

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

Michael M. Gibson, Chairman
Dr. Gary S. Arnold
Dr. Randall J. Charbeneau

In the Matter of

NUCLEAR INNOVATION NORTH AMERICA
LLC

(South Texas Project Units 3 and 4)

Docket Nos. 52-12-COL and 52-13-COL

ASLBP No. 09-885-08-COL-BD01

December 29, 2011

FIRST PARTIAL INITIAL DECISION
(Contention CL-2)

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I. INTRODUCTION

This partial initial decision (PID) concerns the application of Nuclear Innovation North America LLC (Applicant) for combined licenses (COLs) under 10 C.F.R. Part 52 that would permit the construction and operation of two new nuclear reactor units—South Texas Project (STP) Units 3 and 4, employing the Advanced Boiling Water Reactor (ABWR) certified design—on the existing South Texas site, located near Bay City, Texas.¹ The South Texas site currently houses two reactors, STP Units 1 and 2.

At issue, we rule on the merits of Contention CL-2. This contention challenges the estimated replacement power costs used in Applicant's Environmental Report (ER) analysis of STP Units 3 and 4. As admitted by the Board, Contention CL-2 states:

The Applicant's calculation in ER Section 7.5S of replacement power costs in the event of a forced shutdown of multiple STP Units is erroneous because it

¹ South Texas Project Nuclear Operating Company; Notice of Receipt and Availability of Application for a Combined License, 72 Fed. Reg. 60,394 (Oct. 24, 2007).

underestimates replacement power costs and fails to consider disruptive impacts, including [Electric Reliability Council of Texas (“ERCOT”)] market price spikes.²

Intervenors claim that certain assumptions in the estimate of replacement power costs produce an erroneously low averted cost. Intervenors argue that underestimating the costs of replacement power in turn improperly skews the cost-benefit balance in the ER’s Severe Accident Mitigation Design Alternatives (SAMDA) analysis.³

On August 18, 2011, this Board held an evidentiary hearing in Austin, Texas on Contention CL-2. After considering all the evidence and legal arguments, the Board rules that Applicant and the NRC Staff (Staff) have carried their respective burdens of proof to demonstrate the adequacy of the environmental review in accordance with NEPA and 10 C.F.R. Part 51 regarding Contention CL-2. Thus, the Board rules on the merits in favor of Applicant and Staff on CL-2.

II. BACKGROUND⁴

A. Procedural History

On September 20, 2007, Applicant⁵ submitted an application to the Nuclear Regulatory Commission (NRC) for COLs that would permit the construction and operation of STP Units 3 and 4. Following the NRC’s docketing of that application and publication of a notice of hearing

² South Texas Project Nuclear Operating Co. (South Texas Project Units 3 and 4), LBP-10-14, 72 NRC __, __ (slip op. at 30) (July 2, 2010).

³ Intervenors’ CL Contentions attach., Clarence L. Johnson, Ph.D., Review of Replacement Power Costs for Unaffected Units at the STP Site (Dec. 21, 2009) at 3-4.

⁴ This proceeding produced a number of procedural detours that have no material bearing on the decision regarding the contention at issue here, and so we do not recite this proceeding’s entire procedural history. For such an account see LBP-09-21, LBP-10-14, LBP-11-07.

⁵ At the outset of this proceeding, the lead applicant for the South Texas Project (STP) Units 3 and 4 was the STP Nuclear Operating Company (STPNOC). In early 2011, Nuclear Innovation North America LLC (NINA) replaced STPNOC as the lead applicant among a consortium of several. Licensing Board Order (Revising Case Caption) (Feb. 7, 2011) at 1. This Partial Initial Decision (PID) refers to NINA as the lead applicant, although at the time the Board admitted Contention CL-2, STPNOC was the lead applicant.

and opportunity to petition for leave to intervene in this matter,⁶ Intervenor⁷ jointly filed a petition that challenged several aspects of Applicant's COL application (COLA).⁸ Among twenty-eight proposed contentions, Contention 21 claimed that the ER for STP Units 3 and 4 failed to consider the impacts of severe radiological accident scenarios on the operation of other units at the STP site.⁹ The Board admitted Contention 21 on August 27, 2009.¹⁰

On November 11, 2009, Applicant notified the Board of revisions to the ER that added a new Section 7.5S to cure the omission that Intervenor⁷ had alleged as the basis for Contention 21.¹¹ Shortly thereafter, on November 30, 2009, Applicant requested that the Board dismiss Contention 21 as moot based on new ER Section 7.5S.¹² Intervenor⁷ opposed this request and instead requested the Board to modify Contention 21.¹³ Then on December 22, 2009, Intervenor⁷ filed four new contentions, Contentions CL-1 through CL-4, arising from the new ER Section 7.5S.¹⁴ Applicant and Staff opposed these four new and revised contentions.¹⁵

⁶ South Texas Project Nuclear Operating Company Application for the South Texas Project Units 3 and 4; Notice of Order, Hearing, and Opportunity To Petition for Leave To Intervene, 74 Fed. Reg. 7,934 (Feb. 20, 2009).

⁷ Intervenor⁷ are three public interest organizations: the Sustainable Energy and Economic Development Coalition, the South Texas Association for Responsible Energy, and Public Citizen.

⁸ Petition for Intervention and Request for Hearing (Apr. 21, 2009) (Petition).

⁹ Petition at 46.

¹⁰ South Texas Project Nuclear Operating Co. (South Texas Project Units 3 and 4), LBP-09-21, 70 NRC 581, 617-20 (2009).

¹¹ Notification of Filing Related to Contention 21, Letter from Stephen J. Burdick, Counsel for STP Nuclear Operating Company, to the Board at 1 (Nov. 11, 2009).

¹² Applicant's Motion to Dismiss Contention 21 as Moot, at 1, 5 (Nov. 30, 2009).

¹³ Intervenor⁷' Response to Applicant's Motion to Dismiss Contention 21 as Moot, at 1, 5 (Dec. 14, 2009).

¹⁴ Intervenor⁷' Contentions Regarding Applicant's Proposed Revision to Environmental Report Section 7.5S and Request for Hearing, at 2-3 (Dec. 22, 2009) (Motion on Co-Location Contention).

The Board issued LBP-10-14 on July 2, 2010, in which we dismissed Contention 21 along with Intervenors' request to amend it, and denied Intervenors' request to admit Contention CL-1. However, the Board also admitted in part Intervenors' newly proffered Contentions CL-2, CL-3, and CL-4—which were reformulated into one new contention, CL-2.¹⁶

On July 22, 2010, Staff moved for summary disposition of Contention CL-2, arguing that, as a matter of law, the SAMDA analysis¹⁷ for the ABWR certified design at STP Units 3 and 4 has finality, and therefore that issues related to SAMDAs are not open for litigation in this proceeding.¹⁸ Applicant supported Staff's motion.¹⁹ Applicant also moved for summary disposition of Contention CL-2, arguing that the material facts demonstrate that SAMDAs are not cost-effective even after accounting for the factors identified by the Intervenors.²⁰ Staff supported Applicant's motion.²¹ Intervenors opposed both Applicant's and Staff's motions.²² On

¹⁵ Applicant's Answer Opposing New and Revised Contentions Regarding Environmental Report Section 7.5S, at 25 (Jan. 22, 2010); NRC Staff's Answer to the Intervenors' Amended and New Accident Contentions, at 1, 30 (Jan. 22, 2010).

¹⁶ LBP-10-14, 73 NRC at __ (slip op. at 57).

¹⁷ For a background discussion on SAMDA analyses in general as well as the subject SAMDA analysis see section I.B., infra.

¹⁸ NRC Staff Motion for Summary Disposition (July 22, 2010) at 14.

¹⁹ STP Nuclear Operating Company's Answer Supporting the NRC Staff Motion for Summary Disposition of Contention CL-2, at 1, 4 (July 29, 2010).

²⁰ STP Nuclear Operating Company's Motion for Summary Disposition of Contention CL-2, at 27 (Sept. 14, 2010).

²¹ NRC Staff Answer to Applicant's Motion for Summary Disposition of Contention CL-2, at 13-14 (Oct. 7, 2010).

²² Intervenors' Response to Staff's Motion for Summary Disposition (Aug. 11, 2010); Intervenors' Response to Applicant's Motion for Summary Disposition of Contention CL-2 (Oct. 8, 2010).

February 28, 2011, the Board issued LBP-11-07,²³ denying both motions for summary disposition.²⁴

Thereafter, and with Staff's publication of its FEIS in late-February 2011,²⁵ the Board and parties agreed to expedite the environmental portion of this proceeding and set a schedule for an evidentiary hearing on the environmental contentions.²⁶ Under that schedule, the parties submitted pre-filed direct testimony, initial position statements, and exhibits on May 9, 2011.²⁷ On May 31, 2011, the parties submitted rebuttal testimony, rebuttal position statements, and exhibits.²⁸

²³ In addition to addressing CL-2, LBP-11-07 also admitted a new contention, DEIS-1-G, that challenged the DEIS's need for power analysis as failing to account for the reduced demand that would result from the adoption of an energy efficient building code in Texas. Nuclear Innovation North America LLC (South Texas Project Units 3 and 4), LBP-11-07, 73 NRC ___, ___ (slip op. at 48) (Feb. 28, 2011).

²⁴ LBP-11-07, 73 NRC at ___, ___ (slip op. at 2, 74). Staff petitioned for review of the Board's denial of summary disposition regarding CL-2 on March 15, 2011. NRC Staff Petition for Review of the Licensing board's Decision in LBP-11-07 Denying the NRC Staff Motion for Summary Disposition (Mar. 15, 2011). Applicant did not similarly petition for review, but did answer in support of the Staff petition. [NINA's] Answer to NRC Staff Appeal of LBP-11-07 (Mar. 25, 2011). Intervenors answered in opposition on March 25, 2011. Intervenors' Answer in Opposition to NRC Staff's Petition for Review of the Licensing Board's Decision in LBP-11-07 Denying NRC Staff Motion for Summary Disposition. On September 9, 2011, the Commission denied the petition for review as premature. CLI-11-06, 74 NRC ___, ___ (slip op. at 9-11) (Sept. 9, 2011).

²⁵ Nuclear Innovation North America LLC; Notice of Availability of the Final Environmental Impact Statement for South Texas Project Units 3 and 4 Combined License Application Review, 76 Fed. Reg. 11,522, 11,522 (Mar. 2, 2011); NRC Staff Status Update on Safety and Environmental Documents (Mar. 1, 2011).

²⁶ Licensing Board Memorandum and Order (Establishing Schedule for Evidentiary Hearing) (Mar. 11, 2011) at 1-2 (unpublished).

²⁷ Nuclear Innovation North America LLC's Initial Statement of Position on Contention CL-2 (May 9, 2011); NRC Staff Initial Statement of Position (May 9, 2011); Intervenors' Initial Statements of Position in Support of Contentions CL-2 and DEIS-1 (May 9, 2011).

²⁸ Nuclear Innovation North America LLC's Rebuttal Statement of Position on Contention CL-2 (May 31, 2011); NRC Staff Rebuttal Statement of Position (May 31, 2011); Intervenors' Consolidated Response to Applicant's and Staff's Statements of Initial Positions (May 31, 2011).

On June 17, 2011, Applicant and Staff filed motions in limine, seeking to strike aspects of the Intervenor's pre-filed direct and rebuttal testimony and accompanying exhibits.²⁹ Intervenor's responded to the motions, conceding that portions of testimony and certain exhibits should be excluded, but arguing that, in all other respects, the motions in limine should be denied.³⁰ Insofar as the parties agreed material was irrelevant, we granted the motions in limine, but in all other respects, we denied the motions.³¹

On August 18 and 19, 2011 the Board held an evidentiary hearing on CL-2 in Austin, Texas.³² The hearing was conducted in accordance with the provisions of Subpart L to 10 C.F.R. Part 2, and none of the parties requested an opportunity to conduct cross-examination. The parties offered various exhibits including pre-filed testimony and other documents for evidence³³ and the Board received live testimony from several witnesses.³⁴ After

²⁹ Nuclear Innovation North America's Motion In Limine to Strike Portions of Intervenor's Initial and Rebuttal Submissions (June 17, 2011); NRC Staff Motion In Limine to Exclude Portions of Testimony and Exhibits Filed by the Intervenor's (June 17, 2011).

³⁰ Intervenor's Consolidated Response to Applicant's & Staff's Motions in Limine (June 27, 2011) at 1-2.

³¹ Order (Ruling on Motions in Limine) (July 14, 2011) at 3-4 (unpublished).

³² The hearing on DEIS-1-G was delayed from August 2011 until October 31, 2011 to accommodate Intervenor's witness, who experienced a medical emergency at the time of the first hearing.

³³ For the exhibit numbers used in this PID and reflected in the agency's electronic hearing docket, evidence was described as follows: (1) a three-character party identifier, i.e., STP, NRC, and INT; followed by (2) six-character evidence identifier—designed to reflect the sequential number of the exhibit and whether it was revised subsequent to its original submission as a pre-filed exhibit, e.g., evidentiary exhibit INTR20045 admitted at the August 2011 hearing is the second revised version of pre-filed exhibit INT000045; (3) followed by a two-character identifier, here "00" (where there is a mandatory/uncontested portion of a proceeding, the identifier would indicate that the exhibit was utilized in the mandatory/uncontested portion of a proceeding, i.e., MA); followed by (4) the designation BD01, which indicates that this Licensing Board, i.e., BD01, was involved in its identification and admission. Accordingly, the official designation for Intervenor's pre-filed rebuttal testimony on CL-2, referenced above, is INTR20045-00-BD01. But for simplicity, we will refer to all admitted exhibits admitted by their initial nine-character designation only, e.g., INTR20045.

questioning these witnesses regarding the merits of CL-2 the Board afforded the parties an opportunity to suggest cross-examination or rehabilitation questions. In accordance with 10 C.F.R. § 2.315(a), before the hearing, the Board also entertained written limited appearance statements from members of the public in connection with the hearing.³⁵

Following the August 18 evidentiary hearing, the Board adopted certain corrections to the hearing transcript and closed the evidentiary record for CL-2.³⁶ On September 23, 2011 the parties filed proposed findings of fact and conclusions of law regarding CL-2.³⁷

B. ER's SAMDA Analysis³⁸

Severe accidents are reactor accidents more severe than design basis accidents and involve substantial damage to the reactor core.³⁹ Although the likelihood of severe accidents occurring is lower than that for design basis accidents (i.e., those accidents the reactor is

³⁴ Tr. at 1470 (Pieniasek and Zimmerly); Tr. at 1553 (Johnson); Tr. at 1597 (Emch, Anderson, and Rishel).

³⁵ Atomic Safety and Licensing Board; In the Matter of Nuclear Innovation North America LLC (South Texas Project Units 3 and 4); Notice of Hearing; Opportunity To Submit Written Limited Appearance Statements; and Notice of Oral Argument 76 Fed. Reg. 44,623, 44,623 (July 26, 2011).

³⁶ Licensing Board Memorandum and Order (Adopting Transcript Corrections and Partially Closing Evidentiary Record) (Sept. 8, 2011) at 1 (unpublished).

³⁷ [NINA's] Proposed Findings of Fact and Conclusions of Law for Contention CL-2 (Sept. 23, 2011); NRC Staff Proposed Findings of Fact and Conclusions of Law on Contention CL-2 in the Form of a Partial Initial Decision (Sept. 23, 2011); Intervenors' Proposed Findings of Fact and Conclusions of Law Concerning Contention CL-2 (Sept. 23, 2011).

³⁸ The following background material on SAMDA analyses in general and the STP Units 3 and 4 SAMDA analysis specifically is principally based on the undisputed testimony of Applicant and Staff witnesses. The Board recognizes that while the methodology may derived from longstanding practice and logic, no Commission regulation and scant Commission precedent broadly delineates how a SAMDA analysis shall be performed. As a result, our review of NEPA and Part 51 compliance is necessarily specific to the STP site and the allegations of CL-2.

³⁹ Policy Statement on Severe Reactor Accidents Regarding Future Designs and Existing Plants, 50 Fed. Reg. 32,138, 32,138 (Aug. 8, 1985).

designed to withstand), the consequences of severe accidents are generally greater.⁴⁰ The NRC requires that applications for certified reactor designs include a probabilistic risk assessment (PRA) for severe accidents.⁴¹ According to Applicant, a generic PRA was conducted for the ABWR certified design and accounted for a range of potential severe accident sequences that could affect plant integrity.⁴²

The witnesses for Applicant stated that rather than rely exclusively on the generic ABWR PRA, Applicant updated it to include site-specific characteristics.⁴³ Applicant asserted that its purpose in providing this STP site-specific analysis was (1) to disclose the impacts of severe accidents, and (2) to support severe accident mitigation alternatives (SAMA) analyses.⁴⁴

Design or procedural modifications that could mitigate the consequences of a severe accident are known as severe accident mitigation alternatives (SAMAs). SAMAs are somewhat broader than SAMDAs, which focus on design changes and do not consider procedural modifications. As part of the ABWR certified design, Applicant stated that no potential mitigating design alternatives—SAMDAs—were identified as being cost-effective.⁴⁵

⁴⁰ Id.

⁴¹ 10 C.F.R. §§ 52.47(a)(23), (27); see also 50 Fed. Reg. at 32,138-39.

⁴² Exh. STP000013 (Environmental Report for STP Units 3 and 4, Chapter 7 (Rev. 5, Jan. 2011)) at 7.2-1.

⁴³ Exh. STP000011 (“Direct Testimony of Applicant Witnesses Jeffrey L. Zimmerly and Adrian Pieniasek Regarding Contention CL-2” (May 9, 2011)) at 7 (Zimmerly/Pieniasek Direct Testimony); Exh. STP000013 at 7.3-1; Exh. NRC000004 (“Prefiled Direct Testimony of Richard L. Emch, Jr., Jeremy P. Rishel, and David M. Anderson Regarding Contention CL-2” and “Affidavit of Richard L. Emch, Jr., Concerning Prefiled Testimony Regarding Contention CL-2” and “Affidavit of Jeremy P. Rishel Concerning Prefiled Testimony Regarding Contention CL-2” and “Affidavit of David M. Anderson Concerning Prefiled Testimony Regarding Contention CL-2.”) at 28 (Emch/Rishel/Anderson Direct Testimony).

⁴⁴ Exh. STP000013 at 7.2-1.

⁴⁵ Id. at 7.3.1.

In Section 7.5S of its ER, Applicant provided a SAMDA analysis for an accident at a single unit with multi-year outages at the other three co-located units.⁴⁶ It is these aspects of Applicant's SAMDA analysis that Intervenor's have challenged in Contention CL-2.

A SAMDA analysis examines whether implementing a SAMDA would decrease the probability-weighted consequences of severe accidents.⁴⁷ According to Staff and Applicant witnesses, in general, to perform a SAMDA analysis, the cost of implementing the SAMDA is compared against the benefit provided by implementing the SAMDA.⁴⁸

Typically, a SAMDA analysis begins with a screening test⁴⁹ to determine whether the maximum benefit from averting all severe accidents is lower than the cost of the lowest-cost SAMDA. If so, according to Applicant's witness, Mr. Zimmerly, all SAMDAs are screened out as not cost-beneficial, and hence no further SAMDA analysis is conducted.⁵⁰ On the other hand, if the screening test calculates a maximum benefit from averting all severe accidents that is greater than the cost of any of the SAMDAs, those SAMDAs might be cost-beneficial and further

⁴⁶ Id. §§ 7.3, 7.5S.

⁴⁷ See Entergy Nuclear Generation Co. (Pilgrim Nuclear Power Station), CLI-10-11, 71 NRC 287, 291 (2010).

⁴⁸ Zimmerly/Pieniasek Direct Testimony at 8 (Zimmerly Testimony); Emch/Rishel/Anderson Direct Testimony at 9 (Emch and Rishel Testimony).

⁴⁹ Zimmerly/Pieniasek Direct Testimony at 8 (Zimmerly Testimony); Exh. STP000013 at 7.3-1 to -3; Emch/Rishel/Anderson Direct Testimony at 10-11 (Emch and Rishel Testimony). The use of a screening test is endorsed by the NRC Staff in its Environmental Standard Review Plan, NUREG-1555. Exh. STP000018 (NUREG-1555, "Standard Review Plans for Environmental Reviews for Nuclear Power Plants," Section 7.3 (Oct. 1999)) at 7.3-6. The approach is also consistent with the Staff's environmental assessment for SAMDAs generally, for the ABWR certified design in particular, and in this very proceeding. Emch/Rishel/Anderson Direct Testimony at 10-11, 34, 60-61, 65 (Emch, Rishel, and Anderson Testimony). Intervenor's did not dispute this method of calculation. Rather Intervenor's disputed various inputs to the calculation.

⁵⁰ Zimmerly/Pieniasek Direct Testimony at 8. Since no SAMDA can avert all risk of a severe accident the screening test artificially inflates the benefit side of the cost-benefit comparison, thus excluding only those SAMDAs clearly not cost-beneficial.

analysis is required beyond the screening test.⁵¹ Stated otherwise, if the initial screening test does not screen out a SAMDA, the risk-informed benefit of implementing the SAMDA must be compared to the cost of implementing the SAMDA.

Cost: Witnesses for Applicant and Staff testified that during the ABWR certified design process, the ABWR's Technical Support Document (TSD) identified the SAMDAs that would be analyzed and estimated the costs of implementing those SAMDAs.⁵² They added that after evaluating a wide variety of ABWR modifications as potential SAMDAs, the TSD narrowed the list to twenty-one (after excluding modifications already incorporated or not applicable).⁵³ The three lowest-cost SAMDAs for the ABWR were all estimated to cost \$100,000 (1991 dollars)⁵⁴ and to correspond to modifications for improved vacuum breakers, drywell head flooding, and reactor building sprays.⁵⁵

Benefit: Witnesses for Applicant and Staff testified that a probabilistic approach is used to estimate the maximum averted cost-risk⁵⁶ that would result from implementing a SAMDA.⁵⁷ They stated that benefits include averting the exposure costs, cleanup costs, and replacement power costs that would be associated with the postulated severe accident sequence and

⁵¹ Zimmerly/Pieniasek Direct Testimony at 8 (Zimmerly Testimony); Exh. STP000013 at 7.3-2.

⁵² Zimmerly/Pieniasek Direct Testimony at 8 (Zimmerly Testimony); Exh. NRC00009A (Technical Support Document for the ABWR, attachment 1 to NEPA/SAMDA Submittal for the ABWR from J.F. Quirk to R.W. Borchardt (Dec. 21, 1994). NRC00009A includes the Technical Support Document through page 30.) at 1; Emch/Rishel/Anderson Direct Testimony at 11 (Emch and Rishel Testimony).

⁵³ Zimmerly/Pieniasek Direct Testimony at 9 (Zimmerly Testimony); Exh. NRC00009A at 15, 19-24; Emch/Rishel/Anderson Direct Testimony at 15-18 (Emch and Rishel Testimony).

⁵⁴ Zimmerly/Pieniasek Direct Testimony at 10 (Zimmerly Testimony); Exh. NRC00009A at 25-26.

⁵⁵ Zimmerly/Pieniasek Direct Testimony at 10; Exh. NRC00009A at 25-26.

⁵⁶ By cost-risk we mean the accident's probability multiplied by its cost in dollars.

⁵⁷ Zimmerly/Pieniasek Direct Testimony at 10 (Zimmerly Testimony); Exh. STP000013 at 7.3-1 to -2; Emch/Rishel/Anderson Direct Testimony at 9 (Emch and Rishel Testimony).

corresponding power outage.⁵⁸ They added that benefits are calculated by considering the likelihood of averting the above costs given the reactor's Core Damage Frequency.⁵⁹

In ER Section 7.5S.5, Applicant considered the economic impacts of severe accidents on co-located units for SAMDA analyses; and as noted above, one of these economic impacts is the cost of replacing the power that would otherwise be produced from STP Units 3 and 4.⁶⁰ Applicant's witness, Mr. Zimmerly, asserted that the projections of replacement power costs were based on the NRC's guidance contained in its Regulatory Analysis Technical Evaluation Handbook, NUREG/BR-0184.⁶¹

Mr. Zimmerly testified that the starting point for projecting replacement power costs for the co-located units after a severe accident at the STP site was an estimate of typical short-term replacement power costs for a 910 MWe power plant, which NUREG/BR-0184 calculated to be \$310,000 per day (1993 dollars).⁶² He stated that Applicant assumed a hypothetical severe accident at an ABWR unit would cause an outage at the co-located ABWR unit for six years and an outage at the co-located STP Units 1 and 2 for two years.⁶³ The ER multiplied the estimated

⁵⁸ Contention CL-2 only challenges the ER calculation of replacement power costs. As a result, other averted costs, e.g., exposure and cleanup, are undisputed facts in this proceeding.

⁵⁹ Zimmerly/Pieniasek Direct Testimony at 10 (Zimmerly Testimony); Exh. STP000013 at 7.5S-6; Emch/Rishel/Anderson Direct Testimony at 10 (Emch and Rishel Testimony).

⁶⁰ Exh. STP000013 at 7.5S-6.

⁶¹ Zimmerly/Pieniasek Direct Testimony at 15; Exh. STP000013 at 7.5S-6.

⁶² Zimmerly/Pieniasek Direct Testimony at 15; Exh. NRC00008B (NUREG/BR-0184, Regulatory Analysis Technical Evaluation Handbook (Jan. 1997) (portions). Exh. NRC00008B includes chapter 5 and pages B.1 and B.2.) at 5.51.

⁶³ Exh. STP000013 at 7.5S-6; Zimmerly/Pieniasek Direct Testimony at 16; see also Emch/Rishel/Anderson Direct Testimony at 31 (Emch and Rishel Testimony).

duration of the outage at the co-located units by the \$310,000 per day value to produce a generic replacement power cost.⁶⁴

Applying this generic replacement power cost to each unit, Mr. Zimmerly stated that the ER calculated the net present value of those costs over the life of the facility. To do so, the ER used a discount rate of 7%, and for sensitivity analysis, used a discount rate of 3%.⁶⁵ The ER then scaled up the net present value of the NUREG/BR-0184 costs (which were based on a 910 MWe reference plant) to 1,350 MWe for each of the proposed STP Units 3 and 4 as well as 1,280 MWe for each of the existing STP Units 1 and 2.⁶⁶ Finally, Mr. Zimmerly stated the ER multiplied the net present value of the costs by the Core Damage Frequency for an ABWR (1.56×10^{-7} per year)⁶⁷ to obtain the probability-weighted (“monetized”) replacement power costs for use in the SAMDA analysis.⁶⁸

Next, according to Mr. Zimmerly the ER added these monetized replacement power costs to the monetized costs of other impacts associated with onsite exposure and onsite cleanup to obtain the total monetized impact for each unit.⁶⁹ Thus, having calculated all the averted costs (i.e., benefits) of implementing a SAMDA and all the costs of implementing the

⁶⁴ Exh. STP000013 at 7.5S-6; see also Zimmerly/Pieniazek Direct Testimony at 15-16 (Zimmerly Testimony); Emch/Rishel/Anderson Direct Testimony at 31-32 (Emch and Rishel Testimony).

⁶⁵ Zimmerly/Pieniazek Direct Testimony at 16-17; Exh. STP000013 at 7.5S-7; Exh. NRC00008B at 5.21.

⁶⁶ Zimmerly/Pieniazek Direct Testimony at 16-17; Exh. STP000013 at 7.5S-7.

⁶⁷ The CDF of 1.56×10^{-7} per year is for internal events, while the unit operates at full power. Exh. STP000013 at 7.5S-4. The Board previously rejected other contributions to the CDF from low power, shutdown, or external events because they were so low that they were incapable of having a material impact on our analysis of CL-2. See LBP-10-14, 72 NRC at ___ (slip op. at 20, 22).

⁶⁸ Zimmerly/Pieniazek Direct Testimony at 16; Exh. STP000013 at 7.5S-4, 7.5S-6.

⁶⁹ Zimmerly/Pieniazek Direct Testimony at 17; Exh. STP000013 at 7.5S-6; see also Emch/Rishel/Anderson Direct Testimony at 31 (Emch and Rishel Testimony).

SAMDA (the cost), the ER determined that the lowest-cost SAMDAs (\$100,000 apiece) were more costly than the total monetized impacts of a severe accident without implementing the SAMDAs (\$13,377 for a 7% discount rate and \$23,015 for a 3% discount rate). Therefore, the ER concluded that there are no cost-beneficial SAMDAs.⁷⁰

C. FEIS's SAMDA Analysis

Although Staff issued its FEIS well after the filing of Contention CL-2, the FEIS does not explicitly address the issues raised by Contention CL-2. Rather, Staff incorporated by reference the Environmental Assessment (EA) for the ABWR certified design⁷¹ and took the position that the STP site characteristics are bounded by the site parameters in the SAMDA analysis for the ABWR certified design.⁷² Thus, in Staff's view, the SAMDA analysis for STP Units 3 and 4 would be resolved by rule.⁷³ The FEIS, however, did discuss the SAMDA analysis in Sections 7.3 and 7.5S.5 of the ER,⁷⁴ concluding that "[t]he increase in monetized risk due to explicitly considering the impacts on the unaffected units is not sufficient to make any of the ABWR SAMDAs cost beneficial."⁷⁵

⁷⁰ Zimmerly/Pieniasek Direct Testimony at 18 (Zimmerly Testimony); Exh. STP000013 at 7.3-1; Emch/Rishel/Anderson Direct Testimony at 30 (Emch and Rishel Testimony).

⁷¹ Exh. NRC00003C (NUREG-1937, Volumes 1 and 2, Final Environmental Impact Statement for Combined Licenses (COLs) for South Texas Project Electric Generating Station Units 3 and 4: Final Report (Feb. 2011). Exh. NRC00003C (Volume 1, from Chapter 3 through the end of Volume 1,) at 5-111 to -112.

⁷² Emch/Rishel/Anderson Direct Testimony at 35 (Emch and Rishel Testimony).

⁷³ NRC Staff Motion for Summary Disposition (July 22, 2010) at 6; see also Exh. NRC00003C at 5-112 to -113.

⁷⁴ Exh. NRC00003C at 5-112.

⁷⁵ Id.

III. LEGAL STANDARDS

A. Burden and Standard of Proof

Generally, an applicant in a licensing proceeding⁷⁶ must meet its burden of proof by a preponderance of the evidence.⁷⁷ But for NEPA contentions, as here, the burden shifts to Staff, because the NRC, not the applicant, bears the ultimate burden of complying with NEPA.⁷⁸ Even so, as a practical matter, Staff relies heavily upon the applicant's ER in preparing its EIS.⁷⁹ Therefore, while all environmental contentions may, in a general sense, ultimately challenge the NRC's compliance with NEPA,⁸⁰ the Commission's regulations expressly permit the lodging of contentions against an applicant's ER—well before release of the NRC's NEPA-documents.⁸¹ An applicant therefore may bear the burden of proof on contentions asserting deficiencies in its ER⁸² and where the applicant becomes a proponent of a particular challenged position set forth in the EIS.⁸³

⁷⁶ 10 C.F.R. § 2.325.

⁷⁷ Pacific Gas and Electric Co. (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation), CLI-08-26, 68 NRC 509, 521 (2008) (applying a preponderance of the evidence standard to resolution of an environmental contention). Throughout this PID, all the Board's factual findings are based on a preponderance of the evidence standard.

⁷⁸ See, e.g., Duke Power Company (Catawba Nuclear Station, Units 1 & 2), CLI-83-19, 17 NRC 1041, 1049 (1983).

⁷⁹ See 10 C.F.R. §§ 51.41, 51.45(c).

⁸⁰ Catawba, CLI-83-19, 17 NRC at 1049.

⁸¹ 10 C.F.R. § 2.309(f)(2).

⁸² Louisiana Energy Services L.P. (Claiborne Enrichment Center), LBP-96-25, 44 NRC 331, 338-39 (1996) (citing Consumers Power Company (Midland Plant, Units 1 and 2), CLI-74-05, 7 AEC 19, 31 (1974)), rev'd on other grounds, CLI-97-15, 46 NRC 294 (1997).

⁸³ LES, LBP-96-25, 44 NRC at 338-39 (citing Public Service Commission of New Hampshire (Seabrook Station, Units 1 & 2), ALAB-471, 7 NRC 477, 489 n.8 (1978)), rev'd on other grounds, CLI-97-15, 46 NRC 294 (1997).

B. NEPA and 10 C.F.R. Part 51

The contention at issue, CL-2, arises under the National Environmental Policy Act (NEPA) and the NRC's implementing regulations.⁸⁴ NEPA requires that an agency prepare an environmental impact statement (EIS) before approving any major Federal action that will significantly affect the quality of the human environment.⁸⁵ NEPA does not mandate substantive results; rather, NEPA imposes procedural restraints on agencies, requiring them to take a "hard look" at the environmental impacts of a proposed action and reasonable alternatives to that action.⁸⁶ This standard requires the agency to undertake a rigorous exploration and an objective analysis of environmental impacts. Merely offering "general statements about 'possible' effects and 'some risk' do[es] not constitute a 'hard look' absent a justification regarding why more definitive information could not be provided."⁸⁷ Taking a hard look "foster[s] both informed decision-making and informed public participation," and thus ensures that the agency does not act upon "incomplete information, only to regret its decision after it is too late to correct."⁸⁸

NEPA's "hard look," however, is tempered by a "rule of reason."⁸⁹ According to the rule of reason, an agency need only address reasonably foreseeable impacts, not those that are

⁸⁴ 42 U.S.C. §§ 4321- 4370; 10 C.F.R. Part 51.

⁸⁵ 42 U.S.C. § 4332(2)(C).

⁸⁶ LES, CLI-98-3, 47 NRC 77, 87-88 (1998); see also Baltimore Gas & Electric Co. v. NRDC, 462 U.S. 87, 97-98 (1983) (holding that NEPA requires agencies to take a "hard look" at environmental consequences prior to taking major actions).

⁸⁷ Pa'ina Hawaii, LLC (Materials License Application), CLI-10-18, 72 NRC __, __ (slip op. at 21) (quoting Blue Mountains Biodiversity Project v. Blackwood, 161 F.3d 1208, 1213 (9th Cir. 1998)).

⁸⁸ LES, CLI-98-3, 47 NRC at 88 (quoting Marsh v. Oregon Natural Resources Council, 490 U.S. 360, 371 (1989)).

⁸⁹ Louisiana Energy Services, L.P. (National Enrichment Facility), LBP-06-8, 63 NRC 241, 258-59 (2006) (citing Long Island Lighting Co. (Shoreham Nuclear Power Station), ALAB-156, 6 AEC 831, 836 (1973)); see also Department of Transportation v. Public Citizen, 541 U.S. 752,

“remote and speculative” or “inconsequentially small.”⁹⁰ After all, NEPA only requires “reasonable forecasting.”⁹¹ As the Commission stated in Pilgrim:

There is no NEPA requirement to use the best scientific methodology, and NEPA “should be construed in the light of reason if it is not to demand” virtually infinite study and resources. Nor is an environmental impact statement intended to be a “research document,” reflecting the frontiers of scientific methodology, studies and data. . . . And while there “will always be more data that could be gathered,” agencies “must have some discretion to draw the line and move forward with decisionmaking.” In short, NEPA allows agencies “to select their own methodology as long as that methodology is reasonable.”⁹²

These NEPA principles apply to SAMDA analyses.⁹³ In judging the adequacy of a SAMDA analysis, the pertinent legal question becomes not whether “plainly better” SAMDA analysis assumptions or methodologies could have been employed, or whether a particular SAMDA analysis could have been refined further.⁹⁴ Rather, our inquiry is to ascertain whether “it looks genuinely plausible that inclusion of an additional factor or use of other assumptions or models may change the cost-benefit conclusions” for the SAMDA analysis.⁹⁵ The reason for this, in the Commission’s words, is that “[u]ltimately, NEPA requires the NRC to provide a ‘reasonable’ mitigation alternatives analysis, containing ‘reasonable’ estimates, including, where

767-69 (2004) (stating that the rule of reason is inherent in NEPA and its implementing regulations).

⁹⁰ See, e.g., Long Island Lighting Co. (Shoreham Nuclear Power Station, Unit 1), ALAB-156, 6 AEC 831, 836 (1973). According to the Council on Environmental Quality (CEQ), the “rule of reason” is “a judicial device to ensure that common sense and reason are not lost in the rubric of regulation.” Final Rule: National Environmental Policy Act Regulations; Incomplete or Unavailable Information, 51 Fed. Reg. 15,618, 15,621 (Apr. 25, 1986).

⁹¹ Scientists’ Institute for Public Information, Inc. v. AEC, 481 F.2d 1079, 1092 (D.C. Cir. 1973); see also Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 354-55, 359 (1989) (rejecting the notion that NEPA requires a “worst case analysis”).

⁹² Pilgrim, CLI-10-11, 71 NRC at 315-16 (citations omitted).

⁹³ See Id. at 315-16.

⁹⁴ See Id. at 315-16.

⁹⁵ See Id. at 316-17.

appropriate, full disclosures of any known shortcomings in available methodology, disclosure of incomplete or unavailable information and significant uncertainties, and a reasoned evaluation of whether and to what extent these or other considerations credibly could or would alter” the analysis on which SAMDAs are considered.⁹⁶

C. Supplementing Environmental Record

As the Commission recently reaffirmed, “[b]oards frequently hold hearings on contentions challenging the staff’s final environmental review documents . . . In such cases, ‘[t]he adjudicatory record and Board decision (and . . . any Commission appellate decisions) become, in effect, part of the FEIS.’”⁹⁷ In other words, Staff’s review (the FEIS itself) and the adjudicatory record become the pertinent environmental record of decision.⁹⁸ Our review of CL-2 therefore encompasses all pertinent environmental analyses properly before us.

IV. FACTUAL FINDINGS AND LEGAL CONCLUSIONS

A. Scope of CL-2

Contention CL-2 challenges the ER’s estimated replacement power costs used in Applicant’s SAMDA evaluation for STP Units 3 and 4. As admitted by the Board, Contention CL-2 states:

The Applicant’s calculation in ER Section 7.5S of replacement power costs in the event of a forced shutdown of multiple STP Units is erroneous because it underestimates replacement power costs and fails to consider disruptive impacts, including [Electric Reliability Council of Texas (“ERCOT”)] market price spikes.⁹⁹

⁹⁶ See Pilgrim, CLI-10-22, 72 NRC at ___ (slip op. at 9-10) (citations omitted); see also 10 C.F.R. § 51.53(c)(3)(L).

⁹⁷ Nuclear Innovation North America LLC (South Texas Project, Units 3 and 4) CLI-11-06, 74 NRC ___, ___ (slip op. at 7-8) (Sept. 9, 2011) (citing LES, CLI-98-3, 47 NRC at 89 and Philadelphia Electric Co. (Limerick Generating Station, Units 1 and 2), ALAB-819, 22 NRC 681, 705-07 (1985)).

⁹⁸ See, e.g., Pacific Gas and Electric Co. (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation), CLI-08-26, 68 NRC 509, 526 (2008), petition for review denied on other grounds, San Luis Obispo Mothers for Peace v. NRC, 635 F.3d 1109 (9th Cir. 2011).

⁹⁹ LBP-10-14, 72 NRC at ___ (slip op. at 30).

As pled by Intervenor, CL-2 challenges only certain economic considerations relevant to the ER's SAMDA analysis. Because the scope of a contention is limited to the issues of law and fact pled with particularity in the contention and any factual and legal material in support thereof,¹⁰⁰ CL-2 is limited to those certain economic considerations relevant to Intervenor's contention as-pled. Therefore, Intervenor's claim, that the ER section 7.5S.5 calculation of replacement power costs is deficient, encompasses the following arguments:¹⁰¹

1. Replacement power costs should be specific to the Electric Reliability Council of Texas (ERCOT) region.¹⁰²
2. Replacement power costs should account for the increase of ERCOT market prices due to the market effects of an STP outage.¹⁰³
3. Impacts on ERCOT consumers should have been evaluated.¹⁰⁴
4. The effects of price spikes should have been addressed.¹⁰⁵
5. The impacts of grid outages should have been addressed.¹⁰⁶

¹⁰⁰ Southern Nuclear Operating Company (Early Site Permit for Vogtle ESP Site), CLI-10-5, 71 NRC 90, 100 (2010); Duke Energy Corp. (McGuire Nuclear Station, Units 1 & 2; Catawba Nuclear Station, Units 1 & 2), CLI-02-28, 56 NRC 373, 379 (2002); see also Public Service Company of New Hampshire (Seabrook Station, Units 1 & 2), ALAB-899, 28 NRC 93, 97 & n.11 (1988) (stating that the "intervenor is not free to change the focus of its admitted contention, at will, as the litigation progresses"), aff'd in part and remanded in part on other matters, Massachusetts v. NRC, 924 F.2d 311 (D.C. Cir.) (1991), cert. denied, 502 U.S. 899 (1991).

¹⁰¹ Other challenges to the ER's Section 7.5S.5 SAMDA analysis are therefore beyond the scope of Contention CL-2 as either not in dispute or already resolved.

¹⁰² Motion on Co-Location Contention at 7-8 (as-filed Contention CL-2). Intervenor originally pled Contention CL-2 as three contentions, Contentions CL-2, CL-3, and CL-4, that the Board consolidated and reformulated.

¹⁰³ Id. at 8-9 (as-filed Contention CL-3).

¹⁰⁴ Id. at 9 (as-filed Contention CL-4).

¹⁰⁵ Id. at 9 (as-filed Contention CL-4).

¹⁰⁶ Id. at 9-10 (as-filed Contention CL-4).

Responding to Intervenors' arguments, Applicant and Staff raise several countervailing economic considerations—inflation rate, discount rate; and risk reduction—that are within the scope of this hearing on CL-2.

B. Evidentiary Record

1. Testimony

During the evidentiary hearing on CL-2, Applicant presented two witnesses, Jeffrey L. Zimmerly and Adrian Pieniasek, to testify on the SAMDA analysis performed in the ER, the revised analyses they performed, and the propriety of assumptions made therein and by Intervenors. Based on their respective qualifications in education and experience, Applicant's witnesses were found qualified to testify on CL-2.¹⁰⁷ Accordingly, the witnesses responded to the Board's questions at hearing and offered pre-filed testimony.¹⁰⁸

Staff presented three witnesses to testify on CL-2, Richard L. Emch, Jr., Jeremy P. Rishel, and David M. Anderson. Based on their respective qualifications in education and experience, Staff's witnesses were found qualified to testify on CL-2.¹⁰⁹ Accordingly, the witnesses responded to the Board's questions at hearing and offered pre-filed testimony.¹¹⁰

¹⁰⁷ Tr. at 1470; see Exh. STP000012 (Jeffrey L. Zimmerly Resume (May 9, 2011)) at 1; Exh. STP000002 (Adrian Pieniasek Resume (May 9, 2011)) at 1-2.

¹⁰⁸ Zimmerly/Pieniasek Direct Testimony; Exh. STP000030 ("Rebuttal Testimony of Applicant Witnesses Jeffrey L. Zimmerly and Adrian Pieniasek Regarding Contention CL-2" (May 31, 2011)) (Zimmerly/Pieniasek Rebuttal Testimony).

¹⁰⁹ Tr. at 1597; see Exh. NRC000005 (Statement of Professional Qualifications for Richard L. Emch, Jr.) at 1; Exh. NRC000006 (Statement of Professional Qualifications for Jeremy P. Rishel) at 1; Exh. NRC000007 (Statement of Professional Qualifications for David M. Anderson) at 1.

¹¹⁰ Emch/Rishel/Anderson Direct Testimony; Exh. NRC000058 ("Prefiled Rebuttal Testimony of Richard L. Emch, Jr., Jeremy P. Rishel, and David M. Anderson Regarding Contention CL-2" and "Affidavit of Richard L. Emch, Jr., Concerning Prefiled Rebuttal Testimony Regarding Contention CL-2" and "Affidavit of Jeremy P. Rishel Concerning Prefiled Rebuttal Testimony Regarding Contention CL-2" and "Affidavit of David M. Anderson Concerning Prefiled Rebuttal Testimony Regarding Contention CL-2.") (Emch/Rishel/Anderson Direct Testimony).

Intervenors presented one witness to testify regarding CL-2, Clarence Johnson. Based on his qualifications in education and experience, Intervenors' witness was found qualified to testify on CL-2,¹¹¹ although not specifically on issues related to nuclear engineering, such as the events at the Fukushima Dai-ichi plant, Core Damage Frequency (CDF) calculations, and the effectiveness of SAMDAs.¹¹² Accordingly, the witness responded to the Board's questions at hearing and offered pre-filed testimony.¹¹³

2. Documentary Exhibits

In support of its position on CL-2, Applicant offered the following exhibits: Exh. STP000002; Exhs. STP000011 through STP000013; Exh. STP000016; Exhs. STP000018 through STP000027; Exh. STP000030; and Exh. STP000031. These exhibits were admitted.¹¹⁴

Staff offered the following exhibits in support of its position on CL-2: Exh. NRC000001; Exh. NRC000002; Exhs. NRC00003A, NRC00003B, NRC00003C, and NRC00003D; Exhs. NRC000004 through NRC000007; Exhs. NRC00008A and NRC00008B; Exhs. NRC00009A and NRC00009B; Exhs. NRC000010 through NRC000030; and Exhs. NRC000058 through NRC000061. These exhibits were admitted.¹¹⁵

Intervenors offered the following exhibits in support of their position on CL-2: Exhs. INT000021 through INT000040; Exh. INTR20045; Exhs. INT000046 through INT000049; Exh.

¹¹¹ Tr. at 1553; Exh. INT000022 (Resume of Clarence L. Johnson) at 2.

¹¹² See Duke Energy Corporation (Catawba Nuclear Station, Units 1 and 2), CLI-04-21, 60 NRC 21, 27-28 (2004).

¹¹³ Johnson Direct Testimony; Exh. INTR20045 (Intervenor's rebuttal testimony of Clarence Johnson) (Johnson Rebuttal Testimony).

¹¹⁴ Tr. at 1456.

¹¹⁵ Tr. at 1450, 1452, 1459.

INTR00050; Exhs. INT000051 through INT000054; and Exh. INTR00055. These exhibits were admitted.¹¹⁶

C. Legal Analysis and Findings

To resolve Contention CL-2, the Board addresses the scaling of SAMDA implementation costs and benefits (averted replacement power costs), based on relevant economic considerations.

1. Scaling SAMDA Implementation Costs

a. Inflation Rate

Recitation of Evidence

The testimony of witnesses for Staff, Applicant, and Intervenors contain analyses and results in 2009 dollars.¹¹⁷ Yet, the SAMDA implementation costs presented in the ABWR TSD are in 1991 dollars.¹¹⁸ To perform an apples-to-apples analysis, each party offered evidence as to the proper method of scaling SAMDA implementation costs from 1991 dollars to 2009 dollars.

Staff presented Mr. Anderson, who testified that the proper index for scaling SAMDA costs for inflation is the Bureau of Economic Analysis' Gross Domestic Product Implicit Price Deflator (GDP-IPD) for Nonresidential Structures.¹¹⁹ Mr. Anderson testified that this index is appropriate "because SAMDAs relate to structural alternatives in plant design and the GDP deflators are more specific to private capital investment than other inflation indexes such as the

¹¹⁶ Tr. at 1461, 1468, 1515.

¹¹⁷ Zimmerly/Pieniazek Direct Testimony at 19; Emch/Rishel/Anderson Direct Testimony at 33-34; Johnson Direct Testimony at 15-16.

¹¹⁸ Exh. NRC00009B (Technical Support Document for the ABWR, attachment 1 to NEPA/SAMDA Submittal for the ABWR from J.F. Quirk to R.W. Borchardt (Dec. 21, 1994). NRC00009B begins on page 31 with "Attachment A: Evaluation of Potential Modifications to the ABWR Design.") at 47.

¹¹⁹ Emch/Rishel/Anderson Direct Testimony at 37.

Consumer Price Index or the Producer Price Index.”¹²⁰ Mr. Anderson also testified that the use of an inflation index based on personal consumption expenditures, as advocated by Intervenors, is not a valid approach to scaling SAMDA costs for inflation because such indices reflect retail inflation faced by persons and households, not inflation associated with large-scale capital expenditures like those of nuclear power plant construction.¹²¹ Relying on the GDP-IPD for Nonresidential Structures, Mr. Anderson scaled SAMDA costs for inflation by a factor of 2.25.¹²² Therefore, the cost of the lowest-cost SAMDA would be adjusted for inflation from \$100,000 in 1991 dollars to \$225,000 in 2009 dollars.¹²³

Applicant presented Mr. Pieniazek and Mr. Zimmerly to address the proper factor for scaling SAMDA costs to account for inflation.¹²⁴ Mr. Pieniazek and Mr. Zimmerly testified that SAMDA costs should be converted from 1991 dollars to 2009 dollars using a multiplication factor of 1.58 from the Consumer Price Index of the Bureau of Labor Statistics (CPI),¹²⁵ which scales the lowest-cost SAMDA to \$158,000 in 2009 dollars. Mr. Pieniazek and Mr. Zimmerly testified that use of the CPI is consistent with Office of Management and Budget (OMB) guidance in Circular A-94, “Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs”¹²⁶ and the approach used in the ABWR TSD.¹²⁷ However, Applicant’s witnesses

¹²⁰ Emch/Rishel/Anderson Direct Testimony at 37.

¹²¹ Emch/Rishel/Anderson Direct Testimony at 40 (citing Exh. NRC000021 (Bureau of Economic Analysis, NIPA Handbook: Chapter 5: Personal Consumption Expenditures (pages 5-1 to 5-3). (retrieved May 4, 2011)) at 5-2).

¹²² Emch/Rishel/Anderson Direct Testimony at 37 (citing Exh. NRC000018 (Bureau of Economic Analysis - National Economic Accounts National Income and Product Accounts Table; Table 1.1.9. Implicit Price Deflators for Gross Domestic Product. (retrieved Apr. 21, 2011)) tbl. 1.1.9).

¹²³ Emch/Rishel/Anderson Direct Testimony at 37.

¹²⁴ Zimmerly/Pieniazek Direct Testimony at 19.

¹²⁵ Zimmerly/Pieniazek Direct Testimony at 19.

¹²⁶ Issued by the White House’s Office of Management and Budget (OMB), Circular A-94 purports to “promote efficient resource allocation” for Federal decision-making by providing

agreed that Staff's index, the GDP-IPD for Nonresidential Structures, "is more specific to private capital investment" than the CPI or Intervenors' inflation index and that SAMDA implementation "likely would involve more manufacturing and construction activities, rather than consumer activities."¹²⁸ Applicant's witnesses agreed that Staff's index was reasonable.¹²⁹ According to Mr. Pieniazek and Mr. Zimmerly, Applicant used the CPI "to be more conservative, to use a more general inflation index, and to use the methodology consistent with the TSD."¹³⁰

Intervenors presented Mr. Johnson, who testified that the proper index for scaling SAMDA costs for inflation is Core Personal Consumption Expenditures (PCE) price index.¹³¹ Mr. Johnson testified that SAMDA costs should be converted from 1991 dollars to 2009 dollars using a multiplication factor of 1.437 from the Core PCE index.¹³² According to Mr. Johnson the Core PCE index excludes volatile indexing factors that are considered by the GDP-IPD and CPI.¹³³ The Core PCE would escalate the lowest-cost SAMDA to \$143,700 in 2009 dollars.¹³⁴

In rebuttal, Mr. Johnson testified that although he could "understand the Staff's view that household consumer inflation should be excluded from the escalation index" and that the GDP-IPD for Nonresidential Structures would "be appropriate for inflating the overall total costs of a plant or building," it was his opinion that Staff had not demonstrated the individual SAMDA

guidance for conducting cost-benefit analyses. Exh. STP000016 (OMB Circular A-94, "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs" (1992)) at 2-3.

¹²⁷ Zimmerly/Pieniazek Direct Testimony at 19 (citing Exh. NRC00009B at 47).

¹²⁸ Zimmerly/Pieniazek Direct Testimony at 22-23.

¹²⁹ Zimmerly/Pieniazek Direct Testimony at 22-23.

¹³⁰ Zimmerly/Pieniazek Direct Testimony at 22-23.

¹³¹ Johnson Direct Testimony at 15-16.

¹³² Johnson Direct Testimony at 16.

¹³³ Johnson Direct Testimony at 15-16.

¹³⁴ Johnson Direct Testimony at 16.

projects are composed of costs appropriately compared to the GDP-IPD for Non-residential Structures.¹³⁵ According to Mr. Johnson, perhaps another GDP-IPD would be more appropriate, such as the Equipment and Software index or the Private Investment index.¹³⁶ At the evidentiary hearing Mr. Johnson suggested that GDP-IPD for Private Investment, which includes both non-residential structures and equipment and software, was “probably preferable.”¹³⁷ However, Mr. Johnson did not perform any calculations using this index.¹³⁸

At the evidentiary hearing Applicant’s witnesses testified that the implementation costs of a SAMDA would include the following cost components: (1) engineering design and analysis, (2) procurement, (3) manufacturing, (4) shipping, (5) developing and implementing procedures, (6) quality assurance (QA), and (7) regulatory approval by the NRC.¹³⁹ According to Mr. Zimmerly, the GDP-IDP for Nonresidential Structures would likely be more appropriate than either the CPI or the Core PCE for addressing the inflation of these cost components.¹⁴⁰ Mr. Johnson testified that for those seven cost components, a consumer expenditure index would not be the most appropriate inflation index,¹⁴¹ however, Mr. Johnson also testified that he did not specifically know the breakdown of each SAMDA in terms of each of these cost components.¹⁴²

Mr. Anderson testified that Staff witnesses chose the non-residential structures index because this index applies to “major construction activities. . . . [w]hich are identified there, such

¹³⁵ Johnson Rebuttal Testimony at 6.

¹³⁶ Johnson Rebuttal Testimony at 6-7.

¹³⁷ Tr. at 1581.

¹³⁸ Tr. at 1590.

¹³⁹ Tr. at 1480-81.

¹⁴⁰ Tr. at 1482-83.

¹⁴¹ Tr. at 1580-81; see also id. at 1590 (Mr. Johnson: “I think there is merit to saying that the index should not be a consumer index and that it should be an investment index”).

¹⁴² Tr. at 1582.

as . . . additions, alterations, structural replacements, pipelines, railroad tracks, power lines and plants, dams and levies. Large industrial construction.”¹⁴³ For this reason, Mr. Anderson concluded that the Non-residential Structures index was the most relevant available index.¹⁴⁴ In addition, Mr. Anderson testified that because SAMDAs are alternatives to plant design that affect the entire project, SAMDAs should be viewed in the context of the overall project construction.¹⁴⁵ Finally, Mr. Anderson testified that the GDP-IPD Nonresidential Structures index covers the following components of SAMDA costs: design, procurement, installation, procedures, quality assurance, and licensee activities for regulatory approvals.¹⁴⁶

Legal Analysis and Findings

The Board finds that the GDP-IPD for Nonresidential Structures is a reasonable scaling factor for the inflation of SAMDA implementation costs.¹⁴⁷ The GDP-IPD for Nonresidential Structures is the most specific index applicable to the cost components of SAMDA implementation and is a more appropriate scaling factor than the personal consumption indices the Intervenor and Applicant propose, i.e., the Core-PCE and CPI. Although personal consumption indices are conservative when applied to scaling SAMDA implementation costs, witnesses for both Applicant and Intervenor conceded that a private investment index is better

¹⁴³ Tr. at 1613; see also Exh. NRC000022 (Bureau of Economic Analysis, NIPA Handbook: Chapter 6: Private Fixed Investment (pages 6-1 to 6-3) (retrieved May 2, 2011)) at 6-3 (enumerating the items included within “Structures” at Row 1 of Table 6.1).

¹⁴⁴ Tr. at 1613.

¹⁴⁵ Tr. at 1608.

¹⁴⁶ Tr. at 1627.

¹⁴⁷ Regardless of this conclusion, Applicant demonstrated that no SAMDA is cost-beneficial even if inflation is scaled by the Core PCE index favored by the Intervenor along with Intervenor’s other preferred assumptions. Applicant’s witnesses inflated SAMDA implementation costs with a factor of 1.31, encompassing both the Core-PCE price index and a regional cost-of-living index for the area, as suggested by Mr. Johnson. Doing so, Applicant’s witnesses testified, did not change the conclusion that no SAMDAs are cost-beneficial. Zimmerly/Pieniazek Direct Testimony at 22; see also Emch/Rishel/Anderson Direct Testimony at 38-39 (Anderson Testimony).

for inflating SAMDA costs than a consumer index. Furthermore, witnesses for both Applicant and Staff testified that the Nonresidential Structures index covered the various cost components of the SAMDAs. Mr. Johnson did not contradict this testimony. Instead, Mr. Johnson conceded that he did not specifically know the breakdown of each SAMDA in terms of these cost components, and he was uncertain, based on the definition of the indices, whether SAMDA cost components appropriately fit under the Nonresidential Structures index or the Equipment and Software index. Therefore, the Board finds that the lowest-cost SAMDA is reasonably scaled for inflation from \$100,000 in 1991 dollars to \$225,000 in 2009 dollars.

b. Regional Cost-of-Living Adjustment

Recitation of Evidence

In addition to scaling for inflation, Intervenors' witness, Mr. Johnson testified that SAMDA implementation costs should also be adjusted to reflect local variations in the cost of living.¹⁴⁸ Mr. Johnson testified that it was appropriate to account for region-specific costs because "[e]ven if one assumes that materials and equipment are purchased outside the region or locality, local labor costs will be incurred; and salary and wage rates vary by region."¹⁴⁹ To adjust for cost of living differences, Mr. Johnson testified that SAMDA implementation costs should be multiplied by the ACCRA¹⁵⁰ cost of living index for the Houston area, 90.7%.¹⁵¹

In response, Applicant's witnesses, Mr. Zimmerly and Mr. Pieniazek, disagreed with this scaling because "SAMDAs generally involve components that can be manufactured anywhere

¹⁴⁸ Johnson Direct Testimony at 17.

¹⁴⁹ Johnson Rebuttal Testimony at 15.

¹⁵⁰ American Chamber of Commerce Research Association (now Council for Community and Economic Research).

¹⁵¹ Johnson Direct Testimony at 17-18 (citing Exh. INT000027 (ACCRA Cost of Living Index, Comparative Date for 322 Urban Areas, 2009 Annual (excerpt))).

in the United States, not just in the region of Texas in which the plant is located.”¹⁵² Moreover, Mr. Zimmerly’s and Mr. Pieniazek’s testified that the TSD already conservatively used lower bounding costs, such that any regional cost differences would already be accounted for in their analysis.¹⁵³

Staff’s witness, Mr. Anderson, also disagreed with the Intervenors’ cost-of-living adjustment. Mr. Anderson testified that the ACCRA cost of living index, on which Intervenors rely, is based on data that “have been carefully chosen to reflect the different categories of consumer expenditures.”¹⁵⁴ Rather, Mr. Anderson testified, “SAMDA’s are design modifications to a nuclear power station and would not be represented by items typically purchased by persons or households.”¹⁵⁵

Legal Analysis and Findings

The Board finds that it was reasonable for Applicant and Staff to omit a region-specific cost of living adjustment in performing their SAMDA analyses of STP Units 3 and 4. As Applicant witnesses testified, the TSD already uses lower bound costs, thus encompassing price variations in the cost components of SAMDA’s—whatever the source of the price variation. And as Staff witness testified, the cost of living index used by the Intervenors applies to consumer expenditures, not private capital expenditures. At the evidentiary hearing, Intervenors conceded that a consumer inflation index should not apply to SAMDA costs,¹⁵⁶ and could offer no reason for applying a consumer-based cost of living index. Further, Applicant’s witnesses

¹⁵² Zimmerly/Pieniazek Direct Testimony at 20-21.

¹⁵³ Zimmerly/Pieniazek Direct Testimony at 21 citing (Exh. NRC00009B at 47-52).

¹⁵⁴ Emch/Rishel/Anderson Rebuttal Testimony at 3 (citing Exh. NRC000059 (The Council for Community and Economic Research, “About the ACCRA Cost Of Living Index” (retrieved on May 23, 2011))).

¹⁵⁵ Emch/Rishel/Anderson Rebuttal Testimony at 3.

¹⁵⁶ Tr. at 1590.

testified that SAMDAs generally involve components that can be manufactured anywhere in the United States, and so SAMDA implementation costs would not be subject to the consumer-based, region-specific cost of living differences that Intervenors sought. We agree.

c. Risk Reduction Factor

Recitation of Evidence

As described above,¹⁵⁷ the ER's SAMDA screening analysis compares the maximum averted cost offered by the SAMDA to the costs of implementing the SAMDA. The maximum averted cost used in that analysis assumes that each SAMDA would eliminate all risk of a severe accident.¹⁵⁸ Staff and Applicant witnesses, Mr. Emch, Mr. Rishel and Mr. Zimmerly, testified that the ER's approach in this regard is conservative because "no one design change can address all possible accident sequences and reduce total accident frequency to zero."¹⁵⁹ A more refined SAMDA analysis would, according to Staff witnesses, examine the PRA to estimate the actual risk-reduction expected as a result of implementing each SAMDA.¹⁶⁰ Both Applicant and Staff presented testimony addressing the effectiveness of the SAMDAs at reducing the risk of severe accidents. Intervenors did not controvert these new analyses. Rather, Intervenors' witness, Mr. Johnson, suggested more broadly that the TSD's SAMDA analysis should be revised from scratch, using up-to-date cost estimates and information gained since the ABWR TSD was published, including the Fukushima Dai-Ichi accident.¹⁶¹ Mr. Johnson also disputed the method employed by Applicant and Staff in accounting for the

¹⁵⁷ Supra, section II.B.

¹⁵⁸ Zimmerly/Pieniazek Direct Testimony at 23-24; Emch/Rishel/Anderson Direct Testimony at 10.

¹⁵⁹ Emch/Rishel/Anderson Direct Testimony at 10; see also Zimmerly/Pieniazek Direct Testimony at 24.

¹⁶⁰ Emch/Rishel/Anderson Direct Testimony at 65.

¹⁶¹ Johnson Rebuttal Testimony at 17-18.

SAMDAs' actual risk reduction with Core Damage Frequency by asserting that Applicant and Staff did not support their analyses, and that Intervenors were not afforded an effective opportunity to respond to those analyses.¹⁶²

Witnesses for Applicant and Staff took slightly different approaches to identify the SAMDA that comes closest to being cost-beneficial. However, their approaches were substantively similar. Applicant viewed the risk reduction factor as increasing the cost of a SAMDA, whereas Staff viewed the risk reduction factor as decreasing the benefit of a SAMDA.

Mr. Emch and Mr. Rishel for Staff reduced the benefit (averted costs) of SAMDAs to account for the percent reduction in Core Damage Frequency achieved by the SAMDA, then selected the SAMDA that came closest to being cost-beneficial among all SAMDAs.¹⁶³

According to Staff witnesses, SAMDAs that do not reduce Core Damage Frequency should not be credited with averting onsite costs—which include replacement power costs.¹⁶⁴ This practice is consistent with that of the ABWR design certification, which estimated averted onsite costs only for SAMDAs that reduced Core Damage Frequency.¹⁶⁵ SAMDAs that reduce Core Damage Frequency are preventive, while SAMDAs that do not reduce Core Damage Frequency are mitigative.¹⁶⁶ Mr. Emch testified that preventive SAMDAs are intended to prevent core damage, and if core damage occurs, any resulting shutdown would be substantially longer.¹⁶⁷ On the other hand, Mr. Emch stated that mitigative SAMDAs “reduce[] the amount of radioactive

¹⁶² Johnson Rebuttal Testimony at 17.

¹⁶³ Emch/Rishel/Anderson Direct Testimony at 66-69.

¹⁶⁴ Emch/Rishel/Anderson Direct Testimony at 67.

¹⁶⁵ Emch/Rishel/Anderson Direct Testimony at 16, 19 (citing NRC00009B at 33).

¹⁶⁶ Emch/Rishel/Anderson Direct Testimony at 16.

¹⁶⁷ Tr. at 1641-42.

material . . . released.”¹⁶⁸ In Mr. Emch’s words, this means mitigative SAMDAs would beneficially affect “public exposure, property damage, occupational exposure and in reality, cleanup and decontamination, even though the equations don’t show that.”¹⁶⁹ Regardless, Mr. Emch testified that the “overwhelming[] . . . contributor” to the averted cost is replacement power, and for a SAMDA to reduce this cost, the SAMDA would need to reduce Core Damage Frequency.¹⁷⁰

Based on the TSD, Staff calculated the Core Damage Frequency reduction of each SAMDA. For SAMDAs that did not avert onsite costs, including replacement power costs, Staff assigned a Core Damage Frequency reduction of zero.¹⁷¹ Linking these Core Damage Frequency reduction values to their respective SAMDAs, Staff’s witnesses testified that the lowest-cost SAMDAs (those deemed most cost-beneficial from the screening test) do not reduce Core Damage Frequency.¹⁷² Instead, Staff’s witnesses determined that higher-cost SAMDAs reduce accident frequency, thus offering greater benefit for their cost.¹⁷³ Staff concluded that SAMDA 9b (Alternate Pump Power Source), with a cost of \$2,686,500 (2009 dollars), is the SAMDA that is the closest to being cost-beneficial. It has a cost-benefit ratio of 29.3, whereas a cost-beneficial SAMDA would have a ratio less than 1.0.¹⁷⁴ Staff calculated that SAMDA 9b reduces Core Damage Frequency by 52.0%, and therefore Staff credited it with

¹⁶⁸ Tr. at 1642.

¹⁶⁹ Tr. at 1643.

¹⁷⁰ Tr. at 1643.

¹⁷¹ Emch/Rishel/Anderson Direct Testimony 15-19, 66 (Emch and Rishel Testimony).

¹⁷² Emch/Rishel/Anderson Direct Testimony at 66 (Emch and Rishel Testimony).

¹⁷³ Emch/Rishel/Anderson Direct Testimony at 66-69 (Emch and Rishel Testimony).

¹⁷⁴ Emch/Rishel/Anderson Direct Testimony at 67 (Emch and Rishel Testimony).

averting onsite costs by \$91,586, and offsite costs by \$45, leading to a total of \$91,631 in averted costs (2009 dollars).¹⁷⁵

Instead of addressing the Core Damage Frequency reduction of each SAMDA, Applicant addressed the Core Damage Frequency reduction of SAMDAs with TSD costs of up to and including \$750,000 in 1991 dollars. According to Applicant witness, Mr. Zimmerly, the ABWR TSD provides the reduction of Core Damage Frequency for many of the ABWR SAMDAs.¹⁷⁶ The lowest-cost SAMDA for which the TSD does not provide Core Damage Frequency reduction information is SAMDA 3d (Improved Bottom Head Penetration Design), at \$750,000 in 1991 dollars.¹⁷⁷ Mr. Zimmerly testified that according to the TSD each SAMDA costing less than \$750,000 reduces Core Damage Frequency by only a small fraction—at most, a 14% reduction in Core Damage Frequency (for SAMDA 2b that costs \$598,600 in 1991 dollars), while the remaining SAMDAs effected a reduction of less than 10%.¹⁷⁸ Thus, after considering risk reduction, Mr. Zimmerly testified that all SAMDAs have a risk-adjusted cost higher than \$750,000 in 1991 dollars.¹⁷⁹ On that basis, Mr. Zimmerly testified that the risk-adjusted lowest-cost SAMDA is bounded by the cost of SAMDA 3d, and that the cost for SAMDA 3d conservatively does not account for any risk reduction itself.¹⁸⁰ Even scaling from 1991 to 2009

¹⁷⁵ Emch/Rishel/Anderson Direct Testimony at 66-69 (Emch and Rishel Testimony).

¹⁷⁶ The TSD did not go further and address all risk reduction factors because, according to the testimony of Mr. Zimmerly, the TSD did not identify any cost-effective SAMDAs even after conservatively assuming that each SAMDA would reduce the severe accident risk to zero, i.e., the TSD did not need to account for the actual risk reduction. Zimmerly/Pieniazek Direct Testimony at 24.

¹⁷⁷ Zimmerly/Pieniazek Direct Testimony at 24.

¹⁷⁸ Zimmerly/Pieniazek Direct Testimony at 25-26.

¹⁷⁹ Zimmerly/Pieniazek Direct Testimony at 27.

¹⁸⁰ Zimmerly/Pieniazek Direct Testimony at 27.

dollars with Intervenor's preferred factor of 1.31, as Mr. Zimmerly testified, results in bounding the lowest risk-adjusted cost SAMDA in 2009 dollars (SAMDA 3d) at \$982,500.¹⁸¹

Applicant's witnesses, Mr. Zimmerly and Mr. Pieniazek, testified in rebuttal about the different conclusions reached by Applicant and Staff as to which SAMDA came closest to being cost-beneficial: Applicant identified SAMDA 3d (Improved Bottom Head Penetration Design), whereas Staff identified SAMDA 9b (Alternate Pump Power Source).¹⁸² Applicant's witnesses, testified that they took a conservative lower bounding approach by identifying SAMDA 3d and did not examine SAMDAs with costs as high as SAMDA 9b (\$2,686,500 in 2009 dollars).¹⁸³ In contrast to Staff's treatment, Applicant's witnesses testified that they did not assume zero Core Damage Frequency reduction for mitigative SAMDAs. Instead Applicant conservatively assumed complete risk reduction (including for SAMDA 3d).¹⁸⁴ Despite these differences, Applicant's witnesses testified that "[they] agree with the rationale in the [Staff] Direct Testimony for selecting SAMDA 9b as the SAMDA that is closest to being cost beneficial."¹⁸⁵

Legal Analysis and Findings

We find that Applicant and Staff have reasonably accounted for the risk reduction offered by individual SAMDAs, rather than assuming that each SAMDA completely prevents all severe accidents. For their respective analyses, Staff and Applicant used the SAMDA identities and costs from the ABWR TSD, which was reviewed and approved by the NRC during the ABWR design certification rulemaking. Additionally, Staff's and Applicant's approach to mitigative versus preventive SAMDAs follows that taken in the ABWR TSD. Quantitatively, Staff showed

¹⁸¹ Zimmerly/Pieniazek Direct Testimony at 27.

¹⁸² Zimmerly/Pieniazek Direct Testimony Rebuttal Testimony at 7-8.

¹⁸³ Zimmerly/Pieniazek Direct Testimony Rebuttal Testimony at 7.

¹⁸⁴ Zimmerly/Pieniazek Direct Testimony Rebuttal Testimony at 7.

¹⁸⁵ Zimmerly/Pieniazek Direct Testimony Rebuttal Testimony at 7-8.

that the cost of a severe accident is principally driven by replacement power. If a SAMDA merely mitigated instead of prevented core damage the dominant cost of replacement power would not be significantly reduced. Therefore, rather than focusing on mitigative SAMDAs, Staff and Applicant reasonably focused on preventive SAMDAs and their reduction on Core Damage Frequency as a proxy for risk reduction. The Board finds that the SAMDA that comes closest to being cost-effective with this approach is SAMDA 9b with a cost of \$2,686,500 (2009 dollars), as shown by Staff, agreed to by Applicant, and uncontested by the Intervenors. Applicant's original estimate bounds this value by suggesting a lowest risk-adjusted cost SAMDA in 2009 dollars (SAMDA 3d) at \$982,500, even adopting Intervenors' cost scaling factors.

Finally, instead of controverting the evidence of Staff and Applicant on risk reduction or offering their own preferred approach, Intervenors suggested more broadly that the TSD's SAMDA analysis should be revised from scratch to include updated cost estimates and information gained from such events as the Fukushima Dai-Ichi accident. However, issues related to the identity and costs of SAMDAs (except for escalation of costs from 1991 dollars to current dollars) are not relevant to Contention CL-2, which pertains specifically to replacement power costs. Moreover, Intervenors' argument merely challenges the ABWR design certification, wherein the ABWR TSD identifies the SAMDAs and their costs in 1991 dollars. As such, the challenge is impermissible.¹⁸⁶ Intervenors also contend that Applicant and Staff did not support their analyses and did not justify use of Core Damage Frequency reduction to account for risk reduction. Intervenors also claim they did not have an effective opportunity to respond to those analyses. We disagree. Based on our preceding analyses, we find that Staff and Applicant have supported their SAMDA analyses, including use of Core Damage Frequency

¹⁸⁶ See 10 C.F.R. § 2.335; see also 10 C.F.R. § 52.63(a)(5) (providing that in making its COL findings, the Commission will treat as resolved those matters resolved in the issuance of a design certification rule).

for risk reduction. Intervenors could have affirmatively rebutted the use of risk reduction with rebuttal testimony and evidence, but they did not.

2. Scaling SAMDA Implementation Benefits (Averted Replacement Power Costs)

Contention CL-2 concerns the Intervenors' claim that the replacement power costs calculations in ER Section 7.5S.5 are deficient because they rely on a generic value from NUREG/BR-0184 instead of (1) using ERCOT prices, (2) accounting for market effects, (3) accounting for consumer impacts, (4) accounting for price spike impacts, and (5) accounting for grid outages. The parties presented evidence addressing each of these factors. As explained below, we find that Applicant and Staff reasonably accounted for all five economic factors, and demonstrated that there are no cost-beneficial SAMDAs.

a. Discount Rate

Recitation of Evidence

The postulated severe accident underlying CL-2 may occur any time during the 40-year lifetime of STP Units 3 and 4. Therefore there is a 40-year timeframe within which replacement power must be purchased. In order to determine the net present value of replacement power costs across that timeframe, Applicant and Staff witnesses applied a discount rate to the future replacement power costs.¹⁸⁷

To obtain the present value of future cash flows, it is necessary to apply a discount rate. A discount rate is used for two reasons: (1) because resources that are invested will normally earn a positive return, current consumption will be more expensive than future consumption, i.e., an investor is giving up an expected return on investment, and (2) postponed benefits have

¹⁸⁷ Zimmerly/Pieniazek Direct Testimony at 10-12 (Zimmerly Testimony); Emch/Rishel/Anderson Direct Testimony at 27-30, 42 (Emch, Rishel, and Anderson Testimony).

a cost because people generally prefer present consumption to future consumption.¹⁸⁸ The higher the discount rate, the lower is the present value of future cash flows. While witnesses for all parties agreed that it is appropriate to apply a discount rate in calculating replacement power costs,¹⁸⁹ they disagreed on which discount rate should be applied. Applicant's witness, Mr. Zimmerly, used a long-term 7% discount rate, with a 3% discount rate for sensitivity analysis.¹⁹⁰ Staff's witness, Mr. Anderson, also testified that use of a 7% discount rate, with a 3% discount rate as sensitivity analysis, is appropriate.¹⁹¹ Intervenor's witness, Mr. Johnson, claimed that only a 3% discount rate should be used.¹⁹²

Both Staff's and Applicant's witnesses, Mr. Anderson and Mr. Zimmerly respectively, testified that the NRC and other government agencies generally discount future costs with a 7% discount rate.¹⁹³ As these witnesses testified, NUREG/BR-0184 Section 5.7 states that a 7% discount rate, and 3% discount rate sensitivity analysis, should be used.¹⁹⁴ This approach is also consistent with OMB guidance in Circular A-94.¹⁹⁵

¹⁸⁸ Exh. NRC000060 (Office of Management and Budget Circular A-4, "Regulatory Analysis" (Sept. 17, 2003) (retrieved on May 17, 2011)) at 31-32; Exh. STP000016 at 4; Tr. 1573-76 (Johnson Testimony).

¹⁸⁹ E.g., Zimmerly/Pieniasek Direct Testimony at 10-12 (Zimmerly Testimony); Emch/Rishel/Anderson Direct Testimony at 27. 30 (Emch and Rishel Testimony); Johnson Direct Testimony at 18-19 (Johnson Testimony).

¹⁹⁰ Zimmerly/Pieniasek Direct Testimony at 10-11.

¹⁹¹ Tr. at 1624; Emch/Rishel/Anderson Rebuttal Testimony at 3-4.

¹⁹² Johnson Direct Testimony at 18-19.

¹⁹³ Emch/Rishel/Anderson Rebuttal Testimony at 4; Zimmerly/Pieniasek Direct Testimony at 11; Exh. NRC000010 (NUREG/BR-0058, Rev. 4, Analysis Guidelines of the U.S. Nuclear Regulatory Commission (Sept. 2004)) at 32.

¹⁹⁴ Zimmerly/Pieniasek Direct Testimony at 11; Exh. STP000016; Emch/Rishel/Anderson Rebuttal Testimony at 4-6; Exh. NRC00008B at 5.21.

¹⁹⁵ Zimmerly/Pieniasek Direct Testimony at 11; Emch/Rishel/Anderson Rebuttal Testimony at 4-6; Exh. NRC00008B at 5.21; Exh. STP000016 at 9.

Further, Mr. Anderson testified that OMB recommends a 7% discount rate to reflect “the opportunity cost of private capital (pre-tax expected return on investment in lieu of undertaking the project).”¹⁹⁶ As Mr. Anderson testified, a 7% discount rate is appropriate for SAMDA implementation because SAMDAs are design alternatives “that would be purchased using private (the [A]pplicant’s) capital construction funding.”¹⁹⁷ He also testified that he did not object to the OMB guidance suggesting 3% as the societal rate of return for comparative purposes in a sensitivity analysis.¹⁹⁸

Intervenors suggest the only correct discount rate is 3%. Intervenors’ witness, Mr. Johnson, testified that a 3% discount rate is appropriate because OMB performs cost-effectiveness analysis using discount rates that are based upon Treasury Bills, which are in the 3% range.¹⁹⁹ Mr. Johnson also testified that, because Applicant is seeking a DOE loan guarantee to finance STP Units 3 and 4, a discount rate below normal interest rates for corporate borrowing is appropriate.²⁰⁰

In rebuttal, Mr. Anderson rejected Mr. Johnson’s claim that a SAMDA analysis is a cost-effectiveness analysis, which would render a 3% discount rate erroneous. Mr. Anderson testified that because all of the costs and benefits are monetized in a SAMDA analysis, it is a true cost-benefit analysis—as opposed to a cost-effectiveness analysis, where some costs or benefits have not been monetized.²⁰¹ Mr. Zimmerly’s and Mr. Pieniazek’s testimony, for Applicant, supported this point, indicating that OMB defines “cost-effectiveness” as “[a]

¹⁹⁶ Emch/Rishel/Anderson Rebuttal Testimony at 5 (citing Exh. NRC000060 at 33).

¹⁹⁷ Emch/Rishel/Anderson Rebuttal Testimony at 5.

¹⁹⁸ Emch/Rishel/Anderson Rebuttal Testimony at 6.

¹⁹⁹ Johnson Direct Testimony at 18-19.

²⁰⁰ Johnson Direct Testimony at 19.

²⁰¹ Emch/Rishel/Anderson Rebuttal Testimony at 6.

systematic quantitative method for comparing the costs of alternative means of achieving the same stream of benefits or a given objective.”²⁰² Mr. Zimmerly and Mr. Pieniasek testified that a SAMDA analysis does not meet this definition of “cost effectiveness” because it does not compare alternatives against each other using the same stream of benefits; instead, it evaluates the costs and benefits of each SAMDA.²⁰³

Both Applicant and Staff witnesses presented testimony rebutting Mr. Johnson’s statements that, because STP Units 3 and 4 may be funded via DOE loan guarantee, a 3% discount rate should be used. Applicant’s witnesses, Mr. Zimmerly and Mr. Pieniasek, testified that the DOE loan guarantee for financing construction is not relevant to the discount rate for the SAMDA analysis.²⁰⁴ According to Applicant’s witnesses, the SAMDA analysis does not use the discount rate to calculate the cost of implementing SAMDAs (those costs are fixed by the TSD and escalated from 1991 dollars to current dollars).²⁰⁵ Instead, the SAMDA analysis for STP Units 3 and 4 uses the discount rate to calculate the net present value of future replacement power costs.²⁰⁶ As a result, Applicant’s witnesses testified that the replacement power costs (and the discount rate for replacement power costs) are independent of the rate of the DOE loan guarantee for financing construction.²⁰⁷ For Staff, Mr. Anderson testified that Mr. Johnson failed to explain why a federal loan guarantee for plant construction translates into a 3% rate for discounting replacement power costs.²⁰⁸

²⁰² Zimmerly/Pieniasek Rebuttal Testimony at 16 (citing Exh. STP000016 at 18).

²⁰³ Zimmerly/Pieniasek Rebuttal Testimony at 16.

²⁰⁴ Zimmerly/Pieniasek Rebuttal Testimony at 16.

²⁰⁵ Zimmerly/Pieniasek Rebuttal Testimony at 16.

²⁰⁶ Zimmerly/Pieniasek Rebuttal Testimony at 16.

²⁰⁷ Zimmerly/Pieniasek Rebuttal Testimony at 16.

²⁰⁸ Emch/Rishel/Anderson Rebuttal Testimony at 6.

Legal Analysis and Findings

The Board finds that Staff and Applicant have reasonably employed discount rates—using a long-term 7% discount rate and a 3% discount rate as part of a sensitivity analysis—in accordance with established guidance from OMB and the NRC. Discounting reflects the opportunity cost for using funds that could otherwise be invested elsewhere. Because Applicant would be paying for the SAMDA (private construction and implementation costs) to offset the discounted replacement power costs, we agree with Staff that a private rate of return is appropriate to reflect Applicant’s lost opportunity cost. Moreover, Mr. Johnson’s testimony that the SAMDA analysis should be considered a cost-effectiveness analysis rather than a cost-benefit analysis is not convincing. As Applicant’s witnesses testified, and we conclude, a SAMDA analysis does not compare alternatives against each other using the same stream of benefits; instead, a SAMDA analysis evaluates the costs and benefits of each SAMDA individually. That is, all cost-beneficial SAMDAs would be implemented, not just the most cost-effective ones.

b. ERCOT Pricing Data

Recitation of Evidence

At its heart, the ER used methodology from NUREG/BR-0184 to calculate replacement power costs (\$310,000 per day for a 910 MWe power plant in 1993 dollars).²⁰⁹ The replacement power costs were then scaled by other factors to arrive at a total averted cost for the SAMDA cost-benefit comparison.²¹⁰

Intervenors’ witness, Mr. Johnson, testified that, rather than using the values in NUREG/BR-0184 to calculate replacement power costs, the ER should have used actual pricing

²⁰⁹ Exh. STP000013 at 7.5S-6; see also Exh. NRC00008B at 5.51.

²¹⁰ Exh. STP000013 at 7.5S-6.

data specific to the ERCOT region.²¹¹ Mr. Johnson testified that NUREG/BR-0184 premises its estimates of replacement power costs for a regulated utility market, whereas the Texas market is deregulated.²¹² Moreover, the ERCOT region, unlike any other, has limited interconnections to other power pools, thus sensitizing it to significant capacity outages and fixing the cost of replacement power to the cost of natural gas power, rather than the more commonly used standard of coal power.²¹³

Rather than relying purely on the replacement power costs of NUREG/BR-0184, both Applicant and Staff witnesses reanalyzed replacement power costs using actual ERCOT prices.²¹⁴ Mr. Johnson testified that this reanalysis was insufficient because Applicant and Staff used 2009 ERCOT market prices, and instead should have used 2008 ERCOT market prices. According to Mr. Johnson, 2009 ERCOT market prices understate forward looking natural gas prices because (1) 2009 market prices were the lowest since 2001, and (2) 2009 market prices reflected the recession conditions of the time.²¹⁵ In contrast, Mr. Johnson testified that 2008 ERCOT market prices are most appropriate because they approach the long-term forecasts of escalating natural gas prices for the life of the proposed units.²¹⁶

Applicant's witness, Mr. Pieniasek, testified that he used ERCOT pricing data from 2009 and 2010 to reanalyze the cost of replacement power.²¹⁷ Mr. Pieniasek testified that he chose data from these years as being representative of future power prices because—recognizing that

²¹¹ Johnson Direct Testimony at 7-8.

²¹² Johnson Direct Testimony at 7-8.

²¹³ Johnson Direct Testimony at 7-8.

²¹⁴ Zimmerly/Pieniasek Direct Testimony at 32 (Pieniasek Testimony); Emch/Rishel/Anderson Direct Testimony at 44-45 (Anderson Testimony).

²¹⁵ Johnson Rebuttal Testimony at 9-10.

²¹⁶ Johnson Rebuttal Testimony at 10-11.

²¹⁷ Zimmerly/Pieniasek Direct Testimony at 33-34 (noting the prices were very similar).

ERCOT's energy prices have been closely correlated to the price of natural gas—recent developments in shale gas formations have pushed down forecasts for natural gas energy prices in the 2026 to 2035 timeframe.²¹⁸ Mr. Pieniazek testified that ERCOT energy prices for 2009 and 2010 are representative of stable and relatively low energy prices in the foreseeable future, and that this is an outlook shared by U.S. Energy Information Administration.²¹⁹

Mr. Pieniazek testified that these ERCOT prices for 2009-2010 did not alter the ER's original SAMDA conclusion that the averted costs from implementing any SAMDA would be well below the cost of the SAMDA itself.²²⁰ Moreover, Mr. Pieniazek, for Applicant, and Mr. Anderson, for Staff, testified that they also looked to 2008 ERCOT pricing data, for a bounding analysis. The average price of electricity in the ERCOT market in 2008 was approximately \$80 per MWh, which is more than twice the price in 2009-2010.²²¹ As Mr. Pieniazek testified, the elevated 2008 energy prices were attributable to significant transmission congestion, and the inefficient way by which congestion was relieved in ERCOT's zonal market structure, coupled with relatively high natural gas prices.²²² However, Mr. Pieniazek testified that even after using the 2008 ERCOT data, a substantial margin remained between the averted costs from the SAMDAs and the cost of the SAMDAs.²²³ Staff's witness, Mr. Anderson, agreed that even accounting for the anomalous 2008 ERCOT prices does not lead to a cost-beneficial SAMDA.²²⁴

²¹⁸ Zimmerly/Pieniazek Direct Testimony at 34; Exh. STP000021 (U.S. Energy Information Administration, "Natural Gas Delivered: Electric Power: West South Central: Reference Case").

²¹⁹ Zimmerly/Pieniazek Direct Testimony at 34; Tr. at 1503-04.

²²⁰ Zimmerly/Pieniazek Direct Testimony at 36.

²²¹ Zimmerly/Pieniazek Direct Testimony at 34-35; Emch/Rishel/Anderson Direct Testimony at 46.

²²² Zimmerly/Pieniazek Direct Testimony at 37; Exh. STP000021.

²²³ Zimmerly/Pieniazek Direct Testimony at 39; Emch/Rishel/Anderson Direct Testimony at 46.

²²⁴ Emch/Rishel/Anderson Direct Testimony at 46.

Legal Analysis and Findings

The Board finds that Applicant's initial use of NUREG/BR-0184 to calculate replacement power costs is not reasonable for the deregulated ERCOT market. However, the Board also finds that, as an alternative to the replacement power costs in NUREG/BR-0184, the 2009-2010 ERCOT market prices are reasonable for use in the SAMDA analysis. Fluctuation in the price of power is the norm. Although Intervenors showed that NUREG/BR-0184 costs may be inappropriate in an unregulated market such as Texas, they offered inadequate support for using 2008 ERCOT prices as a reasonable basis for projecting future replacement power costs. Applicant's testimony was convincing that natural gas prices establish the price of replacement power and that those prices are likely to remain low and stable for the foreseeable near term. Accordingly, we find that ERCOT prices from 2009-2010 are reasonably representative of future replacement power prices in the relevant market, and that Applicant and Staff reasonably used 2009-2010 ERCOT prices in their respective SAMDA analyses. Further, since the testimony and evidence—and our decision—supporting ERCOT pricing data forms part of the record of this proceeding and supplements the respective analyses in the ER and FEIS, we conclude Applicant and Staff have carried their respective burdens to comply with NEPA.

c. ERCOT Market Effects

Recitation of Evidence

With Contention CL-2, Intervenors also challenge the ER's replacement power cost estimates for failing to consider the market effect of a severe accident, i.e., the alleged increase in ERCOT replacement power prices due to the unavailability of power from the four STP units. According to Intervenors' witness, Mr. Johnson, considering market effects would have a significant impact on the SAMDA analysis because outages at the four STP units would "fundamentally change the supply-demand relationship in the energy market."²²⁵ Mr. Johnson

²²⁵ Johnson Direct Testimony at 7.

testified that removing the STP units from ERCOT's generating profile would have a "domino impact" that would allow less efficient generators to sell into the market, thus raising power prices.²²⁶ Mr. Johnson, however, did not offer any testimony or analysis quantifying the change in replacement power costs due to the alleged market effects. Mr. Johnson testified only that business considerations on behalf of new generators made the one year assumption to replace lost STP capacity "overly optimistic."²²⁷

Applicant and Staff witnesses testified regarding their qualitative and quantitative analyses of market effects. For Applicant, Mr. Pieniazek testified that loss of the STP units would not have a significant impact on replacement power costs in the ERCOT region.²²⁸ According to him, market effects would be mitigated by buffering from reserve margin and stimulation of new generating sources.²²⁹ Mr. Pieniazek also testified that the combined capacity of the four STP units (approximately 5,324 MWe) would be less than the generation capacity represented by ERCOT's planning reserve margin for peak load conditions of 13.75%.²³⁰ While conceding that the loss of STP power would diminish the available margin,²³¹ Mr. Pieniazek testified that ERCOT would quickly restore reserves.²³² He further testified that a multi-year outage at the STP site would stimulate new generation capacity.²³³ Mr. Pieniazek

²²⁶ Johnson Direct Testimony at 9.

²²⁷ Johnson Direct Testimony at 9.

²²⁸ Zimmerly/Pieniazek Direct Testimony at 42.

²²⁹ Zimmerly/Pieniazek Direct Testimony at 42.

²³⁰ Zimmerly/Pieniazek Direct Testimony at 43; Tr. at 1474-75; see also Tr. at 1570 (Johnson Testimony).

²³¹ Mr. Pieniazek testified that during most of the year, ERCOT also operates well below the peak hour demand. Zimmerly/Pieniazek Direct Testimony at 43.

²³² Tr. at 1474-75.

²³³ Zimmerly/Pieniazek Direct Testimony at 44.

testified that ERCOT has now indicated that 5,505 MW of mothballed capacity will exist in 2016, which could be brought back into service in a matter of months and be used to offset some of the lost generation.²³⁴ He also testified that new simple cycle or combined cycle generation could enter the market within a year or two to offset lost STP generation.²³⁵

Quantitatively, Applicant and Staff witnesses calculated market effects by using a dispatch model, created by Applicant, that determines the difference between the ERCOT prices with all four STP units operating and the ERCOT prices with all four STP units shut down.²³⁶ One of Staff's witnesses, Mr. Anderson, responded to criticisms of the model previously raised by the Intervenors in response to Applicant's Motion for Summary Disposition by making adjustments that he considered appropriate.²³⁷

After running the dispatch model, Applicant's witness, Mr. Pieniazek, testified that loss of all four STP units would increase the load-weighted average annual market price in ERCOT by \$1.80 per MWh, based on 2009 ERCOT pricing data.²³⁸ Using the higher 2008 ERCOT pricing data and other more conservative assumptions, Mr. Pieniazek testified that the dispatch model

²³⁴ Zimmerly/Pieniazek Direct Testimony at 44 (citing Exh. STP000007 (ERCOT, "Report on the Capacity, Demand, and Reserves in the ERCOT Region" (Dec. 2010)) at 7).

²³⁵ Zimmerly/Pieniazek Direct Testimony at 44.

²³⁶ Zimmerly/Pieniazek Direct Testimony at 45 (Pieniazek Testimony); Zimmerly/Pieniazek Rebuttal Testimony at 8-10 (Pieniazek Testimony); Emch/Rishel/Anderson Direct Testimony, at 48-53 (Anderson Testimony); see also Tr. at 1484-86 (Pieniazek Testimony).

²³⁷ Emch/Rishel/Anderson Direct Testimony at 48-54. Mr. Anderson made a minor adjustment of the nuclear capacity factor assumed in the Applicant's model (increasing 88.5% to 90.0%), which is consistent with recent operating experience at STP. However, according to Mr. Anderson, this adjustment had no meaningful effect on the prices estimated by the model. Emch/Rishel/Anderson Direct Testimony at 50-51. Mr. Anderson also adjusted the model by scaling to 2008 ERCOT pricing and adopting Intervenors' preferred wind capacity factor of 9%. Mr. Anderson testified that these adjustments had no effect on the SAMDA conclusion. Emch/Rishel/Anderson Direct Testimony at 51-52.

²³⁸ Zimmerly/Pieniazek Direct Testimony at 48-50.

predicted a price increase of \$5.23 per MWh.²³⁹ Nevertheless, according to Mr. Pieniasek, these changes are well within the normal range of ERCOT power prices, which typically fluctuate by up to \$20 per MWh.²⁴⁰ Integrating these replacement power price changes into the calculation for total averted cost, Mr. Pieniasek testified that, even considering market effects, the ER's conclusion remains unchanged, i.e., there are no cost-effective SAMDA's.²⁴¹ The testimony of Staff's witness, Mr. Anderson, agreed with this analysis.²⁴²

Intervenors' witness, Mr. Johnson, criticized the dispatch model in several respects.²⁴³ First, Mr. Johnson testified that the "model's treatment of ancillary service capacity²⁴⁴ appears simplistic."²⁴⁵ Mr. Pieniasek disputed this in his testimony, claiming that the dispatch model properly accounts for ancillary service capacity by including it for the hourly loads evaluated in the model.²⁴⁶ According to Mr. Pieniasek, including it for hourly loads conservatively inflates the price of power because ancillary service capacity is not typically relied on both for operating reserves and for hourly demand.²⁴⁷

²³⁹ Zimmerly/Pieniasek Rebuttal Testimony at 8, 10.

²⁴⁰ See Zimmerly/Pieniasek Direct Testimony at 35.

²⁴¹ Zimmerly/Pieniasek Direct Testimony at 51.

²⁴² Emch/Rishel/Anderson Direct Testimony at 52-53.

²⁴³ In response to Mr. Johnson's criticisms, Mr. Anderson—while conceding that Mr. Johnson's concerns were not unreasonable—testified that the concerns "ultimately have little effect on replacement power costs." Emch/Rishel/Anderson Direct Testimony at 49.

²⁴⁴ Mr. Anderson and Mr. Pieniasek testified that ancillary services are those power sources used to ensure reliability of the electric system by protecting it from unforeseen events such as unplanned generator outages, load forecast error, and wind forecast error, through maintaining sufficient reserve capacity. Emch/Rishel/Anderson Direct Testimony, at 50; Zimmerly/Pieniasek Direct Testimony at 46.

²⁴⁵ Johnson Direct Testimony at 23.

²⁴⁶ Zimmerly/Pieniasek Direct Testimony at 46.

²⁴⁷ Zimmerly/Pieniasek Direct Testimony at 46-47.

Second, Mr. Johnson claimed that the model's "assumption that no market power [abuse] will affect power prices is unrealistic" because it assumes perfect competition.²⁴⁸ Mr. Johnson testified that "under certain market conditions, the generator may realize that a bid substantially above marginal cost will be accepted."²⁴⁹ Mr. Pieniazek testified that, while the model does assume perfect competition, consideration of market power abuse would have minimal effect because the model calculates the price change from market effects as a difference of cost between two scenarios (one with operation of STP units and one without operation of the STP units).²⁵⁰ As Mr. Pieniazek testified, because the model calculates a differential cost, any assumptions regarding market power would affect both scenarios, and so the net effect on the differential cost would be minimal.²⁵¹ He further testified that "since the market opened to competition in 2002, there has never been a finding of market power abuse by any regulatory or enforcement agency in ERCOT."²⁵² Even then, Mr. Pieniazek testified that there is no practical method to estimate the impacts of market power abuse, since such abuse would occur as a result of intentional wrongdoing by a supplier and this cannot be predicted, much less quantitatively estimated.²⁵³ Mr. Anderson, in turn, testified that no independent market abuse term would likely be needed for calculating replacement power because were there to be any market power abuse in the region, ERCOT pricing data would already reflect the abuse because the market has been deregulated since 2002.²⁵⁴

²⁴⁸ Johnson Direct Testimony at 23; Johnson Rebuttal Testimony at 14-15.

²⁴⁹ Johnson Direct Testimony at 23.

²⁵⁰ Zimmerly/Pieniazek Direct Testimony at 47-48.

²⁵¹ Zimmerly/Pieniazek Direct Testimony at 47-48.

²⁵² Zimmerly/Pieniazek Direct Testimony at 48; Tr. 1522-23.

²⁵³ Zimmerly/Pieniazek Direct Testimony at 48.

²⁵⁴ Emch/Rishel/Anderson Direct Testimony at 50.

Finally, Mr. Johnson testified that Applicant's assumptions regarding wind capacity factor (24.5%) are too high and should be dropped (to 9%).²⁵⁵ Reiterating his argument for market abuse, Mr. Pieniazek testified that because the model compares two scenarios that include the same wind capacity factors, any effect tends to be offset.²⁵⁶ Nonetheless, Mr. Pieniazek testified that he reran the dispatch model with a wind capacity factor of zero, thus completely removing wind resources from the model and artificially increasing the marginal price of power.²⁵⁷ With a wind factor of zero, Mr. Pieniazek testified that the market effects of an STP outage increased the price of power slightly, to \$2.39 per MWh based on 2009 ERCOT prices.²⁵⁸ Mr. Anderson supported that assessment, testifying that running the model with a wind capacity factor of 9%, as Mr. Johnson suggested, changed power prices by only 2.0%.²⁵⁹

Legal Analysis and Findings

The Board finds that Applicant and Staff reasonably accounted for market effects through Applicant's dispatch model as calibrated to use 2009 ERCOT prices (and with the more conservative 2008 ERCOT prices). Applicant and Staff also reasonably accounted for both Intervenors' wind capacity concerns, by adopting Intervenors' suggested wind capacity factor, as well as Intervenors' ancillary service concerns, by showing how ancillary services are conservatively built into the model. As for market power abuse, the Board agrees with Applicant and Staff that market power abuse need not be given additional consideration. With no evidence of actual abuse in the ERCOT region, it is not reasonable to speculate that power generators will deliberately violate utility regulations. Given our finding that there has been a

²⁵⁵ Johnson Direct Testimony at 22-23.

²⁵⁶ Zimmerly/Pieniazek Direct Testimony at 49.

²⁵⁷ Zimmerly/Pieniazek Direct Testimony at 49.

²⁵⁸ Zimmerly/Pieniazek Rebuttal Testimony at 6-7.

²⁵⁹ Emch/Rishel/Anderson Direct Testimony at 49-50.

reasonable accounting for market effects, we find that the values calculated by Applicant and Staff show that incorporating market effects into the analysis does not result in a cost-beneficial SAMDA. Further, since the testimony and evidence—and our decision—supporting the consideration of market effects forms part of the environmental record of this proceeding and supplements the respective analyses in the ER and FEIS, we conclude Applicant and Staff have carried their respective burdens to comply with NEPA.

d. Consumer Impacts

Recitation of Evidence

Intervenors argued not only that the cost of replacement power affects Applicant by having to replace power that would have been provided by the STP units, but also that any concomitant “higher power costs [would be] imposed on all consumers” in the ERCOT region.²⁶⁰ According to Intervenors’ witness, Mr. Johnson, this impact “relates to higher costs imposed on the overall market because the STP outages fundamentally change the supply-demand relationship in the energy market.”²⁶¹ Mr. Johnson, however, did not provide an estimate of this impact.

Witnesses for both Applicant and Staff, Mr. Zimmerly and Mr. Anderson respectively, testified that the impact on consumers of higher power prices after a severe accident at STP Units 3 or 4 should not be included in the SAMDA evaluation of replacement power costs.²⁶² For Applicant, Mr. Zimmerly testified that the impact on consumers due to an increase in ERCOT electricity prices does not affect the cost of replacement power.²⁶³ According to Mr. Zimmerly, in the context of a SAMDA analysis, replacement power costs are those costs that

²⁶⁰ Johnson Direct Testimony at 6-7.

²⁶¹ Johnson Direct Testimony at 6-7.

²⁶² Tr. at 1490-91 (Zimmerly Testimony); Tr. at 1623 (Anderson Testimony).

²⁶³ Tr. at 1490.

the owner of the STP units would pay to ensure power is provided to the ERCOT region. Replacement power costs do not include costs that would be borne by consumers.²⁶⁴ At the hearing, Mr. Johnson conceded that the impacts to which he was referring would not be borne by the owners of the STP units.²⁶⁵

Regardless of whether consumer impacts should be considered a replacement power cost, Applicant and Staff calculated the impacts and included them in their respective SAMDA analyses. To do so, Applicant and Staff witnesses, Mr. Pieniazek and Mr. Anderson, respectively, testified that they used the incremental market cost of energy from losing the four STP units (the market effect price increases, calculated infra at p. 43-46) and multiplied that price increase by the total energy generation in the ERCOT region.²⁶⁶ Both Mr. Pieniazek and Mr. Anderson testified that even after integrating these costs into the total averted cost for implementing SAMDAs, the SAMDA analysis results remained unchanged; i.e., there are no cost-beneficial SAMDAs.²⁶⁷

Legal Analysis and Findings

As a threshold matter, the Board concludes that consumer financial impacts are not replacement power costs for SAMDA analyses, and accordingly cannot be considered as part of Contention CL-2. In the ER's SAMDA analysis, and carried forward in Applicant's and Staff's adjustments, replacement power costs are onsite costs that would be paid by the owner of the STP site to compensate for the outage from a severe accident. By considering this cost, among others, a decision can be made about whether the SAMDA is cost-beneficial. It is this cost that

²⁶⁴ Tr. at 1490-91.

²⁶⁵ Tr. at 1563.

²⁶⁶ Zimmerly/Pieniazek Direct Testimony at 52; Emch/Rishel/Anderson Direct Testimony at 53-54; see also Tr. at 1492 (Pieniazek Testimony).

²⁶⁷ Zimmerly/Pieniazek Direct Testimony at 53; Emch/Rishel/Anderson Direct Testimony at 53-54.

Intervenors challenge with CL-2. Moreover, Intervenors' witness, Mr. Johnson, conceded that consumer impacts would not be borne by the owner of the STP site. Therefore, while consumer financial impacts could potentially be a relevant offsite cost, it is assuredly not a cost associated with replacement power costs for SAMDA analyses, and so there is no need to make such calculations.

Even so, the Board finds that Staff and Applicant still conservatively accounted for this extraneous cost by using the dispatch model developed to assess market effects. The Board also finds that the values calculated by Applicant and Staff show that incorporating consumer impacts into the analysis does not result in a cost-beneficial SAMDA.

e. ERCOT Price Spikes

Recitation of Evidence

Intervenors also argue that the ER's SAMDA evaluation is inadequate because it fails to account for spikes in ERCOT prices that may occur as a result of an outage of the four STP units.²⁶⁸ Although Intervenors' witness, Mr. Johnson, did not quantify the magnitude or frequency of such price spikes, he testified that price spikes in 2008 increased the average annual price of power in the ERCOT region by 20%.²⁶⁹ According to Mr. Johnson, an outage of the four STP units would likely lead to "severe price spikes" at least in the immediate Houston/South Texas region because the loss of all four STP units simultaneously would represent 43% of total baseload capacity and 11% of installed capacity in the area.²⁷⁰ Mr. Johnson also testified that as time elapsed after the start of the outage the severity of price spikes would diminish, but the "time frame of this adjustment is difficult to forecast."²⁷¹

²⁶⁸ Johnson Direct Testimony at 10-11.

²⁶⁹ Johnson Direct Testimony at 11.

²⁷⁰ Johnson Direct Testimony at 10.

²⁷¹ Johnson Direct Testimony at 11.

According to Applicant's witness, Mr. Pieniazek, ERCOT defines price spikes as the price of energy exceeding a specific threshold tied to the price of natural gas.²⁷² Mr. Pieniazek testified that price spikes occur with some regularity in the ERCOT region, but last only briefly.²⁷³ The short duration, according to Mr. Pieniazek, is due to ERCOT carrying responsive reserves, regulation reserves, and non-spin reserves, all three of which are carried twenty-four hours a day to handle contingencies.²⁷⁴ Additionally, Mr. Pieniazek testified that many of the historical price spikes were due to inefficient zonal management techniques rather than to outages of generation stations. Moreover, Mr. Pieniazek testified zonal management techniques ceased as a grid management method beginning December 1, 2010, when ERCOT implemented a nodal market design.²⁷⁵ According to Mr. Pieniazek, a nodal market design provides improved dispatch efficiencies and unit specific management of transmission congestion, a significant improvement over the pre-December 2010 zonal market design.²⁷⁶

Mr. Pieniazek testified that price spikes have impacted average power prices, the effect of which the Independent Market Monitor has estimated for ERCOT to be between 10% and 20% of average price from 2006 through 2009.²⁷⁷ Mr. Pieniazek testified, therefore, that price

²⁷² Zimmerly/Pieniazek Direct Testimony at 53 (citing Exh. STP000020 (Potomac Economics, Ltd., "2009 State of the Market Report for the ERCOT Wholesale Electricity Markets," pages i-v, 6-8 (July 2010)) at 6-7); Tr. at 1492-93.

²⁷³ Zimmerly/Pieniazek Direct Testimony at 53-54.

²⁷⁴ Zimmerly/Pieniazek Direct Testimony at 54.

²⁷⁵ Zimmerly/Pieniazek Direct Testimony at 55-56; Tr. at 1500.

²⁷⁶ Zimmerly/Pieniazek Direct Testimony at 55-56; Tr. at 1500-01.

²⁷⁷ Zimmerly/Pieniazek Direct Testimony at 54 (citing Exh. STP000020 at 7).

spikes are already accounted for by ERCOT's average prices.²⁷⁸ Mr. Anderson, for Staff, concurred.²⁷⁹

Both Applicant and Staff offered witnesses who testified about how they adjusted their analyses to consider price spikes due to an STP outage. Both Mr. Pieniazek for Applicant and Mr. Anderson for Staff testified that even were the conservative 2008 ERCOT annual prices to be further increased by 20% to account for additional price spikes for a year—which Mr. Johnson deemed acceptable²⁸⁰—and after accounting for the additional ERCOT market effects and impacts to consumers discussed above, there still is no SAMDA that is cost-beneficial.²⁸¹

Legal Analysis and Findings

The Board finds that Applicant and Staff have reasonably accounted for price spikes associated with an STP outage by adding an additional 20% impact on top of conservative ERCOT prices that already account for price spikes. All parties agree that this approach is reasonable. The Board also finds that the values calculated by Applicant and Staff show that incorporating price spikes into the analysis does not result in a cost-beneficial SAMDA. Further, since the testimony and evidence—and our decision—supporting the analysis of price spikes forms part of the record of this proceeding and supplements the respective analyses in the ER and FEIS, we conclude Applicant and Staff have carried their respective burdens to comply with NEPA.

²⁷⁸ Zimmerly/Pieniazek Direct Testimony at 54

²⁷⁹ Emch/Rishel/Anderson Direct Testimony at 54.

²⁸⁰ Tr. at 1562 (Johnson Testimony).

²⁸¹ Zimmerly/Pieniazek Direct Testimony at 56; Emch/Rishel/Anderson Direct Testimony at 55-56.

f. Loss of Grid

Recitation of Evidence

For Intervenors, Mr. Johnson testified that the simultaneous loss of four STP units “could increase the likelihood of outages on the ERCOT grid which [would] result in load shedding, or even uncontrolled blackouts.”²⁸² Although Mr. Johnson did not quantify the cost of grid outages associated with STP unit outages in the ERCOT region, he did estimate that they would “produce severe economic damage.”²⁸³ Mr. Johnson testified that for industrial and commercial customers, the cost of an outage would be significant, perhaps even as high as \$500,000 to \$1 million per customer for an hour of outage.²⁸⁴ And for society overall, Mr. Johnson testified that the California energy crisis of 2000/2001 caused about \$45 billion in economic damage and the Northeast blackout of 2003 caused about \$10 billion in economic damage.²⁸⁵ According to Mr. Johnson, “[t]hese events may represent close to worst case examples, but they illustrate that grid outage costs can produce severe economic damages beyond replacement power costs.”²⁸⁶

For Applicant, Mr. Pieniazek testified that an outage of the ERCOT grid is extremely unlikely because of protective measures established by ERCOT, the Texas Reliability Entity, and the North American Electric Reliability Corporation (NERC).²⁸⁷ Mr. Pieniazek further testified that there has never been a loss of the entire ERCOT grid due to any event.²⁸⁸ Mr.

²⁸² Johnson Direct Testimony at 11.

²⁸³ Johnson Direct Testimony at 11-12.

²⁸⁴ Johnson Direct Testimony at 12.

²⁸⁵ Johnson Direct Testimony at 12.

²⁸⁶ Johnson Direct Testimony at 12.

²⁸⁷ Zimmerly/Pieniazek Direct Testimony at 57.

²⁸⁸ Zimmerly/Pieniazek Direct Testimony at 57.

Pieniasek described the measures ERCOT could take to ensure that no grid outage would occur.²⁸⁹ As an example of the resiliency of the system, Mr. Pieniasek testified that there was no grid outage in conjunction with a severe weather event in February 2011 that disabled 7,000 MW of generating capacity, an amount exceeding the total capacity of the STP units.²⁹⁰

According to Mr. Pieniasek, Mr. Johnson's grid outage scenario is remote and speculative because it is reasonable to assume that the probability of a severe accident leading to a grid outage is far less than 10%, and combining this probability with the ABWR Core Damage Frequency produces a combined probability far less than 10^{-8} per year.²⁹¹ In his testimony, Mr. Anderson, a Staff witness, echoed Mr. Pieniasek's statements on the probability of a grid outage.²⁹² Mr. Anderson testified that "[e]vents with such low probabilities of occurrence would be remote by any measure."²⁹³ For these reasons, Mr. Anderson testified in support of Mr. Pieniasek's assessment that the grid outage scenario postulated by Mr. Johnson was remote and speculative.²⁹⁴

Nonetheless, Mr. Pieniasek calculated grid outage impacts that assumed a \$45 billion cost, even though he testified that at most \$5 billion of the societal impact was due to the blackouts.²⁹⁵ By using the conservative 2008 ERCOT pricing data, and by accounting for the consumer impacts due to market effects and increases in price spikes, the total monetized

²⁸⁹ Zimmerly/Pieniasek Direct Testimony at 57-58.

²⁹⁰ Zimmerly/Pieniasek Direct Testimony at 57-58.

²⁹¹ Zimmerly/Pieniasek Direct Testimony at 60.

²⁹² Emch/Rishel/Anderson Direct Testimony at 57.

²⁹³ Emch/Rishel/Anderson Direct Testimony at 58.

²⁹⁴ Emch/Rishel/Anderson Direct Testimony at 58.

²⁹⁵ Zimmerly/Pieniasek Direct Testimony at 61.

impact still shows that no SAMDA is cost-beneficial.²⁹⁶ Mr. Anderson testified that he came to the same conclusion, except that he used the \$10 billion cost for the Northeast blackout.²⁹⁷

Legal Analysis and Findings

As with Intervenor's arguments for considering the financial impact on individual customers, the Board concludes that societal financial impacts are not relevant to assessing replacement power costs for the instant SAMDA analyses, and accordingly cannot be considered as part of Contention CL-2. As Intervenor challenge it, replacement power costs are onsite costs that would be paid by the owner of the STP site to compensate for the outage from a severe accident. By contrast, Mr. Johnson points to widespread societal costs when referring to the impact of a grid outage. Therefore, while grid outage impacts could potentially be a relevant offsite cost, it is assuredly not a cost associated with replacement power costs for SAMDA analyses, and so there is no need to make such calculations.

Moreover, the Board finds that given the low probability of a severe accident, multiplied by the low probability that the STP shutdown would result in a loss of the grid, loss of the grid is a remote and speculative event. Consideration of such "remote and speculative" impacts is not required by NEPA.²⁹⁸ The Commission previously upheld a licensing board determination that an accident sequence with a probability conservatively estimated at 2.0×10^{-7} per reactor year was remote and speculative for the purposes of NEPA.²⁹⁹ Certainly, a cumulative grid outage probability of less than 10^{-8} per reactor-year is less than the accident probability that the Commission considered to be remote and speculative.

²⁹⁶ Zimmerly/Pieniazek Direct Testimony at 62-63.

²⁹⁷ Emch/Rishel/Anderson Direct Testimony at 58-59.

²⁹⁸ Vermont Yankee, ALAB-919, 30 NRC at 44; Limerick Ecology Action, Inc. v. NRC, 869 F.2d 719, 739 (3d Cir. 1989) ("It is undisputed that NEPA does not require consideration of remote and speculative risks").

²⁹⁹ Carolina Power & Light Co. (Shearon Harris Nuclear Power Plant), CLI-01-11, 53 NRC 370, 387-88 (2001).

Even if a grid outage had to be considered, the Board finds that Applicant and Staff reasonably assessed the impact of a grid outage by assuming a conservative probability of occurrence and large impact that even Mr. Johnson concedes are close to being worst-case examples. Doing so, the Board finds that Staff and Applicant reasonably demonstrated that the total maximum averted costs remain less than the value of the lowest-cost SAMDA, i.e., there is no cost-beneficial SAMDA.

D. Findings of Fact and Conclusions of Law

The Board has considered the testimony and evidence presented by the parties on Contention CL-2. Based upon a review of the entire record in this proceeding and the proposed findings of fact and conclusions of law submitted by the parties, and based upon the findings of fact set forth above, which are supported by reliable, probative and substantial evidence in the record, the Board has decided all matters in controversy concerning this contention and makes the following findings of fact and conclusions of law. Applicant and Staff have met their respective burdens of showing that the STP FEIS and ER, as supplemented by the record for this hearing, comply with the requirements of NEPA and 10 C.F.R. Part 51. The evidence confirms the claims of Applicant and Staff in those documents that there are no cost-beneficial SAMDAs. As explained above, we find that Applicant and Staff have reasonably accounted for the economic factors raised by Intervenors in Contention CL-2. By addressing those factors, and even adopting Intervenors' own assumptions, Applicant and Staff have shown that no cost-beneficial SAMDA exist for the STP COLA. Contention CL-2 is therefore resolved in favor of Applicant and Staff.

Pursuant to 10 C.F.R. § 2.1210, it is this 29th day of December 2011, ORDERED, that:

A. Intervenors' Contention CL-2 is resolved on the merits in favor of Applicant and Staff.

B. In accordance with 10 C.F.R. § 2.1210, this partial initial decision will constitute a final decision of the Commission forty (40) days from the date of issuance (or the first agency business day following that date if it is a Saturday, Sunday, or federal holiday, see 10 C.F.R. § 2.306(a)), i.e., on February 7, 2012, unless a petition for review is filed in accordance with 10 C.F.R. § 2.1212, or the Commission directs otherwise. Any party wishing to file a petition for review on the grounds specified in 10 C.F.R. § 2.341(b)(4) must do so within fifteen (15) days after service of this partial initial decision. The filing of a petition for review is mandatory for a party to have exhausted its administrative remedies before seeking judicial review. Within ten (10) days after service of a petition for review, parties to the proceeding may file an answer supporting or opposing Commission review. Any petition for review and any answer shall conform to the requirements of 10 C.F.R. § 2.341(b)(2)-(3).

THE ATOMIC SAFETY
AND LICENSING BOARD

/RA/

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ADMINISTRATIVE JUDGE

/RA/

Gary S. Arnold
ADMINISTRATIVE JUDGE

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Randall J. Charbeneau
ADMINISTRATIVE JUDGE

Rockville, Maryland
December 29, 2011

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of)
)
NUCLEAR INNOVATION NORTH AMERICA LLC) Docket Nos. 52-012-COL and 52-013-COL
(NINA))
)
(South Texas Project Units 3 and 4))
)

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing **FIRST PARTIAL INITIAL DECISION (Contention CL-2) (LBP-11-38)** have been served upon the following persons by the Electronic Information Exchange.

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FIRST PARTIAL INITIAL DECISION (Contention CL-2) (LBP-11-38)

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Docket Nos. 52-012-COL and 52-013-COL

FIRST PARTIAL INITIAL DECISION (Contention CL-2) (LBP-11-38)

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[Original signed by Nancy Greathead]
Office of the Secretary of the Commission

Dated at Rockville, Maryland
this 29th day of December 2011