Comments on Cost-Benefit Analysis in the NRC's Draft EIS (DEIS) for the Holtec Int'l CISF (NUREG-2237)

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I. Summary

This review evaluates the cost-benefit analysis (CBA) contained within the Draft Environmental Impact Statement (Draft EIS or DEIS) for the proposed Holtec International (Holtec) consolidated interim storage facility (CISF) for spent nuclear fuel (SNF) and high level waste. It is a key document for informing the public and the U.S. Nuclear Regulatory Commission (NRC's) licensing decision. The EIS process under the National Environmental Policy Act (NEPA) supplements but does not supplant NRC's statutory decision-making authority. Nor are the statutory and regulatory requirements for licensing identical to NEPA requirements for EISs. It is understood that NRC will take public comments into account as it prepares the Final EIS (FEIS).

Minimum practice in CBA requires all significant effects to analyzed and, to the extent practicable, objectively quantified and monetized. That is, CBA provides a structured format for capturing disparate effects and enabling them to be examined in a single format using common metrics. This requires monetization – i.e., the conversion of effects into dollars. Of course, some environmental impacts are difficult to quantify, and some that can be quantified are difficult to monetize. That means every CBA will be incomplete, just like every other body of knowledge.

This review begins with a characterization of the baseline from which environmental impacts, costs, and benefits attributable to the proposed project are estimated. Other fundamental attributes of CBAs are then identified, including the alternatives to be analyzed and an array of technical matters, such as valuation, discounting, and distributional impacts. A special form in which distributional impacts are assessed takes account of disproportionate and adverse effects on minority and/or low-income communities ("environmental justice," or EJ). The DEIS includes an EJ analysis that has been reviewed as part of the CBA.

Several key conclusions can be drawn from this review. In particular, the CBA fails to meet minimum standards:

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1. ***The CBA includes no genuine assessment of alternatives*.** Multiple alternatives are essential for CBA to be useful in informing decision-making at the margin.

2. ***The CBA includes no benefits assessment*.** A CBA without a benefits assessment is just a cost assessment, not a CBA.

3. ***The CBA incorrectly characterizes transfers as benefits*.** The only purported benefits estimated are tax payments to state and local governments near the project site. Tax payments and receipts are transfers, not benefits.

4. ***The CBA lacks quantitative and monetized estimates of environmental impacts even in cases where quantification and monetization was easy to do*.** The key environmental impacts are human health and safety risks. While NRC had available to it ample resources in this area, including its own guidance documents that prescribe nominal risk values and valuation formula, the DEIS relied on none of these resources.

5. ***The CBA focuses almost exclusively on private rather than social costs.*** Private costs to Holtec, the applicant, are not environmental impacts. Similarly, private cost savings to reactor owners who may choose to ship SNF to Holtec also are not environmental impacts. Yet the CBA focuses almost entirely on these private costs instead of the external costs and benefits that are expected to result from the project if it is licensed and built.

6. ***The CBA inappropriately subtracts certain private costs avoided by reactor owners as reductions in private costs to Holtec.*** There is no legitimate basis for assuming that Holtec would capture all of these cost savings. The prospect of cost savings may motivate some reactor owners to take advantage of Holtec's services. However, reactor owners should be expected to do so only if it reduces net outlays.

7. ***The CBA exhibits an egregious amount of excess precision in its cost estimates*.** Private costs are reported with up to 10 significant digits, falsely implying a high degree of confidence in their accuracy. The fact that a calculator or computer can perform addition and subtraction with unlimited precision does not render its calculations meaningful.

8. ***Cost estimates in the CBA are reported without any regard for uncertainty and without sensitivity analysis.*** All cost estimates are uncertain; they are the product of a complex mix of data, models, and assumptions. Proper CBA practice requires the identification of key uncertainties and the conduct of sensitivity analyses to determine how results differ if these uncertainties are resolved differently than expected. The DEIS does not acknowledges uncertainty, estimate

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the effects of key uncertainties in data, models, and assumptions, or provide the public with the tools necessary to conduct such analyses on their own.

NRC's EJ analysis was reviewed separately but within the CBA framework. This review shows that the EJ analysis does not comply with NRC guidance for such analyses. In particular, the EJ analysis did not determine whether the project was reasonably expected to have disproportionate adverse effects on minority and/or low-income communities. In lieu of this required determination, the DEIS incorrectly assumes that environmental impacts that are insignificant when averaged over a large domain also are insignificant in subsets of that domain.

The DEIS (including its CBA component) also does not comply with applicable information quality guidelines. These guidelines have been in place since 2002. NRC has issued its own information quality guidelines and committed to comply with them. Adherence to these guidelines is essential for stakeholders and the public to have confidence in the DEIS.

NRC's information quality guidelines include procedures whereby the public can seek and obtain the correction of information it disseminates that does not comply. NRC may manage such requests or correction within its various public comment procedures. However, it cannot simply deem such requests moot or otherwise ineligible for receiving a formal response.

II. Background

A. NEPA requirements

Environmental Impact Statements (EISs) are conducted as required by the National Environmental Policy Act (NEPA),[1] CEQ regulations,[2] NRC regulations,[3] and NRC guidance.[4] As required by NRC licensing regulations, Holtec International (Holtec) submitted as part

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[1] Pub. L 91-190, 83 Stat. 852.

[2] 40 CFR Parts 1500-1508.

[3] 10 CFR §§ 51.10–51.17.

[4] U.S. Nuclear Regulatory Commission (2004a), Chapters 4 and 5 (environmental reviews); U.S. Nuclear Regulatory Commission (2004c) [Revision 4], U.S. Nuclear Regulatory Commission (2017) [Draft Revision 5] (regulator analysis); and U.S. Nuclear Regulatory Commission (1995) [Final], U.S. Nuclear Regulatory Commission (2015) [Draft] (normal risk values and valuation of avoided radiation exposure).

of its application an Environment Report (ER)[5] and Safety Analysis Report (SAR).[6] The ER must comply with 10 C.F.R. § 45(c), which says, in part:

> The environmental report must include an analysis that considers and balances the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and alternatives available for reducing or avoiding adverse environmental effects...
>
> The analyses for environmental reports shall, to the fullest extent practicable, quantify the various factors considered. To the extent that there are important qualitative considerations or factors that cannot be quantified, those considerations or factors shall be discussed in qualitative terms. The environmental report should contain sufficient data to aid the Commission in its development of an independent analysis.

The SAR must comply numerous provisions in 10 CFR Part 72, applicable Regulatory Guides,[7] and NUREG-1567.[8] The ER and SAR are relevant insofar as NRC disseminates information from them in the DEIS and conveys its substantive agreement with information contained therein. Third-party information disseminated by a federal agency in a manner reasonably interpreted to constitute agency endorsement must adhere to information quality guidelines.[9]

The scope of an NRC EIS is guided by NUREG-1748,[10] Required content is set forth in Section 5; matters related to safety, public health, and security are not directly identified as "environmental impacts," but they are included, albeit asymmetrically. For example, Sec. 4.2.5.3 requires that a key category of public health *costs* be addressed ("Are there

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[5] Holtec International (2017a) [Revision 6] is most recent.

[6] Holtec International (2017b) [Revision OH] is most recent.

[7] NRC has published 10 Regulatory Guides. See U.S. Nuclear Regulatory Commission (2019).

[8] U.S. Nuclear Regulatory Commission (2000).

[9] Office of Management and Budget (2002) at 8454 ("[I]f an agency, as an institution, disseminates information prepared by an outside party in a manner that reasonably suggests that the agency agrees with the information, this appearance of having the information represent agency views makes agency dissemination of the information subject to these guidelines.")

[10] U.S. Nuclear Regulatory Commission (2003), most notably Section 4.2.

undesirable public health or safety effects?") but not public health *benefits* ("Are there desirable reductions in public health or safety effects compared to the no-action alternative?").[11]

Other guidance also applies, including guidance on the conduct of CBA.[12] The asymmetry noted above with respect to costs and benefits in NUREG-1748 is impermissible in CBA. All expected costs and benefits that are incremental to the baseline must be counted, and counted exactly once.

As part of its NEPA responsibilities, NRC is required to conduct a cost-benefit analysis (CBA) for the proposed project within the DEIS. Section III summarizes relevant NRC guidance on its CBA practice. Section H analyzes the extent to which the CBA components in the DEIS comply with applicable regulations and guidance.[13]

B. Information quality

Certain other administrative and regulatory requirements also apply to the DEIS (and later the FEIS). In particular, influential information disseminated by NRC is subject to government-wide[14] and NRC-specific[15] information quality guidelines (IGQs). The IQGs define *information* broadly:

> ''Information'' means any communication or representation of knowledge such as facts or data, in any medium or form, including textual, numerical, graphic, cartographic, narrative, or audiovisual forms. This definition includes information that an agency disseminates from a web page, but does not include the provision of hyperlinks to information that others

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[11] NRC may be unresponsive to concerns we raise that stem from problems in NUREG-1748. That argues for segregating these concerns from the main analysis.

[12] U.S. Nuclear Regulatory Commission (2004c), U.S. Nuclear Regulatory Commission (2017). "Cost-benefit analysis" (CBA) and "benefit-cost analysis" (BCA) are alternative names for the same analytic technologies. Some federal agencies use CBA; most use BCA. In this review, the term cost-benefit analysis or CBA is used to ensure consistency with NRC practice.

[13] U.S. Nuclear Regulatory Commission (2020a).

[14] Office of Management and Budget (2002), as authorized by 42 U.S.C. 3516 note. NRC is a covered federal agency pursuant to 44 U.S.C. 3502(1) (definition of *agency*).

[15] U.S. Nuclear Regulatory Commission (2002).

> disseminate. This definition does not include opinions, where the agency's presentation makes it clear that what is being offered is someone's opinion rather than fact or the agency's views.[16]

Generally, the IQGs apply to information disseminated by federal agencies, though with important exceptions:

> ''Dissemination'' means agency initiated or sponsored distribution of information to the public (see 5 CFR 1320.3(d) (definition of ''Conduct or Sponsor'')). Dissemination does not include distribution limited to government employees or agency contractors or grantees; intra- or inter-agency use or sharing of government information; and responses to requests for agency records under the Freedom of Information Act, the Privacy Act, the Federal Advisory Committee Act or other similar law. This definition also does not include distribution limited to correspondence with individuals or persons, press releases, archival records, public filings, subpoenas or adjudicative processes.[17]

In addition, agencies are responsible for the quality of third-party information they disseminate "in a manner that reasonably suggests that the agency agrees." [18] Thus, the IQGs apply to information NRC derives from third-party information (such as the Holtec ER and SAR) and disseminates in a manner that conveys agency agreement.

Finally, EISs are per se covered by the IQGs because they unambiguously meet the definition of *influential* information:

> ''Influential'', when used in the phrase "influential scientific, financial, or statistical information", means that the agency can reasonably determine that dissemination of the information will have or does have a clear and substantial impact on important public policies or important private sector decisions…[19]

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[16] Office of Management and Budget (2002) at 8460 [Sec. V.5].

[17] Office of Management and Budget (2002) at 8460 [Sec. V.8].

[18] Office of Management and Budget (2002) at 8460 [Sec. V.8].

[19] Office of Management and Budget (2002) at 8454: "[I]f an agency, as an institution, disseminates information prepared by an outside party in a manner that reasonably suggests that the agency agrees with the information, this appearance of having

Information quality concerns are reflected in CEQ's recent revision of its rules for NEPA compliance.[20] New § 1502.23 requires agencies to "ensure the professional integrity, including scientific integrity, of the discussions and analyses in environmental documents;" "make use of reliable existing data and resources"; and "identify any methodologies used and [] make explicit reference to the scientific and other sources relied upon for conclusions."

III. NRC Guidance on Cost-Benefit Analysis

There are two relevant versions of NUREG/BR-0058, NRC's guidance documents for regulatory analysis including CBA: (1) Revision 4, the most recent finalized version, [21] and (2) Revision 5, which is in draft.[22] Revision 5 includes a separate chapter on CBAs conducted pursuant to NEPA. Neither version is referenced in the DEIS, however, so it is unclear which version was relied upon. Draft Revision 5 is more than a decade newer, and more than three years have elapsed since it was published for comment. However, it does not include the disclaimer required by Office of Management and Budget (2005 at 2667) for draft documents distributed for comment or peer review, so the public may reasonably infer that it is operative. With that in mind, this analysis relies on Draft Revision 5 except insofar as it is inconsistent with Revision 4, in which case Revision 4 is used as the standard for review.[23]

Draft Revision 5 consists of a main document, which includes chapters on methods for regulatory analysis, and 12 appendices. Methods chapters deal with general CBA elements (Chapter 2) and the identification and quantification of costs and benefits

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the information represent agency views makes agency dissemination of the information subject to these guidelines."

[20] Council on Environmental Quality (2020) at 43367. The revised regulations are binding on NEPA actions begun after September 14, 2020, but "[a]n agency may apply the regulations in this subchapter to ongoing activities and environmental documents begun before September 14, 2020" (at 43372-43373).

[21] U.S. Nuclear Regulatory Commission (2004c).

[22] U.S. Nuclear Regulatory Commission (2017).

[23] The extent to which non-NRC guidance documents applies is unclear. NRC's current guidance on radiological risk valuation explicitly acknowledges Executive Orders 12,291 Reagan (1981) and 12,866 Clinton (1993), guidance accompanying EO 12,866 Office of Management and Budget (1996), and Office of Management and Budget (2003) (OMB Circular A-4). See U.S. Nuclear Regulatory Commission (2015).

(Chapter 5). Chapter 4 concerns requirements specifically related to NEPA analyses, including CBA, environmental justice, and public and occupational health impact analysis. Relevant appendices deal with best practices in cost estimation (Appendix B), uncertainty (Appendix C), special circumstances and related procedural requirements (Appendix E), severe accident consequence analysis (Appendix H), and morbidity (Appendix K).[24]

Chapter 4 of the 2017 Draft Revision specifically addresses environmental analyses (including EISs) performed in compliance with NEPA; section § 4.2 addresses the conduct of CBAs within these documents. CBAs must be complete and quantitative, with limited exceptions,[25] and may rely on "an independent analysis of benefits and costs by State or regional authorities, [or] the applicant's analysis."[26]

A. Definition of the baseline

1. <u>No-action alternative</u>

NRC guidance defines the baseline for estimating costs and benefits effects as the no-action alternative ("how things would be" if the project were not licensed and completed).[27] All effects must be estimated with respect to the same baseline and be based

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[24] Like Revision 4, Draft Revision 5 has notable weaknesses. For example, it gives little attention to benefits. Thus, comparisons of the proposal and other alternatives to the baseline are likely to be comparisons of relative costs, as if benefits do not differ or do not matter. Missing from Appendix E is any consideration at all of information quality, yet adherence to information quality principles and guidelines is essential for an EIS to be a reliable aid for decision-making. Appendices H (severe accident consequences), I (NEPA), and K (morbidity) are only placeholders for future content.

[25] U.S. Nuclear Regulatory Commission (2017) at 4-2: "When cost-benefit analyses are required, they will, to the fullest extent practicable, quantify the various factors considered. To the extent that there are important qualitative considerations or factors that cannot be quantified, those considerations or factors will be discussed in qualitative terms."

[26] As noted in Section II.B above, when an agency disseminates information from external sources in a manner that conveys agreement (including the reliance on information from external sources for decision-making), they are responsible for ensuring that such information adheres to applicable information quality guidelines in the same manner and to the same extent that would apply if the information was produced by the agency.

[27] U.S. Nuclear Regulatory Commission (2017) at 5-7.

on consistent methods.[28] This guidance is consistent with government-wide guidance,[29] guidance issued by other agencies,[30] and advice provided by nongovernmental experts.[31] All effects must be estimated with respect to the same baseline and be based on consistent methods.[32]

2. Significant minority and low-income populations potentially relevant to the analysis of distributional effects

The EIS includes a descriptive discussion of "socioeconomics."[33] Many communities were found with disproportionally large minority populations[34] or low-income populations.[35] Baseline conditions notwithstanding, the key analytic task is to estimate the extent to which each alternative is expected to have disproportionate impacts on these communities.

B. Alternatives

NRC guidance requires that a wide ranging preliminary analysis of potential alternatives be preliminarily considered,[36] but detailed quantitative examination in the EIS

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[28] U.S. Nuclear Regulatory Commission (2017) at A-2.

[29] Office of Management and Budget (2003) at 2.

[30] U.S. Environmental Protection Agency (2016) [Chapter 5]

[31] See, e.g., Dudley, et al. (2017) at 8.

[32] U.S. Nuclear Regulatory Commission (2017) at A-2.

[33] U.S. Nuclear Regulatory Commission (2020a) at 3-75 to 3-94.

[34] U.S. Nuclear Regulatory Commission (2020a) at 3-84.

[35] U.S. Nuclear Regulatory Commission (2020a) at 3-84 to 3-86

[36] U.S. Nuclear Regulatory Commission (2017) at 2-10 to 2-11: "The initial set of alternatives should be broad and comprehensive but should also be sufficiently different to provide meaningful comparisons and to represent the spectrum of reasonable possibilities. Alternatives that are minor variations of each other should be avoided. Taking no action should be viewed as a viable alternative, except in cases where action has been mandated by legislation or a court decision. If a viable new alternative is identified after analysis has begun, it should be added to the list of alternatives and treated in the same manner as the original alternatives" (at 2-10).

be limited to the "most promising"[37] "selected"[38] alternatives that meet the objectives of the proposed project. No specific number of alternatives is required.

C. Categories of effects

The purpose of the CBA is to "identif[y] and estimate[] the relevant costs and benefits likely to result from a proposed NRC action" through "a systematic definition and evaluation of those costs and benefits."[39] There are six categories of effects (which NRC calls "attributes"):

1. Effects on public health from accidents
2. Effects on public health from routine operations
3. Effects on occupational health from accidents
4. Effects on occupational health from routine operations
5. Effects on offsite property
6. Effects on onsite property[40]

The first five categories involve external effects, in accordance with the purposes of NEPA. The sixth category consists of internal effects, and for symmetry must include all benefits accruing to and costs borne by the applicant.

All significant effects must be included, quantified to the extent possible, and reported in the form of net benefits. Consistent with longstanding principles of welfare economics, quantitative estimates are summed without regard for the identities of those persons who benefit or bear costs. All effects are estimated compared to the baseline, which is the no-action alternative.[41]

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[37] U.S. Nuclear Regulatory Commission (2017) at 2-1.

[38] U.S. Nuclear Regulatory Commission (2017) at 5-1.

[39] U.S. Nuclear Regulatory Commission (2017) at 5-1.

[40] U.S. Nuclear Regulatory Commission (2017) at 5-2.

[41] U.S. Nuclear Regulatory Commission (2017) at B-36 and 5-7. "In establishing the baseline case, an assumption should be made that all existing NRC and Agreement State requirements and written licensee commitments are already being implemented and that costs and benefits associated with these requirements are not part of the incremental estimates prepared for the regulatory analysis." Whether the costs and benefits of industry initiatives taken outside of or beyond NRC regulations belong in the baseline is a separate

D. Valuation of effects

NRC guidance is fully consistent with key elements of the IQGs. Specifically, "the cost-benefit analysis should be transparent and the results should be reproducible."[42] Moreover, "[a] qualified individual reading the analysis should be able to understand the basic elements of the analysis and the way in which estimates were developed."[43]

The valuation of avoided radiological risks is governed by separate NRC guidance (NUREG-1530). The most recent final version dates from 1995,[44] and a draft revision was published in 2015 but has not been finalized.[45] The 1995 version updated NRC's previous default conversion factor from $1,000 to $2,000 per person-rem. The 2015 draft revision updated the 1995 default to $5,100 per person-rem, with low and high values established for sensitivity analysis and procedures for automatically updating these figures over time.[46] The 2015 draft is used here.

E. Discounting of future effects

Consistent with OMB Circular A-4, NRC guidance prescribes the use of a 7% real discount rate on future costs and benefits, with 3% used for sensitivity analysis to "indicate the robustness of the results to the choice of discount rate."[47] Circular A-4 advises analysts to present tables showing the streams of costs and benefits by year they are expected to be

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and complex question, but it is less relevant for EISs than for regulatory cost-benefit analysis.

[42] U.S. Nuclear Regulatory Commission (2017) at 5-9.

[43] Id.

[44] U.S. Nuclear Regulatory Commission (1995).

[45] U.S. Nuclear Regulatory Commission (2015).

[46] The 2015 default value assumes a nominal risk coefficient factor of 5.7×10^{-4} per person-rem and value of statistical life (VSL) of $9 million. See U.S. Nuclear Regulatory Commission (2015) [Chapters 5 and 6, respectively].

[47] U.S. Nuclear Regulatory Commission (2017) at 5-43 to 5-46.

realized.[48] Nongovernmental experts offer similar advice, emphasizing that costs and benefits must be treated symmetrically.[49]

F. Cumulative impacts

Consistent with conventional practice, NRC guidance does not require the CBA within the EIA to *estimate* cumulative impacts (i.e., impacts likely to result from the project *and* an array of other actions or events). Cumulative impacts are to be discussed qualitatively as part of the background.[50]

G. Distributional effects

Likely because of its age, NRC's 2003 environmental review guidance does not include the consideration of distributional effects. The guidance does include a section on "socioeconomics," however, but it does not define the term and the information it directs be included in an EIS is vague: "relevant past and current population distributions," "permanent and transient populations," and "low-income and minority populations."[51] Because of this ambiguity, this provision is largely hortatory and does not translate into an analytic requirement the absence or insufficiency of which could be demonstrated.

NRC CBA guidance is more useful, acknowledging that project-related costs and benefits may not be distributed equally and thus may call for quantitation in a distributional analysis:[52]

> Significant differences may exist between the recipients of benefits and those who incur costs. The distribution of costs and benefits on various groups should be *presented* and discussed.[53]

This NRC's guidance is generally consistent with government-wide regulatory analysis guidance,[54] guidance issued by other federal agencies,[55] and accepted advice from practitioners in the field.[56]

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[48] Office of Management and Budget (2003) at 18.

[49] See, e.g., Dudley, et al. (2017) at 14.

[50] U.S. Nuclear Regulatory Commission (2017) at 5-43 to 5-46

[51] U.S. Nuclear Regulatory Commission (2003) at 5-12 to 5-13 [Sec. 5.3.10].

[52] U.S. Nuclear Regulatory Commission (2017) at 2-9.

[53] U.S. Nuclear Regulatory Commission (2017) at 5-2, emphasis added.

A separate and distinct form of distributional analysis is an examination of "environmental justice" (EJ), a shorthand term for disproportionately adverse impacts on minority and/or low-income subpopulations.[57] NRC's Policy Statement on Environmental Justice identifies as tasks relevant to an EJ analysis (1) characterization of the affected geographic area, (2) identification of minority and low-income communities within the affected geographic area, and (3) determination whether disproportionately adverse effects are expected to occur within these communities. Note that NRC requires that its relevant analyses "be limited to the impacts associated with the proposed action,"[58] which normally is understood as an assessment of *disproportionate effects*, not *disparate impacts*.[59]

H. Information quality

NRC environmental analysis guidance implicitly mandates a high level of compliance with the Commission's IQGs:

> To facilitate review by non-NRC stakeholders, the staff generally posts the analysis, with all the supporting documents, as publicly available documents

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[54] Office of Management and Budget (1990) at 659-660, Office of Management and Budget (1996) ["General Principles" Sec. 8], Office of Management and Budget (2003) at 14.

[55] See, e.g., U.S. Environmental Protection Agency (2016) {Chapter 9].

[56] See, e.g., Dudley, et al. (2017) at 13-14: "If [a CBA] ignores distributional effects – implying that they are not 'thought to be important' by the promulgating agency – one should look for a compelling explanation, based on logic and evidence, that costs and benefits generally fall on the same groups of people" (at 14).

[57] See Clinton (1994), which does not apply to independent agencies such as NRC, and U.S. Nuclear Regulatory Commission (2004b), which implements EJ-related matters as required by NEPA. EJ analysis is asymmetric insofar as it ignores disproportionately beneficial effects. When EJ analysis is conducted within a CBA, this asymmetry is impermissible.

[58] U.S. Nuclear Regulatory Commission (2004b) at 52047. The text may be confusing, however, because NRC uses the term "*disparate* impacts," which typically refers to differential effects associated with (but not necessarily caused by) a project or regulation when the Commission clearly intends its EJ analyses be limited to "*disproportionate* impacts" (i.e., those actually resulting from the project).

[59] *Disproportionate impacts* are those which result from a project; *disparate impacts* are those which are associated with the population independent of the project.

> in the Agencywide Documents Access and Management System (ADAMS) to allow public access to the analyses. A good analysis should be transparent with reproducible results. The assumptions, methods, data underlying the analysis, and discussion of the uncertainties associated with the estimates should be provided. Information obtained from outside the NRC, including that from parties interested in a proposed regulatory action, may be used in the regulatory analysis after the staff has validated the reasonableness of the information.[60]

Transparency and *reproducibility* are key procedural touchstones in the IQGs. Reproducibility[61] is a prerequisite that must be met before a credible claim of adherence to substantive information quality standards (utility, integrity, and objectivity) can be made. ter.[62]

IV. Cost-Benefit Analysis in the DEIS

Chapter 8 of the DEIS summarizes NRC's CBA. As noted in Section III above, by its own terms this CBA is supposed to be comprehensive. However, its purpose

> is not to exhaustively identify and quantify all of the potential costs and benefits, but instead, focus on those benefits and costs of such magnitude or importance that their inclusion in this analysis can inform the decision-making process (e.g., distinguish the proposed action from the No-Action alternative)… [T]he cost-benefit analysis provides input to determine the relative merits of various alternatives; however, the U.S. Nuclear Regulatory

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[60] U.S. Nuclear Regulatory Commission (2017) at 2-8.

[61] Office of Management and Budget (2002) at 8460: "'Reproducibility' means that the information is capable of being substantially reproduced, subject to an acceptable degree of imprecision. For information judged to have more (less) important impacts, the degree of imprecision that is tolerated is reduced (increased)… With respect to analytic results, 'capable of being substantially reproduced' means that independent analysis of the original or supporting data using identical methods would generate similar analytic results, subject to an acceptable degree of imprecision or error."

[62] Office of Management and Budget (2002) at 8459-8460. Of the three substantive information quality standards, objectivity often is the most important. To be objective, information must be substantively "accurate, reliable, and unbiased" and "presented in an accurate, clear, complete, and unbiased manner."

> Commission (NRC) will ultimately base its decision on the protection of public health and safety.[63]

Because the exclusion of costs and benefits that are not "of such magnitude or importance that their inclusion in this analysis can inform the decision-making process" is standard practice in regulatory analysis, their exclusion in the CBA is neither unusual nor presumptive evidence of material incompleteness. The relevant question is whether, in the DEIS, NRC has excluded costs and benefits that are large enough to potentially misinform the decision-making process concerning environmental impacts.

A. Baseline

The DEIS correctly identifies the no-action alternative as the analytic baseline. Spent nuclear fuel (SNF) would be managed in accordance with the status quo – i.e., onsite by nuclear power plant licensees. The baseline reasonably assumes that no permanent SNF repository would be licensed, built, and operational during the project's 120-year lifetime.[64]

The CBA correctly includes no estimates of costs, benefits, or other effects in the baseline. All effects are reported to have been captured in the incremental analysis of the proposed project. Costs and benefits are given negative and positive signs, respectively.[65]

B. The proposed project

Holtec International seeks NRC licensure for the construction and operation of a consolidated interim storage facility (CISF) for spent nuclear fuel (SNF), Greater-Than-Class-C (GTCC) waste, and a small amount of mixed oxide fuel from nuclear power plants.[66] Because Holtec's application applies only to the first of 20 units, and subsequent NRC approvals would be necessary to license any of the remaining 19 units, the scope of the EIS is properly limited to the first unit.[67]

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[63] U.S. Nuclear Regulatory Commission (2020a) at 8-1.

[64] U.S. Nuclear Regulatory Commission (2020a) at 8-1, citing U.S. Nuclear Regulatory Commission (2004c), U.S. Nuclear Regulatory Commission (2017).

[65] See U.S. Nuclear Regulatory Commission (2020a) at 8-2.

[66] U.S. Nuclear Regulatory Commission (2020a) at 2-1 to 2-19.

[67] U.S. Nuclear Regulatory Commission (2020a) at Section 5.1.1.3 includes within the cumulative impacts analysis a "reasonably foreseeable" second (i.e., competing) CISF.

C. Alternatives eliminated from detailed analysis in the Draft EIS

Four alternatives are reported to have been given preliminary consideration and eliminated from further analysis in the EIS:

1. Storage at a government-owned CISF operated by the U.S. Department of Energy (DOE).

Plans for a DOE CISF were not sufficiently developed to permit detailed analysis.[68]

2. Three alternative design or storage technologies.

Holtec's proprietary technology is licensed by NRC. The three others alternative technologies consist of (a) a competing proprietary system (manufactured by NAC), also licensed; (b) an unlicensed conceptual alternative (Hardened Onsite Storage Systems ["HOSS"]; and (c) a technology suggested by commenters during scoping (Hardened Extended-Life Local Monitored Surface Storage ["HELMS"]) that is the subject of a rulemaking petition seeking approval.[69] All were eliminated from further analysis because they were either irrelevant to the application (the NAC technology) or insufficiently developed to permit analysis.

3. Alternative locations

NRC's review of Holtec's site selection process, and the six alternative locations that were considered as a result, indicated that none of the alternative locations was demonstrably superior such that inclusion in the EIS would have material effect on environmental impacts, costs, or benefits.[70]

4. Alternative facility layouts

NRC determined that the proposal "optimizes the site access and facility layout and minimizes the potential impact to ecological and cultural resources," and that no

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Arguably, this should have been included as an explicit alternative rather than part of a cumulative impacts analysis. In addition, the CBA considers Phases 2-20 as an "alternative." However, estimates for this "alternative" should be considered only illustrative because it is not a substitute for the proposed project.

[68] U.S. Nuclear Regulatory Commission (2020a) at 2-20.

[69] U.S. Nuclear Regulatory Commission (2020a) at 2-20 to 2-22.

[70] U.S. Nuclear Regulatory Commission (2020a) at 2-22 to 2-25.

alternative facility layout "was clearly superior … such that it should be considered as an alternative to the facility layout proposed.[71]

D. Alternatives examined in the DEIS

The DEIS includes no alternatives except the no-action alternative, and no explanation is given for their absence. The DEIS includes some analysis concerning Holtec's intended Phase 2-20 expansion, which should be outside the scope of the EIS. This is summarized in a table comparing predicted environmental impacts. The DEIS concludes that all impacts are SMALL, or SMALL to MODERATE, for both the proposal and Phases 2-20.[72]

E. Categories and valuations of environmental impacts

The DEIS identifies 16 distinct categories of environmental impacts. These categories, NRC's estimates of their magnitude, and professional judgments about their value in the absence of declarative statements from NRC, are summarized in this subsection. In many cases, the identified impacts are not externalities. Holtec would bear all or virtually all of these impacts. When costs and benefits are borne by a project applicant, their inclusion is not normally understood as cognizable in a CBA the purpose of which is to identify and quantify *external* effects. Because the DEIS includes no benefit estimates to Holtec, costs borne by Holtec should be excluded from the CBA.

NRC characterizes the magnitude of environmental impacts in semi-quantitative terms:

> SMALL: The environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource considered.
>
> MODERATE: The environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource considered.
>
> LARGE: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.[73]

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[71] U.S. Nuclear Regulatory Commission (2020a) at 2-25 to 2-26.

[72] U.S. Nuclear Regulatory Commission (2020a) at 2-26 to 2-29 [Table 2.4-1].

[73] U.S. Nuclear Regulatory Commission (2020a) at 2-26.

SMALL effects can be interpreted economically as effects with zero value. Effects so small that they do not "noticeably alter" the environment cannot have value precisely because they are too small to notice. MODERATE effects are large enough to notice, so a prerequisite for valuation is at least present. Other information, including reliable and objective evidence of revealed or stated preferences, is needed to monetize them. LARGE effects are unambiguously significant enough to have economic value, but estimating them also requires reliable and objective evidence of revealed preference.[74]

For no environmental impact does the DEIS report monetized estimates for environmental costs, and NRC does not account at all for environmental benefits. These are generally fatal defects in an environmental CBA.

1. Land use impacts[75]

The DEIS notes that the primary land use impact of the project (both Phase 1 and Phases 2-20) is the conversion of 1,040 acres of land now used as rangeland for cattle grazing. Holtec would purchase this land from its current owner, the Eddy-Lea Energy Alliance.

The proposed 3.8 mile rail spur and a 1 mile site access road would be built and operated on land owned by the Bureau of Land Management (BLM), which is charged with permitting multiple uses. A total of 39.4 acres would be committed for the rail spur, and the access road appears to commit approximately 10 additional acres.[76]

The DEIS characterizes land use impacts as SMALL,[77] which implies a monetary value of zero. Nothing in the DEIS suggests that this value is understated.

2. Transportation impacts[78]

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[74] Note that the definition of LARGE effects is asymmetric. Only adverse environmental effects qualify.

[75] U.S. Nuclear Regulatory Commission (2020a) at 4-3 to 4-8.

[76] A 3.8 mile rail spur requiring 39.4 acres is, on average, about 85 feet wide. Assuming the site access road has the same width, it would require 5,280 feet x 85 feet = 263,000 square feet, or about 10 acres.

[77] U.S. Nuclear Regulatory Commission (2020a) at 4-6.

[78] U.S. Nuclear Regulatory Commission (2020a) at 4-9 to 4-24.

The DEIS characterizes non-radiological transportation impacts as "minor," and radiological transportation risks as "minor" or "negligible" based on prior NRC reports.[79]

a. Traffic impacts

The DEIS distinguishes transportation impacts from construction, operations, and decommissioning. During construction, the DEIS estimates a 5.6% increase in truck traffic on U.S. Highway 62/180 in the vicinity of the project site, an amount that it concludes is "a minor impact." Estimated changes in truck traffic are smaller because the baseline traffic level is lower. The DEIS estimates even less truck traffic during operations. Estimates of traffic impacts from commuting employees are smaller still.[80]

Additional transportation impacts are estimated from rail traffic. The increase in truck and commuter traffic from construction of the rail line is not quantified, but it is reasonably expected to be less than traffic impacts from facility construction. Traffic related to operations would be limited, and the DEIS reasonably characterizes these impacts as SMALL, which implies a monetary value of zero. Nothing in the DEIS suggests this cost is understated.

b. Radiological risks from incident-free transportation of SNF

NRC relies on a U.S. Department of Energy (DOE) analysis that estimated aggregate occupational and population risk from transportation from reactors to a permanent waste repository.[81] Regardless of the mix of rail and barge used for transport, these risks were reported to be 1.7 latent cancer fatalities to workers and 0.7 latent cancer fatality to the public for 24 years of national SNF transportation.[82] The DEIS correctly excludes the costs

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[79] U.S. Nuclear Regulatory Commission (2020a) at 4-12, citing U.S. Nuclear Regulatory Commission (1977), U.S. Nuclear Regulatory Commission (2001), U.S. Nuclear Regulatory Commission (2014). These documents have not been reviewed for this project.

[80] Elsewhere in these comments [[cross reference to Bruce's memo]], concerns are raised about whether the facility staffing estimates (notably for security) are accurate. Even if staffing requirements are adjusted upward, however, these adjustments would have a negligible effect on traffic volume.

[81] U.S. Nuclear Regulatory Commission (2020a) at 4-13, citing U.S. Department of Energy (2008). This document has not been reviewed for this report.

[82] For perspective, note that 1.7 latent occupational cancers discounted for 35 years (one-half of a standard lifetime) at 7% has a present value of 0.0123 cancer, which when valued at $9m per fatality (as prescribed by U.S. Nuclear Regulatory Commission (2015)

of infrastructure upgrades that may be required at reactor sites that are closed to decommissioned because any such costs would have to be borne to transport SNF to a permanent waste repository, and thus are not incremental to the proposed CSIF.[83] The DEIS also excludes radiological risks that would be borne anyway when SNF is shipped from a reactor to a permanent repository. This may be approximately correct, but it is possible that these transportation risks would be different under the no-action alternative if the Holtec CSIF is licensed.

Radiological risks from incident-free transportation that are attributable to the proposed CSIF occur when SNF is shipped from reactor sites to the CSIF. The DEIS includes a calculated upper-bound estimate of health effects[84] to workers and the public from the project at 1.3 and 0.18 person-Sv, respectively. Baseline cancer risks are 192 and 4.4 million times greater.[85] The DEIS characterizes this risk as "minor."[86]

The DEIS also calculated radiological risk from SNF transportation to the CISF to a maximally exposed member of the public. The maximally exposed individual (MEI) is assumed to be located 30 m (98 ft) from the rail track and is exposed to all 10,000 passing

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yields present value 24-year nationwide costs of $110,680 for incident-free transportation. The equivalent present value for 0.7 latent population cancer is $45,574. Evaluating the merits and information quality compliance would require a separate review. Note that these risks are in the baseline

[83] If the Holtec CSIF expedites the transportation of SNF stored onsite at closed or decommissioned reactors, fewer such reactors would require infrastructure upgrades to transport SNF, thus yielding a benefit reasonably attributable to the project.

[84] "Health effects" are defined as fatal cancer, nonfatal cancer, and severe hereditary effects, estimated by multiplying the population dose by the health risk coefficient of 5.7×10^{-2} health effects per person-Sv. See U.S. Nuclear Regulatory Commission (2020a) at Table 4.3-1, footnote †. This equals 5.7×10 person-rem. NRC values a person-rem at $5,100 ($2014); see U.S. Nuclear Regulatory Commission (2015). Evaluating the merits and information quality compliance would require a separate review.

[85] U.S. Nuclear Regulatory Commission (2020a) at Table 4.3-1.

[86] U.S. Nuclear Regulatory Commission (2020a) at 4-15. In support of that judgment, note that when NRC's prescribed valuation is used ($5,100 per person-rem in $2014, per U.S. Nuclear Regulatory Commission (2015)), the aggregate value of these risks is $6,630 and $918, respectively.) Evaluating the merits and information quality compliance would require a separate review.

rail shipments (i.e., after all 20 Phases are complete).[87] According to the DEIS, the accumulated dose is 0.006 rem (6 mrem), which the DEIS characterizes as "minor."

Note that if the MEI dose were received at the outset and there was no lag in cancer risk realization, using the NRC's nominal risk value and unit valuation (U.S. Nuclear Regulatory Commission 2015) the value of preventing this exposure would be $30.60 ($5,100/person-rem × 0.006 rem). If the MEI dose were instead spread out evenly over the 20-year period during which the 10,000 shipments of SNF would be transported, present value risk would be a small fraction of 0.006 rem, so its valuation would be a small fraction of $30.60. If cancer risk were properly lagged to reflect the latency of cancer realization and properly discounted, valuation would be indistinguishable from $0.[88]

c. Radiological risks from SNF transportation accidents

The DEIS asserts that "conservatively modeled" an "accidental release of canistered fuel during transportation [would] not occur under the most severe impacts studied, which encompasse[s] all historic or realistic accidents."[89] Occupational risk is characterized as "minor," and risk to the public is characterized as "likely to be zero."[90]

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[87] U.S. Nuclear Regulatory Commission (2020a) at 4-16, citing U.S. Nuclear Regulatory Commission (2014). Evaluating the merits and information quality compliance would require a separate review.

[88] Evaluating the merits and information quality compliance of NRC's nominal risk value and unit valuation would require a separate review.

[89] U.S. Nuclear Regulatory Commission (2020a) at 4-17, citing U.S. Department of Energy (2008), U.S. Nuclear Regulatory Commission (2001), U.S. Nuclear Regulatory Commission (2014) and summarized in the DEIS. Evaluating the merits and information quality compliance would require a separate review.

[90] U.S. Nuclear Regulatory Commission (2020a) at 4-17: "Because the proposed design of the [Holtec] CISF would require SNF to be contained within inner welded canisters, the transportation of the SNF to the proposed CISF would also require SNF to be in canisters that would be shipped in transportation casks similar to the configuration evaluated in NUREG–2125. Therefore, the DEIS considers the conclusion in NUREG–2125 regarding the resiliency of the rail-steel cask to severe accident conditions (resulting in no release under severe accident conditions) applicable to the evaluation of potential CISF SNF transportation impacts under accident conditions." Evaluating the merits of NUREG-2125 and its information quality compliance would require a separate review.

d. Non-radiological risks from SNF transportation

Non-radiological occupational risks examined were occupational injuries, diesel emissions, and greenhouse gas emissions. Cumulative occupational risks over the 20-year period for all 20 Phases of the project were estimated at 22 injuries and 6.2×10^{-2} fatalities.[91] Using NRC's default valuation formula, non-radiological mortality risk is valued at $558,000 ($2014). The valuation of injuries depends on their nature, and sufficient detail is not provided in the DEIS to permit an estimate.

Non-radiological risks to the public examined consisted of traffic fatalities at rail crossings and deaths resulting from trespassing. The DEIS estimated 1.5 fatalities resulting from shipping all SNF from reactors to the proposed CISF over the 20-year period for all 20 Phases of the project, an estimate characterized as "conservative."[92]

e. Transportation risks from defueling

The DEIS includes estimates of upper-bound radiological and non-radiological risks resulting from incident-free transportation of SNF from the proposed CISF to a permanent waste repository, which was presumed to be Yucca Mountain.[93] These risks are summarized in Table 4.3-2. Radiological health effects[94] attributed to Phase 1 of the proposed CISF are estimated at 0.03 for workers and 0.005 to the public, which are reported as 0.3% of baseline occupational risk and 0.00001% of baseline public risks.[95] No estimates are provided for radiological accident risks analogous to the radiological accident

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[91] U.S. Nuclear Regulatory Commission (2020a) at 4-18.

[92] U.S. Nuclear Regulatory Commission (2020a) at 4-18 to 4-19. "Conservative" estimates by design overestimate likely effects and cannot be used for estimating costs or benefits in a CBA. With this caveat noted, a "conservative" valuation for this risk is $14 million ($2014).

[93] U.S. Nuclear Regulatory Commission (2020a) at 4-19 to 4-21.

[94] "Health effects" are defined as fatal cancer, nonfatal cancer, and severe hereditary effects, estimated by multiplying the population dose by the health risk coefficient of 5.7×10^{-2} health effects per person-Sv. See U.S. Nuclear Regulatory Commission (2020a) at Table 4.3-2, footnote *.

[95] Health effects for all 20 Phases are estimated at 0.57 for workers and 0.10 for the public, which are reported as 5.7% of baseline for workers and 0.0001% of baseline for the public.

risk estimates for transportation from reactors to the proposed CSIF. No estimates are provided for non-radiological risks. It is inferred that they are negligible.

f. Transportation risks from decommissioning

The DEIS concludes that the transportation risks related to decommissioning would be SMALL.[96] The estimation method is similar to the one used to derive estimated impacts from construction, updated to include 2% regional economic growth per year.

g. NRC staff judgment on transportation risks

Overall transportation risks from construction,[97] operation,[98] and decommissioning[99] are reported as SMALL, which implies a monetary value of zero. Nothing in the DEIS suggests these risks are understated.

3. Geology and soils impacts[100]

The DEIS describes geological and soils impacts of the proposed CSIF. Because many of these impacts were previously addressed,[101] accounting for them again in the CBA would result in double-counting.

Additional potential impacts, beyond those previously addressed, consist of soil erosion, stormwater runoff, and leaks and spills of oil and hazardous materials. These environmental impacts are subject to federal and state regulation under other authorities. The DEIS expects the relevant agencies to ensure regulatory compliance. Therefore, it is concluded that these impacts would be SMALL,[102] which implies a monetary value of zero. Nothing in the DEIS suggests this cost is understated.

Onsite mineral rights are potentially relevant insofar as they are held in public trust by the New Mexico State Land Office. Questions have been raised concerning whether

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[96] U.S. Nuclear Regulatory Commission (2020a) at 4-23.

[97] U.S. Nuclear Regulatory Commission (2020a) at 4-10, 4-11.

[98] U.S. Nuclear Regulatory Commission (2020a) at 4-21.

[99] U.S. Nuclear Regulatory Commission (2020a) at 4-23.

[100] U.S. Nuclear Regulatory Commission (2020a) at 4-24 to 4-28.

[101] See Section IV.1 above.

[102] U.S. Nuclear Regulatory Commission (2020a) at 4-25.

Holtec's application has sufficiently accounted for the public interest in these subsurface mineral rights.[103] However that matter is resolved, however, it is not relevant to the accuracy or reliability of the CBA.

4. Water resources impacts[104]

Some potential water resources impacts were addressed previously,[105] so including them here in the CBA invites double-counting. Potential water resource impacts not previously addressed include effects on floodplains, wetlands, and groundwater.

According to the DEIS, there are no floodplains or wetlands onsite, and wetlands in the vicinity "are not favorable for the development of aquatic or riparian habitat."[106] The DEIS concludes that these environmental impacts are expected to be SMALL,[107] which implies a monetary value of zero. Nothing in the DEIS suggests this cost is understated.

According to the DEIS, potential impacts on groundwater not previously addressed could arise from onsite wells used to supply consumptive water demands and groundwater discharges. Groundwater usage would be limited to cement mixing during construction, dust control, and worker consumption. Questions may exist concerning whether groundwater drawn onsite is potable. However, if it is not potable and Holtec must bring in potable water from offsite sources (e.g., by truck or from the City of Carlsbad Water Department [see 4-40]), doing so would not create a material environmental impact. The DEIS expects no groundwater discharges from the proposed CISF, and any discharges that might occur would be governed by federal and state regulations implemented by other agencies. Therefore, water resource impacts are said to be SMALL,[108] which implies a monetary value of zero. Nothing in the DEIS suggests this cost is understated.

5. Ecological impacts[109]

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[103] See, e.g.,

[104] U.S. Nuclear Regulatory Commission (2020a) at 4-29 to 4-40.

[105] See Sections IV.E.1 and IV.E.3.

[106] U.S. Nuclear Regulatory Commission (2020a) at 4-30.

[107] U.S. Nuclear Regulatory Commission (2020a) at 4-30, 4-31, 4-32.

[108] U.S. Nuclear Regulatory Commission (2020a) at 4-35.

[109] U.S. Nuclear Regulatory Commission (2020a) at 4-40 to 4-55.

The DEIS reports that, based on consultation with the U.S. fish and Wildlife Service, U.S. Bureau of Land Management, and New Mexico Game and Fish Department, the proposed project site is not a critical habitat for any federal threatened or endangered species; and is not located in a natural vegetation community of concern. The DEIS concludes that "all stages and phases of the proposed CISF project (Phases 1-20) would have 'No Effect' on experimental or Federally listed species and 'No Effect' on any existing or proposed critical habitats."[110] Because it lacks surface water, the proposed project site does not provide a viable aquatic habitat.

The DEIS evaluates potential radiological effects to wildlife based on precautionary assumptions concerning dose rates and exposure durations.[111] The DEIS conservatively estimated absorbed dose rate at the storage pad of 0.26 µGy/d [0.026 mrad/d], with a full build-out dose rate of 1.46 µGy/d 5 [146 µrad/d] and concluded that it "exceeds the DOE initial threshold for demonstrated protection of wildlife but is below the DOE threshold of 100 mGy/d [10 rad/d] for persistent deleterious changes in populations or communities.[112] The DEIS further concludes that "radiation levels at the controlled area fence and beyond during any phase of the proposed CISF project would be generally protective of wildlife,"[113] and that potential ecological impacts during operations an decommissioning would be SMALL to MODERATE.[114] This cost could be zero (if effects are SMALL), or greater than zero by an unknown amount if they are MODERATE. For costs greater than zero to be incorporated into the CBA, there must be a method for monetizing the specific economic impacts. There is insufficient information in the DEIS to derive any such cost estimates.

6. Air quality impacts[115]

The DEIS characterizes peak-year air quality impacts, concluding that they are "below the New Mexico 'no permit required thresholds', except for particulate matter

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[110] U.S. Nuclear Regulatory Commission (2020a) at 4-30.

[111] U.S. Nuclear Regulatory Commission (2020a) at 4-50 to 4-51, citing U.S. Department of Energy (2019) [DOE-STD-1153-2019]. Evaluating the merits and information quality compliance of this reference would require a separate review.

[112] U.S. Nuclear Regulatory Commission (2020a) at 4-51.

[113] U.S. Nuclear Regulatory Commission (2020a) at 4-51.

[114] U.S. Nuclear Regulatory Commission (2020a) at 4-52, 4-54.

[115] U.S. Nuclear Regulatory Commission (2020a) at 4-55 to 4-61.

PM10, which is about 1.7 times this threshold."[116] PM10 emissions are potentially relevant for CBA if there are sufficient human receptors, but the DEIS staff conclude that such receptors are absent and "the potential impacts to air quality from peak-year emission levels would be minor."[117] These impacts are said to be SMALL.[118] Because peak-year impacts would be SMALL, impacts during construction, operations, and decommissioning would also be SMALL,[119] which implies a negligible monetary value. Nothing in the DEIS suggests this cost is understated.

7. Climate change impacts[120]

The DEIS considers climate change effects based on overall emissions of greenhouse gases released by all anthropogenic sources rather than individual sites such as the proposed CSIF. Further, spatial attribution of effects is not possible given the absence of a "strong cause-and-effect relationship between where the greenhouse gases are emitted and where the impacts occur." [121]

The DEIS estimates CO2 emissions of 2,306 tons/year (2,092 metric tons/year) in the peak year. This is 0.06% of the 2019 GHG emissions inventory for Lea County (3.5 million metric tons CO2e).[122] Thus, no climate change effects are expected from the construction, operation, or decommissioning of the proposed CSIF. The best estimate of their value is zero.

8. Noise impacts[123]

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[116] U.S. Nuclear Regulatory Commission (2020a) at 4-55: "Peak-year emissions represent the highest emission levels associated with the proposed CISF project in any one year and therefore also represent the greatest potential impact to air quality." Upper-bound estimates can be useful for determining that effects are too small to be material. However, upper-bound estimates are incompatible with CBA.

[117] U.S. Nuclear Regulatory Commission (2020a) at 4-56.

[118] U.S. Nuclear Regulatory Commission (2020a) at 4-57.

[119] U.S. Nuclear Regulatory Commission (2020a) at 4-58 to 4-59.

[120] U.S. Nuclear Regulatory Commission (2020a) at 4-61.

[121] U.S. Nuclear Regulatory Commission (2020a) at 4-61.

[122] New Mexico Environment Department (2020).

[123] U.S. Nuclear Regulatory Commission (2020a) at 4-61 to 4-64.

The DEIS predicts that the highest noise level predicted at the nearest offsite road ranges from 44 dBa to 59 dBa during construction,[124] the loudest phase of the project. This is less than the sound produced by normal conversation.[125] The DEIS concludes that potential noise impacts from construction, operations, and decommissioning would be SMALL, which implies a negligible monetary value. Nothing in the DEIS suggests this impact is understated.

9. Historical and cultural impacts[126]

The DEIS identifies no known historical or cultural resources reasonably expected to be affected by the proposed CSIF. It is possible that excavation during construction could uncover human remains, which the DEIS characterizes as a low probability. The site would not be recommended for inclusion on the National Register of Historic Properties. All potential impacts are characterized as SMALL, which implies a monetary value of zero. Nothing in the DEIS suggests this cost is understated.

10. Visual and scenic impacts[127]

The DEIS identifies potential impacts to visual and scenic resources as those arising from diminution of the value of the viewshed. Only the cask transfer building would be as much as 60 ft tall, making it potentially observable offsite. The main facility would be below grade and therefore not observable. The most notable visual impact would be night time security lighting "because of the contrast with the darkness of the surrounding landscape." This effect would be minimized by down-shielding. The DEIS concludes that all visual and scenic impacts are SMALL, which implies a monetary value of zero. Nothing in the DEIS suggests this cost is understated.

11. Socioeconomic impacts[128]

The DEIS identifies potential socioeconomic impacts from the construction, operation, and decommissioning of the proposed CSIF consisting of effects on employment and economic activity, population and housing, and public services and finances within the 4-county region of interest. The DEIS concludes that effects on regional employment,

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[124] U.S. Nuclear Regulatory Commission (2020a) at 4-61 to 4-64.

[125] Occupational Safety and Health Administration (2020).

[126] U.S. Nuclear Regulatory Commission (2020a) at 4-64 to 4-67.

[127] U.S. Nuclear Regulatory Commission (2020a) at 4-67 to 4-70.

[128] U.S. Nuclear Regulatory Commission (2020a) at 4-70 to 4-81.

population, and housing would be SMALL, and that the CSIF would increase local government tax revenues by 1-5%, a MODERATE impact.[129]

The socioeconomic impacts discussed in the DEIS are presumptively positive for the region of interest. Increases in employment, population, and housing may be reduced by reductions elsewhere. Increased local tax revenue would be new, but in CBA all tax revenues are considered transfers. Benefits arise to the extent that local governments which receive these new tax revenues use them to create social value.

Interpreting NRC's definition of SMALL effects symmetrically, if the best estimate of the value of SMALL but adverse environmental is zero, then the best estimate of the value of SMALL environmental benefits also is zero. The value of MODERATE benefits depends, as suggested above, on how local governments spend their new tax revenues. In the best case, they allocate the additional revenue to their highest and best use – i.e., purposes for which benefits exceed costs by the greatest amount. However, if local governments allocate the additional tax revenue based on noneconomic considerations, benefits produced may be as low as zero.

12. Environmental justice impacts[130]

Environmental justice (EJ) concerns impacts that are disproportionately borne by minority and low-income communities. The EJ methodology NRC applied in the DEIS is described in an appendix[131] and based on NUREG-1748.[132]

NUREG-1748 prescribes four steps for EJ analysis, summarized below:

- Determine "the area for assessment," which for a rural area "a radius of approximately 4 miles (50 square miles) should be used," recognizing that "the geographic scale should be commensurate with the potential impact area" such that "the 'communities,' neighborhoods, or areas that may be disproportionately impacted" are evaluated.

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[129] See U.S. Nuclear Regulatory Commission (2020a) at Table 4.11-1, describing how NRC staff classify socioeconomic effects as SMALL, MODERATE, or LARGE.

[130] U.S. Nuclear Regulatory Commission (2020a) at 4-81 to 4-86.

[131] U.S. Nuclear Regulatory Commission (2020a) at Appendix B.

[132] U.S. Nuclear Regulatory Commission (2003) at Appendix C. The EJ methodology is described as "draft for interim use."

- "[O]btain demographic data (census data) for the immediate site area and surrounding communities."
- "[C]ompare the percentage of minority population in the block groups in the area for assessment to the state and county percentages of minority population and to compare the area's percentage of economically stressed households to the state and county percentages of economically stressed households."
- "[D]etermine if there is a 'disproportionately high and adverse' impact (human health or environmental effect) to the minority or low-income population near the site," performed by (i) evaluating which "impacts of the proposed action … determined in the usual manner … affect these populations," (ii) "assess if the impacts disproportionately impact the minority or low-income population," and (iii) "determine if the impacts are high and adverse."

If the answer to this determination is affirmative, the EJ analysis must "look at mitigative measures and benefits."[133]

The EJ analysis in the DEIS complies only in part with NUREG-1748. First, it defines the "area for assessment," but it does so very broadly by substituting a 50-mile radius from the facility in place of the 4-mile radius recommended in NUREG-1748. No explanation is provided for this substitution,[134] which as described below makes the analysis incapable of detecting EJ impacts.

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[133] U.S. Nuclear Regulatory Commission (2003) at C-4 to C-7. A key limitation in the methodology is EJ impacts are assumed to be adverse. However, there is no theoretical reason why effects on minority and/or low-income communities could not be beneficial. Moreover, the purpose of EJ analysis is not limited to identifying disproportionately large adverse effects. It is, rather, the predicate for identifying mitigative alternatives and estimating their relative benefits. The NRC's EJ methodology is therefore structurally flawed because it does not account for potential beneficial effects, or allow beneficial effects to be estimated and compared across alternatives, both of which are necessary for identifying mitigative alternatives and estimating their relative benefits.

[134] U.S. Nuclear Regulatory Commission (2020a) at B-3 to B-4: "NRC's NMSS environmental justice guidance, as found in Appendix C to NUREG–1748 (NRC, 2003), recommends that the area for assessment for a facility in a rural area be a circle with a radius of approximately 6.4 km [4 mi] whose centroid is the facility being considered. However, the guidance also states that the scale should be commensurate with the potential impact area. Therefore, for the proposed CISF project, the NRC staff determined that an environmental justice assessment area with an 80-km [50-mi] radius would be appropriate to be inclusive of (i) locations where people could live and work in the vicinity

Second, the EJ analysis includes the prescribed demographic data for the selected impact area. Information was obtained for every census block within this zone.[135] There is convincing evidence that the proportion of the population which is minority or low-income varies substantially across census blocks, and that some census blocks surely include disproportionately large minority and/or low-income populations.[136]

Where the EJ analysis fails is it does not include the analysis prescribed by NUREG-1748. Because the "area or assessment" is a 50-mile radius from the facility, the EJ analysis is indistinguishable from the main analysis – i.e., it includes no EJ-related content. Indeed, the EJ analysis consists of nothing more than a disclaimer:

> No credible accident scenarios for the proposed CISF project could be found with potentially significant releases of radionuclides to air or ground that could result in significant effects to any offsite populations. The overall environmental impact of the accidents at the proposed CISF project during the license term for the proposed action (Phase 1) and Phases 2-20 is SMALL because safety-related structures, systems, and components are designed to function during and after these accidents. Thus, there is no mechanism for disproportionate environmental effects through accidents on minority and low-income residents near the proposed CISF project.[137]

The inference at the end of the disclaimer is patently false. Adverse effects that are indisputably SMALL when *averaged* over a 50-mile radius (7,850 square miles) can be disproportionately large in small communities within this area. Averaging makes these effects difficult or impossible to observe; it does not make them vanish. By expanding the area of assessment by a factor of more than 150 (from 50 square miles to 7,850 square miles), the DEIS makes it virtually certain that if the CISF would have disproportionately large and adverse impacts on minority and/or low-income communities, the EJ analysis would have been unable to detect them.

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of the proposed project and (ii) of other sources of radiation or chemical exposure. As such, New Mexico and Texas and each county with land area within the 80-km [50-mi] radius from the center of the proposed CISF project are considered in the comparative analysis."

[135] U.S. Nuclear Regulatory Commission (2020a) at B-4 to B-6.

[136] U.S. Nuclear Regulatory Commission (2020a) at Table B-3. For example, in Lea County the fraction of the population below the federal poverty line ranges from 0% to 55%, and the Hispanic ethnicity fraction ranges from 14% to 94%. Table B-3 does not report, for each census block, whether it is located within the 4-mile or 50-mile radius.

[137] U.S. Nuclear Regulatory Commission (2020a) at B-6.

13. Public and occupational health and safety impacts[138]

Incremental public health risks are externalities that cannot be captured in prices for market goods and services, and CBA requires that public health impacts be quantified and monetized. However, the potential public health risks discussed in the DEIS are subject to other NRC regulations and myriad federal and state regulation by other agencies. The DEIS concludes that public health risks related to construction, operations, and decommissioning are SMALL,[139] which implies a monetary value of zero. Compliance with NRC and other agencies' regulations does not reduce public and occupational health risks to zero, however, and regulatory violations often occur. Nonetheless, the conclusion in the DEIS that there would be no public health and safety impacts during operations is reasonable because there would be public exposure.

How to quantify and monetize occupational health risks is a more complicated question in CBA. The reason is incremental occupational risks are capitalized in wage rates, especially in labor markets where risks are known, effectively communicated, and thoroughly regulated. The early literature on the valuation of preventing premature mortality consisted of empirical estimates of the wage premium for occupational safety risks.[140] Estimates of non-radiological occupational health and safety risks reported in Table 4.13-1 of the DEIS (presumably as costs) are thus incomplete because they do not account for worker wage premiums (which would be offsetting benefits). As long as information about occupational risk is not substantially asymmetric and to the disadvantage of workers, these costs and benefits are likely to be approximately equal. They would materially differ only if actual risks are substantially greater or less than expectations. Thus, the approach that embeds the fewest assumptions is to estimate monetized occupational risks and workers' wage premiums, and subtract the latter from the former.

According to the DEIS, the magnitude of non-radiological occupational risks is low. The estimated annual fatality rate during construction or decommissioning (9.8×10^{-5}), when multiplied by NRC's default valuation ($9 million)[141] implies an annual monetized risk of $882 per worker ($0.44 per hour over a 2,000 hour work-year). The estimated

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[138] U.S. Nuclear Regulatory Commission (2020a) at 4-87 to 4-95. Occupational and public health risks related to transportation are covered separately in DEIS Chapter 4.3 and discussed in Section IV.E.2 above.

[139] U.S. Nuclear Regulatory Commission (2020a) at 4-88, 4-92, and 4-94.

[140] See, e.g., Viscusi (1979).

[141] See footnote 46.

market-clearing annual wage premium during operations ([1.3 × 10^{-4}] × $9 million = $1,170 ($0.59 per hour) is similarly low.[142] Because the wage premium for risk expected to be received by those employed in construction, operations, and decommissioning is may well exceed the monetized risks, it would have been reasonable to have made a supported analytic argument in the DEIS justifying its inference that these risks are SMALL.

The DEIS relies on the Holtec SAR for estimates of radiological occupational risks.[143] There is no evidence in the DEIS that the NRC staff reproduced Holtec's work to ensure it meets applicable information quality guidelines.[144] The DEIS reports that "Holtec estimated a single worker's annual dose would be 500 mrem (i.e., 200 person-mrem/week × 50 weeks/yr/20 workers)" but it does not cite the relevant Holtec reference, nor does it indicate that NRC staff reproduced the calculation to validate its accuracy.[145] In any case, applying the NRC's nominal risk value and unit valuation (U.S. Nuclear Regulatory Commission 2015), the value of preventing this exposure would be less than $25.50 per worker ($5,100/person-rem × 0.005 rem) before discounting and accounting for latency.

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[142] Wage premiums also include the monetized risk of non-fatal injury, but it is generally agreed among CBA practitioners that premature mortality risks weigh much more heavily in the calculation because of their much higher unit valuation.

[143] U.S. Nuclear Regulatory Commission (2020a) at 4-90, apparently citing Holtec International (2018). There are at least five different versions of the Holtec SAR, however, if the ADAMS Accession No. for the cited version is correct, the reference is misstated as 2019. The DEIS also cites the Holter ER Holtec International (2019), and there are at least 11 different versions of this reference. For neither reference does the DEIS identify the relevant pages, making independent reproduction of Holtec's work unnecessarily difficult.

[144] The DEIS cites Holtec International (2018) at Table 11.3-1 as its source for these occupational radiological dose rates, but this appears to refer to Table 11.3.1. In any case, the dose rates in Table 13.3.3 cannot be independently reproduced. This suggests that in the DEIS, NRC is disseminating Holtec's work with agency endorsement but without having first conducted the pre-dissemination review required by applicable information quality guidelines.

[145] U.S. Nuclear Regulatory Commission (2020a) at 4-90, characterizing doses in (apparently) Holtec International (2018) at Table 11.3-1 as "conservative" (i.e., likely to overstate the true dose) "because they did not account for shielding." Further, the annual worker dose is described as "applicable to the most highly exposed group of workers," "below the 0.05 Sv/yr (5 rem/yr) occupational dose limit specified in 10 CFR 20.1201(a) for occupational exposure," and therefore "minor."

14. Waste management impacts[146]

The DEIS estimates that construction of Phase 1 would generate 5,080 metric tons of nonhazardous waste sufficient to use than 5.4% the capacity of one of the Sandpoint Landfill, one of multiple nearby licensed facilities.[147] However, the DEIS also asserts that construction of Phases 2-20 would generate an additional 96,525 metric tons, and this would use 3.3% of the capacity of the Sandpoint Landfill.[148] These statements appear to be inconsistent.

Small amounts of non-hazardous and hazardous waste would be expected to be generated during operations and disposed at an offsite licensed facility. Liquid sanitary waste would be collected onsite and disposed offsite. The DEIS concludes that these amounts are "relatively minor" in comparison to facility capacities.[149]

Wastes generated during defueling and decommissioning are unremarkable, and the DEIS concludes that their impacts are SMALL,[150] which implies a monetary value of zero. Nothing in the DEIS suggests this cost is understated.

15. Accident impacts[151]

Estimates of environmental impacts from accidents include in the baseline compliance with other NRC regulations and guidance. Thus, risks already subject to regulatory standards or otherwise managed are treated as non-incremental to the project.

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[146] U.S. Nuclear Regulatory Commission (2020a) at 4-95 to 4-100.

[147] U.S. Nuclear Regulatory Commission (2020a) at 4-95.

[148] See Holtec International (2017c) at 3-121: "The Sandpoint Landfill is 25 miles west of the Site and serves Eddy County. The service area covers 4,200 square miles and has a population of 49,000. The County and the City of Carlsbad jointly own the Landfill… The Lea County Solid Waste Authority has a service area that covers 4,400 square miles and has a population of 55,800… Lea Land, Inc. operates an industrial waste landfill three miles from the Site. The landfill is permitted to take non-hazardous industrial waste… has plenty of available capacity and is projected to remain open for 40 years" (internal references omitted).

[149] U.S. Nuclear Regulatory Commission (2020a) at 4-97.

[150] U.S. Nuclear Regulatory Commission (2020a) at 4-97 and 4-98.

[151] U.S. Nuclear Regulatory Commission (2020a) at 4-100 to 4-103.

For purposes of CBA, however, managed risks are not the same as zero risks. Contrary to the methodology in the DEIS,[152] they should be considered incremental costs to the project and objectively estimated. Design Events are subject to applicable regulatory standards.[153] Similarly, accidental risks that are reasonably foreseeable at nuclear plants from which SNF would be received also should be included, but treated as incremental benefits from the project. In fact, all types of design basis events "could occur." For CBA purposes (as opposed to NRC's licensing decision), they only differ by relative probability and conditional consequences. Risks due to unforeseen accidents could be significant, but there appear to be no data that would illuminate the probabilities of such events, and without probabilities, risk and cost estimates are merely speculative. CBAs should not include speculative cost or benefit estimates.

A more important limitation in the DEIS is it does not include the avoided risks Design Events that would not occur at reactors because SNF was transported to the CSIF. A key question a CBA should answer is whether the expected benefits of accidents avoided by the proposed CSIF exceed the expected costs of accidents that occur at the proposed CSIF.

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[152] U.S. Nuclear Regulatory Commission (2020a) at 4-101: "For some design basis events, such as 19 tornadoes, this section describes how the proposed CISF project would be designed and built to withstand the event without loss of systems, structures, and components necessary to ensure public health and safety. In these cases, the environmental impacts are small because no release of radioactive material would occur. Other design basis events, such as spent fuel-handling accidents, are design basis accidents that Holtec must assume could occur."

[153] U.S. Nuclear Regulatory Commission (2020a) at 4-102:

> For Design Events I and II, "[t]he annual dose equivalent to any individual located beyond the controlled area must not exceed 0.25 mSv [25 mrem] to the whole body, 0.75 mSv [75 mrem] to the thyroid, and 0.25 mSv [25 mrem] to any other organ." Based on U.S. Nuclear Regulatory Commission (2015), the value of avoiding a 75 mrem dose is $382.50 ($5,100/person-rem × 0 .075 rem) before discounting.
>
> For Design Events III or IV, the maximum permitted dose equivalent is 0.05 Sv [5 rem] or the sum of the deep dose equivalent to and the committed dose equivalent to any individual organ or tissue (other than eye lens) of 0.05 Sv [50 rem]; a lens dose equivalent of 0.15 Sv [15 rem]; and a shallow dose equivalent to skin or any extremity of 0.5 Sv [50 rem]. Based on U.S. Nuclear Regulatory Commission (2015), the value of avoiding a 50 rem dose is $255,000 ($5,100/person-rem × 50 rem) before discounting.

Nothing in the DEIS illuminates this question because NRC's CBA methodology ignores benefits.

The DEIS concludes that the impacts from Design I and II events, and pending completion of its Final Safety Analysis Review (FSAR), the impacts from such events is SMALL.,[154] which implies a monetary value of zero. Because the benefits of avoiding Design Events at reactors has not been accounted for, it is not clear that zero is the best estimate of net benefits.

16. Cumulative impacts[155]

Cumulative impacts are "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions."[156] The DEIS discusses a range of past, present, and reasonably foreseeable future energy-related actions, including:

- Mining
- Oil and gas development
- The Waste Isolation Pilot Plant (WIPP)
- The National Enrichment Facility (NEF)
- Waste Control Specialists' (WCF) facility for treatment, storage, and disposal of certain radioactive and hazardous waste and byproduct materials, potentially expanded by a CISF similar to this project at its existing facility in Andrews County, Texas[157]
- Texas's potential authorization of a facility for the disposal of GTCC waste
- Fluorine Products' depleted uranium deconversion facility
- Various renewable energy projects
- A proposal to construct a Medical Isotopes Production Facility

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[154] U.S. Nuclear Regulatory Commission (2020a) at 4-103.

[155] U.S. Nuclear Regulatory Commission (2020a) at 5-1 to 5-59.

[156] U.S. Nuclear Regulatory Commission (2020a) at 5-1, citing 40 C.F.R. § 1508.7. This definition was not changed in Council on Environmental Quality (2020).

[157] [[N.B. These proposals are competitors, and either facility alone would be sufficient to store all reactor SNF. Therefore, if both are licensed by NRC, the full buildout size of each will be smaller.]]

In addition, the DEIS accounts for various foreseeable non-energy related development projects, industrial waste land farms, and waste disposal facilities.

The DEIS characterized cumulative impacts based on a CEQ methodology[158] and summarized them in Table 5.1-1. Impacts are characterized as SMALL for some categories, and SMALL to MODERATE for others. By definition, SMALL cumulative impacts have zero value. The magnitude of MODERATE cumulative impacts is not clear. Whether they are nonzero depends on a more refined description of their nature and magnitude and reasonable methods for monetizing them, which would be impact-specific.

17. Environment impacts not accounted for in the DEIS

Potentially significant environmental effects are not included in the DEIS. In particular, The DEIS does not identify or quantify security risks or the costs that would arise if these risks were to materialize.[159] Security risks include physical threats to the facility posed by natural events or human actions; external threats that may result from independent, offsite natural events or human actions; and cyber threats that could adversely affect operations or operational security.

Even if it is presumed that NRC will ensure that Holtec complies with applicable NRC regulations related to security risks, compliance does not eliminate them or make them analytically irrelevant. The Final EIS should identify (and to the extent possible, quantify) these risks in the same way the previous 16 categories of impacts were identified and quantified.

Our review also has uncovered potentially key deficiencies in the way the DEIS evaluates utility services to the proposed CISF. The DEIS does not account for the environmental impacts likely to result from an interruption in utility service, most notably electricity. Similarly, the DEIS also does not account for the costs of providing redundant and/or backup electricity and potable water.[160]

F. Deficiencies in the CBA

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[158] Council on Environmental Quality (1997). Evaluating the merits and information quality compliance of this methodology would require a separate review.

[159] Bittenbender (2020).

[160] Bittenbender (2020). Utilities often have interactive effects. For example, potable water supplies could be limited by an electrical outage.

A DEIS is required by CEQ regulations at 10 C.F.R. § 51.71(d) to include the following components:

- A preliminary analysis that considers and weighs the environmental effects, including any cumulative effects, of the proposed action.
- The environmental impacts of alternatives to the proposed action.
- Alternatives available for reducing or avoiding adverse environmental effects.
- A consideration of the economic, technical, and other benefits and costs of the proposed action and alternatives.

1. Obvious structural defects in the CBA

Chapter 8 of the DEIS is NRC's response to the fourth bullet above.[161] It correctly describes the proper focus of a CBA, which is "societal" (i.e., aggregate) rather than idiosyncratic (i.e., particularized to any individual, company, or industry). Nonetheless, the CBA has the following obvious structural defects.

a. The CBA lacks an explicit analysis of relevant alternatives

Whereas 10 C.F.R. § 51.71(d) calls for analysis of relevant alternatives, the CBA considers none. The CBA purports to include no-action as an "alternative," but no-action actually is just the analytic baseline for evaluating costs and benefits expected from every alternative considered, including the proposed project. In CBA practice, scope is defined by the objectives of the proposed project or the problem to be solved by regulation. Bona fide alternatives are those which could meet the objectives of the proposed project or address the problem to be solved, but in a different manner. Alternatives that differ at the margin from the proposed project or regulation are also often included. Options that address a different project or purport to solve a different problem are not appropriate alternatives in a CBA. The CBA in the DEIS suffers from this defect

Phase 1 is the subject of the application and the CBA, so every alternative considered must be compatible with its scope and scale. However, the CBA includes the full buildout of all 20 Phases as a purported alternative. This supplants the scope and scale of the proposed project with an option of vastly different scope and scale. Thus, it is not a bona fide alternative to Phase 1. Furthermore, its inclusion relies on specious reasoning. "[F]acilities and infrastructure completed as part of [Phase 1] and their associated costs are

[161] See U.S. Nuclear Regulatory Commission (2020a) at 8-1.

integral to the additional phases"[162] only to the extent that they are either fixed costs for Phase 1 or cost-effective investments in potential future phases.

The CBA does include a discussion of a potentially bona fide alternative – the case where a second and competing CISF is licensed by NRC.[163] However, this discussion includes no serious analysis. No information is provided concerning the costs and benefits of a second CISF, and this information is essential for a bona fide alternative. The DEIS is correct that "[t]he presence of a second CISF could impact the costs for the proposed Holtec CISF in several ways," but even the description of these impacts is conceptually incomplete and purely speculative, and fundamentally biased. Delays in the transportation of SNF to the Holtec CISF are foreseeable if a second CISF were licensed, built, and operated, but any such delays would be the result of transporting SNF to the second CISF, and the costs, benefits, and environmental impacts of a second CISF are not addressed. Transportation costs to the Holtec CISF would indeed be lower if a second CISF were licensed, built, and operated, but that would be occur because of offsetting transportation costs to the second CISF, which the DEIS does not estimate. Future construction costs at the Holtec CISF would be lower if Holtec did not seek a license amendment to construct and operate one or more subsequent phases, but offsetting construction costs would be borne at the second CISF, which the DEIS does not include. A second CISF might well, as the DEIS hypothesizes, reduce the optimal size of buildout at Holtec's facility, but this change would be offset by additional construction at the second CISF. In short, the discussion of a second CISF has no information value except to the extent that it states some (but not all) obvious facts.

The proper way to include a second CISF as an alternative in the CBA is to make it a formal alternative. Additional alternatives also could be devised consisting of one or more combinations of the Holtec CSIF and an second CSIF. For any of these alternatives, the DEIS must include a full accounting of environmental impacts for each, and a full CBA for each.

b. The CBA lacks a benefits assessment

The CBA includes no assessment of social benefits reasonably attributable to the project. A purported CBA without a benefits assessment is just a cost assessment. A benefits assessment is necessary to allow costs and benefits to be properly compared, and in particular, for costs to be subtracted from benefits to ascertain whether the project offers net social benefits. By failing to include a benefits assessment, this CBA fails to fulfill its key purpose.

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[162] U.S. Nuclear Regulatory Commission (2020a) at 8-1.

[163] U.S. Nuclear Regulatory Commission (2020a) at 8-5 to 8-6.

The CBA states that benefits consist of "the costs society could save by using the proposed CISF."[164] While these cost savings are indeed social benefits, they are not the only social benefits that the proposed CISF could produce. In particular, the proposed CISF could result in net reductions in environmental impacts, including occupational and public health risks. The CBA does not even consider these benefits, much less account for them, which seems surprising given the statutory and regulatory purpose of environmental assessment is to identify and estimate the full array of impacts expected to result from a project.[165]

c. The CBA incorrectly characterizes transfers as benefits

Table 8.3-2 purports to summarize the assessment of environmental benefits. However, the only item listed is positive revenue effects on local government finances. As noted in Section IV.E.11 above, however, these effects are not cognizable as benefits in CBA; they are transfers. Tax payments made to local governments in the region by Holtec, its suppliers, its employees, and its stockholders would be equal to tax payments received by these governments.[166] If tax receipts by local government are counted as a "benefit," tax payments must be counted as a "cost."

d. The CBA lacks quantitative estimates of environmental impacts

Table 8.3-1 summarizes the assessment of environmental costs. Impacts are characterized semi-quantitatively as SMALL, MODERATE, or LARGE. Semi-quantitative characterizations of costs cannot be summed to produce an aggregate cost estimate, the purported objective of NRC's CBA. There is no way to aggregate 16 environmental impacts described this way.

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[164] U.S. Nuclear Regulatory Commission (2020a) at 8-6.

[165] Some potentially beneficial environmental impacts of the proposed CISF are discussed qualitatively in the discussion of the no-action baseline. See U.S. Nuclear Regulatory Commission (2020a) at 8-7 to 8-8. An evaluation of net environmental impacts requires ascertaining the environmental impacts of the no-action baseline, at least with the same rigor that was used to assess the environmental impacts of the proposed CISF. The CBA does not include this assessment, thus making it impossible to evaluate net environmental impacts, even though this is explicitly required by NRC's CBA guidance.

[166] Tax payments made to federal and state governments are not included in the DEIS. These payments also are transfers that exactly match receipts.

e. The CBA focuses almost exclusively on private (not social) costs

Virtually the entire cost assessment in the CBA consists of estimates of *private* costs to Holtec.[167] To be sure, social cost equals the sum of private and public costs. However, the DEIS excludes private *benefits* to Holtec, thus creating an obvious analysis asymmetry. Moreover, the DEIS implicitly concludes that public costs range from zero to negligible.[168] This focus on private costs, especially in the absence of any attention to private benefits, seems a misguided analytic effort that cannot constructively inform the public or the Commission. Excess precision in these estimates, discussed separately in Subsection g below, make them less (not more) useful, and almost certainly misleading.

f. The CBA estimates private costs for the baseline and calls them benefits

The discussion of environmental impacts in the DEIS treats no-action as the baseline from which effects at the margin can be assessed. As noted above, this approach is generally correct, though with an important proviso: environmental impacts that are reasonably expected to occur in the baseline *but are expected to be prevented by the project* must be counted as project benefits. The CBA completely departs from this conventional framework. It includes private cost estimates for the no-action alternative.[169] It is possible, though by no means clear, that these cost estimates are intended to show how the proposed CISF would *reduce* costs at operating and decommissioned reactors (i.e., produce social benefits). But if so, the calculations in the CBA are woefully incomplete.

g. Excess precision

The DEIS cost estimates are reported with up to 10 significant figures. For example, the CBA reports total undiscounted private costs for phase 1 of $977,288,943 or $1,858,229,346, depending on the scenario. This level of precision implies accuracy ± $0.50. But this precision is impossible, and it is impossible for such precision to be "accurate, clear, [and] complete," even if it is "unbiased," as applicable information quality

[167] U.S. Nuclear Regulatory Commission (2020a) at 8-3 to 6-6, and Appendix C.

[168] Recall that for environmental impacts to be SMALL, they must "not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource." See U.S. Nuclear Regulatory Commission (2020a) at xxiv and 2-26.

[169] U.S. Nuclear Regulatory Commission (2020a) at C-11 to C-15.

guidelines require. The two scenarios differ by a reported $880,940,403 (± $0.50) when the best possible characterization of that difference is a factor of 2x.

Excess precision is a violation of the information quality standard of presentational objectivity.[170] It is inherently misleading because it purports to show the public and the Commission that agency experts are extraordinarily confident about their knowledge when in fact that knowledge is quite limited.

h. The CBA ignores uncertainty, includes no sensitivity analysis, and denies the public sufficient information to conduct its own sensitivity analysis

Excess precision – the error of reporting up to 10 significant digits when perhaps a couple of them are meaningful – indirectly highlights the problem of uncertainty. The DEIS does not acknowledge that the cost estimates it reports are uncertain. Further, it provides no information to the reader that would illuminate the degree of uncertainty present. Failing to discuss uncertainty or provide information about its likely magnitude is a fatal deficiency in this CBA.

Government-wide analytic guidance advises agencies to identify the main sources of uncertainty and conduct sensitivity analysis to ascertain how results differ under alternative states of the world.[171] Private experts in the field offer the same advice.[172] The CBA in the DEIS does not identify any sources of uncertainty and includes no sensitivity analysis – both of which are fatal deficiencies.

Readers of the DEIS interested in how the results of the CBA would change under different assumptions, models, or datasets have nowhere to go. The DEIS provides no tools enabling stakeholders and other members of the public to conduct their own sensitivity analyses.

2. Arbitrary estimates of private costs under "Scenarios A and B"

The CBA estimates private costs for the project and full buildout under two scenarios: Scenario A, described as "based on costs from currently decommissioning reactor sites," and Scenario B, described as "a higher CISF operations estimate based on the costs the applicant identified." Details concerning these scenarios are said to be included in

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[170] Office of Management and Budget (2002) at 8459 [Sec. V.3.a].

[171] Office of Management and Budget (2003).

[172] See, e.g., Dudley, et al. (2017).

Section C-3 of Appendix C.[173] But Appendix C does not illuminate why these scenarios were chosen or provide a thorough explanation of the methodology used to decide how Scenarios A and B should differ, which costs to include in each Scenario, when to include them, or why they should differ.[174]

As for Appendix C, it only records the results. The analysis of private costs in the CBA is not transparent and does not comply with the information quality standard of reproducibility.[175]

3. Insufficient estimates of environmental impacts

As noted above, the CBA does not provide estimates of the environmental impacts of the no-action baseline, and this makes it impossible to estimate *net* environmental impacts. The CBA does include a qualitative discussion of environmental impacts for the no-action alternative.[176] Leaving aside its qualitative nature, this discussion is misleading. The DEIA asserts that the transport of SNF to the Holtec CISF would not reduce environmental impacts at reactors which transport SNF to the Holtec CISF.[177] That is, the DEIS assumes that the transport of SNF to a CISF has neither positive nor negative environmental impacts at the reactor at which it resided. This is almost certainly counterfactual. The CBA should have carefully examined the extent to which the movement of SNF from reactors (whether decommissioned or operating) would be expected to result in environmental impacts.

4. Improperly calculated net benefits

The CBA implicitly treats private costs in the baseline and subtracts them from private costs of the proposed CISF to obtain an estimate of "net benefit."[178] As noted above, this methodology effectively ignores benefits, the estimation of which is essential for any

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[173] U.S. Nuclear Regulatory Commission (2019) at 8-3.

[174] See U.S. Nuclear Regulatory Commission (2019) at C-4 to C-5. The only text relevant to this matter is at 8-4.

[175] Office of Management and Budget (2002) at 8460 [Sec. V.10].

[176] U.S. Nuclear Regulatory Commission (2020a) at 8-8 to 8-9.

[177] U.S. Nuclear Regulatory Commission (2020a) at 8-8: "[E]nvironmental impacts would continue to occur at the nuclear power plants and ISFSIs with the exception of any sites that are fully decommissioned such that NRC terminates its license and releases the property for other uses."

[178] U.S. Nuclear Regulatory Commission (2020a) at 8-9 to 8-10.

CBA. But it also makes no sense to subtract private costs otherwise borne by Holtec's prospective customers from the costs Holtec would bear to license, construct, and operate the proposed CISF. The DEIS implicitly assumes that Holtec would capture 100% of the costs reactor owners otherwise would bear if they kept SNF on site. But if this were true, reactor owners would be indifferent between retaining SNF onsite or shipping it to the Holtec CISF. In that case, the best estimate of cost savings would be half as large as reported in the DEIS. Reactor owners' decisions to retain SNF or transship it to Holtec could be determined by a series of coin flips.

Calculated this bizarre way, net private benefits for the project are positive, an unsurprising result.[179] Less convincing is the calculation that full buildout would have substantial net private *costs*.[180] Of course, if Holtec agreed with the DEIS it would not apply for all remaining 19 phases of the project.

V. Information quality review

The DEIS is silent with respect to information quality issues; applicable information quality guidelines published by the Office of Management and Budget and the NRC are not cited. There is no text affirming that the information therein (including analytic results) is reproducible. Similarly, the DEIS does not show that the information reported (including analytic results) satisfies the substantive information quality standard of objectivity. Silence about information quality, combined with a number of obvious violations, strongly suggests that NRC staff are either unaware of the guidelines even though they were published 18 years ago, or they are aware of the guidelines but actively opposed to compliance.

To a great extent, the DEIS appears to have relied on Holtec's ERs and SARs, each of which follows the same structure as the DEIS. Indeed, the DEIS cites a Holtec ER or SAR no fewer than 414 times. But in none of these cases does the DEIS indicate that NRC staff reproduced Holtec's work, much less conducted some form of validation of its accuracy. Applicable information quality guidelines require NRC to do so, however. Every item of

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[179] See U.S. Nuclear Regulatory Commission (2020a) at Table 8.5-1, showing net private value of $700 million to $900 million at a discount rate of 7% and $1 billion to $1.5 billion at a discount rate of 3%. Holtec likely would not have filed the application if net private benefits were negative, and its hurdle rate for investment projects may be quite different than either of these federally prescribed discount rates for federal (not private) projects.

[180] See U.S. Nuclear Regulatory Commission (2020a) at Table 8.5-2, showing negative net private value except in the case of Scenario 2 at a discount rate of 3%.

information in the Holtec ERs and SARs that the DEIS disseminates in a manner reasonably conveying agreement is subject to these guidelines, and NRC is required to conduct a pre-dissemination review to ensure information quality compliance.

A. Reproducibility of other documents

The DEIS also relies on numerous NRC documents and documents disseminated by other federal agencies. To the extent that these documents affirmatively comply with applicable information quality guidelines, nothing besides an acknowledgement of this fact is required. However, to the extent that these documents do not comply with applicable information quality guidelines – likely to be true if, like the DEIS, they are silent on the subject – it is NRC's responsibility to conduct the requisite pre-dissemination review before disseminating the cited information.

As for the CBA, it is simply not reproducible. Key tables (e.g., Tables 8.3-3, 8.4-1, 8.5-1, and 8.5-2) cannot be reproduced from the details provided in Appendix C. To the extent that NRC is relying on Holtec's ERs and SARs, but these documents and their supporting materials are not reproducible, then additional work will be required to secure the necessary background information so that they can be reproduced.

Reproducibility is the means by which the information quality guidelines ensure that the goal of transparency is achieved. For that reason, federal agencies are generally forbidden from disseminating significant information that is not reproducible, and a formal Request for Correction may be required, in addition to conventional public comments.[181]

B. Objectivity

Among the three substantive information quality standards applicable to the DEIS, objectivity and utility stand out as likely to be the most important. For information (such as the cost analyses) to be objective, it must be "accurate, reliable, and unbiased," and "presented in an accurate, clear, complete, and unbiased manner." Only after this information adheres to the reproducibility standard can the objectivity of the CBA be assessed.

VI. References

[181] Agencies are required to establish and operate administrative procedures whereby the public can seek and obtain the correction of information disseminated by an agency that does not adhere to information quality guidelines. For government-wide requirements, see Office of Management and Budget (2002) at 8459 [Sec. II.3]. For the NRC's error correction procedures, see U.S. Nuclear Regulatory Commission (2020b).

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