to the applicant or licensee or the NRC."[278] Mr. Johnson emphasized that "the process for change is one that is expected for the facility, and that there was never any expectation when Part 70 regulations were promulgated that this integrated safety analysis would be a static document."[279] The principal guidance document used by the Staff was NUREG-1520, which guides the Staff on the scope of the review, the areas to review, and the acceptance criteria to be used for licensing a fuel cycle facility.[280] The Staff believed application of NUREG-1520 was appropriate in this case because the proposed GLE facility shares similar hazards and structures with other fuel cycle facilities.[281] If the Staff finds a proposed facility to be of higher risk, then the Staff will "inform the review with respect to the overall hazards and the specific activities that are being proposed by an applicant."[282] This approach has been used in facilities that handle highly-enriched uranium, which is higher risk, and the Staff created a separate standard review plan for the MOX fuel fabrication facility due to the significant difference in hazards.[283]

Because enrichment facility licenses are combined construction and operational licenses, the Staff does not "expect the final level of design detail to be available prior to the construction and, therefore, prior to licensing."[284] The Staff requires "a sufficient level of detail

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[278] Tr. at 175-76 (7/11/12 Hearing). The slides associated with Mr. Johnson's presentation to the Board on Topic 2 can be viewed at Ex. NRC112.

[279] Tr. at 176 (7/11/12 Hearing).

[280] Id.

[281] Id. at 177.

[282] Id. at 178.

[283] Id. at 177-78.

[284] Id. at 179.

. . . to understand the processes, the process hazards, and enough detail . . . to understand the function of IROFS with respect to their use in meeting performance requirements."[285] Commitments to well-established codes and standards also are an important part of the Staff's review.[286] If an applicant commits to well-known codes and standards, the final design details of sizing or selection of specific models is not necessary because the Staff is "assured that an appropriate design code and standard is being applied to those components."[287]

In addition to the Staff's preliminary review of facility design safety, enrichment facilities are also required to undergo a construction inspection after the facility is constructed but before operations are authorized "to insure that the construction has been done in accordance with the requirements of the license."[288] Through the inspection process, the Staff confirms that the facility has been built in accordance with all of the commitments made in the license application.[289]

This approach to the level of design required has been used for evaluating the three more recently approved enrichment facilities.[290] However, as discussed earlier, the approach was questioned during the USEC American Centrifuge Plant licensing through the DPO process.[291] After appeals through the Executive Director of Operations, the approach was

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[285] Id.

[286] See id. at 180.

[287] Id. at 181.

[288] Id.

[289] Id. at 182.

[290] Id. at 182-83.

[291] Id. at 183.

affirmed, though recommendations were made to revise NUREG-1520 to incorporate some guidance on the level of detail, which occurred in 2010.[292]

In the cascade area, the Staff believed the design was sufficient because the regulatory requirements were met.[293] Enough detail was presented to understand the processes, hazards, and IROFS.[294] The Staff also focused on the commitments to particular codes and standards, which gives "confidence that the facility can be constructed and operated safely."[295] The codes and standards are key aspects of cascade safety because they are promulgated to ensure that the cascade will be leak-tight and to prevent moderator from entering.[296]

The NRC encourages reviewers to participate in future inspections, so the Staff has "a fairly good confidence that the people that understand the criticality issues are going to be the same ones that do the inspections."[297]

Mr. Johnson estimated that the current design is "probably at maybe a 40 percent level" of completion.[298] He added that "[t]here's substantially a lot of detail design left to do," and "a great deal of work is still left for the engineers at GLE in order to complete this."[299] However, he emphasized that enough information was provided to understand the processes and hazards.[300] The Staff expects "changes to be primarily focused on the cascade design itself, which we feel

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[292] Id.

[293] Id. at 189-90.

[294] Id. at 189.

[295] Id.

[296] Id. at 191.

[297] Id. at 194-95.

[298] Id. at 199.

[299] Id.

[300] Id.

really isn't the riskiest part of the facility."[301] Mr. Johnson did not know whether those changes would be done by amendment or without review, but he suspected "that the changes will be similar to what we're seeing with Louisiana Energy Services where most of the changes that are done do not require submittal of an amendment."[302] Using the Louisiana Energy Services facility as an example, Mr. Johnson stated that they were making "several hundred changes over the course of a year" with maybe fifty changes that required an amendment.[303] Although changes are generally public documents, he suspects "that the changes related to the cascade system would be primarily classified and would not be subject to public disclosure."[304] The license also discusses the qualifications of those GLE officials who will be making change determinations – so the Staff assumes "that they are going to have qualified people in accordance with their commitments . . . to manage this program and to carry it out in accordance with the regulation[s]."[305] If a change is made inappropriately, it becomes an enforcement matter beginning with a notice of violation.[306]

Brian W. Smith. Since 2003, Mr. Smith has been Chief of the Uranium Enrichment Branch in the NRC's Office of Nuclear Material Safety and Safeguards.[307] He has a B.S. in Nuclear Engineering from North Carolina State University.[308] As Branch Chief, he has been the first-line manager responsible for the oversight of the technical review performed on the GLE

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[301] Id. at 200.

[302] Id. at 200-01.

[303] Id. at 201.

[304] Id. at 202.

[305] Id. at 204.

[306] Id. at 205.

[307] Ex. NRC120 at 1.

[308] Id. Attach. (Brian W. Smith Statement of Professional Qualifications).

Application and preparation of the SER.[309] He has provided similar oversight in connection with license applications for other uranium enrichment facilities.[310] Prior to his current position, Mr. Smith served as a Senior Assistant in the Office of the Executive Director for Operations and as a Health Physicist and Regional Program Coordinator in the Office of Nuclear Material Safety and Safeguards.[311]

In his written testimony, Mr. Smith testified to the same matters as Mr. Johnson. Additionally, he described the process by which other uranium enrichment facility licensees have made significant changes in the designs of their plants, pursuant to NRC-approved license amendments.[312]

In his oral testimony, Mr. Smith testified as follows:

The Staff expects all licensees to make changes over time, and the regulations account for these changes.[313] The Staff has "seen some licensees evaluate hundreds of changes each year through this process."[314] The Staff believes the cascade will be the area of likely change in this facility.[315] However, Mr. Smith stated, "[b]ecause of the fundamentals of the design as we know it now, we don't believe that any changes will have a significant impact on safety."[316] In

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[309] Id. at 2. The SER can be viewed at Ex. NRC001.

[310] Ex. NRC120 at 1.

[311] Id. Attach. (Brian W. Smith Statement of Professional Qualifications).

[312] Id. at 19-20.

[313] Tr. at 183-84 (7/11/12 Hearing). The slides associated with Mr. Smith's presentation to the Board can be viewed at Ex. NRC112.

[314] Tr. at 184 (7/11/12 Hearing).

[315] Id.

[316] Id. at 184-85.

addition, he emphasized that the primary facility hazard is in the sampling system, and no significant changes are expected in that area.[317]

All licensees must have a Configuration Management system to evaluate and track changes.[318] The system contains the criteria by which licensees evaluate changes and assess whether an amendment is required to be submitted to the NRC for approval.[319] If an amendment is required, no change can be made until NRC approval is granted.[320] All previously unreviewed changes must be submitted annually to the NRC, which the Staff then reviews and the Regional Office uses to perform its annual inspection.[321] The Staff review includes an examination of all changes, with a selected sampling reviewed in more detail.[322] GLE requested separate authorization to utilize a similar process to change its license application – if a proposed change creates a decrease in the effectiveness of any requirement, the change must be submitted in the form of an amendment request to the NRC.[323]

The inspection process prior to operation verifies not only proper construction, but also programs that ensure "the safety of facility, including the criticality safety program, the radiation safety program, the emergency preparedness program, [and] the transportation of materials."[324] Further, during the operational readiness review inspection, revisions of Staff guidance have

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[317] Id. at 185.

[318] Id. at 186.

[319] Id.

[320] Id.

[321] Id. at 186-87.

[322] Id. at 203.

[323] Id. at 187.

[324] Id. at 192-93.

recognized the need to have some of the technical reviewers involved.[325] Consequently, the Staff budgets additional funding to allow for technical staff to assist in inspections.[326] Region II will be primarily responsible for the inspections and authorization of operations; however, it will be done in conjunction with NRC Headquarters office.[327] This type of collaboration has already occurred in relation to the MOX and Louisiana Energy Services facilities, and has been built into the budget to allow for Headquarters participation in inspections going forward.[328] This inspection process is rigorous and is planned in detail in advance in collaboration with Region II.[329]

C. Topic 3: Safety Impact of External Hazards

1. NRC Staff Witnesses

John A. Stamatakos. Dr. Stamatakos is the Director of Technical Programs at the Center for Nuclear Waste Regulatory Analyses, Geosciences and Engineering Division, Southwest Research Institute.[330] He received his B.A. in Geology from Franklin and Marshall College and his M.S. and Ph.D. in Geology from Lehigh University.[331] Dr. Stamatakos is a structural geologist and geophysicist with expertise in paleomagnetism, magnetostratigraphy, paleogeography, exploration geophysics, neotectonics, and earthquake seismology.[332] He is experienced in applications of this expertise to the evaluation of seismic hazards at nuclear

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[325] Id. at 195.

[326] Id.

[327] Id. at 196.

[328] Id.

[329] Id. at 196-97.

[330] Ex. NRC121 at 1.

[331] Id. Attach. (John Stamatakos Statement of Professional Qualifications).

[332] Id.

facilities, the development of tectonic models, and the evaluation of earthquake and volcanic risks at critical nuclear facilities.[333] Prior to joining the Center for Nuclear Waste Regulatory Analyses, he held various teaching positions in his field, wrote or collaborated on more than sixty papers, and made presentations on geological issues at various international conferences.[334]

In his written testimony, Dr. Stamatakos testified as follows:

Dr. Stamatakos was the primary reviewer of GLE's seismic hazard assessment, as contained in GLE's ISA Summary Section 2.5.1.[335] His evaluation of GLE's seismic hazard assessment is contained in Sections 1.2.2.4.1 (Seismic Hazards) and 3.3.4.10 (Geology and Seismic Events) of the SER.[336] Dr. Stamatakos also supported the reviews documented in Sections 3.3.4.2 (Hurricane and Tsunami), 1.2.2.4.1 (Seismic Hazards), 3.3.4.10 (Geology and Seismic Events), and 3.3.12 (IROFS Structures Review) of the SER as they pertained to reviews of GLE's evaluation of hazards related to other natural phenomena and GLE's seismic hazard and design evaluations.[337]

Dr. Stamatakos explained that external hazards are those natural and human-induced events that originate off-site and over which the facility operator has little or no control.[338] These

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[333] Id.

[334] Id.

[335] Id. at 1. GLE's seismic hazard assessment can be found at Ex. GLE010 at 2-18 to 2-22.

[336] See Ex. NRC121 at 1-2. See also Ex. NRC001 at 1-39 to 1-41, 3-17 to 3-21. Notwithstanding Dr. Stamatakos' written testimony, the Seismic Hazard Evaluation and Staff Evaluation of Seismic Hazard Assessment is contained in Section 1.3.3.4.1. Because there is no Section 1.2.2.4.1 in either the public or non-public SER documents, the Board assumes Dr. Stamatakos intended to claim credit for Section 1.3.3.4.1.

[337] Ex. NRC121 at 2. See also Ex. NRC001 at 3-10 to 3-11, 1-39 to 1-41, 3-17 to 3-21, 3-38 to 3-41. As was noted supra, Seismic Hazards is contained in SER Section 1.3.3.4.1, not Section 1.2.2.4.1.

[338] Ex. NRC121 at 3.

events "can be safety-significant contributors to the risk of facility operations."[339] Substantial regulatory and guidance documents guided the Staff review of these hazards. For example, 10 C.F.R. § 70.61(a) required GLE to evaluate and reduce the risk of events that could have significant impacts on workers or the public. Further, 10 C.F.R. § 70.61(b), (c) require high consequence events to be highly unlikely and intermediate consequence events to be unlikely.[340] The ISA Summary must assess potential accidents caused by credible external events and design the facility to protect against natural phenomena.[341] NRC regulations require that these requirements are met and that the Staff determine that the proposed facility and equipment are adequate to protect health and minimize danger to life or property before a license may issue.[342] Section 3.4.3.2(1)(c) of NUREG-1520,[343] Interim Staff Guidance Document FCSS-ISG-08,[344] Regulatory Guide 1.59,[345] and NUREG/CR-4461[346] provided further guidance to reviewers on external hazard issues, including assessing whether GLE identified all design basis natural events and characterized hazards with sufficient detail to support GLE's assessment of impacts on facility safety and likelihood of occurrence; allowed for utilization of alternative data sources when historical data was insufficient or unavailable; and provided

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339 Id.

340 Id. at 4.

341 Id. (citing 10 C.F.R. §§ 70.62(c)(iv) & 70.64(a)(2)).

342 Id. at 4-5 (citing 10 C.F.R. §§ 70.23(a)(4), 70.66(a)).

343 Ex. NRC005 at 3-12.

344 Ex. NRC036.

345 Ex. NRC029.

346 Ex. NRC030.

specialized guidance for reviewing flooding, high winds, tornados, and earthquakes.[347] The Staff also used well-established codes and standards from external sources, including those of the American Society of Civil Engineers, the American Institute of Steel Construction, and the American Concrete Institute, to review GLE's proposed design.[348]

The flooding hazard at the proposed GLE site was evaluated on the basis of rainfall in the Northeast Cape Fear River and the Cape Fear River watersheds, locally heavy site rainfall, and a hurricane surge.[349] GLE calculated these numbers using the probable maximum flood in the river watersheds, the probable maximum precipitation, and the probable maximum hurricane surge.[350] Tsunamis were assessed in accordance with the distance to the coastline and site elevation relative to mean sea level.[351] Flood analysis indicated that both rivers could potentially impact the GLE site.[352] The proposed facility is located ten miles inland from the Atlantic Ocean at twenty-five feet above mean sea level.[353] The surrounding area is relatively flat, so a flood above mean sea level would occur slowly due to the large flat region that would accommodate flood water.[354] GLE indicated that a probable maximum flood is twenty-eight feet above mean sea level for the proposed site, which is three feet above the facility floor.[355] Because the rise in water during a probable maximum flood would occur slowly, personnel would have ample time

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[347] Ex. NRC121 at 5-6.

[348] Id. at 6.

[349] Id. at 6-7.

[350] Id. at 7.

[351] Id.

[352] Id.

[353] Id.

[354] Id.

[355] Id. at 7-8.

to take necessary mitigating steps.[356] While a seismically-induced dam failure on the Cape Fear River could cause flooding of the proposed site, GLE determined and the Staff agreed that a dam flood would not exceed the flooding level of the probable maximum flood.[357] The maximum rainfall in the area was recorded in September 1999 during Hurricane Floyd. At that rainfall level, the Northeast Cape Fear River Basin would not flood the site, and because the proposed facility is located at a relative high point, high rainfall accumulations will drain to lower elevations.[358]

GLE's approach of using the probable maximum flood to estimate design basis flood is acceptable because FCSS-ISG-08 states that the probable maximum flood can be applied to 10 C.F.R. Part 70 facilities as "highly unlikely" events.[359] Applying the guidance of FCSS-ISG-08, the approach of using the probable maximum flood, the probable maximum precipitation, and the probable maximum hurricane surge were acceptable. Because there is a large flat region to accommodate a flood, it also is very unlikely that the probable maximum flood would reach an elevation greater than twenty-five feet. For those reasons, the Staff found that GLE's design basis flood level was conservative.[360]

The estimated probable maximum hurricane surge at the open-coast shoreline of North Carolina is 21.9 feet using the probable maximum hurricane required by RG 1.59.[361] Adding

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[356] Id. at 8.

[357] Id.

[358] Id.

[359] Id. In fact, Dr. Stamatakos testified that FCSS-ISG-08 states that using the probable maximum flood may even be preferable to the use of historical data, depending on the quality of historical data available. Id. (citing Ex. NRC036 at 16).

[360] Id. at 9.

[361] Id. (citing Ex. NRC029). Dr. Stamatakos also noted this approach was consistent with that outlined in FCSS-ISG-08. Id.

additional conservatism to this estimate is the assumption that a surge of this height could reach the facility without considering possible dissipation and the facility's distance from water sources.[362] Nonetheless, the design basis flood water level of twenty-eight feet for the site bounds the flooding for a hurricane, leading Dr. Stamatakos to conclude that the design basis is conservative relative to any flooding hazards from hurricanes.[363]

The probability that a large tsunami would reach the facility site is highly unlikely because the Atlantic seaboard is not conducive to forming large earthquake-generated tsunamis and there are no historical records of tsunamis along the North Carolina coast since colonial settlement.[364] Fractures discovered along a stretch of the continental shelf could trigger a tsunami with a surge similar to a storm surge from a Category 3 or 4 hurricane.[365] Therefore, Dr. Stamatakos concluded that a tsunami wave size similar to a Category 3 or 4 hurricane is bounded by the maximum hurricane surge. Because the design basis flood was conservative relative to the probable maximum hurricane surge, it is also adequately conservative to the flooding hazard from tsunamis.[366] Operational safety is enhanced by GLE's plan to evacuate and shutdown prior to any flood threat and because GLE has opted to use established codes AISC N690, ASCE 7-05 and ACI-349 when designing IROFS structures to mitigate flooding hazards which would provide significant reserve strength associated with the analysis, load combinations, and design of steel and reinforced concrete structures.[367]

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[362] Id. at 9-10.

[363] Id. at 10.

[364] Id.

[365] Id. (citing Ex. NRC038 at 410).

[366] Id.

[367] Id. at 10-11.

GLE discussed its earthquake hazard analysis in the ISA Summary Section 2.5.1, which consisted of three parts: (1) the historical seismic record; (2) a United States Geologic Survey (USGS) probabilistic seismic hazard assessment, and (3) the response of the earthquake energy to site soil conditions.[368] First, GLE discussed the historical earthquake record and identified the largest historical local and regional earthquakes.[369] Second, GLE provided the probabilistic ground motions for the site based on the 2008 USGS National Seismic Hazard Maps.[370] GLE cited the USGS maps for a return period of 2,500 years or an annual probability of 4×10^{-4}.[371] Building code requirements in the 2006 International Building Code specify that the building should withstand 2,500 year return period ground motions.[372] The USGS ground motions predicted for the site exceed those that resulted from any known historical earthquake.[373] With this seismic design basis, GLE then must design the facility to provide adequate assurance that IROFS will maintain their safety functions under the earthquake ground motions predicted by the USGS model.[374] GLE and the Staff found that the design methods outlined in DOE-STD-1020 and ASCE 43-05 provide sufficient margins that the IROFS will maintain their safety functions for the 10,000 year return period ground motions predicted by the USGS model.[375] Finally, GLE provided an assessment of the site soil conditions and

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[368] Id. at 13 (citing Ex. GLE010 at 2-18 to 2-22).

[369] Id.

[370] Id. at 14.

[371] Id.

[372] Id. (citing Ex. NRC034).

[373] Id.

[374] Id.

[375] Id.

determined that the site was Class C, according to the USGS soil classification system.[376] To account for the impacts to potential group motions of these softer soil conditions at the site, GLE applied the site amplification coefficients from the International Building Code.[377]

In fact, GLE's approach to seismic hazard assessment and seismic design was more conservative than the one described in FCSS-ISG-08.[378] It was appropriate for GLE to use the approach it had utilized in the ISA Summary rather than the deterministic approach developed in FCSS-ISG-08.[379] An FCSS-ISG-08 approach would have led to a seismic design roughly equivalent to the 1,000 year return period earthquake, rather than the 10,000 year return period earthquake GLE's approach now encompasses.[380] Further, GLE will conduct seismic analyses of the IROFS structures using one or more of the seismic analyses methods permitted by ASCE7-05. By using design methods drawn from these proposed codes and standards, the IROFS structures will be constructed to withstand ground motions from earthquakes that are substantially less likely than the design basis ground motions.[381] Finally, Dr. Stamatakos testified that if a highly unlikely earthquake (one that exceeds design basis) occurs, it may cause non-elastic damage, like cracking or tilting, without actual building collapse. Accordingly, exceeding the design basis (already highly unlikely) may lead to building damage without damage to the IROFS in the building.[382]

In his oral testimony, Dr. Stamatakos testified as follows:

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[376] Id. at 15.

[377] Id.

[378] Id.

[379] Id.

[380] Id. at 15-16.

[381] Id. at 16.

[382] Id.

Dr. Stamatakos explained in greater detail why, when it assessed the earthquake hazard, GLE adopted an approach other than the FCSS-ISG-08 approach it used to assess other hazard risks.[383] GLE adopted a more probability-based approach and defined a failure probability of 10^{-4} as a highly unlikely performance objective for seismic design.[384] GLE's use of USGS 2,500 year return period ground motions and appropriate design analysis and methodology to construct the facility ensures that the facility will be built with an earthquake failure probability of 10^{-4}.[385] While the ISG-08 approach looks at the largest local and the largest regional earthquakes and would have resulted in only about a 1,000 year return period, the approach GLE adopted ensures that structural IROFS will be able to withstand ground motions at least equal to the 10,000 year return period earthquake.[386]

Dr. Stamatakos explained that historical earthquakes under the ISG-08 approach were estimates since there were no recordings of the largest regional earthquake.[387] Historical evidence indicates that a similar earthquake had occurred several thousand years prior, but there was no evidence of significantly larger events.[388] Dr. Stamatakos also explained the difficulty in identifying local earthquake sources and history – stating that there is often "not a good understanding of what the sources are, especially for those small earthquakes."[389] The USGS model provides substantial benefits when the historical record, as here, contains

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[383] The slides associated with Dr. Stamatakos' oral presentation to the Board can be viewed at Ex. NRC113.

[384] Tr. at 224-25 (7/11/12 Hearing).

[385] Id. at 225.

[386] Id. at 225-26.

[387] Id. at 228.

[388] Id. at 229-30.

[389] Id. at 231.

insufficient data on which to base analysis. In addition to accounting for higher and lower magnitude events, the model accounts for long time lags between major events. Dr. Stamatakos asserted that "the USGS model incorporates lower term period, high magnitude events, up to magnitude 7.5 in there, and they randomly float that earthquake in their probabilistic analysis. . . . It's probably one of the reasons why the USGS curve is significantly higher than the hazard you get by simply looking at historical events."[390]

The local source for tsunamis in the Wilmington area would be submarine landslides from sediment off of the continental shelf.[391] While landslide generated tsunamis could cause quite severe localized damage, the likelihood of a landslide generated tsunami affecting the proposed site is "so small that [it] would fall well below the highly unlikely."[392] However, Dr. Stamatakos acknowledged that a locally generated tsunami from a local landslide or earthquake would give minutes warning, at best, to plant operators.[393] He also discussed the low likelihood of effects from a subduction related tsunami. Referring to analysis in NUREG/CR-6966,[394] Dr. Stamatakos explained that newer studies indicate that changes to water depth greatly affect the analysis, leading to "greater dispersion of the waves and effects . . . mitigated substantially by the time the tsunami could reach the Atlantic seaboard."[395] He concluded that "in reference to either the local or distant tsunamis, there's not a very strong record on the Atlantic Seaboard for

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[390] Id. at 231-32.

[391] Id. at 236.

[392] Id. at 237.

[393] Id. at 242.

[394] While this document is excerpted in Ex. NRC093, the parts discussed at hearing were not included in the Staff's exhibit.

[395] Tr. at 240-41 (7/11/12 Hearing).

geologic . . . tsunamis,"[396] confirming his earlier testimony that large tsunami reaching the proposed site "is highly unlikely."[397]

Asadul H. Chowdhury. Dr. Chowdhury is currently a Staff Engineer at the Center for Nuclear Waste Regulatory Analyses, Geosciences and Engineering Division, Southwest Research Institute.[398] He received his B.S. in Civil Engineering at East Pakistan University of Engineering & Technology (now Bangladesh University of Engineering & Technology) and his M.S. and Ph.D. in Structural Mechanics from Cornell University.[399] Dr. Chowdhury is a structural engineer, specializing in structural and geotechnical engineering, and is experienced in evaluating the analysis, design, and operations of various nuclear facilities dealing with the enrichment of uranium; fabrication of nuclear fuel; spent fuel storage; and the storage, handling, and disposal of high-level radioactive waste.[400] He also is experienced with design codes and standards for the design of structural and foundation systems of nuclear facilities, with special emphasis on seismic design.[401] Prior to his current role assisting the NRC Staff in its seismic review, Dr. Chowdhury worked in the nuclear industry, conducting analyses and technical support in several specialized areas.[402] He has written or co-written over 125 technical papers and reports.[403]

In his written testimony, Dr. Chowdhury testified as follows:

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[396] Id. at 241.

[397] Ex. NRC121 at 10.

[398] Id. at 1.

[399] Id. Attach. (Asadul H. Chowdhury Statement of Professional Qualifications).

[400] Id.

[401] Id.

[402] Id.

[403] Id.

Dr. Chowdhury was the primary reviewer of GLE's IROFS structural analysis and design. His review and evaluation are located in Section 3.3.12 (IROFS Structures Review) of the SER.[404] He also supported reviews of GLE's evaluation of external hazards due to seismic activity, high winds and tornados, and flooding, including hurricanes and tsunamis – ensuring "that the external hazards information was used appropriately and consistently to develop the design bases."[405] Staff reviews in these areas are located in Sections 1.2.2.4.1 (Seismic Hazards), 3.3.4.10 (Geology and Seismic Events), 1.3.3.3.1 (Tornado Hazard), 1.3.3.3.2 (High Winds and Hurricanes), 1.3.3.3.7 (Floods), 1.3.3.3.8 (Tsunami), 3.3.4.1 (High Wind and Tornado Hazards), 3.3.4.2 (Hurricane and Tsunami), and 3.3.4.4 (Flooding) of the SER.[406]

Dr. Chowdhury reviewed many of same seismic and flooding issues covered by Dr. Stamatakos, and using the same analysis, he drew the same conclusions. In addition, he reviewed GLE's high wind and tornado hazard evaluation and discussed the Staff's evaluation thereof.[407] GLE reviewed high wind and tornado hazards in the ISA Summary Sections 2.5.5 (Hurricanes) and 2.5.6 (Tornados).[408] The highest 3-second wind gust recorded in the area of the facility was 107 mph. Based on this information, GLE determined that hurricane winds

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[404] Id. at 2. Section 3.3.12 (IROFS Structures Review) is located in Ex. NRC001 at 3-38 to 3-41.

[405] Id. at 2.

[406] Id. Sections 3.3.4.10 (Geology and Seismic Events), 1.3.3.3.1 (Tornado Hazard), 1.3.3.3.2 (High Winds and Hurricanes), 1.3.3.3.7 (Floods), 1.3.3.3.8 (Tsunami), 3.3.4.1 (High Wind and Tornado Hazards), 3.3.4.2 (Hurricane and Tsunami), and 3.3.4.4 (Flooding) can be found at Ex. NRC001 at 3-17 to 3-21, 1-34 to 1-35, 1-35 to 1-36, 1-38 to 1-39, 1-39, 3-9 to 3-10, 3-10 to 3-11, and 3-12 to 3-13, respectively. Section 1.2.2.4.1 (Seismic Hazards) was also incorrectly identified incorrectly by Dr. Stamatakos. The proper section, Section 1.3.3.4.1 is located at Ex. NRC001 at 1-39 to 1-40.

[407] Ex. NRC121 at 11-13.

[408] Id. at 11 (citing Ex. GLE010 at 2-26 to 2-30, 2-30 to 2-32 respectively).

define the design basis wind speed, as they exceed the highest reported wind gust.[409] Because no Category 4 hurricanes have been reported in the vicinity of the proposed facility, GLE selected a Category 4 hurricane with a 3-second wind gust speed of 157.5 mph as the deterministically "highly unlikely" event.[410] Historical data justified this as the highly unlikely event. For example, only six Category 4 and six Category 5 hurricanes have been recorded with wind speeds greater than 157.5 mph at landfall – and none occurred within 500 miles of the proposed site.[411] The more severe hurricanes that made landfall on the Carolina coast recorded wind speeds below the 157.5 mph threshold.[412]

Reviewing this analysis, Dr. Chowdhury testified "the design basis wind speed is adequately conservative for hurricane, high wind, and tornado hazards."[413] In support of this view, Dr. Chowdhury explained that only fifteen tornados have been recorded between 1950 and 2004 in New Hanover County, all at the F1 or F0 level on the Fujita Scale.[414] The strongest tornado in the area was an F2 in the neighboring Brunswick County, and no F4 or F5 tornados have ever been recorded in North Carolina.[415] NUREG/CR-4461[416] recommends a design wind speed of 112 mph for a "highly unlikely" tornado with an annual probability of 10^{-5}. This is less

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[409] Id.

[410] Id.

[411] Id.

[412] Id. Those hurricanes were Hurricane Hugo in 1989 with a 152 mph gust reported, and Hurricane Hazel in 1954, with an estimated wind speed gust of 140 mph. Id.

[413] Id. at 13.

[414] Id. at 12.

[415] Id.

[416] Ex. NRC030 at 8-1.

than 157.5 mph, the design basis wind speed for the "highly unlikely" Category 4 hurricane windspeed.[417]

The design basis wind speed of 157.5 mph based on the wind speed of a Category 4 hurricane is sufficiently conservative for several reasons.[418] First, this design basis is greater than the upper bound wind speed for a Category 3 hurricane (131-155 mph), and no Category 3 or 4 winds have ever been reported in the area.[419] Second, hurricane wind speed decreases as a hurricane moves inland – and GLE's proposed site is about ten miles inland.[420] Third, the highly unlikely tornado event has a wind speed of 112 mph – so the facility is adequately conservative for hurricane, high wind, and tornado hazards and will be designed to exceed the winds of the "highly unlikely" tornado event.[421] Finally, GLE will convert these design bases to applied loads to the IROFS structures in accordance with established codes, ASCE 7-05, AISC N690, and ACI 349. Utilizing these codes and standards builds in an "inherent design margin."[422]

In his oral testimony, Dr. Chowdhury testified as follows:

Liquefaction concerns on the GLE site were limited to soil, not rock. Because liquefaction appears to be a localized phenomenon, it "could be mitigated through the design of the foundation."[423] While the seismic design of the cascade hall had not been detailed, GLE committed to parallel DOE and ASC design standards, which are "used extensively for new

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[417] Ex. NRC121 at 12.

[418] Id.

[419] Id.

[420] Id.

[421] Id. at 13.

[422] Id.

[423] Tr. at 233-34 (7/11/12 Hearing).

facilities" and "are consensus standards."[424] GLE has also committed to using the established design code ACI-349 for concrete structures and the American Institute of Steel Construction Standard N-690 for steel structures which means IROFS buildings are structured with a "steel frame structure with a concrete foundation system" in accordance with these codes and standards.[425]

Sui-Min (Simon) Hsiung. Dr. Hsiung is currently a Staff Engineer at the Center for Nuclear Waste Regulatory Analyses, Geosciences and Engineering Division, Southwest Research Institute.[426] He received his B.S. in Mining Engineering from National Cheng Kung University, his M.S. in Rock Mechanics from National Cheng Kung University, and his Ph.D. in Mining Engineering from West Virginia University.[427] He is a mining engineer with experience in geotechnical engineering, ISA, and hazard assessments.[428] Dr. Hsiung has substantial experience in providing technical support to the NRC on license application reviews of fuel cycle facilities of various types, including MOX, gas centrifuge, laser enrichment, and independent fuel storage installation facilities, and assessing their hazards analyses and structural designs.[429] Dr. Hsiung has authored over 130 technical papers and reports.[430]

In his written testimony, Dr. Hsiung testified as follows:

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[424] Id. at 246-47.

[425] Id. at 247, 249.

[426] Ex. NRC121 at 1.

[427] Id. Attach. (Sui-Min (Simon) Hsiung Statement of Professional Qualifications).

[428] Id.

[429] Id.

[430] Id.

Dr. Hsiung was the primary reviewer of GLE's assessment of external hazards for the proposed GLE Facility in areas other than seismic hazards.[431] His review included the assessment of hazards due to flooding, hurricanes, tsunamis, high winds, and tornados. Dr. Hsiung testified that his analysis of GLE's assessment of those hazards is found in Sections 1.3.3.3.1 (Tornado), 1.3.3.3.2 (High Winds and Hurricanes), 1.3.3.3.7 (Floods), 1.3.3.3.8 (Tsunami), 3.3.4.1 (High Wind and Tornado Hazards), 3.3.4.2 (Hurricane and Tsunami), and 3.3.4.4 (Flooding) of the SER.[432]

The details of Dr. Hsiung's written testimony addressed the same external hazard assessment issues discussed by Drs. Stamatakos and Chowdhury, supra.[433]

In his oral testimony, Dr. Hsiung testified as follows:

The Staff's external hazard evaluation focused on determining whether the relevant regulatory requirements have been met.[434] These regulations require the identification of potential accident sequences involving credible external events and a design that provides adequate protection against natural hazards, with consideration of the most severe historical documented events for the site.[435] The ultimate goal of the Staff's review was "to ensure that the applicant's assessment complies with the performance requirements in [§] 70.61(b) and (c) to review the risk of events that could have significant impacts on workers and the public."[436]

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[431] Id. at 2.

[432] Id. Those Sections can be found at NRC001 at 1-34 to 1-35 (Tornado Hazard); 1-35 to 1-36 (High Winds and Hurricanes); 1-38 to 1-39 (Floods); 1-39 (Tsunami); 3-9 to 3-10 (High Wind and Tornado Hazards); 3-10 to 3-11 (Hurricane and Tsunami); and 3-12 to 3-13 (Flooding).

[433] See Ex. NRC121 at 3-16.

[434] The slides associated with Dr. Hsiung's oral presentation to the Board can be viewed at Ex. NRC113.

[435] Tr. at 212-13 (7/11/12 Hearing).

[436] Id. at 213 (stating "specifically, [§] 70.61(b) requires high consequence events to be highly unlikely, and [§] 70.61(c) requires intermediate consequence events to be unlikely").

Using NUREG-1520, the Staff assessed whether GLE had characterized hazards with sufficient detail; whether GLE accurately classified the likelihood of hazards and provided adequate bases for that determination; and whether GLE identified all design bases related to these hazards.[437] Dr. Hsiung also reviewed several guidance documents and well-established codes and standards that the Staff used in its review of GLE's application.[438]

The Staff found that GLE's application of various guidance documents was appropriate and that all floods were bounded by the highly unlikely maximum probable river flood of twenty-eight feet.[439] The topography of the landscape around the proposed site – a relative high point surrounded by flat areas with gentle sloping surfaces at gradients less than 2 percent with little relief – provides the site with much protection from potential flood hazards.[440]

The Staff also reviewed GLE's assessment that a high wind hazard of 157 mph is an appropriate design basis for wind for the facility.[441] Historical data in the area indicates that the highest wind recorded in the region was approximately 107 mph, and hurricane winds never equaled or exceeded those of a Category 3 hurricane.[442] The high wind hazard of 157 mph equals the winds of a Category 4 hurricane, which the Staff found sufficiently bounding and conservative on all wind-related events.[443] Additional conservatism was built into those numbers through the likelihood that hurricane wind speeds will have dropped by the time they

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[437] Id. at 213-14.

[438] Id. at 214-15.

[439] Id. at 216-22.

[440] Id. at 217.

[441] Id. at 222.

[442] Id.

[443] Id. at 223.

would reach an inland location like the proposed site and through GLE's use of codes and standards in its structural design.[444]

In addressing concerns about soil liquefaction at the site, Dr. Hsiung explained that thus far a very small mineral pocket has been found, which will be designed around to avoid impact to that particular area.[445] GLE has committed to additional investigation to ensure there are not further liquefaction issues.[446] If further issues arise, structural and engineering adjustments can be made to avoid the potential effect of the liquefaction.[447] After GLE has performed further investigations, the Staff will review those results, ensure they are accurate, and determine any design changes that may be necessary.[448]

Dr. Hsiung also clarified that different water levels and elevations are used for different flooding-related measurements. For the particular hurricane surge assessed here, GLE and the Staff applied a calculation based on mean low water, which differs by about 2.3 feet from mean sea level.[449] Differences in tides, seasons, and other variations in water level are accounted for.[450] For calculations concerning hurricane surges, the regulatory guidance suggests use of the mean low water, as was applied here.[451]

Dr. Hsiung acknowledged that changing weather patterns do limit the usefulness of historical data, but NRC regulations and guidance set out the criteria necessary for the Staff to

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[444] Id. at 223-24.

[445] Id. at 233.

[446] Id.

[447] Id. at 235.

[448] Id.

[449] Id. at 244.

[450] Id. at 245.

[451] Id. at 246.

review hazards. Additionally, layers of accident analysis and structural design add additional protection, and design basis events are likely to cause only minor structural damage.[452]

D. Topic 4: Tracking and Implementation of Applicant Commitments

1. GLE Witnesses

Julie Anne Olivier. Ms. Olivier's background and qualifications have been previously summarized in regard to her testimony on Topic 2.

In her written testimony on Topic 4, Ms. Olivier testified as follows:

GLE has an inclusive process to ensure that commitments, license conditions, and other regulatory requirements are properly tracked and implemented.[453] GLE will use compliance checklists to identify and implement existing, new, or modified regulatory requirements.[454] A Self-Assessment Program and Corrective Action Program will provide reasonable assurance that GLE detects precursor conditions and corrects noncompliances.[455] Additionally, GLE's reporting and incident investigation procedures will provide direction as to whether a discovered noncompliance merits an investigation and report to the appropriate regulatory agency.[456] Finally, in preparation for the NRC's Operational Readiness Review, GLE will perform comprehensive internal readiness reviews.[457]

Mandatory commitments are those required by a regulatory agency and include compliance with NRC license conditions.[458] In addition to mandatory commitments, when

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[452] Id. at 251-52.

[453] Ex. GLE021-R at 4.

[454] Id.

[455] Id.

[456] Id.

[457] Id.

[458] Id. at 6.

practicable GLE seeks to achieve and maintain standards regarding protection of its workers, the public, and the environment that go above and beyond regulatory requirements.[459] To achieve this objective, GLE has made various voluntary commitments to the NRC and to other local, state and federal agencies during the licensing process.[460] Both mandatory and voluntary commitments will be tracked by a comprehensive GLE tracking and implementation process.[461]

Changes to the proposed facility that require prior NRC approval in accordance with 10 C.F.R. § 70.72 will be documented as license amendments.[462] For changes that do not require prior NRC approval under 10 C.F.R. § 70.72(d)(2), GLE will submit to the NRC annually, within thirty days after the end of the calendar year during which the change occurred, a brief summary of all changes.[463] In addition, in accordance with 10 C.F.R. § 70.72(f), GLE will maintain records of such changes that include a written evaluation providing the bases for determining that the changes did not require prior NRC approval.[464] These records will be maintained until termination of the license.[465]

GLE is in the process of completing similar compliance checklists for (1) the majority of mandatory licensing basis commitments; (2) commitments arising from the ISA; and (3) commitments to codes and standards, as well as regulatory guidance documents.[466] In addition

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[459] Id.

[460] Id.

[461] Id.

[462] Id. at 7.

[463] Id. at 8.

[464] Id.

[465] Id.

[466] Id. at 8-12.

to comprehensively identifying such commitments, the checklists will, as appropriate, identify a commitment's action owner and responsible manager, so that an electronic calendar system can be used to capture the action, action owner, responsible manager, and relevant due dates.[467]

In the case of commitments to codes, standards, and regulatory guides, if GLE finds that it cannot meet these commitments, the responsible employee, with oversight and approval by the responsible manager, will make a conservative decision regarding how best to proceed.[468] For example, if the direction in one industry standard conflicts with the direction in another, GLE will use a conservative approach to determine which to follow and then document resolution of the issue on the checklist.[469] This information will be maintained in dedicated records that will either be submitted directly to the NRC upon request or made available to the NRC during an inspection.[470]

GLE will transfer the compliance checklists discussed above, which will capture all of GLE's requirements and commitments, to a database that will allow electronic searching for individual regulatory requirements and commitments.[471] The database will be updated as actions are taken on commitments.[472] During onsite NRC inspections, the database will be available for review by inspectors.[473]

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[467] Id. at 9.

[468] Id. at 11.

[469] Id.

[470] Id. at 11-12.

[471] Id. at 12.

[472] Id.

[473] Id.

GLE also has procedures for reviewing, tracking, and implementing new or modified regulatory requirements and guidance.[474] These procedures are intended (1) to provide guidance concerning the review and implementation of new or modified domestic and foreign regulations, directives, and regulatory guidance; and (2) to establish a process for submitting comments to regulatory agencies, as deemed appropriate.[475]

GLE will determine the feasibility of implementing voluntary commitments on the basis of several factors, including (1) practicability (e.g., the availability of low-sulfur fuel oil and ultra-low sulfur diesel fuel); (2) the potential for conflict between commitments; (3) overall feasibility with respect to project schedule; and (4) cost-benefit analysis.[476] If a voluntary commitment is not feasible to complete, GLE will note that fact in the same tracking system discussed above for mandatory commitments, along with a justification as to why the action will not be performed.[477] In addition, GLE will likely consult with the affected regulatory authority.[478]

Finally, GLE will perform comprehensive internal readiness reviews in preparation for the NRC's Operational Readiness Review.[479] GLE will form a multi-disciplinary team and utilize the NRC inspection manual or other relevant guidance documents to perform the review.[480] It is GLE's objective to perform the internal readiness review prior to scheduling the NRC inspection, thus allowing time for potential corrective actions to be implemented and evaluated before the

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[474] Id.

[475] Id.

[476] Id. at 13.

[477] Id.

[478] Id.

[479] Id. at 17.

[480] Id.

NRC inspection team arrives.[481] In addition, GLE will also perform various, albeit more limited internal readiness reviews before beginning a new process or activity, including radioactive material handling, connecting new computer networks, and installing new safety or security equipment.[482]

In her oral testimony on Topic 4, Ms. Olivier testified as follows:

Commitments can be either mandatory or voluntary.[483] Mandatory commitments are categorized as those commitments required by a regulatory agency. Voluntary commitments are selective actions that go above and beyond the regulations.[484] GLE viewed environmental mitigation measures as a subset of commitments.[485] Changes to commitments requiring NRC approval will involve a license amendment.[486] If NRC approval is not required, GLE will submit a summary of the changes to the NRC.[487] Commitments are implemented through compliance checklists, which map out implementing procedures for each commitment, assign responsibility, and track responsibilities in an electronic calendar system.[488] GLE will also track voluntary

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[481] Id.

[482] Id.

[483] Tr. at 13 (7/12/12 Hearing). The slides associated with Ms. Olivier's presentation to the Board can be viewed at Ex. GLE022.

[484] Tr. at 13 (7/12/12 Hearing).

[485] Id.

[486] Id. at 14.

[487] Id.

[488] Id.

commitments.[489] If a voluntary commitment is not feasible or not implemented, GLE will note the decision and justification in the compliance checklist.[490]

Although no construction activities have begun, GLE has not made any changes to its commitments.[491] Because preconstruction is now lumped into construction, GLE will perform all mitigation measures that have been committed to in the license application, ER, and FEIS as it begins work on the site.[492] If a voluntary measure cannot be implemented due to one of GLE's five assessment factors, it will be documented on the compliance checklist.[493] Compliance checklists are not public because they can contain proprietary or sensitive information about safety or security systems, but they are available to the NRC and other regulators.[494] GLE determined mitigation measures largely based on experience and knowledge of the Wilmington site; thus, GLE intends "to go through all of these mitigation measures unless one of these factors prevents [them] from doing so."[495] GLE will follow the same process for NRC recommended mitigation measures – which will also be performed unless some reason prevents GLE from performance. If that is the case, the deviation and the reason for such deviation will be documented.[496]

The decision to determine whether or not a change requires a license amendment is a formalized process led by individuals trained in making conservative decisions and familiar with

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[489] Id. at 15.

[490] Id.

[491] Id. at 17-18.

[492] Id. at 18.

[493] See id. at 19-20.

[494] Id. at 22.

[495] Id. at 20.

[496] Id. at 21.

the license application.[497] Once changes are entered through the electronic workflow system for change requests, reviewers will consider whether they reflect any decrease in effectiveness and determine what action should be made.[498]

Compliance checklists must be completed before any inspection – internal or external can occur.[499] The internal review that occurs prior to the NRC's Operational Readiness Review will utilize the checklists to ensure compliance.[500] Any changes to the ISA Summary or ISA would go through the GLE change request process, reviewed against GLE's documents, and a determination would be made on whether a license amendment is required.[501]

GLE tracks voluntary commitments the same way as other commitments; however, there is no requirement to share those records with the NRC.[502] GLE nonetheless will make them available should the agency request access to them.[503] Despite their voluntary nature, Ms. Olivier stated that "[t]here are several reasons that it behooves GLE to comply with those voluntary commitments. . . . [O]ne area is typically those commitments are good for our business. . . . [T]here are some public relation aspects to being stewards to the environment, as well as, [the fact that] it's our site, it's our community."[504]

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[497] Id. at 23.

[498] Id. at 23-24.

[499] Id. at 24-25.

[500] Id. at 24.

[501] Id. at 25-26.

[502] Id. at 27.

[503] Id.

[504] Id. at 27-28.

Robert Crate. Mr. Crate is the Operations Manager for the GLE project.[505] He has a B.S. degree in Sociology from the University of the State of New York and was certified by the U.S. Navy as a Nuclear Plant Engineering Officer.[506] During his thirty-seven year career, he has been employed in various segments of the nuclear industry, from the Nuclear Navy and Department of Energy to, more recently, working at a commercial nuclear power plant and fuel fabrication facility.[507]

In his written testimony, Mr. Crate testified to many of the same matters regarding compliance and tracking as Ms. Olivier. Additionally, he testified as follows:

GLE's Corrective Action Program was established to ensure that a broad range of conditions, including improper implementation of commitments and noncompliances are detected, reported, and resolved appropriately to improve quality and performance.[508] The Corrective Action Program is a repository designed to capture significant conditions adverse to quality, safety and other conditions that may be precursors to more significant issues, possibly involving noncompliances with a commitment or other regulatory requirement.[509] Many of these issues are identified through other GLE programs, including, for example, its Self-Assessment, Quality Assurance, 10 C.F.R. Part 21, and Configuration Management programs, and are captured and resolved through the Corrective Action Program.[510] The Corrective Action Program includes condition reporting, investigation, analysis, corrective action, preventive

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[505] Ex. GLE021-R at 1.

[506] Id. at 2.

[507] Id.

[508] Id. at 13.

[509] Id. at 13-14.

[510] Id. at 14.

action, trend analysis, and reviews.[511] Approved written policies, plans, and procedures specify requirements for documenting conditions adverse to quality including identification, classification, appropriate notifications, and corrective actions taken.[512] In addition, follow-up actions to verify implementation of corrective actions and trending analyses are required for significant conditions adverse to quality.[513] The Corrective Action Program also allows for continuous improvement through entry and resolution of new requirements and commitments.[514]

The primary method for identifying noncompliances is through GLE's Self-Assessment Program, which was developed on the basis of a widely-used nuclear industry guidance adopted from the Institute of Nuclear Power Operations Principles for Effective Self-Assessment and Corrective Action Programs.[515] Should GLE determine that a noncompliance has occurred, the noncompliance will be evaluated in accordance with GLE's reporting procedures to determine if the NRC or other regulatory agencies need to be notified.[516] In addition, when a noncompliance occurs, GLE will institute a corrective action request that requires GLE to determine whether an incident investigation is necessary.[517]

Incident investigations are performed to ensure that the noncompliance is understood and appropriate corrective actions are identified and implemented to prevent recurrence.[518] The implementing procedure requires that noncompliances are documented in an investigation

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[511] Id.

[512] Id.

[513] Id.

[514] Id.

[515] Id.

[516] Id. at 16.

[517] Id.

[518] Id.

report.[519] These reports are entered into the Corrective Action Program and the associated corrective actions are tracked to completion.[520] The objectives of the incident investigation and reporting procedures are to establish the validity of the data related to the incident, to develop and implement corrective action plans when appropriate, to document an event that was or could become a danger to persons or property, and to ensure that proper levels of GLE management and public agencies are notified as appropriate.[521]

In his oral testimony on Topic 4, Mr. Crate testified as follows:

GLE's Corrective Action Program captures improper implementation of commitments and other noncompliances.[522] GLE also has a self-assessment program, which proactively identifies noncompliances for inclusion in the Corrective Action Program.[523] Corrective action requests are initiated through the Corrective Action Programs.[524] GLE also will conduct incident investigations, implement corrective actions, notify appropriate agencies, and conduct periodic assessments and audits.[525] To prepare for the Operational Readiness Review, GLE will conduct internal readiness reviews.[526]

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[519] Id.

[520] Id.

[521] Id. at 16-17.

[522] Tr. at 16 (7/12/12 Hearing). The slides associated with Mr. Crate's presentation to the Board can be viewed at Ex. GLE022.

[523] Tr. at 16 (7/12/12 Hearing).

[524] Id.

[525] Id.

[526] Id. at 17.

2. NRC Staff Witnesses

Jennifer A. Davis. Ms. Davis is a Senior Project Manager in the NRC's Environmental Review Branch, Environmental Protection and Performance Assessment Directorate, Division of Waste Management and Environmental Protection, Office of Federal and State Materials and Environmental Management Programs Office.[527] She has a B.A. in Historic Preservation/Classical Civilization from Mary Washington College, and has taken several advanced courses and seminars in her area of expertise.[528] She has ten years experience at the NRC managing and participating in major, multidisciplinary environmental projects.[529] As the Project Manager for the environmental review of GLE's application, she was responsible for overseeing the preparation of the FEIS.[530]

In her written testimony on Topic 4, Ms. Davis testified as follows:

The NRC distinguishes between license conditions and mandatory mitigation measures, on the one hand, and voluntary commitments on the other.[531] A commitment is a statement in a licensing document, such as the ER, in which an applicant promises to take certain actions.[532] Unlike regulations and orders, commitments in and of themselves are not legally binding.[533] A commitment becomes legally binding only if it is "tied down" in the license (that is, if the

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[527] Ex. NRC122 at 1.

[528] Id. Attach. (Jennifer Davis Statement of Professional Qualifications).

[529] Id.

[530] Id. at 2. The FEIS can be viewed at Exs. NRC003A & B.

[531] Ex. NRC122 at 3-4.

[532] Id. at 3.

[533] Id.

licensing document in which the commitment is stated is incorporated into the license by reference).[534]

The Staff will have an ongoing role in inspecting and monitoring the implementation of mitigation measures that are required to meet 10 C.F.R. Parts 20, 30, 40, and 70.[535] Specifically, NRC Region II Staff is responsible for tracking implementation of these mandatory mitigation measures, which fall within the NRC's regulatory authority, as well as for oversight and tracking of the construction and facility operations inspection program.[536] Mandatory measures that are covered by permits issued by other federal, state, and local permitting agencies would be tracked by the agency that issued the particular permit.[537] Because the NRC does not have the legal authority to require the Applicant to comply with voluntary commitments, the Staff will not require that voluntary commitments are tracked or implemented.[538]

The implementation of the mandatory mitigation measures by GLE would be protective of public health and safety and of the environment.[539] If GLE implemented some of the voluntary mitigation measures, impacts in some resource areas could be lower, but the NRC Staff's overall impact conclusion in the FEIS would not change.[540] As a result, none of the voluntary mitigation measures would be considered by the Staff to be necessary commitments.[541]

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[534] Id.

[535] Id. at 15.

[536] Id.

[537] Id. at 16

[538] Id. at 17.

[539] Id. at 16.

[540] Id.

[541] Id.

In her oral testimony on Topic 4, Ms. Davis testified as follows:

A commitment becomes legally binding only if the licensing document in which the commitment is stated is tied down in the license.[542] Once a licensing document is tied down in a license, any commitments made in that document become mandatory.[543] License conditions and mandatory mitigation measures are also mandatory.[544] The NRC Region II staff is responsible for tracking implementation of mandatory mitigation measures and for oversight and tracking of the construction and operations of the facility.[545]

If GLE only implements mandatory mitigation measures, without complying with its various voluntary commitments, the Staff determined this adequately protects public health and safety and the environment.[546] GLE's ER could not be incorporated into an NRC license.[547] The Staff "does not have the authority to require the applicant to comply with all of its statements in the environmental report, because many of these statements fall outside of the NRC's regulatory authority."[548] If GLE only implements mandatory measures, "the impacts in some resource areas could be incrementally higher than estimated in the FEIS, but the staff's overall impact conclusions would not change."[549]

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[542] Tr. at 31 (7/12/12 Hearing). The slides associated with Ms. Davis's presentation to the Board can be viewed at Ex. NRC114.

[543] Tr. at 31-32 (7/12/12 Hearing).

[544] Id. at 32.

[545] Id. at 36.

[546] Id. at 39.

[547] Id.

[548] Id. at 40.

[549] Id. at 40-41.

Although GLE's tracking of voluntary commitments is available to the NRC, NRC inspectors do not track voluntary commitments because the Staff has no authority to make sure commitments outside the NRC's regulatory authority are implemented.[550] To the extent GLE's commitments to state, local, and other federal agencies involve radiological health and safety, the Staff also follows up on those commitments, but "[n]ot every construction or operating permit that GLE obtains would require notification necessarily to the NRC."[551]

The Staff was able to perform its cost-benefit balancing without giving weight to the voluntary commitments and still found the facility cost-beneficial.[552] Because the voluntary measures go "above and beyond and [are] hard to track," they do not necessarily weigh heavily into the Staff's analysis.[553] The mandatory measures are sufficiently protective to meet the NRC's regulatory requirements.[554]

Timothy C. Johnson. Mr. Johnson's background and qualifications have been previously summarized in relation to his testimony on Topic 2.

In his written testimony on Topic 4, Mr. Johnson testified to some of the same matters regarding commitment tracking as Ms. Davis. Additionally, he summarized the safety-related conditions that the NRC Staff proposes to include in the license for the proposed GLE facility.[555] Additionally, he described the process by which the NRC includes a tie down condition in the license to make enforceable an applicant's statements and commitments that support the NRC

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[550] Id. at 63.

[551] Id. at 64.

[552] Id. at 85-86.

[553] Id. at 87.

[554] Id. at 89.

[555] Ex. NRC122 at 18-22.

Staff's safety and security reviews.[556] Finally, he explained how the NRC will ensure compliance with the license conditions, as well as other regulatory requirements, through its inspection program.[557]

In his oral testimony on Topic 4, Mr. Johnson testified as follows:

On the safety side, license conditions fall into two categories: standard conditions used for all materials licenses and facility-specific license conditions.[558] Standard conditions include the license term and authorized place of use.[559] Facility-specific conditions include limitations on the tails cylinder storage capacity, availability of funding for the facility, and a requirement that the proposed GLE facility be specifically added to the insurance policy covering the Wilmington site.[560] A license exemption allows GLE to make changes that do not have safety significance to its licensing application, exempting GLE from license amendments for administrative changes.[561] Another significant exemption allows GLE to provide decommissioning funding assurance for its depleted uranium tails on an annual forward-looking assessment, rather than requiring financial assurance at the time of licensing for the entire forty-year period during which the facility will generate tails.[562] GLE was also given an exemption from providing locations and details of criticality accident alarms in the ISA "because not all of the areas have been specifically designed, [so] the exact detail required under this regulation is

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[556] Id. at 22-24.

[557] Id. at 24.

[558] Tr. at 41 (7/12/12 Hearing). The slides associated with Mr. Johnson's presentation to the Board on Topic 4 can be viewed at Ex. NRC114.

[559] Tr. at 42 (7/12/12 Hearing).

[560] Id. at 43-44.

[561] Id. at 46.

[562] Id. at 48.

not available at this time."[563] The Staff has allowed GLE to submit this information for review and approval prior to its receipt of licensed material.[564] GLE was also required to address the details of its detection systems for material control and accounting; however, these systems have not yet been designed, so the Staff granted GLE an exemption that requires GLE to submit this information for review and approval prior to the receipt of license material.[565] This detail will come to the NRC in the form of a license amendment subject to AEA Section 189a public notice and hearing opportunity requirements.[566]

License conditions tie down the important licensing basis documents, making them enforceable.[567] Documents that are tied down include the license application, the fundamental nuclear control plan, the emergency plan, the standard practice and procedure plans for the protection of classified matter, the quality assurance program description, the validation report for the criticality analyses, the physical security plan, the decommissioning funding plan, the nuclear material transportation security plan, the human factors engineering plan, and the program cyber security plans.[568]

With regard to the $200 million insurance policy that covers the Wilmington site, the Staff will ensure the GLE facility specifically is added to the policy and that this amount of coverage is sufficient for both facilities.[569] The insurer will not provide coverage beyond $200 million, but "the reviewer agreed that that was sufficient to meet the regulatory requirements."[570]

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[563] Id. at 50.

[564] Id.

[565] Id.

[566] Id. at 89-90.

[567] Id. at 53.

[568] Id. at 54.

[569] Id. at 65.

The ISA and ISA Summary are not tied down because, under NRC regulations, the ISA Summary is not part of the license application and is not considered a licensing basis document.[571] The rationale for not including them is that the ISA and ISA Summary are dynamic documents that will change, and when an ISA Summary contains a commitment, the Staff required the Applicant to put the commitments into the license application, which is tied down.[572] The Monte Carlo validation report is tied down because it is an important part of criticality safety analysis.[573] Changes to that document could change the conservatism of how the margin of subcriticality is calculated and used.[574] The dates of the validation reports that are tied down relate to GLE's initial filing and subsequent revision, but if future changes are made, the Staff would expect that those changes would be integrated into current validation report or a new document would be reflected in the tie down.[575] The ER is not tied down.[576]

Deborah Seymour. Ms. Seymour is a Branch Chief in the NRC's Region II Office in Atlanta, Georgia.[577] Ms. Seymour has a B.S. in Chemical Engineering and Materials Engineering from the University of Connecticut, and has worked for the NRC for twenty-five years.[578] In her current role, Ms. Seymour provides direction and oversight to the construction

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[570] Id. at 92.

[571] Id. at 77-78.

[572] Id. at 78-79.

[573] Id. at 80.

[574] Id.

[575] Id. at 81-82.

[576] Id. at 90.

[577] Ex. NRC122 at 1.

[578] Id. Attach. (Deborah Seymour Statement of Professional Qualifications).

inspection programs at fuel facilities under construction.[579] Previously, she held various NRC Inspector and Engineer positions.[580] She holds four different NRC Inspector Qualifications and has graduated from the NRC Senior Resident Inspector Development Program.[581]

In her written testimony, Ms Seymour testified as follows:

If the Applicant is granted a license, the NRC's Division of Construction Projects in Region II will oversee implementation of the construction inspections and the Operational Readiness Review inspections that must be completed before the licensee can begin operations.[582] Ms. Seymour will be the Branch Chief overseeing these activities for the proposed GLE facility.[583] She was involved in these activities for the Louisiana Energy Services National Enrichment Facility and is currently involved in these activities for the Shaw AREVA MOX Services Mixed Oxide Fuel Fabrication Facility.[584]

The Staff will conduct construction inspections, in addition to Operational Readiness Review inspections, to confirm that GLE has constructed the proposed facility in accordance with applicable requirements.[585] The Operational Readiness Review inspections will address the facility's operational programs, or significant changes to those operational programs, for each of the applicable phases.[586]

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[579] Id.

[580] Id.

[581] Id.

[582] Id. at 2.

[583] Id.

[584] Id.

[585] Id. at 25.

[586] Id.

The NRC's Division of Construction Projects Staff in Region II is responsible for overseeing and implementing the GLE construction and Operational Readiness Review inspection programs.[587] A Senior Project Inspector, in conjunction with a senior project manager from the NRC's Office of Nuclear Material Safety and Safeguards, will be assigned to the GLE facility to oversee and coordinate both programs.[588]

The inspection program will be outlined in a site-specific inspection manual chapter that describes fuel facility construction and preoperational readiness review inspection programs.[589] The relevant inspection manual chapter is expected to be issued in advance of the onset of construction at the GLE facility.[590]

Prior to the NRC's authorizing operation of the facility, Operational Readiness Review inspections will be conducted to verify safety programs and operational readiness.[591] Typical areas covered by Operational Readiness Review inspections include radiation safety, environmental and waste, transportation, nuclear criticality, operations, fire protection, emergency preparedness, and material control and accountability.[592]

Region II typically obtains licensee construction schedules in Primavera scheduling software (commonly used by many NRC licensees).[593] The Primavera schedule is integrated into the NRC's construction inspection schedule.[594] The goal is to inspect, identify issues, and

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[587] Id.

[588] Id.

[589] Id. at 26.

[590] Id.

[591] Id.

[592] Id.

[593] Id. at 27.

[594] Id.

verify the implementation of appropriate corrective actions early in the construction/preoperational readiness process.[595]

In her oral testimony, Ms. Seymour testified as follows:

After the license is issued, Ms. Seymour and a senior project inspector will be responsible for oversight of the implementation of construction inspections and the Operational Readiness Review inspections that must be completed before the licensee can begin operations.[596] This team will be responsible for the planning, performance, documentation and enforcement associated with the construction inspection program, and will track implementation of licensee requirements and commitments.[597] The team will receive assistance from headquarters, regional inspectors, and other Division of Construction Projects inspectors.[598] Required construction and Operational Readiness Review inspections ensure the facility is constructed as designed and licensed.[599] The inspection process for the proposed facility will be outlined in an inspection manual chapter that describes the construction and Operational Readiness Review inspection programs and that will be available prior to construction onset.[600] Commitments and requirements are sampled at each inspection stage with inspections focusing on the facility IROFS.[601]

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[595] Id.

[596] Tr. at 55 (7/12/12 Hearing). The slides associated with Ms. Seymour's presentation to the Board can be viewed at Ex. NRC114.

[597] Tr. at 55 (7/12/12 Hearing).

[598] Id.

[599] Id. at 56.

[600] Id. at 57.

[601] Id. at 57-58.

Inspectors receive training specific to the facilities to be inspected and are informed of licensee-specific commitments and requirements.[602] Inspectors must go through a rigorous qualification process, which takes eighteen months to two years.[603] Like GLE, the Staff also tracks commitments and requirements through a software program, which guides inspections by tracking when inspections of certain areas are to be made.[604] As part of routine inspections, the Staff inspectors will look at changes to the facility that have been made without license amendment and will perform a sampling of those revisions to check that GLE's determinations that no license amendment was required were appropriate.[605] In addition, lists of changes are sent to headquarters reviewers who give recommendations to the regional inspectors on which changes should be included in an inspection.[606]

With regard to the Operational Readiness Review inspection, the Staff ensures that it uses the appropriate technical specialist for each area under review, including confirming that inspectors have the proper qualifications.[607] The result is that some inspectors in certain specialized areas, like criticality safety, come from headquarters so that appropriately qualified individuals are performing each inspection.[608]

Jose Diaz. Mr. Diaz is a Senior Fuel Facility Project Inspector in the NRC's Region II Office in Atlanta, Georgia.[609] He has a B.S. in Physics from the University of Puerto Rico and

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[602] Id. at 66.

[603] Id.

[604] Id. at 67.

[605] Id. at 69.

[606] Id. at 70.

[607] Id. at 74-75.

[608] Id. at 75.

[609] Ex. NRC122 at 1.

an M.Div. in Biblical Languages from New Orleans Baptist Theological Seminary.[610] Mr. Diaz has over nineteen years experience implementing NRC inspection programs and holds three NRC Inspection Qualifications and one Reviewer Qualification.[611]

In his written testimony on Topic 4, Mr. Diaz testified as follows:

Mr. Diaz is the Senior Fuel Facility Inspector within the division (in the NRC's Region II Office) that is responsible for performing the Operational Readiness Review inspection that, if the Applicant is granted a license, would need to be completed before the Applicant could begin operations.[612] He would also be responsible for performing regular facility inspections that would occur during operation of the proposed GLE facility.[613]

After operations begin, the Staff will conduct routine inspections of various aspects of facility operations based on the core inspection program to ensure compliance with regulatory requirements and mandatory commitments in the license application.[614] These inspections are conducted throughout the calendar year.[615] Results of these inspections are evaluated by NRC management and staff to assess licensee performance in various functional areas.[616]

The Region II office would have direct responsibility for oversight of the facility once operations begin.[617] The Region II office, with support from the Office of Nuclear Material Safety

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[610] Id. Attach. (Jose M. Diaz Velez Statement of Professional Qualifications).

[611] Id.

[612] Id. at 2.

[613] Id.

[614] Id. at 27.

[615] Id.

[616] Id.

[617] Id.

and Safeguards and the Office of Nuclear Security and Incident Response as applicable, is responsible for conducting the various inspection activities.[618] Tracking and verification of compliance with mandatory licensee commitments are part of the overall inspection program.[619]

In his oral testimony on Topic 4, Mr. Diaz testified as follows:

After passing the Operational Readiness Review inspection, GLE will continue to be inspected by NRC operations inspectors.[620] The results of these inspections are evaluated by the Region II management and headquarters offices, and inspectors receive support from headquarters staff.[621]

The frequency of operational inspections is defined in the NRC Inspection Manual Chapter 2600 for fuel cycle facilities.[622] The majority of inspections are once a year with a bigger inspection occurring every three years.[623]

E. Topic 5: Need/Alternatives/Environmental Cost-Benefit Analysis

1. GLE Witnesses

Julie Anne Olivier. Ms. Olivier's education and background were discussed previously in reference to her testimony on Topic 2.

In her written testimony on Topic 5, Ms. Olivier testified as follows:

Ms. Olivier has been involved with the GLE Facility project since its early phases.[624] She served as the technical lead for preparation and submittal of the GLE license application,

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[618] Id.

[619] Id. at 28.

[620] Tr. at 60 (7/12/12 Hearing). The slides associated with Mr. Diaz's presentation to the Board can be viewed at Ex. NRC114.

[621] Tr. at 61 (7/12/12 Hearing).

[622] Id. at 71.

[623] Id. at 72.

authoring sections related to chemical safety, environmental protection, decommissioning, management measures, and project administration.[625] She also served as the interface between the design and safety teams. Currently, she manages project-related interactions with federal, state, and local government agencies; oversees matters concerning the NRC's ongoing review of the GLE license application; and serves as technical lead on environmental issues.[626]

Since the proposed license for this uranium enrichment facility is covered by 10 C.F.R. Part 51, GLE was required by NRC regulations to prepare an ER. Using relevant provisions of 10 C.F.R. Part 51 and assistance from NUREG-1748, GLE developed its ER.[627]

Section 1.2 of the ER addresses the need for the proposed GLE facility, which GLE sees as threefold: (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.[628] The information in the ER was based on the information available to GLE in January 2009.[629]

Section 2.2 of the ER addresses alternatives to the proposed action with respect to (1) enrichment technology; (2) facility design; (3) site location; and (4) facility location within the preferred site.[630] GLE evaluated other enrichment technologies and concluded they were not reasonable alternatives for economic, commercial, technological, and environmental reasons.[631]

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[624] Ex. GLE012 at 4.

[625] Id.

[626] Id.

[627] Id. at 6-7. NUREG-1748 can be found at Ex. NRC006.

[628] Ex. GLE012 at 8 (citing Ex. GLE006A at 1-4).

[629] Id.

[630] Id. at 33. See also Ex. GLE006A.

[631] Ex. GLE012 at 34.

Through the facility design process, several design alternatives were considered but eliminated due to environmental impacts, contamination of the facility, ease of decommissioning, waste minimization, emergency response, and uranium-separation efficiency.[632]

GLE also evaluated the No Action Alternative or maintenance of the status quo, as required by NUREG-1748.[633] Under the No Action Alternative, the proposed GLE facility is not constructed, and the positive socioeconomic impacts like employment, economic activity, and tax revenue do not occur.[634] There is no increase in domestic supply of low-enriched uranium, no technological advance of a first-of-kind facility, and a less diverse supply of uranium.[635] Under the No Action Alternative, the small to moderate beneficial impacts of the proposed GLE facility would not accrue.[636] On the other hand, potential local environmental impacts would be avoided by the No Action Alternative, including those related to water and land use, potential groundwater contamination, ecology, air emissions, human health and occupation safety, and waste storage and disposal.[637] All of these effects were found to be small, excepting community effects brought on by motor vehicle traffic, flora and fauna, noise during construction/decommissioning, and UF_6 waste management, which would produce moderate impacts.[638] Comparing the costs and benefits, the Staff concluded the GLE proposed facility is preferable to the No Action Alternative because it contributes to fulfilling future demand for

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[632] Id.

[633] Id. This guidance can be found at Ex. NRC006 at 6-3.

[634] Ex. GLE012 at 35.

[635] Id.

[636] Id. at 37.

[637] Id.

[638] Id. at 37-38.

enrichment services from domestic nuclear plants and increases national energy security. It also introduces a new technology that has the potential to have lower resource and environmental impacts than existing technologies. The proposed facility also generates positive impacts in the region of interest in the form of employment, income, and tax revenues.[639]

The GLE site selection process is described in both the ER and the FEIS.[640] The steps undertaken to select a site were: (1) identification of candidate sites; (2) initial screening; (3) coarse screening; (4) site reconnaissance visits; (5) fine screening; and (6) qualitative cost-benefit analysis.[641] The process began with the identification of candidate sites, subject to initial screening for seismic, tectonic, and flooding hazards.[642] Sites passing this step entered the coarse screening phase, which considered property size requirements and potential impediments to property transfer. Sites failing one or more of these criteria were eliminated.[643] Reconnaissance visits then were conducted at the remaining sites to identify potential issues, and the sites that passed that step entered fine screening.[644] Fine screening involved consideration of detailed criteria for each project phase.[645]

A total of twenty-two potential sites were screened using this multi-stage evaluation process. Of the twenty-two sites, three were eliminated on seismic grounds and sixteen were eliminated because they were too small, government owned, at significant risk for litigation or

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[639] Id. at 38.

[640] Id. The site selection process is described in ER Section 2.2.3.1, which can be found at Ex. GLE006A at 2-15 and FEIS Section 2.3.1, which can be found at Ex. NRC003A at 2-43.

[641] Ex. GLE012 at 38-39. See also Ex. GLE006A at Figure 2.2-1 and Ex. NRC003A at 2-44, Figure 2-4.

[642] Ex. GLE012 at 39.

[643] Id.

[644] Id.

[645] Id. (citing Ex. GLE006A at 2-15).

public opposition, subject to Resource Conservation and Recovery Act Corrective Action, or designated as CERCLA National Priority List sites.[646] Of the three remaining sites, one had insufficient uncommitted land.[647] The remaining two sites (Morris, Illinois and Wilmington, North Carolina) were compared using the fine screening criteria.[648]

The comparison between the Morris and Wilmington sites was conducted under a multi-criteria decision analysis methodology referred to as the Analytic Hierarchy Process.[649] The Wilmington site scored higher in three of four criteria clusters, and a qualitative cost-benefit analysis indicated that net benefits would be slightly higher on the Wilmington site.[650] GLE determined that the Wilmington site was the preferred site due to existing nuclear infrastructure and greater cost savings and smaller adverse impacts in Wilmington on several environmental resources.[651]

The 2014 operations start-up date listed in the ER was GLE's best estimate when that document was produced.[652] Although subsequent events have rendered that date infeasible, no alternative schedule has been established.[653] Despite delays in preconstruction activities, GLE does not intend to expedite or compress the construction schedule, and as such, the impacts of construction activities described in the ER and FEIS remain current.[654]

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[646] Id.

[647] Id.

[648] Id.

[649] Id. at 40.

[650] Id.

[651] Id.

[652] Id. at 46.

[653] Id.

[654] Id.

GLE has confirmed with Progress Energy that sufficient capacity exists at the Sutton Electrical Plant to supply the expected electricity demands of the proposed facility. To meet this demand, Progress Energy has noted that several upgrades to feeder line and terminals will be needed.[655] Original discussions for planning and design work were put on hold due to construction delays and by agreement of the parties.[656] In September 2011, GLE and Progress discussed the plan to resume planning and preliminary design once a decision is made to proceed with construction.[657] Progress Energy affirmed its ability and willingness to provide the services once a cost-sharing arrangement had been established.[658]

In her oral testimony on Topic 5, Ms. Olivier testified as follows:

Based on the GLE evaluation in the environmental report, there are four areas of environmental costs in which the proposed facility would create small to moderate impacts.[659] All remaining impacts were small.[660] Moderate impacts indicate that impacts would not destabilize a resource, and in the majority of environmental cost areas with small to moderate impacts, those impacts were characterized as temporary or related to the construction phase.[661]

In the site selection process, key factors led GLE to select the Wilmington site over the Morris site. One was the existing nuclear infrastructure on the Wilmington site, such as existing radiation protection programs, environmental management programs, and emergency

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[655] Id. at 47.

[656] Id.

[657] Id.

[658] Id. (citing Ex. GLE017).

[659] Tr. at 108 (7/12/12 Hearing). See also Ex. GLE018 for the slides related to an oral presentation to the Board on this topic.

[660] Tr. at 108 (7/12/12 Hearing).

[661] Id.

preparedness programs that can be built on when the GLE facility is constructed.[662] Another was greater cost savings to GLE for the Wilmington site, as well as slightly smaller adverse impacts to the environment.[663] On the other hand, the Morris site provided slightly higher positive impacts in the socioeconomic area.[664] But this did not qualify the Morris site as an obviously superior site, and so, based on the factors discussed above, the Wilmington site was the preferred location for GLE and was selected.[665]

With regard to mitigation measures, Ms. Olivier testified that "GLE will implement those mitigation measures whether they are mandatory, required by another federal, local, or state agency, or if they were voluntary. If GLE finds a reason that they cannot implement one of the voluntary commitments, [GLE] will perform an analysis . . . and document that in [GLE's] compliance checklist, which will be made available to the NRC."[666]

Ms. Olivier explained the limitations on GLE under the SILEX Treaty between the United States and Australia and GLE's Technology and Commercialization Licensing Agreement with SILEX. The SILEX Treaty gives GLE the exclusive right to commercialize the technology in the United States with the caveat that the enriched uranium can only be used for peaceful purposes.[667] The SILEX Treaty allows SILEX technology to be used in countries that execute the Treaty; however, currently the United States is the only signatory.[668] Ms. Olivier acknowledged that some of the national objectives she stated in her written testimony might be

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[662] Id. at 109-10.

[663] Id. at 110.

[664] Id.

[665] Id.

[666] Id. at 118-19.

[667] Id. at 129.

[668] Id. at 136.

accomplished through GLE's facility – such as "[p]roviding the U.S. an unencumbered source of enriched uranium, critical in the near-term for the national security tritium production mission" and "[p]roviding 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" – would in fact violate GLE's treaty obligations.[669] Neither the treaty nor any other document requires GLE to conserve or confine its services for domestic use[670] but there are some restrictions on the exportation of enrichment services contained in the SILEX Treaty.[671] Ms. Olivier stated that "there is a lot of interest domestically, and so GLE is in the process of finalizing contracts with domestic customers."[672]

Michael Schwartz. Mr. Schwartz is the Chairman of the Board for Energy Resources International, Inc. in Washington, D.C.[673] He holds B.S. and M.S. degrees in Nuclear Engineering from the University of Michigan and has completed graduate-level courses in finance, economics, and management.[674] He is a registered Professional Engineer in California and has been a consultant on issues related to the nuclear fuel cycle for over thirty-five years.[675] In his current role as Chairman of the Board, he oversees all consulting services provided by the firm, which offers energy and resource consulting services to a range of institutions, industries, and government agencies.[676] Energy Resources International produces an annual market

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669 Id. at 133. See Ex. GLE012 at 36 for the referenced written testimony.

670 Tr. at 130 (7/12/12 Hearing).

671 Id. at 178.

672 Id. at 133.

673 Ex. GLE012 at 1.

674 Id. at 2.

675 Id.

676 Id.

projection that addresses all nuclear fuel market elements, including the international sector.[677] Mr. Schwartz has previously testified in both state and federal proceedings on issues relating to the need for new uranium facilities and the pricing of enrichment services by the federal government.[678] Prior to his current role, Mr. Schwartz held positions as an engineer and consultant at various other entities.[679]

In his written testimony, Mr. Schwartz testified as follows:

Mr. Schwartz was recently retained by GLE to consult on issues related to domestic and global uranium enrichment supply and requirements.[680] He has reviewed portions of the ER and FEIS related to the need for the proposed facility and researched enriched uranium supply and demand, as well as other considerations key to NEPA analysis.[681]

Mr. Schwartz is the primary author of a report entitled "A Detailed Review of the Need for Future Enrichment Capability – Response to ASLB 5A" (ERI Report).[682] The report details a supply and demand requirements analysis of the world installed nuclear generating capacity and global enrichment services for 2012-35.[683] The ERI Report was based on currently-available data and information concerning future uranium enrichment demand and supply and was created using conservative assumptions and accepted forecasting methodologies.[684] The

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[677] Id.

[678] Id. at 2-3.

[679] Id. App. B.

[680] Id. at 4.

[681] Id.

[682] Id. at 9. The report can viewed in its entirety at Ex. GLE014.

[683] Ex. GLE012 at 9.

[684] Id.

ERI Report was generated from an array of publicly available sources, as well as from direct communications with market participants. Data were obtained from various government and international entity sources, World Nuclear Association publications, nuclear trade press articles and reports, newspaper articles, meeting materials, industry press releases, and financial filings.[685] The information was evaluated, to the extent possible, for reliability and accuracy.[686]

The ERI Report indicates that enriched uranium from the GLE Facility would be used in commercial nuclear power plants, most of which are fueled by low-enriched uranium.[687] The enrichment services market is global, with the United States purchasing the majority of its enrichment services overseas, while USEC's Paducah plant exports much of its production.[688]

To develop a forecast of future demand, ERI looked at installed nuclear power generating capacity based on a country-by-country and unit-by-unit review of current nuclear power programs and future plans.[689] The forecast considered: (1) plants currently in operation and retirements among those units during the forecast period (assuming no license renewals); (2) capacity created by power uprates or by restarting units on extended outage; (3) capacity created by extending operating lifetimes of existing units through license renewal; (4) units under construction, ordered, or firmly planned; and (5) additional future capacity at expected sites still requiring approval.[690]

Using this data, the ERI Report generated Reference, High and Low Nuclear Power Growth forecasts of installed nuclear power generating capacity and divided the world into five

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[685] Id.

[686] Id.

[687] Id. at 10.

[688] Id.

[689] Id.

[690] Id. (citing Ex. GLE014 at 3).

regions: the United States; Western Europe; the Commonwealth of Independent States and Eastern Europe; East Asia; and Other (including all remaining countries).[691] The Reference, High and Low Nuclear Power Growth forecasts illustrate what could occur to installed nuclear generating capacity under three different scenarios.[692]

The Reference forecast is considered most likely at this time and predicts a steady average annual nuclear generating capacity growth rate of 1.9% through 2035.[693] This model assumed aggressive expansion in Asia; license renewals for most American plants; and power plant uprates.[694] It also predicts some growth in Russia and countries in the Commonwealth of Independent States/Eastern Europe category.[695]

The High forecast is considered an upper bound scenario, with a comparatively low probability of occurrence.[696] The High forecast assumes most countries grant fifty-year or greater license extensions and replace retiring units.[697] It also assumes persistent high coal and natural gas prices, broad agreement regarding the need for new base load capacity, and more stringent environmental controls and costs imposed on fossil-fired capacity.[698]

The ERI Low forecast is considered to be a lower bound scenario, with a comparatively low probability of occurrence.[699] This forecast assumes a lack of support for the nuclear energy

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[691] Id. at 11 (citing Ex. GLE014 at 2).

[692] Id. at 12.

[693] Id.

[694] Id.

[695] Id.

[696] Id.

[697] Id. at 12-13.

[698] Id. at 13.

[699] Id.

option in most countries, as well as low natural gas prices, lack of carbon-based taxes, difficulties in raising capital for new construction, 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.[700]

The Fukushima Daiichi event has had some immediate effects on world installed nuclear generating capacity. In Germany, the adverse sociopolitical reaction led to the permanent shut down of the seven oldest units in the country, along with another unit that had been in long-term outage.[701] Thus, including the six units at the Fukushima Daiichi station itself, fourteen units totaling approximately thirteen gigawatts-electric (GWe) were retired as an immediate result of the Fukushima event.[702] This was the equivalent of 3.5% of existing world capacity. The long term impact of the Fukushima event is estimated to be a 4.6% reduction in installed nuclear generation by 2020, growing to a 7.9% reduction by 2030.[703] This is equivalent by 2020 to a two to three-year slippage in projected installed nuclear generation capacity compared to pre-Fukushima estimates, and as much as a four-year slippage by 2030.[704] ERI's Reference forecast does take into account the additional reduced capacity resulting from the Fukushima event. Specifically, the Reference forecast assumes twelve Japanese units will retire without ever restarting, while the restart of other units is spread out over the next thirty months.[705] The Reference forecast also assumes that Japan will complete the two reactors under construction

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[700] Id.

[701] Id.

[702] Id.

[703] Id. at 13-14.

[704] Id. at 14 (citing Ex. GLE014 at 2).

[705] Id.

(which is currently suspended), but that all other Japanese projects, regardless of planning stage, will not be built.[706]

Under the Reference forecast, 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.[707] The Reference forecast considers the majority of world nuclear capacity to be generated by currently operating units and license renewals for units whose licenses expire during the forecast period.[708] A small increased capacity contribution is obtained from uprates and plant restarts.[709] Plants currently under construction or firmly planned account for 9% of total operable capacity in 2015 and an average of 23% of total operable capacity between 2020 and 2035.[710] Cumulative retirements are also accounted for – 3% of total operable capacity in 2015, slowly rising to 14% by 2030, and then doubling to 28% by 2035.[711] Capacity growth in the United States is expected to be modest with eleven new units added by 2030.[712]

Mr. Schwartz asserted that, in comparison to other available forecasts, his is conservative. The full range of forecasts indicates variation of ±16% in 2020, increasing to ±41% by 2030.[713] The ERI Low forecast was lower than most other forecasts, and the High

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[706] Id. (citing Ex. GLE014 at 5).

[707] Id.

[708] Id. Mr. Schwartz noted that "[t]he 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." Id. at 14-15.

[709] Id. at 14.

[710] Id. at 15.

[711] Id.

[712] Id.

[713] Id. at 16.

forecasts are in general agreement.[714] The Reference forecasts have low variation initially (±4% in 2015) but increase to ±9% by 2035.[715] The ERI Report Reference is at nearly all points more conservative than comparative models.[716] This conservatism comes from assuming both a more consistent (rather than accelerated) growth rate after 2020, and a slower Japanese recovery with an overall reduced commitment to nuclear power as a result of the Fukushima event.[717] With regard to American generating capacity, the three existing forecasts are in close agreement (±3 to 5 % from 2020 to 2030), and of the two that extend to 2035, the predictions in that year are identical.[718]

The ERI Report then translated the nuclear generating capacity projections into forecasts of demand for enrichment services that also considered certain fuel design and management parameters that contribute to demand.[719] In developing this enrichment services forecast, the ERI Report considered: (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 ^{235}U; (4) current plant-specific fuel discharge burnup rates for American 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.[720]

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[714] Id.

[715] Id.

[716] Id. at 16-17. See also Ex. GLE014 at 8 (illustrating the ERI Reference forecast as compared to several others).

[717] Ex. GLE012 at 17.

[718] Id. at 17-18.

[719] Id. at 18.

[720] Id. at 18-19 (citing Ex. GLE014 at 9-10).

The ERI Report generated High, Low, and Reference forecasts for the world, as well as each country group, four five-year blocks beginning in 2016.[721] The Reference forecast indicates a 45% increase in world enrichment requirements over the estimated 2011 value of 40.9 million separative work units (SWU) during the 2021 to 2025 period; by the 2031 to 2035 period, the Reference forecast indicates a 76% increase over 2011.[722] For the United States, the Reference forecast indicates a 31% increase during the period from 2021 to 2025 (as compared to 2011), and a 37% increase over 2011 during the 2031 to 2035 period.[723] These numbers are conservative compared to the only other publicly available forecast of enrichment requirements. From 2016 through 2030, the ERI Reference forecast for the world is 16% lower than the alternative.[724] During the same period, the ERI Reference forecast for the U.S. is 11% lower than the comparison.[725]

The ERI Report also forecast world and American supplies of enrichment services. Base sources employed in the study included: (1) existing inventories of low-enriched uranium; (2) production from existing uranium enrichment plants; (3) enrichment services obtained by blending down Russian weapons-grade high-enriched uranium; (4) the base capacity for enrichment plants presently under construction; (5) capacity expansion at existing facilities; and (6) enrichment services that are presently being obtained by blending down American high-enriched uranium.[726] In addition to these base sources, there are three proposed sources of

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[721] Id. at 20. The information is portrayed in a table found at Ex. GLE014 at 7, T. 1.

[722] Ex. GLE012 at 20.

[723] Id. at 20-21.

[724] Id. at 21.

[725] Id. at 22.

[726] Id. at 23.

additional enriched uranium, all in the United States.[727] Besides the GLE facility, USEC's American Centrifuge Plant and AREVA's Eagle Rock Enrichment Facility have both already received NRC licenses but both have encountered financial challenges and neither appears to be able to surmount the necessary hurdles for operation in the immediate future.[728] The American Centrifuge Plant would replace the Paducah Gaseous Diffusion Plant and produce 3.8 million SWU per year.[729] Eagle Rock Enrichment Facility is authorized to produce 6.6 million SWU per year.[730] GLE is planning an annual target of 6 million SWU for its facility.[731] Comparing the ERI Report's demand forecasts with enrichment supply, the ERI Report found that, without the GLE Facility, American Centrifuge Plant, or the Eagle Rock Enrichment Facility, world supply is not adequate to meet world demand by as early as 2017.[732] Without these sources, under the Reference forecast, the world supply yields a 2.2% annual shortage from 2016 to 2025.[733] From 2026 to 2035, the worldwide annual shortage would increase to 5.4%.[734] If just one of the three facilities is built, there would be adequate world supply, but supply margins would be very small which "is not optimal in terms of diversity and security of supply."[735]

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[727] Id. at 25.

[728] Id. at 25-28.

[729] Id. at 25.

[730] Id. at 26.

[731] Id.

[732] Id. at 28.

[733] Id.

[734] Id. at 28-29.

[735] Id. at 29.

As to the domestic market, at some point between 2016 and 2035, all three facilities are needed to avoid a shortage of American-based supply relative to American-based demand.[736] With only two facilities operating, the average American shortage between 2016 and 2025 is between 10.1% and 29.7% of annual American demand.[737] And, without the two facilities with larger generating capacities (GLE and Eagle Rock Enrichment Facility) operating, the shortage during the period 2026 to 2035 would be about 10.1% of annual requirements. But even if both GLE and the Eagle Rock Enrichment Facility are operating and the smaller American Centrifuge Plant is not, then average domestic supply exceeds average domestic demand by only about 3% – considered a small margin by the ERI study.[738]

Table 4[739] of the study shows that under all three forecasts (High, Low, and Reference), the United States eventually will experience significant shortages of domestic supply unless all three facilities are built.[740] The world will also experience shortages if none of the facilities are built or if the High forecast is accurate.[741] Under all scenarios, "all three of the proposed U.S.-based enrichment facilities [are necessary] if the U.S. is to achieve a domestic enrichment capability that significantly reduces reliance on foreign suppliers . . . . There is only one exception; it is the 2026-2035 periods 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.

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[736] Id. at 30.

[737] Id.

[738] Id.

[739] Id. at 31. This table is also found at Ex. GLE014 at 28 where it is labeled as Table 5.

[740] Ex. GLE012 at 31. Even if all three are built, under the High forecast, the United States would experience a shortage between 2016-2025.

[741] Id.

requirements."[742] The Reference scenario for the alternative forecast indicates that all three American sources would have to be operational to avoid a world shortage during the 2016 through 2030 period. With only two facilities operating, there would be a shortage.[743] When the alternate study's Reference forecast is applied to American supply, even with two of the three facilities in operation, substantial shortages would exist during the 2016 to 2030 time period.[744]

In his oral testimony, Mr. Schwartz testified as follows:

The American Centrifuge Plant's future remains uncertain as both financing and technology-related questions remain open according to the Department of Energy.[745] Likewise, the AREVA Eagle Rock Enrichment Facility announced again in early July 2012 that the project is on indefinite suspension.[746] Mr. Schwartz stated that "[g]iven the previously noted uncertainties with the proposed AREVA Eagle Rock Enrichment Facility, and the USEC American Centrifuge Plant, the Global Laser Enrichment Commercial Facility is clearly needed" to meet American and world demand and prevent shortages domestically and abroad.[747]

In addressing the assumptions that went into the ERI Report, Mr. Schwartz clarified that the study assumed present fuel cycle lengths would hold constant. Generally, these cycles range from eighteen to twenty-four months with pressurized water reactors tending to have eighteen-month cycles and boiling water reactors tending toward twenty-four-month cycles.[748]

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[742] Id. at 31-32.

[743] Id. at 32.

[744] Id.

[745] Tr. at 101 (7/12/12 Hearing). See also Ex. GLE013 for the slides related to an oral presentation given by Mr. Schwartz at the hearing.

[746] Tr. at 101 (7/12/12 Hearing).

[747] Id. at 106.

[748] Id. at 122-23.

Similarly, the study tended to allow burn-ups to increase up to an average of fifty-three gigawatt-days per metric ton.[749] Some reactor units in the United States are operating at about that level and have not indicated any intention of going beyond it.[750] Preproduced inventory in the study also was evaluated on the principle that gaseous diffusion facilities, such as the Paducah Plant, generally cannot operate at extremely low levels of production. Therefore, even as they are shutting down, enrichment facilities tend to operate at a higher level consistent with their more economic level of production, even if they do not have customers.[751] In case there is a transition between shutting down an old enrichment plant and starting up the new one, this inventory is used to serve customers until the new plant can meet its orders.[752] Inventory is not held in significant quantities and has a small overall effect.[753]

The Louisiana Energy Services facility in New Mexico is in the process of ramping up to their current license capacity and has indicated that it might increase beyond that.[754] The model accounts for this likely increase over time.[755] The Eagle Rock Enrichment Facility has confirmed that the project remains on hold while AREVA seeks a potential financial participant in the project. Mr. Schwartz stated that "the key to that project going ahead on a timely basis" is the involvement of "somebody to help share the financial burden."[756]

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[749] Id. at 123.

[750] Id. at 123-24.

[751] Id. at 124.

[752] Id. at 125.

[753] Id.

[754] Id. at 126.

[755] Id.

[756] Id.

Mr. Schwartz explained the phenomenon of underfeeding. Underfeeding is "where the operator of the enrichment plant operates a facility at a lower tails assay than what they have contracted with their customer to provide."[757] Customers will have to provide the uranium feed materials to be enriched, and "depending on what the tails assay is, they would provide more or less uranium, and they'd end up purchasing more or less enrichment services to end up with the same final product."[758] In recent years enrichment facilities "have taken advantage of the fact that they can contract with a customer at one tails assay, receive the appropriate amount of uranium, and . . . bill them for the appropriate amount of enrichment services."[759] Thereafter, they operate the facility at a lower tails assay, which uses more enrichment services than contracted for but leaves the facility with excess natural uranium they can resell as another product.[760] Depending on the respective prices of enrichment services and natural uranium, enrichment facilities can gain financial benefit "actually using that enrichment capability to essentially create additional uranium which they can sell."[761]

Mr. Schwartz concluded by recognizing that an optimistic bias was likely built into many of the sources he consulted in developing his model, which is why "we developed our forecasts of requirements independent of them."[762] All figures were based on "on our own internally generated analyses and forecasts."[763]

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[757] Id. at 127.

[758] Id.

[759] Id.

[760] Id. at 127-28.

[761] Id. at 128.

[762] Id. at 134.

[763] Id.

Katherine Heller. Ms. Heller is a Senior Economist at RTI International in Research Triangle Park, North Carolina.[764] She holds a B.A. in Economics from The College of William and Mary and an M.S. degree in Economics from the University of North Carolina, Chapel Hill.[765] Ms. Heller has been employed as an economist at RTI International since 1985, holding a Research Economist position before promotion to her current role.[766] At RTI, she has performed or assisted with various economic, socioeconomic, and water resource availability analyses for private and governmental entities.[767]

In her written testimony, Ms. Heller testified as follows:

Ms. Heller served as the project lead in analysis of the socioeconomic impacts of the proposed GLE facility.[768] In that evaluation, she profiled existing and projected future demographic and economic conditions in the region and analyzed potential changes in those conditions as a result of construction and operation of the proposed facility.[769] She was principally responsible for performing the cost-benefit analysis described in Chapter 7 and Appendix U of the ER[770] and reviewed corresponding sections of the FEIS.[771]

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[764] Ex. GLE012 at 1.

[765] Id. at 3.

[766] Id.

[767] Id.

[768] Id. at 5.

[769] Id.

[770] Chapter 7 of the ER can be found at Ex. GLE006C. Containing proprietary material, Appendix U was submitted separately as Ex. NRC117.

[771] Ex. GLE012 at 5.

NUREG-1748 requires a cost-benefit analysis as part of the ER and FEIS.[772] The cost-benefit analysis estimates the overall impact of the proposed action on society's well-being, including both private benefits and external benefits and costs. These benefits and costs result from changes in conditions, relative to a baseline.[773] Cost-benefit analysis is a tool used to systematically catalogue, quantify, and value in monetary terms (when possible) the effect of the project on society.[774] The overall effect is measured by project net benefit, defined by benefits minus costs.[775] Economists discount benefits and costs to reflect that those occurring in the future are worth less than those occurring today. The Office of Management and Budget discounts future streams of net benefits using a 7% discount rate to reflect the private cost of capital and a 3% discount rate to reflect society's estimated rate of time preference.[776]

The cost-benefit analysis for the GLE facility compares the proposed action with the No Action Alternative. Benefits were assigned significance levels of small, moderate, or large, as were costs.[777] Both GLE and the Staff found the proposed action preferable to the No Action Alternative, particularly because the proposed facility contributes to future need and increases national energy security; introduces new technology that is expected to have smaller resource requirements and environmental impacts than known technologies; and has positive socioeconomic impacts.[778]

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[772] Ex. GLE012 at 40 (citing Ex. NRC006 at 5-30 to 5-31, 6-32 to 6-33).

[773] Id. The baseline is defined as conditions expected to exist throughout the lifetime of the proposed GLE Facility, in the absence of the impacts that would result from it. Id.

[774] Id.

[775] Id. at 40-41.

[776] Id. at 41.

[777] Id. at 42-43.

[778] Id. at 44.

In her oral testimony on Topic 5, Ms. Heller testified as follows:

Cost-benefit analysis is a widely-used economic method for evaluating the overall impact of a project.[779] The cost-benefit analysis for the GLE site was conducted in accordance with NUREG-1748, Section 6.[780] Generally, the private costs and benefits are assigned dollar values, whereas the public costs and benefits are characterized qualitatively.[781] The qualitative benefits and costs are estimated to be small, moderate, or large, using the same general definitions found in 10 C.F.R. Part 51.[782] Positive impacts may be larger than estimated because assessments focused on the direct employment and payroll impact of the project.[783] However, employees will spend money on goods and services in the region, and GLE will purchase some materials and supplies regionally, increasing the overall benefits regionally.[784] The ER did not attempt to quantify the indirect impacts of the project, but identified that employment and other multipliers apply. Therefore, during construction the total impact on employment could be as much as 1.3 times GLE's employment, and during operations it could reach as high as 3.2 times GLE's employment.[785] Events like Fukushima and the global recession would not impact GLE's overall cost-benefit conclusions in the ER.[786] While projected

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[779] Tr. at 111 (7/12/12 Hearing). See also Ex. GLE018 for the slides associated with Ms. Heller's presentation to the Board.

[780] Tr. at 111 (7/12/12 Hearing).

[781] Id. at 112.

[782] Id. at 113.

[783] Id. at 114.

[784] Id.

[785] Id. at 115.

[786] Id. at 116.

demand for enrichment services may be lower post-Fukushima, projections indicate the need for GLE services is high.[787]

Kimberly Matthews. Ms. Matthews is a Research Environmental Scientist at RTI International in Research Triangle Park, North Carolina.[788] She holds a B.A. in Biology from Wittenberg University and an M.S. degree in Natural Resources with a concentration in Watershed Hydrology from North Carolina State University.[789] In her current role, she provides support to numerous water quality and ecological projects to private entities, as well as local, state, and federal agencies.[790] She specializes in analysis of streams, wetlands, and terrestrial resources; water quality assessment; stormwater quality; protected species; and on-site stormwater management best practices.[791] Prior to joining RTI International, Ms. Matthews worked as a Biologist for another research group and as a Water Quality Monitoring Technician for the City of Greensboro, North Carolina.[792]

In her written testimony, Ms. Matthews testified as follows:

Ms. Matthews led field investigations related to GLE's assessment of ecological resources, wetlands, and surface waters. She served as the primary author of the corresponding chapters in the ER that describe existing resource conditions and estimate potential impacts of the GLE facility and contributed to the mitigation and monitoring chapters of the ER.[793] She also coordinated GLE's interaction with various state and federal agencies to

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[787] Id.

[788] Ex. GLE012 at 1.

[789] Id. at 3.

[790] Id.

[791] Id. at 4.

[792] Id. at 3.

[793] Id. at 5.

ensure compliance with the Coastal Area Management Act, Sections 401 and 404 of the Clean Water Act, and Section 8 of the Endangered Species Act.[794]

GLE will implement the mitigation measures in Table 5-1 of the FEIS that are required by federal, state, and local regulations and those mitigation measures factored into the ER's analysis of environmental impacts.[795] To the extent practicable, GLE will implement additional mitigation measures from Table 5-1, as well as those contained in Table 5-2 of the FEIS.[796] GLE will use the following factors to determine which mitigation measures will be implemented: (1) regulations or ordinances that require implementation; (2) availability of materials; (3) potential conflicts among mitigation measures; (4) safety and security considerations; (5) overall feasibility with respect to project schedule; and (6) cost-benefit analysis.[797] Ms. Matthews' written testimony reproduced Tables 5-1 and 5-2 with notations concerning which mitigation measures GLE intended to implement and in which phases.[798] GLE intends to implement every measure unequivocally, in accordance with law or ordinance, "to the extent practicable" or in accordance with other considerations (i.e., security) except it will not establish food plots along roadways due to the increased risk of human mortality from vehicles and it is unlikely GLE will construct noise control measures, like barriers, as they are not likely to be effective during construction and decommissioning.[799]

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[794] Id.

[795] Id. at 48. See also Ex. NRC003A at 5-2 to 5-13 (T. 5-1).

[796] Ex. GLE012 at 48. See also Ex. NRC003A at 5-2 to 5-18 (Ts. 5-1 and 5-2).

[797] Ex. GLE012 at 48.

[798] Id. at 49-69.

[799] Id.

2. NRC Staff Witnesses

Jennifer A. Davis. Ms. Davis's education and background were discussed previously in reference to her testimony on Topic 4.

In her written testimony on Topic 5, Ms. Davis testified as follows:

Ms. Davis is the Project Manager for the environmental review of GLE's application for the proposed facility and was responsible for overseeing preparation of the FEIS.[800]

The proposed GLE facility is intended to provide an additional reliable and economical domestic source of low-enriched uranium to be used in American commercial nuclear power plants.[801] The need for the GLE facility is based on (1) the need for enriched uranium to fulfill electricity generation requirements in the United States; and (2) the need for domestic supplies of enriched uranium for national energy security purposes.[802] According to the Energy Information Administration, American commercial nuclear power plants currently supply about 20% of the nation's electricity requirements.[803] By 2035, domestic electricity demand is expected to grow by 30%.[804] As electricity demand increases, the need for enriched uranium to fuel commercial nuclear power plants is also expected to increase.[805] Looking at Energy Information Administration projections, nuclear power capacity and nuclear generation is expected to increase in the United States over the coming years.[806] This year's projections indicate that nuclear generating capacity will increase to a high in 2025 and then begin a decline

[800] Ex. NRC123-R1 at 2. The FEIS can be found at Exs. NRC003A and NRC003B.

[801] Ex. NRC123-R1 at 2. See also Ex. NRC003A at 1-2 to 1-9.

[802] Ex. NRC123-R1 at 2-3.

[803] Id. at 3 (citing Ex. NRC044 at 43).

[804] Id. at 3 (citing Ex. NRC045 at 73).

[805] Id.

[806] Id. at 3-4.

as plants are retired.[807] In assessing the need for the proposed facility, the Staff also considered the number of combined license applications for construction and operation of new reactors that are actively before the NRC or expected in the future.[808] The Fukushima Daiichi accident slowed nuclear power growth worldwide, but current information suggests that nuclear power growth will continue globally.[809]

Domestic production of enriched uranium fulfills approximately 16% of American demand.[810] The Paducah Gaseous Diffusion Plant is the primary uranium enrichment facility in the United States, and is currently being evaluated for "whether it is economically feasible to continue operations."[811] The Paducah Gaseous Diffusion Plant will remain open for at least one more year, but "[t]here is still some uncertainty regarding whether [it] will continue to operate beyond this additional year."[812] Another domestic source of enriched uranium is the National Enrichment Facility in New Mexico, which is operated by Louisiana Energy Services and opened in 2010.[813] Currently the National Enrichment Facility is operating below capacity and is expected to reach full capacity of 3 million SWU annually by October 2013.[814] Louisiana Energy Services is considering plans to expand total capacity to 5.9 million SWU per year.[815] The Megatons-to-Megawatts program fulfills about 37% of American demand, but the program is

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[807] Id. at 4.

[808] Id.

[809] Id. at 5.

[810] Id. at 7.

[811] Id.

[812] Id.

[813] Id.

[814] Id.

[815] Id.

scheduled to expire in 2013.[816] Under the TENEX Agreement, beginning in 2013, USEC will receive enriched uranium from Russia, which will ultimately reach half of the current Megatons-to-Megawatts supply by 2015.[817] Imports from other countries currently fulfill about 47% of American demand.[818]

Two other enrichment facilities have been granted licenses, but their construction and operation remains uncertain.[819] The American Centrifuge Plant will require significant additional financing and has run into hurdles obtaining the necessary funding from Department of Energy and Congress.[820] The Eagle Rock Enrichment Facility is currently on hold due to financial issues.[821] The Staff took the uncertain futures of these two facilities into account when developing its FEIS analysis. While the operation of the proposed GLE facility, the American Centrifuge Plant, the Eagle Rock Enrichment Facility, and the National Enrichment Facility at full capacity would lead to a domestic surplus, the uncertainty surrounding the American Centrifuge Plant and the Eagle Rock Enrichment Facility increases the need for the GLE proposed facility to ensure that enriched uranium is available for commercial reactors in the United States.[822]

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[816] Id. at 7-8.

[817] Id. at 8. The agreement allows for the amount to increase to an amount equal to what is received through the Megatons-to-Megawatts program after mutual agreement by the parties. Id.

[818] Id. There is no indication that importation cannot continue at this level, although new nuclear capacity is expected in several of the importing countries, which will increase their domestic demand. Id.

[819] Id. at 9.

[820] Id.

[821] Id.

[822] Id. at 9-10. See also Ex. NRC003 at 1-8.

The proposed GLE facility "could play an important role in assuring the nation's ability to maintain a reliable and economical domestic source of enriched uranium."[823] With approximately 84% of current demand in the United States fulfilled by foreign sources and large portion of the remaining 16% fulfilled by the Paducah Gaseous Diffusion Plant (which has an uncertain future), there could be a supply deficit of enriched uranium available to American commercial nuclear power plants.[824] Combined with the uncertainty around the American Centrifuge Plant and the Eagle Rock Enrichment Facility, the Staff concluded "the proposed GLE Facility is necessary to help assure that there is sufficient domestic enrichment capacity . . . and that having the proposed GLE Facility licensed and in operation would provide an additional domestic source of enriched uranium consistent with national energy security objectives."[825]

In her oral testimony on Topic 5, Ms. Davis testified as follows:

The Fukushima Daiichi event has affected global nuclear growth, but early studies seem to indicate that nuclear power will continue to grow worldwide, albeit at a potentially slower rate than previously anticipated.[826]

The FEIS assumed that GLE's enriched uranium would be sold to domestic nuclear power plants, but the Staff acknowledged that GLE would not be prohibited from selling overseas. Rather, the Staff assessed the proposed facility on the grounds that it would meet national policy objectives and the Energy Policy Act.[827] The Staff considered the international

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[823] Ex. NRC123-R1 at 10.

[824] Id. at 10-11.

[825] Id. at 11.

[826] Tr. at 146 (7/12/12 Hearing). The slides associated with Ms. Davis's presentation to the Board can be viewed at Ex. NRC115.

[827] Tr. at 167 (7/12/12 Hearing).

market for uranium in the context of examining how domestic demand is currently met and how the proposed GLE facility could serve national objectives.[828] The Staff mostly focused its assessment on national energy security policy objectives, but acknowledged possible advantages to the technology this facility would bring.[829] However, the technological advantages came mainly from the Applicant's statements and could not be verified because the Staff is "not privy to a lot of the information behind . . . the advantages."[830] Because the Staff was not "able to independently verify some of these statements, . . . because it is a highly classified technology . . . the staff did not use that per se as a factor in the purpose and needs . . . analysis."[831]

Halil Avci. Dr. Avci is a Nuclear Materials and Waste Disposition Team Lead in the Environmental Science Division of Argonne National Laboratory.[832] Dr. Avci received his B.S., M.S., and Ph.D. in Nuclear Engineering from the University of Wisconsin, Madison.[833] Dr. Avci is a nuclear engineer with over thirty-three years of experience, specializing in the environmental effects of energy production and use, nuclear energy, nuclear reactor licensing and license renewals, waste management, radiation effects, risk assessment, and accident analysis.[834] Dr. Avci manages Argonne's Technical Assistance Program to the NRC.[835] He has also served as an adjunct faculty member at Northwestern University's School of Continuing

[828] Id. at 168.

[829] Id. at 169.

[830] Id.

[831] Id. at 169-70.

[832] Ex. NRC123-R1 at 1.

[833] Id. Attach. (Halil Avci Statement of Professional Qualifications).

[834] Id.

[835] Id.

Studies.[836] He is the author or co-author of more than fifty journal papers, reports, conference publications, and presentations.[837]

In his written testimony, Dr. Avci testified as follows:

Dr. Avci served as Argonne National Laboratory's Project Team Lead on its contract with the Staff to provide technical assistance for the preparation of the FEIS.[838] He oversaw all Argonne National Laboratory activities supporting the Staff's preparation of the FEIS.[839]

The Staff must evaluate the impacts of the proposed action and a reasonable range of alternatives and compare the impacts from all alternatives in the FEIS.[840] To be considered a reasonable alternative, the alternative must meet the proposed objectives and applicable environmental standards and be technically feasible.[841] The purpose of the alternatives analysis is to illustrate and support the Staff's determination that there was no obviously superior site.[842] The No Action Alternative is required to be one of the alternatives considered.[843] In this case, the No Action Alternative is that "the NRC would not issue a license that would allow GLE to construct and operate the proposed GLE Facility at the Wilmington Site."[844]

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[836] Id.

[837] Id.

[838] Id. at 2.

[839] Id.

[840] Id. at 12.

[841] Id. See also Ex. NRC006 at 5-5 to 5-7.

[842] Ex. NRC123-R1 at 13. The concept of "obviously superior" is discussed in NUREG-1555, in relation to site selection for nuclear reactors. See Ex. NRC072.

[843] Ex. NRC123-R1 at 12.

[844] Id. at 13-14.

In analyzing the No Action Alternative, the Staff assumed GLE would not construct the facility, but that the preconstruction activities covered by GLE's exemption request would have taken place.[845] These activities included "site clearing, site grading and erosion control, building of storm water retention ponds, access roadways, guard houses, utilities, parking lots, and administrative buildings not used to process, handle, or store classified information."[846] Because GLE was uncertain at what pace it would undertake preconstruction activities prior to licensing, the Staff assumed all of these activities would occur regardless of whether a license was issued.[847] The No Action Alternative also assumed that enrichment services would continue to be obtained in the same fashion, with the American Centrifuge Plant and the Eagle Rock Enrichment Facility possibly providing services in the future.[848]

The No Action Alternative analysis indicated that the impacts to most resource areas of the GLE proposed facility are small, with small to moderate impacts occurring in the areas of historic and cultural resources, air quality, ecological resources, noise, and transportation. However, the findings of small to moderate in those categories are primarily associated with preconstruction and construction activity.[849] Since the impacts under both the proposed action and the No Action Alternative would be small in most resource areas and slightly different at small to moderate in some limited categories, "the NRC Staff did not consider the differences in impacts between the proposed action and the No Action Alternative to be significant."[850] However, since it was considered likely that GLE would not conduct any preconstruction

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[845] Ex. NRC123-R1 at 14.

[846] Id.

[847] Id. at 14-15.

[848] Id. at 15.

[849] Id. at 15-16.

[850] Id. at 17.

activities prior to licensing, the impacts under the No Action Alternative "would essentially be zero."[851] Despite this reduction in effects, the NRC Staff "determined that the proposed action would better meet the purpose and need than the no-action alternative."[852]

The Staff also considered a range of alternatives, including alternative siting locations both on and off of the Wilmington Site, alternative sources of enriched uranium, and the alternative technologies available.[853] The Staff "reviewed the site selection process used by GLE and determined that GLE's process was rational and objective."[854] The Staff also found that "none of the alternative sites outside of the Wilmington Site or the other potential alternative locations within the Wilmington Site would be environmentally preferable to the location selected by GLE."[855] The Staff "concluded that the only alternative that would meet the purpose and need for the proposed GLE Facility . . . would be the use of gas centrifuge technology instead of GLE's proposed laser-based technology."[856] However, when the Staff conducted a qualitative assessment of the two technologies, the Staff found "employing gas centrifuge technology in place of the proposed laser-based technology would not be environmentally preferable."[857] Therefore, the Staff "concluded, as a result of the alternatives analysis and the cost-benefit analysis in the FEIS, that the overall benefits of the proposed GLE Facility would outweigh the environmental disadvantages and costs."[858]

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[851] Id.

[852] Id. at 18.

[853] Id.

[854] Id.

[855] Id.

[856] Id.

[857] Id. at 18-19.

[858] Id. at 19.

Because no preconstruction activities have occurred, the Staff determined that a compression of the construction schedule may increase some impacts and lower others.[859] Due to resource constraints and a necessary sequencing of activities, there are natural limitations on how significantly a construction schedule could be compressed.[860] However, even if the schedule were compressed, the Staff "believes that the increases in annual impacts would not be great enough to change the impact conclusions in the FEIS."[861]

In his oral testimony, Dr. Avci testified as follows:

The Staff's analysis of the No Action Alternative in the FEIS requires correction. Because of the assumption that preconstruction activities would occur in both cases, the impacts under the No Action Alternative to historic and cultural resources, air quality, ecological resources, noise and transportation would be small to moderate under both the proposed action and the No Action Alternative.[862] These impacts "were incorrectly designated to be small in the FEIS."[863] However, because GLE has not conducted any preconstruction activities to date and it appears GLE will not conduct any prior to a licensing decision, "all the impacts that would be associated with the No Action Alternative at the Wilmington site would essentially be zero or small in . . . NRC impact classification terminology."[864] Though some areas indicated potential moderate impacts, most of those impacts are temporary and associated with preconstruction and construction activity or could have reduced severity if voluntary mediation measures are in

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[859] Id. at 27.

[860] Id.

[861] Id.

[862] Tr. at 153 (7/12/12 Hearing). The slides associated with Dr. Avci's presentation to the Board can be viewed at Ex. NRC115.

[863] Tr. at 153 (7/12/12 Hearing).

[864] Id. at 153-54.

fact employed.[865] Therefore, the Staff "did not consider the difference in impacts between the proposed action and the No Action Alternative to be significant."[866]

Tim Allison. Mr. Allison is an Economist at Argonne National Laboratory's Center for Energy, Environmental and Economic Systems Analysis.[867] Mr. Allison received his B.S. in Economics and Geography from the University of Portsmouth (United Kingdom) and his M.A. in Geography and M.S. in Mineral and Energy Resource Economics from West Virginia University.[868] Mr. Allison has over twenty-one years of experience at Argonne National Laboratory, where he specializes in local and regional economic development impacts, with specific regard to nuclear fuel plant and reactor licensing.[869] His expert areas include input-output and economic base modeling, statistical analysis, fiscal analysis, and the analysis of social and health impacts of energy and waste programs as they relate to low-income and minority populations.[870] He has written over fifty technical reports, published ten papers in peer reviewed journals, and made over thirty presentations to professional conferences and workshops.[871]

In his written testimony, Mr. Allison testified as follows:

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[865] Id. at 154-55.

[866] Id. at 155.

[867] Ex. NRC123-R1 at 1.

[868] Id. Attach. (Tim Allison Statement of Professional Qualifications).

[869] Id.

[870] Id.

[871] Id.

Mr. Allison served as Argonne National Laboratory's Technical Lead for the Socioeconomic, Environmental Justice, and Cost-Benefit Analyses for its contract with the NRC to provide technical assistance in preparation of the FEIS.[872]

Cost-benefit analysis provides a rationale for deciding whether a project has a net positive impact by aggregating the costs and benefits of an associated project.[873] The primary purpose of the cost-benefit analysis is to evaluate all costs and benefits of the proposed action, and compare it to the No Action Alternative "to help determine which had the higher overall net benefits."[874] The cost-benefit analysis values benefits and costs in monetary terms, where possible.[875] Qualitative data is also included to consider unquantifiable costs and benefits.[876] Costs and benefits are also separated into two categories: private and societal.[877] While most private benefits and costs can be quantified, not all societal costs and benefits can.[878] Nonquantifiable societal costs include land use, historic and cultural resources, visual, air quality, water, noise, and waste management impacts.[879] Nonquantifiable societal benefits include meeting national energy policy goals.[880] Quantifiable costs and benefits include tax

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[872] Id. at 2.

[873] Id. at 19-20.

[874] Id. at 20.

[875] Id.

[876] Id.

[877] Id.

[878] Id. at 21.

[879] Id.

[880] Id.

incentives given to GLE, local property and other tax revenue expected to be generated by the project and direct and indirect income and employment.[881]

In the cost-benefit analysis, the Staff defined the socioeconomic region of influence as the Wilmington Statistical Area, a three county area (Brunswick, New Hanover, and Peder Counties) where GLE's employees would likely live and spend income.[882] This region of influence was used to assess the socioeconomic costs and benefits.[883] After comparing all costs and benefits, the Staff concluded that "the net benefits of the proposed action (constructing and operating the proposed GLE Facility) outweighed the overall costs and benefits of the No Action Alternative."[884] Key societal benefits included the contribution of increased domestic sources of enriched uranium to meeting future demand and increased national energy security; the development of a new technology that has the potential to have lower resource and environmental costs than currently employed methods; and positive impacts on the region of influence – including increasing employment and tax revenue.[885]

In his oral testimony, Mr. Allison testified as follows:

The overall result of the cost-benefit analysis was that the quantifiable benefits associated with each stage of the proposed GLE facility would exceed quantifiable costs.[886] Nonquantifiable societal costs and benefits were also considered qualitatively.[887] Certain

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[881] Id.

[882] Id. at 22.

[883] Id.

[884] Id. at 23.

[885] Id. at 24.

[886] Tr. at 162 (7/12/12 Hearing). The slides associated with Mr. Allen's presentation to the Board can be viewed at Ex. NRC115.

[887] Tr. at 162 (7/12/12 Hearing).

impacts were removed from the analysis. This was because the impacts were equal between the proposed action and No Action Alternative or because some benefits and costs are too difficult to weigh or predict, such as trickle-down benefits to customers and suppliers or the impact of uranium prices on the market.[888]

If benefits or costs cannot be quantified, then the analysis ends. The nonquantifiable costs and benefits are appreciated and discussed, but "are not included in the overall net benefit calculus at least as a result of the cost-benefit analysis."[889] Because nonquantifiable impacts and benefits are classified by the NRC system, any larger impacts would be given more weight when balancing out the overall costs and benefits.[890] But monetizing environmental costs, for example, is "quite difficult intellectually and politically quite controversial because there are various aspects to the evaluation of environmental costs."[891] Various socioeconomic factors, like political viewpoints, gender, and education all affect the way individuals would value different environmental impacts, making quantification problematic.[892]

F. Topic 6: Environmental Monitoring Program

1. GLE Witnesses

Joseph Alexander. Mr. Alexander is currently a Senior Geologist and Project Director for RTI International in Research Triangle Park, North Carolina.[893] He has a B.S. in Geology from East Carolina University and an M.S. in Geology with a concentration in Hydrogeology and

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[888] Id. at 162-63.

[889] Id. at 170-71.

[890] Id. at 171-72.

[891] Id. at 172.

[892] Id.

[893] Ex. GLE023 at 1.

Engineering Geology from Northern Arizona University.[894] He is a licensed professional geologist in North Carolina and Georgia.[895] Mr. Alexander has spent most of his career at RTI International, working in various capacities. He has led various groundwater contamination assessments; developed and implemented compliance monitoring programs, shallow-soil remedial efforts, and site characterizations; and provided technical oversight of integrated programs associated with hydrogeology, remedial technology, and geochemistry.[896] Prior to working at RTI International, Mr. Alexander worked as a hydrogeologist and engineering geologist for various private entities.[897]

In his written testimony, Mr. Alexander testified as follows:

Mr. Alexander was involved in the remediation evaluation, site selection, and hydrogeologic characterization projects concerning GLE's proposed project.[898] He also assisted with the development of GLE's ER.[899]

The Wilmington Site is within the North Carolina Coastal Plain physiographic province.[900] The coastal aquifer system within that province is an eastward-dipping and eastward-thickening wedge of depositional sediments and sedimentary rock underlain by igneous and metamorphic rock.[901] Six regional aquifers are present in the region surrounding the site, including the Surficial Aquifer, the Castle Hayne Aquifer, the Peedee Aquifer, the Black Creek Aquifer, and

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[894] Id. at 2.

[895] Id.

[896] Id.

[897] Id. App. A.

[898] Id. at 2.

[899] Id.

[900] Id. at 29.

[901] Id. at 29-30.

the Upper and Lower Cape Fear Aquifers.[902] These aquifers are water-yielding formations that are more permeable than the finer-grained formations that are typically above and beneath coastal aquifers.[903] The Surficial Aquifer is under water table conditions.[904] Groundwater assessments associated with the existing site facilities have focused on the Surficial Aquifer and the upper portion of the underlying Peedee Aquifer.[905] In the eastern portion of the site, these two aquifers are typically separated by a less-permeable semiconfining layer, which is thin or absent in the vicinity of the GLE study area.[906] In the GLE study area, there is also no clear differentiation between the Peedee and Surficial Aquifers.[907]

The Surficial Aquifer includes undifferentiated, stratified deposits generally located approximately nine feet below ground surface at the Wilmington Site.[908] This aquifer is recharged by rainfall, and the water table is generally located nine feet below ground surface, with a range of zero to twenty feet below ground surface.[909] The Surficial Aquifer discharges into streams, drainage canals and ditches, and the low-lying swampy areas of the western and

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[902] Id. at 30.

[903] Id.

[904] Id.

[905] Id. The Peedee Aquifer is also called the Principal Aquifer because it is the only aquifer that provides water to the site. Id.

[906] Id.

[907] Id.

[908] Id. at 31.

[909] Id.

northwestern portions of the Wilmington Site.[910] It also recharges groundwater into the underlying Principal Aquifer.[911]

The relatively less-permeable Peedee clay layer underlies much of the Surficial Aquifer and acts as a semiconfining layer for the Principal Aquifer.[912] The thickness of this layer varies and is not universally present on the Wilmington Site.[913] When present and sufficiently below the water table, the Peedee clay layer hydraulically separates the two aquifers – acting as a semiconfining layer.[914] Site studies indicate this layer is present in the eastern portion of the Wilmington Site, where it eventually transitions to alluvial clay across the north-central portion of the Wilmington Site and is ineffective as a semiconfining layer.[915] The northwestern portion of the Wilmington Site has no clay layers.[916]

The Principal Aquifer at the Wilmington Site refers to the upper zones of the Peedee Aquifer, a deposit that includes greenish-gray to dark-gray silt and sand interbedded with semiconsolidated calcareous sandstone and limestone.[917] The upper portion of the Principal Aquifer is generally more permeable and contains more sand than the lower zones.[918] Groundwater flows from the upland areas toward the surrounding hydrogeologic boundaries,

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[910] Id.

[911] Id.

[912] Id. at 32.

[913] Id.

[914] Id.

[915] Id. at 32-33.

[916] Id. at 33.

[917] Id.

[918] Id.

including streams, the Northeast Cape Fear River, and the low-lying swampy areas.[919] In addition, groundwater is drawn to the Global Nuclear Fuels-America (GNF-A) pumping wells, which provide process water and groundwater remediation for the existing facility.[920] The potable water supply for the site is provided by three wells just east of the Wilmington Site and Castle Hayne Road.[921] The primary input of groundwater to the Principal Aquifer system is recharged from leakage through the overlying semiconfining layer or direct seepage of rainwater in areas where the semiconfining layer is absent, including in the vicinity of the proposed GLE site.[922]

The current GNF-A groundwater monitoring program includes analysis of samples from a large number of wells around the Wilmington Site.[923] GLE will construct thirteen additional sampling wells around its proposed site.[924] These wells and the eight existing wells within the GLE site will be added to the sampling protocol as part of GLE's Environmental Monitoring Program.[925] The GLE site wells will be positioned in seven clusters, with three wells at different depths in each cluster.[926] All of these locations are west of the western extent of the less-permeable clay semiconfining layer.[927] The well-cluster locations were selected on the basis of

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[919] Id.

[920] Id.

[921] Id.

[922] Id.

[923] Id. at 34.

[924] Id.

[925] Id.

[926] Id.

[927] Id. at 35.

groundwater flow directions.[928] Samples will initially be collected quarterly prior to operation to establish baseline conditions.[929] The monitoring frequency of each well will be reviewed and adjusted after a sufficient data set is developed.[930] Samples will be collected using dedicated sampling equipment or other industry accepted practices and will be analyzed for uranium and fluoride.[931] If analytical results for uranium exceed GLE's threshold limit of 0.02 parts per million, then the subsequent quarterly sample will also be analyzed for gross alpha and gross beta activity.[932]

In his oral testimony, Mr. Alexander testified as follows:

The Principal Aquifer provides process water to the Wilmington site, as well as potable water for the Wilmington site and the surrounding communities.[933] Effectively there is no reason to distinguish between the Principal and Surficial Aquifers because they act as one under water table conditions.[934] No aquacludes have been found in the GLE aquifer study, so generally porosity and permeability decrease with depth.[935] If a spill on the GLE site were to reach the water table, it would traverse down and then laterally.[936] The water beneath the GLE site is

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[928] Id.

[929] Id. at 36.

[930] Id.

[931] Id.

[932] Id.

[933] Tr. at 193 (7/12/12 Hearing). The slides associated with Mr. Alexander's presentation to the Board can be viewed at Ex. GLE024.

[934] Tr. at 205-06 (7/12/12 Hearing).

[935] Id. at 206.

[936] Id.

potable quality and flows from the GLE site in all directions.[937] The sites for additional wells were chosen based on a judgmental sampling intended to provide perimeter cover on the basis of knowledge of site hydrogeology and groundwater flows.[938] Based on the initial data, the first well in a cluster will be shallow, at water table level; the second will be at a thirty to forty foot depth; and the deepest may go as deep as fifty feet.[939] Modeling has been done to determine groundwater flow and groundwater contaminant transport.[940] The models were calibrated based on water levels and formation information with depth, which will be used to determine actual well depths.[941]

Kimberly Matthews. Ms. Matthews is an Environmental Scientist for RTI International in Research Triangle Park, North Carolina.[942] Her education and background were discussed previously in reference to her testimony on Topic 5.

In her written testimony on Topic 6, Ms. Matthews testified as follows:

Ms. Matthews was the primary author of the ER's Sections regarding the existing surface water and ecological environmental settings and the potential impacts on surface water from the proposed GLE facility.[943] The Wilmington Site is located within the Northeast Cape Fear River Sub-basin of the Cape Fear River Basin.[944] The Northeast Cape Fear River flows in a southerly direction past the Wilmington Site and, six miles south of the site, joins the Cape

[937] Id. at 207-08.

[938] Id. at 213.

[939] Id. at 213-14.

[940] Id. at 219.

[941] Id.

[942] Ex. GLE023 at 1.

[943] Id. at 3.

[944] Id. at 20.

Fear River to form the Cape Fear River Estuary.[945] The Northeast Cape Fear River is the nearest named waterbody to the proposed site, located along the southwestern property boundary.[946] The river demonstrates conditions that are characteristic of a tidally-influenced river in the North Carolina Coastal Plain.[947] The Wilmington Site is drained by several small streams and an effluent channel.[948] The effluent channel begins in the eastern portion of the Wilmington Site, flows west to the site dam, and then connects to Unnamed Tributary #1 of the Northeast Cape Fear River.[949] The effluent channel receives stormwater runoff from the developed portion of the Site and treated wastewater effluent.[950] Unnamed Tributary #2 of the Northeast Cape Fear River drains the northwestern portion of the site, while two unnamed streams flow north from the property to Prince George Creek, a tributary of the Northeast Cape Fear River.[951] Unnamed Tributary #1 of Prince George Creek originates on the eastern portion of the site and receives site stormwater runoff from parking lots and buildings.[952] Unnamed Tributary #2 of Prince George Creek receives drainage from the largely forested north-central portion of the site.[953]

During facility construction and operation, surface water quality will continue to be monitored on the Wilmington Site in the effluent channel by either GNF-A or GLE, and upstream

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[945] Id. at 20-21.

[946] Id. at 21.

[947] Id.

[948] Id.

[949] Id.

[950] Id. at 22.

[951] Id.

[952] Id.

[953] Id.

and downstream of the site through an existing partnership with the Lower Cape Fear River Program.[954] The Lower Cape Fear River Program also maintains a station near the site's southern border.[955] The North Carolina Department of the Environment and Natural Resources, Division of Water Quality also maintains two monitoring stations along the Northeast Cape Fear River – seventeen miles upstream of the site and six miles downstream of the site.[956] GNF-A or GLE surface water sampling and analysis will be conducted in accordance with North Carolina approved methodologies and analyses will be performed by state-certified labs.[957] The Lower Cape Fear River Program follows similar methodologies as specified in a Memorandum of Agreement with the state.[958] GNF-A or GLE will monitor radiological water quality parameters in the effluent channel, as well as at the Northeast Cape Fear River significantly upstream and just downstream of the Wilmington Site.[959] These samples will be obtained and analyzed in accordance with North Carolina standard operating procedures and other applicable industry best practices.[960]

The surface water at or downstream of the site is not used as drinking water.[961] All water used at the site for both potable and process water is provided through the

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[954] Id.

[955] Id.

[956] Id.

[957] Id.

[958] Id.

[959] Id. at 24.

[960] Id.

[961] Id.

groundwater.[962] There is no public intake of surface water from the Northeast Cape Fear River downstream of the site.[963]

The monitoring program for the surface water pathways also includes wastewater effluent and stormwater discharge as specified by state permits.[964] Sediment samples are also included in the surface water pathway because sediment-bound pollutants are a result of transport through surface wastewater and stormwater runoff.[965]

The Wilmington Site state permit currently mandates three stormwater monitoring locations: two outfalls discharge to the Northeast Cape Fear River and one outfall discharges to Prince George Creek.[966] Semiannual sampling is required during a storm event, with analysis for lead, oil and grease, pH, and total suspended solids.[967] This permit could be modified by the state upon the construction and operation of the proposed GLE facility by adding additional monitoring locations and analytical parameters.[968] Stormwater runoff from the UF_6 cylinder storage area will be collected in a holding pond for monitoring of uranium, gross alpha, gross beta, and fluoride.[969] After monitoring, this stormwater will be released to a stormwater wet detention basin, which will not be monitored except for qualitative monitoring and maintenance inspections.[970]

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[962] Id.

[963] Id.

[964] Id.

[965] Id.

[966] Id. at 27.

[967] Id.

[968] Id.

[969] Id.

[970] Id. at 27-28.

Sediment samples are collected semiannually in the effluent channel and further downstream of the site dam at a road crossing before the channel enters the Tidal Swamp area.[971] These sediment samples are analyzed for uranium.[972] Because GLE sediment will flow through the same process basins as currently used by GNF-A, the current sampling locations are sufficient.[973]

In her oral testimony on Topic 6, Ms. Matthews testified as follows:

Non-radiological monitoring of the Northeast Cape Fear River is conducted by the Lower Cape Fear River Program, but GNF-A or GLE could choose not to participate in this group and conduct their own monitoring in accordance with the state permit.[974]

Water pathways are analyzed for total uranium bound to sediment that would most likely enter the pathways through wastewater or storm water runoff.[975]

Andrew Stahl. Mr. Stahl is a Senior Research Geologist for RTI International in Research Triangle Park, North Carolina.[976] He holds a B.S. degree in Geology from the State University of New York at Binghamton and an M.S. in Geology with a Hydrogeology focus from Pennsylvania State University.[977] He is a licensed professional geologist in North Carolina and certified as a Professional Geologist by the American Institute of Professional Geologists.[978]

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[971] Id. at 28.

[972] Id. at 28-29.

[973] Id. at 29.

[974] Tr. at 187-88 (7/12/12 Hearing). The slides associated with Ms. Matthew's presentation to the Board can be viewed at Ex. GLE024.

[975] Tr. at 204-05 (7/12/12 Hearing).

[976] Ex. GLE023 at 1.

[977] Id. at 3.

[978] Id. at 3.

While at RTI International, Mr. Stahl has led groundwater resource assessments, conducted environmental site assessments, and analyzed the environmental consequences of the Fukushima Daiichi accident and of potential terrorist attacks.[979] Prior to joining RTI International, Mr. Stahl worked as a hydrogeologist at various private entities.[980]

In his written testimony, Mr. Stahl testified as follows:

Mr. Stahl was responsible for various aspects of the ER, including project scoping, technical coordination, and senior management-level review.[981]

The weather in North Carolina is primarily influenced by the position of the jet stream and a large subtropical area of high pressure called the Bermuda high.[982] During summer, the Bermuda high is most often centered over Bermuda and, on occasion, asserts a more direct influence in North Carolina by moving westward.[983] During the winter months, the Bermuda high generally moves eastward, while the jet stream dips further south.[984] On an annual basis, the wind direction in Wilmington is predominantly southwesterly, but during the fall and winter, the wind direction is often northerly.[985] The annual prevailing wind speed at the Wilmington International Airport is nine knots.[986] Because the airport is located approximately four miles

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[979] Id. App. C.

[980] Id.

[981] Id. at 4.

[982] Id. at 14.

[983] Id.

[984] Id. at 14-15.

[985] Id. at 15.

[986] Id.

from the GLE proposed site, meteorological and atmospheric data collected at the airport is considered accurate for characterizing weather conditions at the proposed GLE site.[987]

The primary source of radiological air emissions from the proposed facility will be short-term releases of uranium that could potentially occur inside the operations building during activities associated with the enrichment process and subsequently could be vented through the building's high efficiency, multi-stage emissions control system.[988] To monitor for potential airborne radiological emissions, GLE will sample the vent stack exhaust gas from the main GLE operations building emissions control system; the ambient air at selected locations at and outside of the fenceline of the proposed facility; and the soil at selected locations on and off the Wilmington Site to assess ground surface deposition.[989] Exhaust gas vented to the atmosphere from the main GLE operations building will be sampled continuously to measure its radioactivity.[990] The collection filter will be removed on a daily basis during initial operation; however, the frequency of filter removal and analysis will eventually decrease to weekly if the results during normal operations are shown to be consistently within regulatory requirements.[991] Ambient air levels of radiological emissions will be monitored by placing eleven samplers around the proposed GLE facility to measure gross alpha activity and concentrations of uranium isotopes.[992] The samplers locations were based on the predominant wind directions as determined by a long-term wind rose, which was based on seventeen years of Integrated

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[987] Id.

[988] Id. at 16.

[989] Id.

[990] Id.

[991] Id.

[992] Id. at 17.

Surface Hourly Observation data from the Wilmington International Airport.[993] Nine of the samplers will be placed around the controlled access area fenceline of the proposed facility.[994] One sampler would be placed in the west-northwest direction about a half-mile away from the operations building stack, for the purpose of background or ambient air monitoring.[995]

Soil sampling and analysis will also be performed to assess the deposition of airborne radionuclides.[996] The current GNF-A radiological soil monitoring program analyzes samples from a number of on- and off-site locations.[997] Soil samples will continue to be collected on a semi-annual basis from these areas, plus two additional locations established by GLE based on the location of the main operations building stack and prevailing wind directions.[998] The soil samples will be collected from the upper four inches of soil using decontaminated hand-sampling tools.[999] To establish baseline conditions, these new locations will be sampled prior to operations and throughout operation.[1000] Baseline shallow soil uranium concentrations will be assessed by implementing a statistically-designed sampling program.[1001]

The primary source of non-radiological hazardous air emissions would be the release of small gaseous emissions that could potentially contain HF.[1002] Any such releases will be

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[993] Id.

[994] Id.

[995] Id. at 18.

[996] Id.

[997] Id.

[998] Id. at 18-19.

[999] Id. at 19.

[1000] Id.

[1001] Id.

[1002] Id. at 20.

contained within the main GLE operations building and vented though the building's high-efficiency, multi-stage emissions control system.[1003] The emissions control system vent stack of the main GLE operations building will be sampled continuously to monitor for fluoride emissions.[1004] This sampling will initially occur daily until it is established the results are consistently within regulatory requirements, at which point, the filter will be analyzed weekly.[1005] The quantity of fluoride emissions vented to the atmosphere through the stack will be calculated using the analytical results, the corresponding measured exhaust volume for the stack, and the associated stack sampler volume.[1006]

In his oral testimony, Mr. Stahl testified as follows:

The GLE Environment, Health, and Safety function serves as an internal, unbiased third party – that has the authority to enforce shutdown of any GLE process or facility.[1007] It will also implement the Environmental Monitoring Program.[1008] The Environmental Monitoring Program can be modified to maintain effectiveness, but such changes will be evaluated in accordance with the GLE Change Management Program.[1009]

The monitoring station nearest to any residential area is the fenceline ambient air monitoring station, located in the northeast corner of the controlled access area about 3,000 feet

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[1003] Id.

[1004] Id.

[1005] Id.

[1006] Id.

[1007] Tr. at 180 (7/12/12 Hearing). The slides associated with Mr. Stahl's presentation to the Board can be found at Ex. GLE024.

[1008] Tr. at 180 (7/12/12 Hearing).

[1009] Id. at 180-81.

from a residential area.[1010] The two pairs of sampling locations for soil were selected based on predominant wind directions; they are located in an attempt to provide average measurements along the parts of the wind diagram in the north and northeast quadrant.[1011] Although GLE has only two soil monitoring sites, GNF-A has several more sites as well as historical data from those areas.[1012] One of the GLE soil sampling sites is near a road that traverses the property line to the north; the other is located on a power line.[1013] However, the site near a road is located in a place with little or no traffic – as it is a limited access road for the private hunting grounds north and northwest of the facility.[1014] To allow ground surface deposits to infiltrate to a certain depth, soil samples will be collected semiannually from the upper four inches of the soil.[1015] For its part, GNF-A conducts soil uranium analyses at seven onsite and offsite monitoring locations.[1016]

In modeling the air emissions monitoring stations, height of the stack was assumed to be fifty to seventy-five feet.[1017] The smaller portion of the building on which the stack is to be placed will be located next to the taller portion of the building, which will reach 200 feet.[1018] Mr.

[1010] Id. at 198.

[1011] Id. at 198-99.

[1012] Id.

[1013] Id. at 200.

[1014] Id. at 217.

[1015] Id. at 202.

[1016] Id. at 216-17.

[1017] Id. at 222.

[1018] Id. This statement was made by Ms. Olivier to enhance Mr. Stahl's explanation of this issue.

Stahl did not know if the taller portion of the building was factored into the model used to determine where monitoring stations should be placed.[1019]

Julie Anne Olivier. Ms. Olivier is the Licensing and Regulatory Affairs Manager for the GLE project.[1020] Her education and background were discussed previously in reference to her testimony on Topic 2.

In her written testimony on Topic 6, Ms. Olivier testified as follows:

Data collected from monitoring activities will be managed and tracked according to comprehensive Records Management and Quality Assurance programs.[1021] GLE will ensure compliance with environmental requirements by establishing internal actions that will be set at specific levels to indicate when action, such as an investigation, is necessary.[1022] In the event that GLE exceeds an internal action level or regulatory requirement, GLE will enter a corrective action request into its Corrective Action Program, conduct an investigation, and formulate and implement plans to correct the issue.[1023]

GLE's monitoring programs are guided by several NRC regulations. For example, 10 C.F.R. Part 20 requires that GLE perform the measurements and monitoring necessary to demonstrate that the amount of radioactive material present in effluents is kept As Low As Reasonably Achievable (ALARA).[1024] GLE will also be required to submit semiannual reports to the NRC, specifying the quantities of principal radionuclides released to unrestricted areas.[1025]

[1019] Id. at 222-23.

[1020] Ex. GLE023 at 1.

[1021] Id. at 6.

[1022] Id.

[1023] Id.

[1024] Id. at 7.

[1025] Id.

NRC Regulatory Guides 4.15 and 4.16, as well as local, State, and Federal regulatory requirements, provide guidance and regulation to ensure concentrations in effluents and emissions are properly controlled.[1026]

GLE's approach involves monitoring at the points of release, called source-point monitoring.[1027] To ensure the validity of these measurements, source-point measurements will be verified by additional measurements performed farther away from release points.[1028] To evaluate whether changes are needed in systems or practices to achieve ALARA goals, trends in emissions and monitoring data are reviewed annually by a multidisciplinary team, the Wilmington Safety Review Committee.[1029] The GLE Environmental Monitoring Program's sampling, analytical, and reporting procedures will be conducted in accordance with industry-accepted methods and instrumentation, as well as the requirements of the GLE Quality Assurance program.[1030] Employees involved in the implementation of monitoring will be trained on these procedures.[1031] GLE's Quality Assurance program will require that sampling equipment is properly maintained and calibrated, and functional monitoring and routine checks will ensure this occurs.[1032] Any laboratory that performs testing services will be certified by either the National Environmental Laboratory Accreditation Program or an equivalent state laboratory accreditation agency and these laboratories will be required to employ established

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[1026] Id.

[1027] Id.

[1028] Id. at 8.

[1029] Id.

[1030] Id. at 11.

[1031] Id.

[1032] Id.

standards, like those provided by the National Institute of Standards and Technology.[1033] GLE's program will monitor for both radiological and hazardous, non-radiological releases into the environment.[1034]

Four primary types of monitoring for hazardous releases will be conducted: stack monitoring; water sampling; stormwater runoff sampling; and groundwater quality and levels.[1035] GLE will also incorporate the past experience and data obtained during implementation of the GNF-A's environmental program.[1036] Procedures from that existing environmental program will be replicated, and GLE may use data generated from GNF-A's monitoring program.[1037]

The GLE Environmental, Health, and Safety organization will implement the environmental monitoring program.[1038] This organization will provide independent oversight of operations and ensure that the GLE facility complies with applicable rules, regulations, and codes.[1039]

Separate wastewater effluent monitoring locations are not needed because GLE wastewater effluent discharges will be combined with GNF-A's discharges for treatment at the final process lagoon treatment facility.[1040] The lagoon facility will be monitored at existing outfalls in accordance with a permit issued to GNF-A.[1041] Radioactive liquid waste treatment will

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[1033] Id. at 11-12.

[1034] Id. at 12-13.

[1035] Id. at 13.

[1036] Id.

[1037] Id.

[1038] Id.

[1039] Id. at 14.

[1040] Id. at 25.

[1041] Id.

consist of a system to remove uranium and fluoride.[1042] Uranium removal will be accomplished through pH adjustment, followed by precipitation and filtration.[1043] Fluoride will be removed through the addition of salt to form a solid fluoride precipitate, followed by either filtration or evaporation and removal of the precipitate.[1044] Treated wastewater effluent will be routed to a pump station, which will route the effluent to the final process lagoon facility for further treatment.[1045] The treated process wastewater samples are collected daily at Outfall 001, at the final process lagoons.[1046] The monitoring program includes: daily composite samples for uranium content; weekly composite samples of daily samples for gross alpha and gross beta activity; and quarterly composites for technetium-99.[1047] The treated wastewater effluent is also monitored for various parameters, including total suspended solids, total nitrogen, fluoride, cyanide, pH, metals, oil and grease, and total toxic organics.[1048] GLE sanitary wastewater will be treated in the existing sanitary wastewater treatment facility, with treated effluent being used in onsite cooling towers if there is sufficient demand.[1049] When demand is not sufficient, the portion of treated sanitary wastewater effluent not used in the cooling towers will be discharged

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[1042] Id.

[1043] Id.

[1044] Id.

[1045] Id.

[1046] Id. at 26. For the exact location of Outfall 001, consult Figure 6-6 in Ex. GLE023.

[1047] Id.

[1048] Id. at 26-27.

[1049] Id. at 27.

as surface water and monitored in accordance with the permit governing surface water releases.[1050]

GLE will track its Environmental Monitoring Program data as part of GLE's Quality Assurance Program.[1051] The Quality Assurance Program requires procedures for reviewing, approving, handling, identifying, retaining, retrieving, and maintaining Quality Assurance records.[1052] The records will include test and inspection results and all documentation required by codes, standards, or the Quality Assurance Program.[1053] GLE will store these records electronically using a dual-facility records storage process with backup tape storage in a fireproof safe in a separate location from the computerized records.[1054] To ensure accuracy, analytical data will be transferred directly to the program-specific relational database, so manual transcription errors will be avoided.[1055] Regardless of how data is imported, Quality Assurance checks will verify accurate data storage, and Quality Assurance and Quality Control reviews and audits will also be required.[1056] GLE will track the stored data by using modules which will track sampling completeness and allow GLE to efficiently determine conditions that require further action or review.[1057]

[1050] Id.

[1051] Id. at 36.

[1052] Id. at 37.

[1053] Id.

[1054] Id.

[1055] Id.

[1056] Id.

[1057] Id. at 38.

Further, GLE will work to ensure ongoing compliance with environmental requirements by establishing internal action levels.[1058] The internal action levels for environmental measurements will be set based on the concentration of an analyte that indicates some action needs to be taken.[1059] Internal action levels provide guidance for ensuring compliance with regulatory limits and requirements.[1060] In most cases, these internal action levels are lower than the pertinent regulatory or permit action levels, providing GLE with a margin of safety.[1061] If a monitoring result exceeds an internal action level or a regulatory requirement, GLE will enter a corrective action request into GLE's Corrective Action Program and possibly shutdown the affected process equipment.[1062] The Corrective Action Program is designed to capture various conditions that may be precursors to more significant issues and ensure problems are addressed, analyzed, and corrective actions are taken.[1063] An incident will trigger a investigation, which will help to determine what immediate and long-term actions need to be taken.[1064]

In her oral testimony on Topic 6, Ms. Olivier testified as follows:

In areas where GLE and GNF-A share monitoring responsibilities, the two will have to enter into a memorandum of agreement or a memorandum of understanding to work out the

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[1058] Id.

[1059] Id. at 38-39.

[1060] Id. at 39.

[1061] Id.

[1062] Id. at 39-40.

[1063] Id. at 40.

[1064] Id.

details of monitoring and data sharing.[1065] The onsite sanitary wastewater treatment facility was upgraded about five years ago and was built with a capacity to accommodate the GLE facility.[1066] Currently the treated effluent is recycled into the cooling tower for the GNF-A facility; if additional treatment creates excess effluent, it will be transported to the GLE cooling towers.[1067]

GNF-A's air monitoring stations are located a few meters off the ground.[1068] GLE plans to use the same type, subject to vendor availability.[1069]

Sanitary wastewater effluent is not monitored for radiological substances, as it is not required under the requisite permits.[1070] GLE assesses that there is a very low chance that radiological constituents would get into the sanitary wastewater system because that system is separated from the contaminated systems on the site.[1071] There have been issues at nuclear fuel facilities with accumulation of radionuclides in domestic wastewater treatment systems, but this has not been an issue on the Wilmington Site.[1072]

[1065] Tr. at 189 (7/12/12 Hearing). The slides concerning Ms. Olivier's presentation to the Board on Topic 6 can be viewed at Ex. GLE024.

[1066] Tr. at 189 (7/12/12 Hearing).

[1067] Id. at 189-90.

[1068] Id. at 218.

[1069] Id.

[1070] Id. at 220.

[1071] Id.

[1072] Id. at 221.

2. NRC Staff Witnesses

Karl Fischer. Mr. Fischer was an Environmental Systems Engineer at Argonne National Laboratory.[1073] In June 2012, he joined the University of Michigan as a Senior Health Physicist and is in the process of being rehired part-time by Argonne National Laboratory.[1074] Mr. Fischer received his B.S.E. in Nuclear Engineering and his M.Eng. in Radiological Health Engineering from the University of Michigan.[1075] He became a Certified Health Physicist in 2004 and has been recertified twice since.[1076] His areas of expertise are health physics and radiological health risk.[1077] At Argonne National Laboratory, he provided health physics and programmatic support to various government sponsors, including technical, cumulative impacts, and vulnerability assessments.[1078] Prior to his role at Argonne National Laboratory, Mr. Fischer worked at Northrop Grumman Information Technology, serving as Deputy Program Manager for the Nuclear Test Personnel Review Program for the Department of Defense.[1079] Prior to that, he served as a health physicist and senior health physicist for the National Institutes of Health, Division of Radiation Safety.[1080]

In his written testimony, Mr. Fischer testified as follows:

[1073] Ex. NRC124 at 1.

[1074] Id.

[1075] Id. Attach. (Karl Fischer, CHP, Statement of Professional Qualifications).

[1076] Id.

[1077] Id.

[1078] Id.

[1079] Id.

[1080] Id.

Mr. Fischer was Argonne National Laboratory's Deputy Team Lead and Document Manager on its contract with the NRC to provide assistance on the preparation of the FEIS.[1081] In that role, he oversaw Argonne National Laboratory's subject matter experts who contributed to the FEIS.[1082]

Several key NRC guidance documents are applicable to the Staff's review of an environmental monitoring program for a uranium enrichment facility.[1083] They include NUREG-1748,[1084] NUREG-1520,[1085] Regulatory Guide 4.15,[1086] Regulatory Guide 4.16,[1087] Regulatory Guide 8.37,[1088] and NUREG-1302.[1089]

The GLE Environmental Monitoring Program consists of two components: effluent monitoring activities and environmental monitoring activities.[1090] Both types of monitoring include radiological and non-radiological analyses.[1091] Because GNF-A already conducts effluent and environmental monitoring for existing facilities on the Wilmington Site, the existing

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[1081] Id. at 2.

[1082] Id.

[1083] Id. at 3-5.

[1084] See Ex. NRC006.

[1085] See Ex. NRC005.

[1086] See Ex. NRC077.

[1087] See Ex. NRC078.

[1088] See Ex. NRC079.

[1089] See Ex. NRC080.

[1090] Ex. NRC124 at 5. Effluent monitoring is the monitoring of gaseous and liquid effluents at the point of release. Environmental monitoring is the monitoring of various environmental media in the vicinity of the facility. Id.

[1091] Id.

program would be expanded to include the GLE facility and called the Expanded Monitoring Program.[1092]

Radiological monitoring of effluent releases would be performed to comply with federal and state regulations.[1093] The radiological effluent monitoring program is based on various regulatory requirements, the existing program on the Wilmington Site, and NRC guidance documents.[1094] Non-radiological monitoring of chemical constituents in effluent releases complies with permitting requirements and other agencies' regulations.[1095] Radiological and non-radiological monitoring will include airborne and liquid release, but sanitary wastewater effluent will be used as makeup water in site cooling towers, so no discharge of treated sanitary wastewater is expected.[1096]

Monitoring for contaminants in the various environmental media near the proposed facility would be performed to verify the validity of effluent monitoring results, verify that containment and effluent controls are working properly, and provide a means for evaluating the impacts from GLE operations on the local environment.[1097] Types of monitoring that will occur include direct radiation monitoring, ambient air monitoring, process wastewater monitoring, surface water and sediment monitoring, stormwater runoff monitoring, groundwater monitoring, and soil monitoring.[1098]

[1092] Id.

[1093] Id.

[1094] Id.

[1095] Id. at 5-6.

[1096] Id. at 6.

[1097] Id. at 8.

[1098] Id. at 8-10.

The North Carolina Department of the Environment and Natural Resources, Division of Water Quality conducts water quality monitoring in two locations along the Northeast Cape Fear River, both upstream and downstream of the Wilmington Site.[1099] Monitoring parameters include metals, arsenic, biochemical oxygen demand, chloride, dissolved oxygen, fecal coliform, nitrogen, pH, salinity, phosphorous, suspended solids, and temperature.[1100] The North Carolina Division of Environmental Health, Radiation Protection Section also conducts routine environmental sampling and analysis in the vicinity of the Wilmington Site.[1101] This monitoring includes low-volume air sampling and sampling of vegetation, sediment, soil, surface water, and groundwater.[1102] Water quality monitoring in the Lower Cape Fear River watershed is performed by the Lower Cape Fear River Program.[1103] Physical, chemical, and biological measurements are routinely collected at thirty-four sites within the Cape Fear River Estuary and the Lower Cape Fear River watershed.[1104]

In his oral testimony, Mr. Fischer testified as follows:

The Staff used the guidance in NUREG-1748 Sections 5.6.1 and 6.6.1 to review the radiological monitoring program discussed in the ER and to draft Chapter 6 of the FEIS.[1105] In addition, NUREG-1520 Section 9.4.3.2.2 discusses the acceptance criteria for Effluent and

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[1099] Id. at 16.

[1100] Id.

[1101] Id.

[1102] Id.

[1103] Id.

[1104] Id.

[1105] Tr. at 226-27 (7/12/12 Hearing). The slides associated with Mr. Fischer's presentation to the Board can be viewed at Ex. NRC116.

Environmental Monitoring.[1106] Applicable regulatory guides also assisted in the Staff's review.[1107] All effluents from the proposed GLE facility would be discharged only through monitored pathways – the ventilation system exhaust stack for gaseous effluent and the final process lagoon for liquid effluent.[1108]

The Argonne National Laboratory environmental review staff, aiding the NRC Staff's FEIS preparation, did perform its own air monitoring analysis, including modeling the exhaust stack and the locations around the facility where effluents are likely to be transported.[1109] Mr. Fischer knew the height of the stack was included in this review, but he did not know if building configuration was also considered.[1110]

Stormwater monitoring is done at the outfall of a storm event twice a year.[1111] Mr. Fischer did not know whether storm events occur in different seasons.[1112]

Matthew Bartlett. Dr. Bartlett is a Project Manager and Health Physics Reviewer in the NRC's Office of Nuclear Material Safety and Safeguards, Division of Fuel Cycle Safety and Safeguards.[1113] He received his B.S. in Physics from Bob Jones University, and his M.S. and Ph.D. in Physics from Clemson University.[1114] Dr. Bartlett has over seven years experience as a project manager and health physics reviewer at the NRC and has participated in several

[1106] Tr. at 227 (7/12/12 Hearing).

[1107] Id. at 227-28.

[1108] Id. at 231.

[1109] Id. at 248.

[1110] Id.

[1111] Id. at 250.

[1112] Id.

[1113] Ex. NRC124 at 1.

[1114] Id. Attach. (Matthew Bartlett Statement of Professional Qualifications).

health physics reviews and overseen numerous licensing actions for fuel facilities.[1115] He also serves as the technical contact on the working group to incorporate ISA requirements into 10 C.F.R. Part 40.[1116] Prior to working at the NRC, Dr. Bartlett was a teaching and research assistant at Clemson University.[1117]

In his written testimony, Dr. Bartlett testified as follows:

Dr. Bartlett did not participate in the preparation of the SER, but now serves as the replacement for the Health Physics Reviewer who prepared the SER and has since left the NRC.[1118] He has reviewed the relevant sections of the SER and license application and agrees with the findings of his predecessor.[1119]

GLE's Environmental Monitoring Program must comply with the principles of ALARA and with the dose limitations for members of the public and workers.[1120] Further, applicants must show that the facility design and procedures minimize environmental contamination.[1121] In addition, 10 C.F.R. § 20.1501 requires the licensee to have adequate survey and monitoring measures.[1122]

The Staff found GLE's effluent and environmental monitoring programs acceptable because the programs met the regulatory requirements and acceptance criteria of NUREG-

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[1115] Id.

[1116] Id.

[1117] Id.

[1118] Id. at 2.

[1119] Id. at 2-3.

[1120] Id. at 16.

[1121] Id. at 17.

[1122] Id.

1520.[1123] These acceptance criteria address background level baselines for radiological and non-radiological analyses, monitoring sampling locations and methods, trends in monitoring data, radionuclide-specific analyses, quality control, action levels and corrective actions, and accidental releases.[1124] The Staff also verified that the effluent monitoring program was conducted consistent with Regulatory Guide 8.37.[1125]

The proposed facility uses two complementary mechanisms of containment and ventilation to minimize effluents.[1126] Containment involves the prevention of releases from both the processing equipment and the process buildings.[1127] Process equipment is designed so that leaks are contained within the process equipment.[1128] The process buildings are divided into ventilation zones to further confine airborne releases to localized areas.[1129] Confinement assures effluents are routed through ventilation, filtration, and monitoring systems before release.[1130] Potentially contaminated ventilation exhaust is vented to the Operations Buildings Stack where the exhaust goes through High-Efficiency Particulate Arresting filters, in addition to pre-filters, pressure monitors, and high-efficiency gas absorption filters.[1131] A number of secondary ventilation systems are incorporated into the facility design.[1132]

[1123] Id.

[1124] Id.

[1125] Id.

[1126] Id. at 18.

[1127] Id.

[1128] Id.

[1129] Id.

[1130] Id.

[1131] Id.

[1132] Id.

Contaminated liquid effluents are sent to an onsite treatment facility for chemical treatment.[1133] Once the concentrations have been verified through continuous sampling to be below regulatory release limits, the effluents can be released into the Cape Fear River.[1134]

Airborne and liquid radionuclide analyses will be performed more frequently whenever there is a significant, non-routine, unexplained increase in gross radioactivity.[1135] As discussed in the SER,[1136] there are set action levels that force GLE action when environmental measurements show the concentration of an analyte reaches a specified level.[1137] GLE's corrective action program is implemented when set action levels are reached to ensure the cause of the action level exceedance is discovered and to ensure the issue is corrected.[1138] Additionally, GLE has provisions in place to respond to emergency situations, accidents, or increased emission levels found in routine sampling.[1139] Because effluent compliance levels are set by North Carolina permits, administrative action levels are established below compliance levels for all parameters.[1140] Response actions to address elevated measurements would be set in documented procedures at increasing levels of priority.[1141] The Applicant has a leak detection system in areas where liquid effluents are processed to prevent any unplanned

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[1133] Id.

[1134] Id.

[1135] Id. at 19.

[1136] See Ex. NRC001 at 9-13 to 9-16.

[1137] Ex. NRC124 at 19.

[1138] Id.

[1139] Id.

[1140] Id.

[1141] Id.

releases.[1142] GLE will institute a Corrective Action Program for personnel contamination, and a radiation and monitoring program will include requirements for controlling radiological contamination within the facility and monitoring external and internal radiation exposures.[1143] Corrective actions range in severity from source term investigation to operational modification to operations shutdown.[1144] Because of the Applicant's commitment to monitoring and the Corrective Action Program, the NRC Staff has "reasonable assurance that public health and safety will be protected [and GLE has a program in] compliance with the regulations in 10 C.F.R. § 20.1101.[1145]

In his oral testimony, Dr. Bartlett testified as follows:

Solid waste is another type of waste that will be generated by the GLE facility, in addition to liquid and air effluents.[1146] The solid waste generated will include low-level radioactive waste, such as filters, protective equipment, and uranium-contaminated equipment.[1147] GLE will collect these contaminated materials into disposal containers for onsite storage, survey, and eventual transfer to a licensed disposal facility.[1148] GLE has also developed a radiation protection program, which relies on qualified radiation protection staff, written procedures, dose monitoring, and contamination control.[1149]

[1142] Id. at 20.

[1143] Id.

[1144] Id. at 21.

[1145] Id.

[1146] Tr. at 240 (7/12/12 Hearing). The slides associated with Dr. Bartlett's presentation to the Board may be viewed at Ex. NRC116.

[1147] Tr. at 240 (7/12/12 Hearing).

[1148] Id.

[1149] Id. at 242.

As part of the accident analysis for the facility, the health physics reviewer did independent modeling of an accidental release, verifying GLE's information with use of the NRC RASCAL code.[1150] Dr. Bartlett did not know if this analysis verified the adequacy of the proposed measurement locations around the facility.[1151]

Stan Echols. Dr. Echols is a Project Manager and a Senior Environmental Engineer in the NRC's Office of Nuclear Material Safety and Safeguards, Division of Fuel Cycle Safety and Safeguards.[1152] He received his B.S. in Nuclear Engineering Sciences from the University of Florida, his Ph.D. in Environmental Engineering from the University of Florida, and his J.D. from Georgetown University Law Center.[1153] Dr. Echols has over thirty years experience in the public and private sectors providing regulatory, environmental, technical, legal, and project management support to the government and nuclear industry.[1154] He has worked on a variety of projects involving nuclear reactors, a fuel manufacturing facility, enrichment facilities, a weapons production facility, and a proposed high-level waste disposal facility.[1155] Prior to joining the NRC, Dr. Echols was an associate and partner in the energy group of a national law firm for ten years.[1156] Prior to that, Dr. Echols was an attorney at the Department of Energy where he addressed a broad range of nuclear and environmental issues and briefly served as a

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[1150] Id. at 248-49.

[1151] Id.

[1152] Ex. NRC124 at 1.

[1153] Id. Attach. (Stan Echols Statement of Professional Qualifications).

[1154] Id.

[1155] Id.

[1156] Id.

Special Assistant United States Attorney in the Office of the United States Attorney for the District of Columbia.[1157]

In his written testimony, Dr. Echols testified as follows:

Dr. Echols was the primary reviewer of the Applicant's environmental protection measures.[1158] His review and evaluation are contained in Chapter 9 of the SER.[1159] His written testimony covered the same issues addressed by Dr. Bartlett in his written testimony.

In his oral testimony Dr. Echols testified as follows:

The NUREG-1520 review was conducted by comparing GLE's proposed environmental protection measures against the acceptance criteria found in Chapter 9 of NUREG-1520.[1160]

Dr. Echols testified that he reviewed the predominant wind directions to ensure that air monitoring locations "would pick up anything coming from the stack in the area of concern."[1161]

The Staff asserted that seven three-well clusters, totaling twenty-one wells, was an adequate system to protect against contamination of groundwater, considering the clusters are set at three levels to get measurements at various depths.[1162] In addition to using regulatory guides and regulations to ensure adequacy, the Staff reviews monitoring programs at similar facilities and talks with past project managers.[1163] The Staff conducts various audits, as does

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[1157] Id.

[1158] Id. at 3.

[1159] Id. See also NRC001 at 9-1 to 9-25.

[1160] Tr. at 239-40 (7/12/12 Hearing). The slides associated with Dr. Echols's presentation to the Board can be found at Ex. NRC116.

[1161] Tr. at 247 (7/12/12 Hearing).

[1162] Id. at 254.

[1163] Id. at 254-55.

North Carolina, and the issues are discussed at public meetings.[1164] All of these can inform Staff judgment. However, in the FEIS, there were no public comments related to the environmental monitoring program.[1165]

Timothy C. Johnson. Mr. Johnson is a Senior Project Manager in the NRC's Office of Nuclear Material Safety and Safeguards, Division of Fuel Cycle Safety and Safeguards.[1166] His education and background were discussed previously in reference to his testimony on Topic 2.

In his written testimony on Topic 6, Mr. Johnson testified as follows:

Mr. Johnson is the Licensing Project Manager for the proposed GLE project.[1167] In that role, he oversaw the licensing review of GLE's application for facility construction and operation and preparation of the SER.[1168]

Effluents would be released from specified, monitored locations through the plant stack or various water outflow locations.[1169] In each case, the effluents would be filtered, treated, and monitored.[1170] GLE would use the sampling data to track release trends, which would be documented in an annual ALARA report.[1171] In addition, GLE would submit semiannual effluent release reports under 10 C.F.R. § 70.59.[1172] These reports and GLE's process give "reasonable assurance that GLE will take appropriate actions to protect public health and safety."[1173]

[1164] Id. at 255.

[1165] Id.

[1166] Ex. NRC124 at 2.

[1167] Id.

[1168] Id.

[1169] Id. at 7.

[1170] Id.

[1171] Id.

[1172] Id.

In his oral testimony on Topic 6, Mr. Johnson testified as follows:

The Applicant is required by 10 C.F.R. § 20.1302 to ensure compliance with the effluent release limits in Appendix B to Part 20.[1174] Under 10 C.F.R. § 70.59, the Applicant must provide semiannual release reports to the NRC.[1175] GLE has also committed to using Regulatory Guide 4.16 and to preparing an annual ALARA assessment.[1176] If issues are identified that need correction, GLE would enter them into its Corrective Action Program, process them, and take whatever measures are necessary to address the issues.[1177]

Mr. Johnson believes that the RASCAL modeling of accident conditions that was performed by the Staff did not account for wake effects.[1178] While RASCAL modeling does assume worse-case, conservative scenarios, it is difficult to model the wake effects.[1179]

The safety review did not consider a groundwater modeling analysis.[1180] However, there has been a substantial amount of groundwater monitoring done in association with some previous contamination caused by GNF-A.[1181]

[1173] Id.

[1174] Tr. at 238 (7/12/12 Hearing). The slides associated with Mr. Johnson's presentation to the Board can be viewed at Ex. NRC116.

[1175] Tr. at 238 (7/12/12 Hearing).

[1176] Id. at 238-39.

[1177] Id. at 239.

[1178] Id. at 249.

[1179] Id.

[1180] Id. at 252.

[1181] Id. at 253.

The Staff did evaluate the fact that GLE will not monitor sanitary sewage effluent for radiologic constituents.[1182] Because the sanitary sewage system is not connected to other radiological areas, no additional monitoring is necessary.[1183]

Jose Diaz. Mr. Diaz is a Senior Fuel Facility Project Inspector in the NRC's Region II Office in Atlanta, Georgia.[1184] His education and background were discussed previously in reference to his testimony on Topic 4.

In his written testimony on Topic 6, Mr. Diaz testified as follows:

Mr. Diaz was not involved with the application review for the proposed GLE facility, but as a Senior Fuel Facility Inspector in Region II, his office would be responsible for performing the Operational Readiness Review inspections.[1185]

Once a license is issued, but prior to the start of operations, the NRC will conduct Operational Readiness Review inspections, which are required by license conditions.[1186] The Operational Readiness Review inspections assess program safety readiness and assess different areas of the Environmental Monitoring Program.[1187] If significant issues are identified during Operational Readiness Review inspections, then NRC authorization of operations will be impacted.[1188] The results of these inspections will be documented in inspection reports; most of which will be publicly available on ADAMS.[1189]

[1182] Id. at 256.

[1183] Id.

[1184] Ex. NRC124 at 2.

[1185] Id. at 3.

[1186] Id. at 21.

[1187] Id.

[1188] Id.

[1189] Id.

The NRC will also perform environmental inspections based on Inspection Manual Chapter 2600.[1190] This manual chapter and the license itself will serve as the basis of these inspections, which will include inspections in the areas of radiation protection, effluent control and environmental protection, and radioactive waste management.[1191] The results will be documented in inspection reports that are largely available to the public in ADAMS.[1192]

The NRC's inspection program incorporates a core set of inspections that encompass multiple areas and are performed with a particular periodicity.[1193] Various NRC inspection Procedure documents define the objectives of each type of inspection, as well as directing an inspector on what to consider as part of the inspection.[1194]

If an environmental monitoring program is not implemented properly or if effluent limits are exceeded, the inspection program will identify and document such occurrences, which are assessed in accordance with the NRC Enforcement Policy and the NRC Enforcement Manual.[1195] Licensees are required to take immediate and long-term corrective actions and ensure problems do not reoccur.[1196] And, the inspection program will track findings and perform follow-up inspections until all identified issues are resolved.[1197] In addition to the Operational

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[1190] Id. at 21-22. See also Ex. NRC081.

[1191] Ex. NRC124 at 22.

[1192] Id.

[1193] Id.

[1194] Id. at 22-23 (citing Ex. NRC082, Ex. NRC083, and Ex. NRC084).

[1195] Id. at 23.

[1196] Id.

[1197] Id.

Readiness Review inspections, issues can also be identified as a result of NRC core inspections and reactive inspections.[1198]

In his oral testimony on Topic 6, Mr. Diaz testified as follows:

The Staff uses the same basis for the Operational Readiness Review inspections that it will use for later operational safety and safeguards inspections.[1199] The results of the environmental protection program can indicate the effectiveness of the program.[1200] The inspection program will identify and document occurrences where the environmental monitoring program is not implemented properly or effluent limits are exceeded.[1201] The NRC Inspection Program will follow up on corrective actions, including tracking findings and performing follow-up inspections.[1202] Inspectors review past reports to understand historic problem areas and ensure that GLE has implemented proper corrective actions.[1203] Inspectors may also conduct reactive inspections, which are unscheduled and based on self-revealing events.[1204]

V. DISCUSSION

A. Topic 1: Criticality Safety and Chemical/Radiological Hazard Evaluation

The Board considered two areas – criticality safety and chemical/radiological hazard evaluation – to be central to public and worker safety. Because the laser-based separations process in the cascade area is a first-of-its-kind design, and therefore lacks an extensive full-

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[1198] Id. at 24.

[1199] Tr. at 244 (7/12/12 Hearing). The slides associated with Mr. Diaz's presentation to the Board on Topic 6 can be viewed at Ex. NRC116.

[1200] Tr. at 244-45 (7/12/12 Hearing).

[1201] Id. at 245.

[1202] Id.

[1203] Id. at 246.

[1204] Id.

scale operational history, the Board felt it was especially important to probe the adequacy and thoroughness of the safety evaluation for this part of the facility.[1205]

After integrating the information from our review of the license application, the ISA and ISA Summary, the answers to our written questions, and the prefiled testimony and oral testimony received at the evidentiary hearing, including testimony that is summarized in the classified appendix to this decision, the Board concluded that the Applicant's criticality safety evaluation and chemical/radiological hazard evaluation and the NRC Staff's review of these evaluations are adequate to meet regulatory requirements.

The detailed discussion of the Board's assessment of Topic 1 can be viewed in the classified appendix.

B. Topic 2: Licensing an Evolving Design

The NRC Staff has stated that its safety evaluation in the SER was based on the facility baseline design presented in GLE's License Application.[1206] Based on available documentation, and following a site visit that included a classified briefing on the design, it appeared to the Board that the design was still evolving in significant ways, especially in the Cascade/Gas Handling area. Thus, the Board was concerned whether the baseline design was adequate for a meaningful safety evaluation, and whether future design changes that could impact safety would receive the level of scrutiny appropriate to a first-of-its-kind facility. For these reasons, and recognizing that the necessary level of design detail presents a mixed question of law and fact,[1207] the Board identified this topic for further consideration at the evidentiary hearing.[1208]

[1205] See Prefiled Testimony Order at 2-3.

[1206] Tr. at 163, 165, 198 (7/11/12 Hearing).

[1207] See supra Section II.B.

[1208] Prefiled Testimony Order at 3-4.

The issue of an evolving facility design is closely linked to the Board's sufficiency review of the criticality and chemical/radiological hazards review discussed above. In the SER, the Staff stated that its review of the Applicant's ISA Summary, which is central to the hazards evaluation, "was based on the current facility design."[1209] Furthermore, the Staff concluded in the SER that the process descriptions were sufficient to support the development of an adequate ISA.[1210] Based on a review of the available classified documents and a GLE site visit briefing, it appeared to the Board that important aspects of the laser separations cascade design were still evolving. This caused the Board to ask the Staff about its rationale for concluding that the baseline design was adequate, including the regulatory basis for the Staff's decision.[1211]

The Board first engaged the Staff on this issue through an initial written question, which asked:

> Are there areas in the proposed facility design, such as the separations cascade, where the design is still evolving? If so, how can the NRC Staff assert that the design can and will meet regulatory requirements while important processes steps are still changing? Has a baseline cascade design been established that is subject to the formal change control process?[1212]

Part of the Staff's response was as follows:

> The Applicant's baseline design is the current facility design defined in the ISA. The Applicant has not completed the final design of the facility and there are areas of the facility where the design is evolving. The NRC staff's approach was to review [the] baseline design as described in the ISA Summary and the codes and standards to be applied to the design. By reviewing the Applicant's proposed codes and standards, the NRC review ensures that the Applicant will apply basic engineering principles in developing its final designs needed to ensure containment of hazardous components and nuclear criticality safety. In

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[1209] Ex. NRC002 at 5-37.

[1210] Id. at xxi.

[1211] Prefiled Testimony Order at 3.

[1212] Board Initial Questions Order Attach. A at 3.

> addition, changes to this baseline design would be governed by the change process in 10 CFR 70.72.[1213]

After considering this response, the Board still had questions concerning: (1) the regulatory basis for the determination that the baseline design was adequately complete; (2) whether all important process elements in the cascade region were included in the baseline design; and (3) how will be it ensured that the safety impacts of future design changes will be accounted for. To further probe these issues, the Board identified this topic for the evidentiary hearing.[1214]

Both the NRC Staff and the Applicant provided prefiled testimony on this topic.[1215] The Staff witnesses' testimony included a discussion of the current NRC policy regarding the level of design detail that is required to issue a fuel cycle facility license, and some background on how that policy came to be defined.[1216]

The crux of the Staff's approach to what level of design detail is required was summarized by Mr. Johnson:

> The level of detail required for a licensing decision, therefore, does not require a final detailed facility design or an absolutely complete identification of all supporting items relied on for safety. . . . Instead, sufficient information has to be provided to understand the process and functions of items relied on for safety and to provide reasonable assurance that the integrated safety analysis summary is complete.[1217]

Similarly, on behalf of GLE, Ms. Olivier stated:

> [I]t is unusual at best for a license applicant to have a complete design at the time it submits its license application, and that design evolution after license submittal (and even after license approval) is the rule not the exception in NRC

[1213] Staff Initial Question Responses – Public Attach. A at 31.

[1214] Prefiled Testimony Order at 3-4.

[1215] See Exs. NRC120 & GLE019.

[1216] See supra Section II.B & Exs. NRC021, NRC022, NRC023, NRC024.

[1217] Ex. NRC120 at 9.

> practice. To that end, the NRC's NUREG 1520 states that "[t]he level of detail required for a licensing decision generally does not require final facility design; however, identification of all IROFS and possible accident sequences is necessary to make a licensing decision."[1218]

The Staff also provided testimony to the effect that it had used the same approach as had been used in the recent license proceedings for the Louisiana Energy Services National Enrichment Facility, the USEC American Centrifuge Plant, and the AREVA Eagle Rock Enrichment Facility. Specifically, Mr. Johnson stated, "[T]he staff's approach to addressing the level of detail in the facility design for the proposed GLE facility was the same as the approach used for the other recently licensed gas centrifuge facilities."[1219] He further testified: "There are no significant differences between the proposed GLE facility and the other gas centrifuge projects that would warrant a different level of design detail for the proposed GLE facility because the facility hazards at the GLE facility and the gas centrifuge plants are similar."[1220] Mr. Smith pointed out that both LES and USEC had made significant changes in the design of their plants after their licenses had been granted.[1221]

Another area addressed in both the Staff and the Applicant witnesses' prefiled testimony related to the NRC process for assuring that changes made after a license is issued will be adequately examined in terms of safety impacts. Mr. Johnson testified as follows:

> In addition to the construction inspections required by 10 CFR 40.41(g) and 70.32(k), NRC will also perform an Operational Readiness Review (ORR) to ensure that other safety programs, such as the radiation protection program, nuclear criticality safety program, chemical and fire safety programs, and emergency preparedness programs, are in-place prior to operations and consistent with the applicant's commitments in the license.[1222]

[1218] Ex. GLE019 at 3-4.

[1219] Ex. NRC120 at 13.

[1220] Id.

[1221] Id. at 19.

[1222] Ex. NRC120 at 17.

The oral testimony of Ms. Seymour and Mr. Diaz addressed the rigor and completeness of the construction and operations inspections and the Operational Readiness Review process that would be managed by the NRC Region II staff.[1223] In addition, Mr. Johnson confirmed that the Staff would review the annual update of the ISA Summary required to be submitted under 10 CFR § 70.72.[1224]

In her oral and written testimony, Ms. Olivier represented to the Board that any changes to the current baseline design will be evaluated through the Configuration Management and Change Request programs.[1225] In her written testimony, Ms. Olivier stated:

> Any changes to the design will be thoroughly evaluated, implemented, and tracked based on GLE's Configuration Management Program and applicable change management processes. Changes within the existing safety basis will not affect the safety of the [facility]. . . . Other changes will require prior NRC approval before the change can be made.[1226]

After reviewing and integrating the extensive record on this topic, up to and including the oral testimony at the hearing, the Board concluded:

1. While NRC regulations do not require a detailed facility design as the basis for a license, the design must be complete enough to allow for an adequate ISA to be developed, which includes all important accident sequences and associated IROFS.

2. The baseline design used in the GLE License Application and ISA Summary generally meets this adequacy criterion, which is detailed in NUREG-1520. This conclusion is supported by the criticality safety and chemical/radiological hazard evaluations presented in the classified appendix.

[1223] Tr. at 69-75 (7/12/12 Hearing).

[1224] Ex. NRC120 at 17.

[1225] Ex. GLE019 at 4-5.

[1226] Id. at 6.

3. There is a formal and rigorous process in place to ensure that future design changes will remain in compliance with regulatory requirements and thoroughly evaluated by GLE and the Staff.

C. Topic 3: Safety Impact of External Hazards

An important objective of the safety evaluation of any nuclear facility is to ensure that external hazards will not compromise safety. The events in March 2011 at the Fukushima Daiichi facility in Japan underscored the importance of not underestimating the level and likelihood of external hazards that a facility must be designed to withstand. Therefore, the Board requested testimony on this topic to ensure that the external hazards evaluation for the GLE facility was adequately conservative.

The Board was satisfied that many of the issues related to the external hazards evaluation were resolved in the earlier stages of the hearing process. For example, many of the human-induced hazards discussed in the SER required no further inquiry.[1227] Other external hazards concerns were answered in response to our Initial Questions, including concerns about aircraft crashes given the facility's close proximity to the local airport.[1228] However, the Board remained concerned whether the Staff's evaluation of certain external hazards was adequately conservative in light of the risks of certain naturally occurring external events. We therefore asked for testimony concerning "the external hazards evaluation related to flooding (including hurricanes and tsunamis), high winds and tornados, and earthquakes" and the "rationale behind the NRC Staff's conclusion that the evaluation of these hazards was adequately conservative."[1229]

[1227] Ex. NRC001 at 3-14 to 3-15 (discussing the human-induced hazards of nearby highways, railroads, and industrial facilities).

[1228] Staff Initial Question Responses – Non-public Attach. A at 1-4.

[1229] Prefiled Testimony Order at 4.

The flooding hazard at the proposed GLE site was evaluated on the basis of rainfall in the Northeast Cape Fear River and the Cape Fear River watersheds, locally heavy rainfall, and a potential hurricane surge.[1230] GLE calculated the flooding levels using the probable maximum flood in the river watersheds, the probable maximum precipitation at the site, and the probable maximum hurricane surge.[1231] The bounding flood event was the flooding of both rivers to a probable maximum flood of twenty-eight feet above mean sea level.[1232] A dam failure on the Cape Fear River, maximum rainfall at the Wilmington site, or the probable maximum hurricane surge each produce flooding of less than twenty-eight feet above mean sea level.[1233]

The Wilmington site is located ten miles inland from the Atlantic Ocean at twenty-five feet above mean sea level.[1234] Theoretically, therefore, the maximum probable flood could be three feet above the facility floor.[1235] However, the topography of the landscape around the proposed site – with the site at a relative high point surrounded by flat areas with gentle sloping surfaces at gradients less than 2 percent with little relief – provides considerable protection from potential flood hazards.[1236] Operational safety is enhanced by GLE's plan to evacuate and shut down operations prior to any flood threat and by their commitment to using certain codes and standards that further mitigate the flooding hazard.[1237] Because the bounding flood event was calculated in accordance with NRC guidance stating that the probable maximum flood is

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[1230] Ex. NRC121 at 6-7.

[1231] Id. at 7.

[1232] Id. at 7-8.

[1233] Id. at 8, 10.

[1234] Id. at 7.

[1235] Id. at 7-8.

[1236] Tr. at 217 (7/11/12 Hearing).

[1237] Ex. NRC121 at 10-11.

considered "highly unlikely" for the purposes of 10 C.F.R. Part 70 facilities, and because the area topography and GLE's emergency planning enhance the safety of the facility in a flood event, the Board was satisfied that the treatment of the flood threat was adequately conservative.

The Staff found that the probability that a large tsunami would reach the facility site is "highly unlikely" because the Atlantic seaboard is not conducive to large earthquake-generated tsunamis, and there are no historical records of tsunamis along the North Carolina coast.[1238] Submarine landslides from sediment off of the continental shelf could cause severe localized damage, but in his testimony Dr. Stamatakos emphasized that the likelihood of a landslide-generated tsunami affecting the Wilmington site is "so small that [it] would fall well below the highly unlikely."[1239] Concerning subduction-related tsunamis, Dr. Stamatakos explained that newer studies indicate that changes in water depth greatly affect the analysis, and these studies indicate a "greater dispersion of the waves and effects . . . mitigated substantially by the time the tsunami could reach the Atlantic seaboard."[1240] The Atlantic coast of North Carolina is not a subduction zone in itself and nearby subduction zones are too distant to significantly impact the North Carolina coast.[1241] Tsunamis of any type in the vicinity of the Wilmington site, Dr. Stamatakos testified, are "highly unlikely" occurrences considering the lack of a historical record of such events.[1242] The Board agrees. Although there is some evidence that a tsunami could occur on the Atlantic seaboard, the likelihood that any such tsunami would occur and then reach ten miles inland to the Wilmington site is "highly unlikely."

[1238] Id. at 10.

[1239] Tr. at 237 (7/11/12 Hearing).

[1240] Id. at 240-41.

[1241] Ex. NRC121 at 10.

[1242] Tr. at 241 (7/11/12 Hearing).

GLE's earthquake hazard analysis consisted of three parts: (1) the historical seismic record; (2) the USGS probabilistic seismic hazard assessment; and (3) the response of earthquake energy to site soil conditions.[1243] Because the historical record was inadequate, GLE analyzed seismic risks under the more conservative USGS ground motion model.[1244] The USGS 2,500-year ground motions predicted by the model exceeded those that resulted from any known historical earthquake and amounted to a failure probability of 10^{-4}, which is an acceptable "highly unlikely" objective.[1245] The result was that the seismic design basis was enhanced from something roughly equivalent to the 1,000-year return period earthquake, if only historical earthquakes were used, to the 10,000-year return period earthquake predicted by the USGS 2,500-year ground motion model.[1246] While there is not a good understanding of local earthquake sources and history,[1247] Dr. Stamatakos explained that "the USGS model incorporates lower term period, high magnitude events, up to magnitude 7.5 . . . , and they randomly float that earthquake in their probabilistic analysis. . . . It's probably one of the reasons why the USGS curve is significantly higher than the hazard you get by simply looking at historical events."[1248]

GLE also performed a site soil condition analysis and determined that the site was Class C on the USGS soil classification system.[1249] To account for softer soil conditions, GLE applied the site amplification coefficients from the International Building Code to account for any soil

[1243] Ex. GLE010 at 2-18 to 2-22.

[1244] Tr. at 224-26 (7/11/12 Hearing).

[1245] Ex. NRC121 at 14.

[1246] Id. at 15-16.

[1247] Tr. at 231 (7/11/12 Hearing).

[1248] Id. at 231-32.

[1249] Ex. NRC121 at 15.

impacts to potential ground motions.[1250] In addition, design methods outlined in DOE-STD-1020 and ASCE 43-05 provide sufficient margins to ensure that IROFS will maintain their safety functions for the 10,000-year return period ground motions predicted by the USGS model.[1251] Dr. Stamatakos emphasized that even if a highly unlikely failure event occurred, an earthquake that exceeds the design basis may cause minor damage, like cracking or tilting, rather than building collapse or damage to the IROFS inside the building.[1252]

With a failure probability of 10^{-4} and a design basis that exceeds the known magnitude of historical earthquakes through the use of a model that incorporates lower term period, higher magnitude events, the Board found the proposed facility to be adequately designed to protect against seismic threats. The additional structural assurances and adjustment for softer soil conditions indicate that GLE not only took a more conservative approach than required, but exercised additional caution and conservatism in analyzing the seismic threat.

The "highly unlikely" wind hazard was analyzed by GLE to be 157.5 mph, equaling the winds of a Category 4 hurricane.[1253] Historical data in the area indicates that the highest wind gust ever recorded in the region was approximately 107 mph, and hurricane winds locally have never equaled or exceeded those of a Category 3 hurricane.[1254] Only fifteen tornados were recorded between 1950 and 2004 in New Hanover County, all at the F1 or F0 level.[1255] The strongest tornado in the area was an F2 in a neighboring county, and no F4 or F5 tornados

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[1250] Id.

[1251] Id. at 14.

[1252] Id. at 16.

[1253] Tr. at 222 (7/11/12 Hearing).

[1254] Id.

[1255] Ex. NRC121 at 12.

have ever been recorded in North Carolina.[1256] The "highly unlikely" tornado hazard (with an annual probability of 10^{-5}) would have a wind speed of 112 mph – less than the wind speed of the Category 4 hurricane.[1257] By having a design basis for wind of 157.5 mph, the design sufficiently protects against wind hazards and is adequately conservative to protect against wind gusts, hurricane winds, and tornados.

In summary, the Board concluded that the NRC Staff adequately reviewed GLE's proposals related to external hazards and that the design basis of the proposed facility will adequately protect against floods, seismic events, and wind hazards.

D. Topic 4: Tracking and Implementation of Applicant's Commitments

The FEIS and SER contain many license conditions, mitigation measures, and other commitments. The process for implementation and tracking of these commitments was not always clear. For this reason, the Board identified this topic for further consideration at the evidentiary hearing. Specifically, the Board wanted to review the categories of commitments, both mandatory and voluntary, that play a significant role in meeting safety and environmental requirements, and also review how the commitments in each category will be tracked and their appropriate implementation ensured. The Board also wanted to better understand the NRC Staff's role and responsibilities in this process.

The Board was first drawn to this topic by Tables 5-1 and 5-2 in the FEIS.[1258] The two tables list hundreds of proposed mitigation measures that, if implemented, would reduce environmental impacts during construction, operation, and decommissioning. However, it was unclear to the Board how many of these proposed measures would necessarily be implemented

[1256] Id.

[1257] Id.

[1258] Table 5-1 is entitled "Summary of Mitigation Measures Proposed by GLE" and can be viewed at Ex. NRC003A at 5-2 to 5-13. Table 5-2 is entitled "Summary of Potential Mitigation Measures Identified by NRC" and can be viewed at Ex. NRC003A at 5-14 to 5-18.

or the extent to which the measures were required.[1259] In the Board's Initial Questions Order, we inquired as to which mitigation measures would be implemented and asked how mitigation measures affected the NRC Staff's overall assessment that environmental impacts are small in most resource areas.[1260] Although the parties' answers provided some clarification,[1261] the Board wanted to examine further how GLE obligations are determined, implemented, tracked, and inspected.

GLE has various types of obligations to the NRC and to other regulatory entities, which carry different requirements regarding implementation, tracking, and inspection. License conditions and mandatory mitigation measures are required by the terms of the license and regulated by the NRC, unless the mandatory measure is covered by a permit issued by another federal, state, or local agency.[1262] Unlike these mandatory measures, commitments are statements in a licensing document, such as the ER, in which the applicant has promised to take certain actions.[1263] These commitments are not legally binding, unless the commitment is tied down.[1264] Because the NRC does not have legal authority over these voluntary commitments, the Staff does not ensure that voluntary commitments are implemented and

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[1259] The FEIS does not clearly set forth the tables' applicability, stating that GLE "must comply with applicable laws and regulations, including obtaining all appropriate construction and operating permits." Table 5.1 summarizes the "mitigation measures proposed by GLE, many of which are compliance related." Further, "[t]he NRC identified additional mitigation measures as recommendations (Table 5-2). While the NRC cannot impose mitigation outside its regulatory authority under the Atomic Energy Act, these additional mitigation measures in Table 5-2 could potentially reduce the impacts of the proposed action." Id. at 5-1.

[1260] Board Initial Questions Order Attach. B at 4.

[1261] Staff Initial Question Responses – Public Attach. B at 59-62; GLE Initial Question Responses – Public at 56-58.

[1262] Ex. NRC122 at 15-16.

[1263] Id. at 3.

[1264] Id.

tracked.[1265] Therefore, to the extent Tables 5-1 and 5-2 contained voluntary commitments, as opposed to mandatory ones, those measures are voluntary.

The Staff determined that if GLE only implements mandatory mitigation measures, those measures alone would be adequately protective of public health and safety and the environment.[1266] Ms. Davis testified that if GLE were to implement only mandatory measures, "the impacts in some resource areas could be incrementally higher than estimated in the FEIS, but the staff's overall impact conclusions would not change."[1267] In addition, the Staff does not give weight to the voluntary commitments when performing the cost-benefit analysis because voluntary measures go "above and beyond and [are] hard to track."[1268] Thus in the Staff's view, the mandatory measures alone are sufficiently protective to meet regulatory requirements.[1269]

Although voluntary commitments are not required or tracked by the NRC Staff, GLE seeks to achieve and maintain standards regarding the protection of its workers, the public, and the environment, including those that go above and beyond regulatory requirements.[1270] Ms. Olivier asserted that GLE is committed to implementing voluntary commitments and the NRC-recommended mitigation measures unless there is a clear reason GLE is unable to do so.[1271] GLE will determine the feasibility of implementing voluntary commitments based on several factors: (1) practicability (including resource availability); (2) the potential for conflict between mitigation measures; (3) overall feasibility with respect to project schedule; and (4) cost-benefit

[1265] Id. at 17.

[1266] Tr. at 39 (7/12/12 Hearing).

[1267] Id. at 40-41.

[1268] Id. at 85-87.

[1269] Id. at 88-89.

[1270] Ex. GLE021-R at 6.

[1271] Tr. at 21 (7/12/12 Hearing).

analysis.[1272] GLE uses the same implementation and tracking system for voluntary measures as for mandatory ones, illustrating the seriousness with which GLE approaches all of its commitments. If a voluntary commitment is not implemented, GLE will note that in its tracking system, with a justification for why the action will not be performed.[1273]

GLE's handling of one mandatory license condition raised a concern that GLE might be placing liability insurance on the proposed facility at a relatively low amount.[1274] Section 140.13b of our regulations requires a uranium enrichment facility to carry liability insurance in an amount that the NRC considers "appropriate."[1275]

The existing fuel fabrication plant on the Wilmington site, GNF-A, currently is covered in the amount of $200,000,000 by American Nuclear Insurers, and GLE proposes to cover the new uranium enrichment facility under the same $200,000,000 policy.[1276] According to the SER, American Nuclear Insurers indicated that $200,000,000 "is the maximum limit of liability it will provide for the [Wilmington] site because the fuel manufacturing operations create a legacy exposure that restricts how much insurance capacity ANI [American Nuclear Insurers] is willing to provide."[1277] On this basis, the NRC Staff found that "the $200 million amount of liability insurance is acceptable because it is the maximum amount available from private sources."[1278]

[1272] Ex. GLE021-R at 13.

[1273] Id.

[1274] Ex. NRC001 at 1-8 to 1-9.

[1275] Compare 10 C.F.R. § 140.13a (requiring plutonium processing and fuel fabrication plants to carry liability insurance "in the amount of $200,000,000"), with id. § 140.13b (requiring uranium enrichment facilities to have an "appropriate" amount of liability insurance).

[1276] Ex. NRC001 at 1-8.

[1277] Id. at 1-8 to 1-9.

[1278] Id. at 1-9.

The Board's concern is twofold. First, if $200,000,000 policy is the required amount of liability coverage for GNF-A alone, it would appear that amount might be less satisfactory to cover potential liabilities arising from the operation of two separate facilities on the Wilmington site. Second, the testimony of Mr. Johnson suggested that the NRC Staff had not inquired whether additional liability coverage might be available from any primary or excess insurer other than American Nuclear Insurers. [1279]

Because we do not reconsider the Staff's findings de novo, and because our regulations do not require a specific amount of liability insurance for uranium enrichment facilities, the Board will not impose a formal license condition in this regard. We nonetheless encourage GLE voluntarily to explore the availability of additional liability insurance at reasonable rates, if in fact it has not already done so.

GLE has developed a comprehensive implementation and tracking system for all of its commitments – mandatory and voluntary – to ensure the facility is constructed and operated as required. GLE is developing compliance checklists for its requirements and commitments, which will identify an action owner and responsible manager and be tracked through an electronic calendar with due dates.[1280] All compliance checklists will be transferred to a database that tracks the implementation of commitments.[1281] GLE also has a Corrective Action Program, which seeks to ensure that commitments are properly implemented and noncompliances are detected, reported, and resolved.[1282] Issues that have been identified through other GLE programs will be captured and resolved through the Corrective Action

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[1279] Tr. at 92 (7/12/12 Hearing).

[1280] Ex. GLE021-R at 8-10.

[1281] Id. at 12.

[1282] Id. at 13.

Program.[1283] Once a noncompliance is identified, it is assessed for whether it must be reported to a regulatory agency, and a corrective action request is generated.[1284] The Corrective Action Program tracks issues to completion, including investigation and reporting with periodic assessments and audits.[1285]

Although these GLE systems are intended to ensure that the facility is constructed and operated as required, the NRC Staff also has an inspection and oversight role. Once the Applicant is granted a license, the NRC's Division of Construction Projects in Region II will oversee the implementation of construction inspections and the Operational Readiness Review.[1286] The inspection program will be outlined in an inspection manual chapter that describes fuel facility construction and pre-operational readiness review inspection programs and will be used to confirm that GLE has constructed the facility in accordance with applicable requirements.[1287] The Operational Readiness Review will be conducted prior to the start of operations to verify safety programs and operational readiness.[1288] These inspections will be led by a Region II team with assistance from NRC headquarters, regional inspectors, and other Division of Construction Projects inspectors.[1289] NRC inspectors go through extensive training and a rigorous qualification process, and the Region II inspection team ensures that an appropriate technical specialist is used for each area under review.[1290] Once operations are

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[1283] Id. at 14.

[1284] Id. at 16-17.

[1285] Tr. at 16 (7/12/12 Hearing).

[1286] Ex. NRC122 at 2.

[1287] Id. at 25-26.

[1288] Id. at 26.

[1289] Tr. at 55 (7/12/12 Hearing).

[1290] Id. at 66, 74-75.

authorized, the Staff continues to conduct routine inspections throughout the year.[1291] As part of these routine inspections, Staff inspectors look at changes made to the facility that have been made without license amendments and perform a sampling of those to check GLE's determinations that no license amendment was required.[1292]

The internal and external procedures for implementing commitments and identifying and correcting noncompliances provide adequate assurances that the proposed GLE facility will be constructed and operated as required by the license and regulations.

E. Topic 5: Need/Alternatives/Environmental Cost-Benefit Analysis

The Board is required to make an independent judgment regarding the balance between the benefits of the proposed facility and its environmental impact. Understanding the projected demand for enriched uranium, as well as the alternatives for how this demand could be met, are critical in determining the potential benefit the facility would provide. Given that both the supply and demand for uranium enrichment services are currently volatile, the Board identified this area as a topic for further consideration at the evidentiary hearing. This allowed up-to-date information to be brought to bear on the trade-offs that must be considered.

The Staff's analysis of the need for enriched uranium to fulfill electricity generation requirements in the United States is presented in Section 1.3.1 of the FEIS.[1293] The Staff projected the need based on Energy Information Administration reports from 2003 and 2010, in conjunction with consideration of the pending and potential applications for combined licenses.[1294] The Energy Information Administration predicts a "continuing, if not increasing

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[1291] Ex. NRC122 at 27.

[1292] Tr. at 69 (7/12/12 Hearing).

[1293] Ex. NRC003A at 1-6 to 1-8.

[1294] Id. at 1-6 to 1-7.

demand for enriched uranium."[1295] At the time of the FEIS, the annual demand for enrichment services in the U.S. was about 14 million SWU.[1296] This was projected to increase to 15 to 16 million SWU by 2025.[1297] The Staff also considered the need for domestic sources of enrichment services that would be important to national energy security.[1298]

The Board noted that the FEIS needs projections did not consider factors such as the economic downturn or the Fukushima accident, both of which had the potential to alter demand. The Board was also initially concerned that some of the Energy Information Administration reports used in the projections were rather old.[1299] To address concerns in this area, the Board asked the Staff several written questions. While the Staff's answers sometimes involved factors and projections that were necessarily uncertain, some issues were resolved, and considerable light was shed on others.

An example of a written question where the answer resolved an issue was as follows:

> As support for the need for a domestic supply of LEU, the FEIS offers evidence from 2002 and 2010 that a domestic supply of LEU is an issue of national energy security. Is there more recent support for the proposition that a domestic supply of LEU is a priority as a matter of public policy?[1300]

In response, the Staff provided two recent statements from congressional testimony by the Secretary of Energy, Stephen Chu, as well as an extensive statement by Thomas D'Agostino, Under Secretary for Nuclear Security and Administrator of the National Nuclear Security

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[1295] Id. at 1-6.

[1296] Id. at 1-7.

[1297] Id.

[1298] Id. at 1-8 to 1-9.

[1299] Id. at 1-6 to 1-7 (citing reports from 2003 and 2010).

[1300] Board Initial Questions Order Attach. B at 1.

Administration.[1301] All three statements support the importance, and in some cases the necessity, of the capability to enrich uranium in the United States.[1302] These statements were all made in the three months of 2012.[1303]

An example of a question where the answer was helpful, but was unable to close the issue definitively, was the following:

> Why are the forecasts for annual demand for enrichment services based on 2003 projections? Given the economic turmoil of the past few years, does the NRC believe these forecasts are accurate? Does the NRC staff expect domestic and international demand for low enriched uranium (LEU) to be affected by the Fukushima Daiichi accident and the international economic downturn?[1304]

In its response, the Staff provided some updated information that the Board found to be helpful, particularly in considering the potential impact of the Fukushima accident.[1305] It expressed the view that nuclear power would continue to grow globally, although potentially at a slower rate than anticipated before the Fukushima Daiichi accident.[1306] The Staff ultimately concluded "the forecasted nuclear generation, nuclear capacity, and demand for enriched uranium (discussed in this response and in the FEIS) [was] reasonable and still applicable in the FEIS's analysis of need."[1307]

The Staff's analysis of the potential supply of enrichment services was presented in Section 1.3.1 of the FEIS.[1308] The FEIS points out that American demand is currently being met

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[1301] Staff Initial Question Responses – Public Attach. B at 17-18.

[1302] Id.

[1303] Id. at 17.

[1304] Board Initial Questions Order Attach. B. at 1.

[1305] Staff Initial Question Responses – Public Attach. B at 7-10.

[1306] Id. at 9-10.

[1307] Id. at 10.

[1308] Ex. NRC003A at 1-6 to 1-8.

by three sources. Domestic production supplies 16% of the demand, the Megatons-to-Megawatts program with Russia supplies 37%, and other foreign sources supply 47%. Thus, the United States currently imports about 84% of its low enriched uranium.[1309]

At the time the FEIS was issued, the largest supplier of low enriched uranium in the United States was the USEC's gaseous diffusion plant at Paducah, Kentucky.[1310] This plant was scheduled to be shut down in 2012, however, because it is an aging facility with higher costs.[1311] The National Enrichment Facility, a gas centrifuge facility in Lea County, New Mexico operated by Louisiana Energy Services, began operation in June 2010.[1312] It is expected to reach its licensed capacity of 3 million SWU per year in 2012.[1313] An expansion to 5.9 million SWU per year is being considered by Louisiana Energy Services, but an application for the expansion has not been submitted to the NRC.[1314] The NRC had issued a license to the USEC for a new gas centrifuge facility, the American Centrifuge Plant, to be built in Piketon, Ohio, with the potential to produce 3.8 million SWU per year.[1315] A license was also issued to AREVA Enrichment Services, LLC to construct the Eagle Rock Enrichment Facility in Bonneville County, Idaho, with the potential to produce 6.6 million SWU per year.[1316]

[1309] Id. at 1-6 to 1-7.

[1310] Id. at 1-6.

[1311] Id. at 1-7 (stating "[i]n 2007, DOE projected that gaseous diffusion enrichment operations in the United States would cease in 2012 due to the higher cost of aging facilities").

[1312] Id.

[1313] Id.

[1314] Id.

[1315] Id. at 1-8.

[1316] Id.

With respect to foreign sources of supply, the FEIS pointed out that the Megatons-to-Megawatts program was set to end in 2013.[1317] The FEIS also discussed, however, that the USEC had signed an agreement with a Russian corporation for low-enriched uranium to be supplied to USEC from Russian commercial enrichment activities.[1318] Under the terms of the TENEX agreement, the supply of LEU would begin in 2013, with the expectation that by 2015, the level of supply would be approximately one-half the current level supplied under the Megatons-to-Megawatts program.[1319] Deliveries under the agreement were expected to continue through 2022 and potentially could reach the level of low-enriched uranium supplied through the Megatons-to-Megawatts program.[1320]

The 47% of LEU supplied by other countries included imports from China, France, Germany, the Netherlands, and the United Kingdom.[1321]

The FEIS concluded that if all three of the domestic gas centrifuge plants discussed above, along with the GLE facility, were built and operated at projected capacity, and the Paducah Plant was shut down as planned, the domestic enrichment capacity would be 22.3 million SWU.[1322] This would exceed the projected domestic demand by about 6 million SWU.[1323] The Staff concluded, however, that given the uncertainties in future development and/or potential expansion of the proposed projects, this projected level of extra capacity would

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[1317] Id. at 1-7.

[1318] Id.

[1319] Id.

[1320] Id.

[1321] Id.

[1322] Id. at 1-8.

[1323] Id.

provide needed assurance that enriched uranium would be reliably available when needed for domestic nuclear power production.[1324]

The Board posed several written questions to the Staff seeking expanded and up-to-date information on both the foreign and domestic low enriched uranium supplies discussed in the FEIS. For example, the Board sought additional background on the USEC agreement with TENEX.[1325] The Staff's response indicated that a number of complications and agreements could impact how much low enriched uranium would ultimately be available from this source.[1326]

The Board also asked the Staff for additional information on the status of the National Enrichment Facility, the American Centrifuge Plant, and the Eagle Rock Enrichment Facility.[1327] The Staff indicated the USEC would require significant additional funding before it could complete the American Centrifuge Plant, and as a result concluded that the construction and operation of the American Centrifuge Plant "is uncertain at this time."[1328] The Staff pointed out that AREVA Enrichment Services had announced on December 13, 2011 that construction of the Eagle Rock Enrichment Facility is on hold due to financing issues.[1329] Finally, the Staff stated that Louisiana Energy Services had not announced when they would request a license amendment from the NRC authorizing an expansion of the National Enrichment Facility's enriching capacity from 3 to 5.9 million SWU per year.[1330]

[1324] Id.

[1325] Board Initial Questions Order Attach. B at 1.

[1326] Staff Initial Question Responses – Public Attach. B at 15-16.

[1327] Board Initial Questions Order Attach. B at 1.

[1328] Staff Initial Question Responses – Public Attach. B at 12-13.

[1329] Id. at 13.

[1330] Id. at 11-12.

The Alternatives analysis for the GLE facility is presented in Section 2 of the FEIS.[1331] The Staff concluded that the GLE site selection process had a rational, objective structure and was reasonable.[1332] The Staff also concluded that there were no alternative sites that were superior to the proposed site in Wilmington, North Carolina.[1333] Additionally, it concluded that the particular location chosen on the Wilmington Site offered a lower environmental impact than other potential site locations on the Wilmington site.[1334] After probing a few of the details related to the site selection process through the written question and answer process,[1335] the Board agreed with the Staff conclusions that GLE's process complied with regulatory requirements.[1336]

Alternative enrichment technologies were examined in Section 2.3.2 of the FEIS.[1337] A detailed comparison between the proposed laser-based technology and centrifuge-based technology was presented.[1338] The comparison indicated that, although the impacts would be similar in many comparison areas, the smaller footprint associated with the laser-based technology appeared to offer some environmental advantages. To probe this, the Board posed the following written question to the Staff:

> The NRC Staff comments on the laser-based separations technology by stating "GE-Hitachi expects it to offer certain advantages over both the gaseous diffusion

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[1331] See Ex. NRC003A at 2-1 to 2-69.

[1332] Id. at 2-42.

[1333] Id.

[1334] Id. at 2-49.

[1335] See, e.g., Initial Board Questions Order Attach. B at 2.

[1336] GLE Initial Question Responses – Public at 35-40 (explaining in detail the site selection process).

[1337] Ex. NRC003A at 2-50 to 2-54.

[1338] Id. at 2-55 to 2-64.

> and gas centrifuge processes." From an environmental perspective, what are the advantages that are expected over the gas centrifuge process?[1339]

In response the Staff stated, "Because of the smaller footprint, impacts in the following resource areas are estimated to be less for the proposed GLE Facility than for a gas centrifuge facility with the same enrichment capacity: land use, historic and cultural resources, air quality, geology and soil resources, and ecological resources."[1340]

Through other written questions, the Board asked the Staff to clarify why electricity consumption had not been explicitly considered in the comparison, and to address an issue related to waste generation.[1341] The Staff addressed these questions and the Board was satisfied that there is no reason to select a different technology based on environmental impact considerations.[1342]

The evaluation of the No Action Alternative was presented in Section 2.2 of the FEIS.[1343] This analysis compares the environmental impact of building, operating, and decommissioning the GLE facility in Wilmington, North Carolina, versus the impact of not building it.[1344] The results of this comparison are summarized in Table 2-3 of the FEIS.[1345] This analysis assumed that certain preconstruction activities that had been approved by the NRC would have already been completed, and therefore the impact of these activities would occur even under the No

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[1339] Board Initial Questions Order Attach. B at 4 (citing Ex. NRC003A at 7-13).

[1340] Staff Initial Question Responses – Public Attach. B at 64.

[1341] See Board Initial Questions Order Attach. B at 2.

[1342] See Staff Initial Question Responses – Public Attach. B at 25-30.

[1343] Ex. NRC003A at 2-19.

[1344] Id.

[1345] Id. at 2-20 to 2-41.

Action Alternative.[1346] The environmental impacts associated with the four project phases (preconstruction, construction, operation and decommissioning) are described in Section 4 of the FEIS.[1347] After reviewing the relevant material in the FEIS, the Board posed a number of written questions to the Staff and Applicant to clarify and expand on the evaluation of the environmental impacts.

The implementation of mitigation measures was one area of concern to the Board. While this topic was explicitly covered in the hearing under Topic 4: Tracking and Implementation of Applicant Commitments, its impact on the No Action Alternative was important. For example, the Board posed the following written question to the Staff:

> Explain how the NRC Staff's overall assessment that environmental impacts are SMALL would be impacted if GLE only implemented the mitigation measures proposed in Table 5-1. How would overall impacts change if GLE only implemented mandatory mitigation measures?[1348]

As part of the Staff's response to this question, it stated:

> The NRC staff's impact analysis in the FEIS assumes that all of GLE's proposed mitigation measures would be implemented, and does not presume that GLE would implement any of the NRC's identified mitigation measures. Therefore, the NRC staff's assessment of the environmental impacts (including the overall impact conclusions) in the FEIS would not change if GLE implements only its proposed mitigation measures (which are identified in Table 5-1).[1349]

The Staff further stated: "Accordingly, the NRC staff finds that compliance with the NRC's regulatory requirements and other permitting agencies' requirements is sufficient to be protective of human health and the environment."[1350] The Board concluded, in its discussion

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[1346] Id. at 2-17 to 2-18.

[1347] Id. at 4-1 to 4-165.

[1348] Board Initial Questions Order Attach. B at 4.

[1349] Staff Initial Question Responses – Public Attach. B at 61-62.

[1350] Id. at 62.

above of Topic 4, that a sufficiently rigorous process would be in place to ensure that GLE's commitments would indeed be implemented.[1351]

As part of its sufficiency review, the Board posed a large number of written questions that sought clarification and additional information related to the analysis of impacts in Section 4 of the FEIS. For example, the Board posed several questions related to the analysis of radiological impacts.[1352] In one question the Board asked the Staff to justify its logic in using data from GNF-A to approximate the releases that would be expected from the GLE facility.[1353] In a related question, the Board asked the Staff to justify how the use of such data could be considered a conservative approach.[1354] The Staff's responses were helpful in satisfying the Board that a conservative approach had been used.[1355] Other questions probed the accuracy of the wind speed data used in radiological dispersion calculations, and the basis for assuming that UF_6 release levels would be similar to those in a gas centrifuge plant.[1356] Here again, the Staff's responses increased the Board's confidence that the approach used to evaluate the radiological impacts had been adequate.[1357]

The Board was able to resolve several other areas of concern related to the evaluation of environmental impacts through the written question and answer process. Examples of such questions included:

[1351] See supra Section V.D.

[1352] Board Initial Questions Order Attach. B at 4.

[1353] Id.

[1354] Id.

[1355] Staff Initial Question Responses – Public Attach. B at 51-52, 57-59.

[1356] Board Initial Questions Order Attach. B at 4.

[1357] Staff Initial Question Responses – Public Attach. B at 50-51, 53-56.

> 11. Is the fresh water that could be potentially needed for cooling tower makeup . . . included in the 75,000 gal/day mentioned on page 4-27 [of the FEIS]? If not, where is the impact of the makeup water evaluated?
>
> 22. [In situations where the particulate matter concentrations during construction and preconstruction are predicted to exceed air quality standards, h]ow widespread will [the] decrease in air quality be?
>
> 26. Was there an investigation of how GLE construction and operation may affect active nearby red-cockaded woodpecker (RCW) groups beyond habitat protection? For example, will they be harmed by noise, dust, and other increased human activity in the area?
>
> 27. Did the NRC Staff consider how noise from preconstruction and construction activities may impact the threatened, endangered, and other special status species relevant to this site?
>
> 28. In Appendix B, the Fish and Wildlife Service agrees that impacts can be mitigated on RCWs by engaging in a tree mitigation programs and their agreement to finding no adverse impacts on RCWs seems conditioned on the implementation of this program. . . . Why is this program only being "considered" by GLE, and what is the status of GLE's consideration?
>
> 29. Is there any machinery anticipated to be used during the construction or operation of GLE likely to produce an impact of sound in frequencies outside the range of human hearing such that it would cause discomfort/disruption to humans and/or wildlife?[1358]

Another area of Board inquiry concerned the status and impacts from the preconstruction activities discussed in the FEIS. In two of its written questions, the Board asked if preconstruction activities had begun.[1359] The Applicant answered in both cases that no preconstruction activities had been initiated.[1360] The fact that no preconstruction activities had taken place led to Board concerns about a significant assumption in the No Action Alternative impact analysis. As mentioned above, the No Action Alternative assumed that certain preconstruction activities would be completed before any license would be issued.[1361] Thus the

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[1358] Board Initial Questions Order Attach. B at 2-3.

[1359] Id.

[1360] GLE Initial Question Responses – Public at 34, 52.

[1361] Ex. NRC003A at 2-19.

impacts associated with the preconstruction activities, which were a significant part of the overall environmental impacts, were assumed to occur whether or not a license was issued. Because it appeared that this assumption would no longer apply, the preconstruction impacts should not have been scored against the No Action Alternative in Table 2-3.[1362] Based on this, the Board decided to pursue this issue at the evidentiary hearing.

The final component in balancing the potential impacts and benefits of the proposed action is the cost-benefit analysis. This analysis is presented in Section 7 of the FEIS.[1363] The analysis focused on the various private and societal costs and benefits associated with the proposed action and the No Action Alternative. The cost-benefit analysis can provide a rationale for deciding whether or not a project is likely to have a net positive impact.[1364] The primary socioeconomic impact or benefit from the proposed facility would be an increase in employment and income in the local area.[1365] Other benefits considered included meeting the future demand for domestic uranium enrichment services and introducing a new enrichment technology that potentially has advantages over current enrichment processes.[1366] A monetary societal cost was the proposed state and county tax incentives provided to secure the facility's construction and operation.[1367] The other societal costs considered were the environmental impacts given in Section 4 of the FEIS and discussed above. The private monetary costs and benefits associated with the project are the projected project costs and revenues. This

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[1362] Id. at 2-1 to 2-41.

[1363] Id. at 7-1 to 7-15.

[1364] Id. at 7-1.

[1365] Id. at 7-2.

[1366] Id. at 7-12 to 7-13.

[1367] Id. at 7-3.

information is considered proprietary and is set forth in the non-public Appendix H of the FEIS.[1368]

The Staff's conclusion with respect to the proposed action versus the No Action Alternative is set forth in Section 7.2.5 of the FEIS.[1369] It concludes that the proposed action is preferable to the No Action Alternative in the following respects: (1) the proposed action would contribute to meeting future demand for enriched uranium from domestic sources and increased national security; (2) it would introduce a newer technology with the potential for smaller resource requirements and environmental impacts; and (3) it would have positive impacts on employment, income, and tax revenues throughout all phases of the project.[1370] When these benefits were balanced against the impacts, which were estimated to be small to moderate, the Staff concluded that "the proposed action would be associated with net positive benefits."[1371]

Because of the importance of this area to the findings that the Board must make, we decided to pursue this topic at the evidentiary hearing. This provided an opportunity to get more information concerning enrichment services supply and demand, to follow-up on remaining questions, and to probe the rationale and logic underlying key conclusions in the written record.

The Board gained valuable information and insights at the evidentiary hearing. Both the Staff and the Applicant provided extensive prefiled testimony.[1372] The Applicant included a report, prepared at GLE's request, which provided an updated and integrated analysis of enrichment services supply and demand. The ERI Report was entered as an exhibit, and Mr.

[1368] Ex. NRC004.

[1369] Ex. NRC003A at 7-14.

[1370] Id.

[1371] Id. at 7-15.

[1372] Exs. NRC123-R1, GLE012.

Schwartz, its principal author, testified at the hearing.[1373] The ERI Report projected future supply and demand from both American and international perspectives.[1374] It also considered scenarios that assumed the deployment and non-deployment of several proposed new enrichment facilities in the United States.[1375] It also considered the near-term and potential long-term effects of the Fukushima accident on global uranium enrichment requirements and supply.[1376] The ERI Report's forecast of installed nuclear power generating capacity was based on a country-by-country and unit-by-unit review of current nuclear power programs and planned programs.[1377] It included a number of detailed factors such as license renewals, power uprates, and units under construction or ordered.[1378] Forecasts were made for reference, high, and low nuclear power growth scenarios.[1379]

The ERI Report predicts that the impact of the Fukushima accident would be about a four-year slippage in world-wide installed nuclear generating capacity by the year 2030, when compared to pre-Fukushima projections.[1380] This amounts to about a 7.9% reduction from earlier forecasts for the year 2030.[1381] Thus, the ERI Report predicts continued growth in installed capacity, but at somewhat lower rates.[1382] For the United States, the study predicts

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[1373] Ex. GLE012 at 9, Ex. GLE014.

[1374] Id. at 8-28.

[1375] Ex. GLE012 at 9.

[1376] Id.

[1377] Id. at 10.

[1378] Id.

[1379] Id. at 12.

[1380] Id. at 13-14.

[1381] Id.

[1382] Id. at 20-21.

that annual enrichment requirements will increase from 12.2 million SWU in 2011 to 16.7 million SWU in 2035.[1383]

In terms of the domestic supply of enrichment capability, the Applicant provided testimony on the current status of the two centrifuge enrichment facilities that have been licensed but not constructed. This testimony indicated that recent information on the American Centrifuge Plant and the Eagle Rock Enrichment Facility shows that construction continues to be delayed due to financial difficulties.[1384] Mr. Schwartz's testimony summarized the supply situation as follows:

> 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 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 plants 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.[1385]

The Staff witnesses' testimony summarized their analyses of American requirements for enriched uranium. Ms. Davis testified that the information in the record supported the conclusion that there will be a continued, if not increased, demand for enriched uranium.[1386] Ms. Davis also discussed the potential impact of the Fukushima accident on the demand for enriched uranium and concluded, "[T]he NRC staff finds that the Fukushima Daiichi accident

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[1383] Id. at 20.

[1384] Id. at 27-28.

[1385] Id. at 30 (citing Ex. GLE014 at 25).

[1386] Ex. NRC123-R1 at 4.

does not alter the NRC staff's conclusions in the FEIS."[1387] Dr. Avici addressed the Board's concern regarding the impact on the No Action Alternative analysis if the planned preconstruction activities are not initiated.[1388] He asserted that he did not consider the differences in impacts between the proposed action and the No Action Alternative to be significant,[1389] and that not completing the planned preconstruction activities would not alter the decision that proceeding with the project was the preferred option.[1390]

After reviewing the entire record in this case, the Board agrees with the Staff's conclusion that the proposed action is preferable to No Action Alternative. The Board concluded that the Staff had adequately supported its evaluation that the project has a legitimate need, and that the environmental impacts will all be small, or small to moderate.

Concerning our independent balancing of the costs and benefits, the Board concluded that the project can help to meet the demands for low enriched uranium in American power plants and support national energy security objectives by providing additional domestic enrichment capacity. The Board also concluded that introducing new enrichment technology that has the potential to lower costs and to reduce the environmental impact of enrichment is beneficial. The Board agrees that the impacts associated with constructing, operating, and (eventually) decommissioning the GLE facility at an existing industrial site, where there is already a nuclear fuel fabrication facility, will be small or small to moderate.

F. Topic 6: Environmental Monitoring Program

The environmental monitoring program is intended to ensure that the operating facility will not produce unforeseen environmental impacts. For this reason, the Board identified this

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[1387] Id. at 6.

[1388] Id. at 17-18.

[1389] Id. at 17.

[1390] Id. at 18.

area as a topic for the evidentiary hearing. The Board wanted to review the important elements of the program and the Staff's rationale for concluding that these program elements are adequate, as well as generally ascertain whether the monitoring program will indeed ensure ongoing compliance with environmental requirements.

Overall, GLE has developed a comprehensive tracking and monitoring system, integrated with its other site programs. The GLE Environment, Health, and Safety function serves as an internal, unbiased third party, which has the authority to enforce shutdown of any GLE process or facility.[1391] This entity is responsible for implementation of the Environmental Monitoring Program.[1392] Data collected from monitoring efforts are tracked and managed according to the Records Management and Quality Assurance programs.[1393] If any reading exceeds an internal action level or regulatory requirement, GLE will enter a corrective action request into the Corrective Action Program, which is used to correct all site-related issues.[1394] Under 10 C.F.R. § 70.59, GLE will be obligated to submit biannual reports to the NRC specifying "the quantity of each of the principal radionuclides released to unrestricted areas in liquid and gaseous effluents during the previous six months of operation, and such other information as the Commission may require to estimate maximum potential annual radiation doses to the public resulting from effluent releases."[1395] The NRC will also review the environmental monitoring program before operations begin, through the Operational Readiness Review, and during operations through regular inspections.[1396]

[1391] Tr. at 180 (7/12/12 Hearing).

[1392] Id.

[1393] Ex. GLE023 at 6.

[1394] Id.

[1395] 10 C.F.R. § 70.59.

[1396] Ex. NRC124 at 21-22.

GLE will monitor three key environmental media pathways – air, surface water, and groundwater.[1397] Monitoring will occur at the points of release, with the validity of the source-point monitoring to be verified by additional measures at more distant locations.[1398]

The air pathway is first monitored at the main GLE process building stack, the source of air effluent releases.[1399] This monitoring will occur daily during initial operation and decrease to weekly if the results during normal operations are consistently within regulatory requirements.[1400] Further air monitoring will occur at the expected location of highest potential GLE impact at the property line, as well as at nine monitoring locations positioned around the GLE-controlled access area fenceline.[1401] To select the location of highest potential impact, GLE used the NRC's XOQDOQ model.[1402] That model indicated that the nine fenceline locations should also detect radiological releases from the GLE stack.[1403] The actual placements of the stack and fenceline monitors may be adjusted based on final facility design.[1404] In the case of design changes, GLE would re-run radiological air dispersion modeling to finalize the placement of the air monitoring locations.[1405] GLE also will also sample

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[1397] Ex. GLE023 at 9.

[1398] Id. at 7-8.

[1399] Id. at 10.

[1400] Id. at 16.

[1401] GLE Follow-Up at 2.

[1402] Id. at 3.

[1403] Id.

[1404] Id. at 4.

[1405] Id.

four soil locations on and off the Wilmington Site to assess ground surface deposition.[1406] These soil samples will be collected from the upper four inches of soil using decontaminated hand-sampling tools.[1407]

At the evidentiary hearing, the Board inquired as to whether the air monitoring locations took into account the two-tiered building design of the main GLE building.[1408] Witnesses from GLE and the Staff were unable to offer a clear answer, but following the hearing, GLE filed a supplemental response, stating that the modeling did not account for the differing heights of structures near the stack.[1409]

The 10 C.F.R. Part 20 regulations state that "[t]he licensee shall make or cause to be made, as appropriate, surveys of radiation levels in unrestricted and controlled areas and radioactive materials in effluents released to unrestricted and controlled areas to demonstrate compliance with the dose limits for individual members of the public in § 20.1301."[1410] They further state:

> Each licensee shall make or cause to be made, surveys that – (1) May be necessary for the licensee to comply with the regulations in this part; and (2) Are reasonable under the circumstances to evaluate – (i) The magnitude and extent of radiation levels; and (ii) Concentrations or quantities of radioactive material; and (iii) The potential radiological hazards.[1411]

In light of these regulations, the Board initially had some concerns that the nine fenceline monitors and the expected location of highest potential impact might fail to give accurate dose readings of potential public exposure because GLE's modeling did not properly account for the

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[1406] Ex. GLE023 at 16.

[1407] Id. at 19.

[1408] Tr. at 222, 248 (7/12/12 Hearing).

[1409] GLE Follow-Up at 4.

[1410] 10 C.F.R. § 20.1302(a).

[1411] Id. § 20.1501(a).

two-tiered design of the main GLE building.

Our review, however, is for sufficiency and adequacy. We ultimately conclude that the proposed air pathway monitoring system is adequate. In so finding, we rely on the fact that GLE's primary air pathway monitoring will occur at the source-point and will be daily at the outset of operations.[1412] In addition, GLE used the NRC XOQDOQ model to determine monitoring locations, and GLE has agreed to redo radiological air dispersion modeling as necessary to account for design changes.[1413] While the Board would encourage GLE to account for its two-tiered building design of the main GLE building to confirm monitoring locations, we do not find GLE's plan, and the Staff's approval thereof, to be insufficient.

The groundwater monitoring system was also discussed in detail at the evidentiary hearing. In the vicinity of the GLE site, there is no clear differentiation between the Peedee and Surficial Aquifers.[1414] The uppermost layers of the Peedee Aquifer are referred to as the Principal Aquifer because it is the only aquifer that provides water (including process water) to the Wilmington site.[1415] The Principal Aquifer also provides potable water for the site and the surrounding communities.[1416] The primary input of groundwater into the Principal Aquifer is recharge from leakage through the overlying semiconfining layer (where present) or direct seepage of rainwater in areas where the semiconfining layer is absent, including around the GLE site.[1417] Therefore, a sufficiently detailed understanding of how any contamination that entered this system might be dispersed and how contamination will be monitored is necessary

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[1412] Ex. GLE023 at 16.

[1413] GLE Follow-Up at 3-4.

[1414] Ex. GLE023 at 30.

[1415] Id.

[1416] Tr. at 193 (7/12/12 Hearing).

[1417] Ex. GLE023 at 33.

to ensure that the water supply for the site and surrounding communities will be protected.

The proposed GLE groundwater monitoring system includes twenty-one wells (thirteen are new) in seven clusters.[1418] Each three well-cluster location was selected on the basis of groundwater flow directions.[1419] Based on the initial data, the first well in each cluster would be shallow, at water table level; the second would be at a thirty- to forty-foot depth; and the deepest may go as deep as fifty feet.[1420] The Board was initially concerned that the depths of the second and third wells were not established. However, modeling that determined groundwater flow and groundwater contaminant transport will be used to determine the ultimate well depths.[1421] This modeling, in addition to GLE's demonstration of knowledge of site hydrogeology and groundwater flows, adequately addressed the Board's concerns.

Surface water monitoring will occur at the release point in the effluent channel and upstream and downstream of the site through an existing partnership with the Lower Cape Fear River Program.[1422] The North Carolina Department of the Environment and Natural Resources, Division of Water Quality also maintains monitoring stations upstream and downstream of the site.[1423] Surface water at or downstream of the GLE site is not potable.[1424] GLE will also monitor stormwater and sediment in the surface water to ensure contaminants do not enter surface water through those pathways.[1425]

[1418] Id. at 34.

[1419] Id. at 34-35.

[1420] Tr. at 214 (7/12/12 Hearing).

[1421] Id. at 219.

[1422] Ex. GLE023 at 22.

[1423] Id.

[1424] Id. at 24.

[1425] Id. at 27-29.

Although the Board had some concerns the accuracy of the model used to place distant air monitors, we do not conclude that the proposed plan is inadequate or insufficient. GLE appears to have a sufficient understanding of site topography, which, coupled with the historical knowledge from the existing GNF-A facility, should allow GLE to adequately monitor the environment. GLE has enacted a comprehensive program that allows for shutdown, if necessary, and tracks monitoring and corrective action from beginning to end. In addition, the NRC Staff will assess the Environmental Monitoring Program in both the Operational Readiness Review and regular environmental inspections, ensuring additional checks on GLE's monitoring plan and results.

VI. FINDINGS

For the foregoing reasons, the Board determines as follows the five issues that the Commission has directed us to address:

1. The Board determines, without conducting a de novo evaluation of the application, that (a) the application and record of the proceeding contain sufficient information to support license issuance; and (b) the NRC Staff's review of the application has been adequate to support findings made by the Director of the Office of Nuclear Materials Safety and Safeguards that (i) the application satisfies the standards set forth in the applicable Notice and Commission Order[1426] and the applicable standards in 10 C.F.R. Parts 30, 40, and 70, and (ii) the requirements of NEPA and the NRC's implementing regulations in 10 C.F.R. Part 51 have been met.

2. The Board determines, without conducting a de novo evaluation of the application, that the review conducted by the NRC Staff pursuant to 10 C.F.R. Part 51 has been adequate.

[1426] 75 Fed. Reg. at 1819.

3. In accordance with Subpart A of 10 C.F.R. Part 51, the Board determines that the requirements of Sections 102(2)(A), (C), and (E) of NEPA and Subpart A of 10 C.F.R. Part 51 have been complied with in the proceeding.

4. In accordance with Subpart A of 10 C.F.R. Part 51, the Board has independently considered the final balance among conflicting factors contained in the record of the proceeding with a view to determining the appropriate action to be taken.

5. In accordance with Subpart A of 10 C.F.R. Part 51, the Board determines, after weighing the environmental, economic, technical, and other benefits against the environmental and other costs, and considering reasonable alternatives, that a license should be issued.

VII. ORDER

1. Pursuant to 10 C.F.R. § 2.340(k), if the Directors of the Office of Nuclear Materials Safety and Safeguards and of the Office of Federal and State Materials and Environmental Management Programs have made all findings necessary for license issuance that are not within the scope of this Initial Decision, they are hereby authorized to issue the appropriate licenses authorizing construction and operation of GLE's proposed facility.

2. Pursuant to 10 C.F.R. § 2.341(a)(2), this Initial Decision will constitute a final decision of the Commission 120 days from the date of issuance, unless a petition for review is filed in accordance with 10 C.F.R. § 2.341(b) or the Commission directs otherwise. Any party wishing to file a petition for review on the grounds specified Section 2.341(b) must do so within twenty-five days after service of this Initial Decision.

It is so ORDERED.

THE ATOMIC SAFETY
AND LICENSING BOARD

/RA/

_____
Paul S. Ryerson, Chairman
ADMINISTRATIVE JUDGE

/RA/

_____
Dr. James F. Jackson
ADMINISTRATIVE JUDGE

/RA/

_____
Dr. Michael O. Garcia
ADMINISTRATIVE JUDGE

Rockville, Maryland
September 19, 2012

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
GE-HITACHI GLOBAL LASER ENRICHMENT FACILITY LLC (GLE Commercial Facility)	)	Docket No. 70-7016-ML

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing INITIAL DECISION (LBP-12-21) (PUBLIC) have been served upon the following persons by Electronic Information Exchange.

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Office of the Secretary of the Commission

Dated at Rockville, Maryland
this 28th day of September 2012