

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
PA'INA HAWAII, LLC.	)	Docket No. 30-36974-ML
)	
Material License Application	)	ASLBP No. 06-843-01-ML

NRC STAFF'S INITIAL STATEMENT OF POSITION ON AMENDED
ENVIRONMENTAL CONTENTIONS 3 AND 4

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August 26, 2008

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INTRODUCTION

The NRC Staff hereby submits its initial written testimony and initial statement of position addressing the admitted portions of amended environmental contentions 3 and 4. In these contentions the Intervenor, Concerned Citizens of Honolulu, alleges various deficiencies in the Environmental Assessment (EA) that the Staff agreed to prepare in connection with the application for an underwater irradiator license submitted by Pa'ina Hawaii, LLC. Specifically, the Intervenor claims that the Staff violated the National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321 *et seq.* (NEPA), by failing to take a "hard look" at the impacts of licensing Pa'ina's irradiator and by not considering a reasonable range of alternatives to licensing the irradiator. These claims are without merit. As explained below and in the Staff's testimony, the Staff's experts thoroughly considered the potential impacts of licensing Pa'ina's irradiator and carefully evaluated a broad range of alternatives before issuing a license to Pa'ina. Because the Staff fully complied with NEPA, the Board should dismiss the Intervenor's contentions and affirm the Staff's issuance of a license to Pa'ina.

BACKGROUND

On June 23, 2005, Pa'ina filed an application for a license to possess and use byproduct material in connection with an underwater irradiator.¹ Pa'ina plans to build its irradiator in an industrial area adjacent to the Honolulu International Airport (HNL).² The irradiator will contain doubly-encapsulated cobalt-60 sources that are secured inside a plenum and anchored to the bottom of a pool of water 18'6" deep and approximately 81" by 95" wide.³ Pa'ina plans to use its facility for the commercial irradiation of food and other products, which will be submerged in the pool and exposed to the sources. As is typical of underwater irradiators, the pool water will provide the primary means of radiation shielding.⁴

On October 3, 2005, the Intervenor filed its hearing request, setting forth twelve safety and two environmental contentions.⁵ In a January 2006 Order, the Board admitted environmental contention 1 and a portion of environmental contention 2.⁶ In these contentions the Intervenor challenged the Staff's finding that the present licensing action is categorically excluded from review under NEPA and alleged that the Staff must prepare an Environmental Assessment (EA) or Environmental Impact Statement (EIS). The Intervenor argued in

¹ Application for Material License for Pa'ina Hawaii, Rev. 00 (June 23, 2005) (ADAMS Accession No. ML052060372).

² "HNL" is the Federal Aviation Administration's airport code for Honolulu International Airport.

³ See Final Environmental Assessment for Proposed Pa'ina Hawaii, LLC Irradiator (August 10, 2007) (ADAMS Accession No. ML071150121) at 2-3, A-3.

⁴ Application for Material License for Pa'ina Hawaii, Rev. 00 at 30.

⁵ Request for Hearing by Concerned Citizens of Honolulu (October 3, 2005) (ADAMS Accession No. ML052970026).

⁶ *Pa'ina Hawaii*, LLC, LBP-06-4, 63 NRC 99 (2006). In a March 2006 Order, the Board also admitted several safety contentions in the Intervenor's hearing request. Those contentions have since been dismissed, along with other safety contentions the Intervenor subsequently filed.

contention 1 that the Staff improperly invoked the categorical exclusion for irradiators at 10 C.F.R. § 51.22(c)(14)(vii) by failing to explain why risks associated with aircraft crashes, tsunamis and hurricanes at the HNL do not constitute “special circumstances” such that, under 10 C.F.R. § 51.22(b), the categorical exclusion does not apply. In contention 2, the Intervenor affirmatively argued that risks associated with aircraft crashes, tsunamis and hurricanes constitute “special circumstances.”

On March 20, 2006, the Intervenor and the Staff entered into a joint stipulation resolving all issues associated with the Intervenor’s environmental contentions 1 and 2.⁷ Pursuant to that stipulation, the Staff agreed to complete an EA concerning Pa’ina’s application. The Staff also agreed that, before issuing any final finding of no significant impact (FONSI), the Staff would issue a draft FONSI for public review and comment and hold at least one public meeting in Honolulu. The Intervenor reserved its right pursuant to 10 C.F.R. § 2.309(c) to file additional contentions challenging the adequacy of the Staff’s NEPA review after the Staff published a final FONSI. The Board approved the joint stipulation and dismissed environmental contentions 1 and 2.⁸

To help prepare its EA, the Staff contracted with the Center for Nuclear Waste Regulatory Analyses (CNWRA) to address risks associated with aircraft crashes and various natural phenomena. The CNWRA prepared Draft and Final Topical Reports addressing these risks, and the Staff relied on these reports in its Draft and Final EAs. Following release of the Draft Topical Report⁹ and Draft EA,¹⁰ the Intervenor filed environmental contentions 3 through 5,

⁷ “NRC Staff and Concerned Citizens of Honolulu Joint Motion to Dismiss Environmental Contentions” (March 20, 2006) (ADAMS Accession No. ML060820592).

⁸ Order (Confirming Oral Ruling Granting Motion to Dismiss Contentions) (April 27, 2006) (unpublished).

⁹ Draft Topical Report on the Effects of Potential Natural Phenomena and Aviation Accidents at the Pa’ina (continued. . .)

alleging that the draft documents insufficiently analyzed risks to Pa'ina's irradiator and thus failed to comply with NEPA.¹¹

On August 10, 2007, the Staff issued the Final EA for Pa'ina's irradiator,¹² which incorporated the CNWRA's Final Topical Report.¹³ On August 17, 2007, the Staff issued NRC License No. 53-29296-01, authorizing Pa'ina to possess and use sealed sources in connection with its proposed underwater irradiator.

On September 4, 2007, the Intervenor filed amended environmental contentions 3 through 5, arguing that the Staff's Final EA and Topical Report perpetuated deficiencies in the draft documents and introduced new deficiencies.¹⁴ The Intervenor thereafter filed a motion asking the Board to stay the effectiveness of License No. 53-29296-01.¹⁵ Noting that Pa'ina had not yet executed a lease for the land on which it intends to build its irradiator, the Board

(. . .continued)

Hawaii, LLC Irradiator Facility (Dec. 31, 2006) (ADAMS Accession No. ML063560344).

¹⁰ Draft Environmental Assessment Related to the Proposed Pa'ina Hawaii, LLC Underwater Irradiator in Honolulu, Hawaii (December 21, 2006) (ADAMS Accession No. ML063470231) ("Draft EA") (December 21, 2006) (ADAMS Accession No. ML063470231). On June 1, 2007, the Staff published a supplement to the Draft EA addressing the potential environmental impacts of a terrorism attack at the facility. Consideration of Attacks on the Proposed Pa'ina Hawaii, LLC Irradiator (June 1, 2006) (ADAMS Accession No. ML071290585).

¹¹ Intervenor's Contentions Re: Draft Environmental Assessment and Draft Topical Report (February 9, 2007) (ADAMS Accession No. ML070510116).

¹² Final Environmental Assessment for Proposed Pa'ina Hawaii, LLC Underwater Irradiator in Honolulu, Hawaii, (August 10, 2007) (ADAMS Accession No. ML071150121).

¹³ Final Topical Report on Aircraft Crash and Natural Phenomena Hazard at the Pa'ina Hawaii, LLC Irradiator Facility (May 1, 2007) (ADAMS Accession No. ML071280833).

¹⁴ Intervenor Concerned Citizens of Honolulu's Amended Environmental Contentions #3 Through #5 (September 4, 2007) (ADAMS Accession No. ML072530634).

¹⁵ Intervenor Concerned Citizens of Honolulu's Application for Stay of NRC Staff's Issuance of License for Possession and Use of Byproduct Material (August 27, 2007) (ADAMS Accession No. ML072430872).

neither granted nor denied the stay request; instead, it issued an order holding that request in abeyance and requiring Pa'ina to file monthly status reports regarding the status of its lease negotiations.¹⁶ To this date, Pa'ina has not executed a lease in connection with its irradiator or begun construction of the irradiator.¹⁷

Order Admitting Amended Environmental Contentions 3 and 4

In December 2007, the Board issued an Order admitting a number of segments within amended environmental contentions 3 and 4, while rejecting other segments.¹⁸ In amended environmental contention 3, the Intervenor claimed that the Staff failed to take a “hard look” at the environmental impacts of licensing Pa'ina's irradiator. The Intervenor divided this contention into five portions.

First Portion of Amended Environmental Contention 3

In the first portion, which the Board admitted,¹⁹ the Intervenor claimed that its experts submitted comments on the draft EA that were not addressed in the final EA. In their comments the experts claimed the draft EA failed to:

[1] consider significant factors in evaluating the likelihood the proposed irradiator would be involved in an aviation accident;

[2] quantify the impact of flying airplane and building debris following an aviation accident to determine if sources would be breached;

¹⁶ Order (Temporarily Holding in Abeyance Stay Application) (October 5, 2007) (unpublished).

¹⁷ See “Lease Update in Response to ASLB's October 5, 2007 Order” (noting that “[l]ease negotiations between Pa'ina Hawaii, LLC and the State of Hawaii are still ongoing. No lease has yet been signed.”) (August 5, 2008) (ADAMS Accession No. 082261298).

¹⁸ Order (Ruling on Admissibility of Intervenor's Amended Environmental Contentions) (December 21, 2007) (unpublished). The Board deferred ruling on amended environmental contention 5, in which the Intervenor argued that the Staff must prepare an EIS, deeming that contention premature. Order (Ruling on Admissibility of Intervenor's Amended Environmental Contentions) at 33–34.

¹⁹ Order (Ruling on Admissibility of Intervenor's Amended Environmental Contentions) at 11–13.

- [3] quantify hurricane storm surge and tsunami inundation runoff potential;
- [4] consider the effects on the irradiator pool of increases in buoyancy forces due to hurricane surge or tsunami inundation;
- [5] consider potential consequences of hurricane winds;
- [6] evaluate unique features of Ke'ehi Lagoon that might increase the potential for tsunami-related impacts;
- [7] consider potential focusing effects of seismic energy on O'ahu;
- [8] evaluate properly the threat of liquefaction;
- [9] analyze thoroughly terrorist threats; [and]
- [10] examine accidents involving transportation of cobalt-60 sources to and from the proposed irradiator.

Amended Environmental Contentions #3 Through #5 (Contentions) at 7–8 (citing 2/8/07 Earthjustice Letter, with enclosed expert reports; Sozen/Hoffmann Report; 2/7/07 Resnikoff Report; Pararas-Carayannis Report; Thompson Dec.; 7/9/07 Earthjustice Letter, with enclosed reports; and 7/6/07 Resnikoff Report; 8/24/07 Resnikoff Declaration).

Second Portion of Amended Environmental Contention 3

In the second portion of this contention, the Intervenor claimed that the Final EA lacked sufficient evidence and analysis about the potential impacts of Pa'ina's irradiator. Contentions at 8–14. The Board found that the Intervenor raised an issue as to whether the Staff met NEPA's "hard look" standard in twelve of twenty-five areas identified by the Intervenor.²⁰

Specifically, the Board admitted segments claiming the Staff failed to provide:

- (1) Any calculations, analysis or data substantiating its claim that "it is unlikely that an employee could receive more than the occupational dose limit" or quantification of what it means by "unlikely";
- (2) Any calculations, analysis or data regarding its evaluation of the "expected

²⁰ Order (Ruling on Admissibility of Intervenor's Amended Environmental Contentions) at 13–16.

dose rate" outside the irradiator;

(3) Any calculations, analysis or data substantiating its claim "it is unlikely that a member of the public could receive more than the public limit" or quantification of what it means by "unlikely";

(4) Any calculations, analysis or data substantiating its claim "[t]ransportation impacts from normal operations would be small";

(5) Any calculations, analysis or data substantiating its claim "[t]he proposed irradiator would potentially have small beneficial impacts to socioeconomics";

(6) Any justification for focusing its review of potentially significant impacts on "offsite consequences";

(7) Any calculations, analysis or data substantiating its claim "a loss of 6 feet of pool water would result in a dose of approximately 300 millirem/hour" or justification of its assertion that "the increased dose rate will not be sufficient to have a significant environmental effect on the area around the proposed facility";

(8) Any justification for its decision to analyze only a 6-foot water loss, especially given that the depth of the water table is 2.4 m (8 feet) below the facility floor;

(9) Any calculations, analysis or data substantiating its claim "worker doses should not be significantly increased in the area around the pool" in the event of a loss of shielding water or quantification of what it means by "significantly increased";

(10) Any analysis to justify its assumption that "debris around the pool" would prevent "inadvertent access to the areas of elevated radiation directly above the pool";

....

(24) Any calculations, analysis or data substantiating its claim "[t]he likelihood of accidents involving exposure of workers to lethal doses from this specific irradiator design is expected to be low" or quantification of what it means by a "low" likelihood;

(25) Any calculations, analysis or data to back up its speculation that "there is no reason to believe the irradiator would have any effect" on tourism.

Contentions at 8–14. The Board rejected the thirteen remaining segments of this portion of the contention, explaining that "it appears clear from the face of the final EA" that the Staff

sufficiently addressed each of the issues raised by the Intervenor.²¹

Third Portion of Amended Environmental Contention 3

In the third portion, which the Board also admitted,²² the Intervenor argued that the Staff failed to adequately consider the impact of aircraft crashes and natural disasters involving Pa'ina's irradiator. According to the Intervenor:

[1] The Final EA fails to consider potential impacts associated with major flooding.

[2] The Final EA fails to quantify the risk of tsunamis and hurricanes through numerical modeling or, at a minimum, analyze the range of environmental impacts likely to result in the event of a major tsunami, including the impacts resulting from hurricane storm and tsunami inundation.

[3] The Final EA fails to consider numerous other potential impacts related to natural disasters, such as the potential for increased buoyancy due to hurricane storm surge or tsunami inundation to compromise the irradiator pool's integrity or allow shielding water to drain out, damage from hurricane-force winds, and liquefaction during an earthquake.

[4] The Final EA failed to consider credible scenarios under which an aircraft crash might result in exposures above regulatory limits, including, but not limited to, damage to the irradiator pool structure at or below the groundwater level, resulting in a loss of vital pool shielding water, and release of water contaminated with radioactive cobalt through a tear in the pool lining, contaminating groundwater and nearby Ke'ehi Lagoon.

[5] Although the Final EA presents the results--but not the underlying data--of calculations regarding the increase in radiation dosage associated with a six-foot loss of shielding water, it provides no justification for considering only this scenario, which dramatically understates potential impacts.

[6] In addition, the Final EA was obliged to evaluate situations in which more shielding water is removed from the irradiator, either from the force of an explosion or through evaporation in a fuel fire, which would result in far higher radiation doses.

[7] The Final EA inaccurately assumes the irradiator pool water could become

²¹ Order (Ruling on Admissibility of Intervenor's Amended Environmental Contentions) at 13 n.48.

²² *Id.* at 17-19.

contaminated only if the cobalt-60 sources were allowed to corrode following a breach in the source encapsulation. The analysis ignores the potential for physical destruction of the sources to contaminate pool water or allow dispersal of pulverized cobalt-60 via breaches in the pool lining.

[8] The Final EA improperly dismisses the potential for significant impacts in the event an airplane crash destroys all monitoring equipment or incapacitates irradiator personnel.

[9] While the Final EA considers transportation impacts from normal operations, it fails to examine the likelihood and consequences of accidents that might occur during the annual transport of cobalt-60 sources to and from the proposed irradiator.

Contentions at 15-18. In support of its arguments, the Intervenor relied on various portions of the February 9, 2007 and August 24, 2007 Resnikoff Declarations; the February 7, 2007 Resnikoff Report; the February 9, 2007 Pararas-Carayannis Declaration; and the February 9, 2007 Pararas-Carayannis Report.

Fourth Portion of Amended Environmental Contention 3

In its December 21, 2007 Order, the Board deferred ruling on the fourth portion of amended environmental contention 3, in which the Intervenor challenged the Staff's terrorism analysis in Appendix B of the EA. Contentions at 18–29. The Board deferred ruling on this portion of the contention because it was awaiting a pending Commission decision on a closely parallel contention in *Pacific Gas and Electric Co. (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation)*.²³ On March 4, 2006, after the Commission issued its decision in *Diablo Canyon*,²⁴ the Board ruled on the fourth portion of amended environmental contention 3.²⁵

²³ Order (Ruling on Admissibility of Intervenor's Amended Environmental Contentions) at 19–20.

²⁴ *Pacific Gas and Electric Co. (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation)*, CLI-08-01, 67 NRC 1 (2008).

²⁵ Memorandum and Order (Ruling on Admissibility of Intervenor's Terrorism-Related Challenges) (March (continued. . .))

The Board refused to admit all but one of the issues raised by the Intervenor in its terrorism-related contention. The Board admitted the fourth segment of the Intervenor's contention, but only to the extent it alleged that the Staff failed "to disclose data underlying [its] terrorism analysis." *Id.* at 5. The Board directed the Staff to submit a *Vaughn* index,²⁶ or its equivalent, for any document the Staff claimed was exempt from public disclosure under the Freedom of Information Act (FOIA), 5 U.S.C. § 552. The Board explained that the Staff's submission of a *Vaughn* index "will enable the Intervenor as well as this Board to assess the completeness and adequacy of the data used by the Staff, and thus, whether it applied the requisite 'hard look' standard." *Id.* On July 31, 2008, the Staff submitted a *Vaughn* index and redacted versions of documents that the Staff had referenced in its terrorism analysis but which are at least partially exempt from public disclosure under FOIA.

Amended Environmental Contention 4

In amended environmental contention 4, the Intervenor claimed that the Staff failed to adequately consider alternatives to licensing Pa'ina's irradiator. Contentions at 30–34. In particular, the Intervenor claimed that the Staff's analysis of alternative technologies in the EA was inadequate. Contentions at 32 (citing October 3, 2005 Thompson Declaration at ¶¶ VI-2). The Intervenor also claimed that the Staff violated NEPA by not considering alternative sites for Pa'ina's irradiator. Contentions at 33 (citing February 9, 2007 Pararas-Carayannis Declaration at ¶¶ 13; February 9, 2007 Resnikoff Declaration at ¶¶ 20-23, 26; and October 3, 2005

(. . .continued)

4, 2006) (unpublished).

²⁶ See *Vaughn v. Rosen*, 484 F.2d 820, 823-25 (D.C. Cir. 1973) (explaining how an agency may substantiate its claim that documents are exempt from disclosure under FOIA).

Thompson Declaration at ¶ VI-2). The Board admitted both of these issues.²⁷

DISCUSSION

On July 17, 2008, the Board issued its Scheduling Order for an informal hearing under Subpart L of the NRC's Rules of Practice.²⁸ In its Order, the Board established deadlines for the filing of documents associated with the Subpart L hearing. The Board also addressed the content of certain filings. The Board stated that the parties' initial statements of position should be "in the nature of trial briefs that provide a precise road map of the party's case."²⁹ The Board explained that the statements of position should set forth the applicable legal standards, identify witnesses and evidence, and describe how the witnesses and evidence support the parties' arguments.³⁰

With respect to amended environmental contention 3, the Board noted that, when preparing an environmental assessment under NEPA, the NRC must take a "hard look" at the environmental consequences of licensing a nuclear facility. The Board directed the parties to address Supreme Court and Ninth Circuit case law—and also the case law of other Circuit courts, to the extent it is not inconsistent with Ninth Circuit law—identifying the criteria involved in determining whether an agency has satisfied NEPA's "hard look" requirement. The Board then directed the parties to address the adequacy of each of the portions of the final EA challenged by the admitted segments of amended environmental contention 3, taking into

²⁷ Order (Ruling on Admissibility of Intervenor's Amended Environmental Contentions) at 26–33.

²⁸ Order (Scheduling Order) (July 17, 2008) (unpublished).

²⁹ *Id.* at 2.

³⁰ *Id.* at 3.

account the “hard look” criteria.³¹

With respect to amended environmental contention 4, after stating that NEPA section 102(2)(E) requires the NRC to conduct an alternatives analysis when preparing an environmental analysis, the Board directed the parties to address case law relating to the legal requirements and elements of an alternatives analysis.³² Specifically, the Board directed the parties to address the requirements and elements applying to alternative technologies, as well as the requirements and elements, if any, applying to alternative locations.³³ The Board then directed the parties to address whether, in light of those criteria, the alternatives analyses in the Staff’s EA are adequate.

I. Staff’s Witnesses

As made clear in the Staff’s testimony, in preparing Pa’ina’s EA the Staff fully complied with both NEPA’s “hard look” requirement and the criteria applying to alternatives analyses in an EA. The Staff will address the “hard look” requirement first. The Staff will explain why, after the Board considers the testimony and other evidence filed in connection with this brief, there should be no doubt that the Staff took a hard look at the environmental consequences of licensing Pa’ina’s irradiator.³⁴ Because the Staff satisfied this requirement, the Board should dismiss each of the admitted segments of amended environmental contention 3. The Staff will then explain why, based on the testimony and other evidence, the Board should find that the

³¹ *Id.*

³² *Id.* at 4–5

³³ *Id.*

³⁴ The Staff continues to believe that the EA on its face evidences that the Staff took a hard look at the environmental consequences of licensing Pa’ina’s irradiator, for the reasons set forth in its response to the Intervenor’s amended environmental contentions, as well as for reasons stated in this brief.

Staff's consideration of alternatives to the proposed licensing action fully complies with the requirements for an EA. Accordingly, the Board should dismiss amended environmental contention 4.

The attached testimony presents the opinions of a panel of six witnesses as follows: Matthew Blevins, James Durham, John Stamatakos, Amitava Ghosh, Kaushik Das, and Patricia Swain.

Matthew Blevins is currently an Environment Team Lead for the U.S. Department of Energy, Western Area Power Administration. Statement of Professional Qualifications of Matthew Blevins (Staff Exhibit 4). Prior to his current position, Mr. Blevins was a Senior Project Manager at the NRC in the Environmental and Performance Assessment Directorate, Division of Waste Management and Environmental Protection, of the Office of Nuclear Materials Safety and Safeguards. *Id.* He was the project lead responsible for the completion of the Pa'ina EA. *Id.* Mr. Blevins was the primary preparer of the Draft and Final EAs. He was also the project manager for the Draft and Final Topical Reports drafted by the CNWRA, and as such, coordinated with the CNWRA and reviewed the information contained in the Topical Reports for incorporation into the EAs.

James Durham, Ph.D. is a Senior Research Engineer in the Performance Assessment Group, Engineering and Systems Assessment Section, CNWRA, Geosciences and Engineering Division. Statement of Professional Qualifications of James Durham (Staff Exhibit 6). Mr. Durham is a health physicist with diverse experience in many areas of nuclear engineering and radiological health. *Id.* He was the CNWRA project manager and principal investigator for the Draft and Final Topical Reports on the Effects of Potential Aviation Accidents and Natural Phenomena at the Proposed Pa'ina Irradiator. *Id.*

Amitava Ghosh, Ph.D., is a Staff Engineer in the Mining, Geotechnical, and Facilities Engineering Group, Engineering and Systems Assessment Section, CNWRA, Geosciences and

Engineering Division. Statement of Professional Qualifications of Amitava Ghosh (Staff Exhibit 5). Mr. Ghosh's expertise includes numerical simulations, field and laboratory experiments, rock mechanics, explosives and blasting, soil mechanics, application of probabilistic methods, and risk analysis. *Id.* He was principally responsible for developing the sections of the Draft and Final Topical Reports regarding the potential for aviation accidents at the proposed irradiator. CNWRA Testimony at A.14.

John Stamatakos, Ph.D., is a structural geologist and geophysicist and Assistant Director of the Washington Technical Support Office of the CNWRA, Geosciences and Engineering Division. Statement of Professional Qualifications of John Stamatakos (Staff Exhibit 7). Mr. Stamatakos has expertise in regional and global tectonics, exploration geophysics, neotectonics, and earthquake seismology. *Id.* He wrote section three of the Topical Reports, "Natural Phenomena," which documents his analysis of the potential effects of earthquakes, tsunamis, and hurricanes on the proposed irradiator. CNWRA Testimony at A.27.

Kaushik Das, Ph.D., is a Research Engineer in the Hydrology Group, Earth Sciences Section, CNWRA, Geosciences and Engineering Division. Statement of Professional Qualifications of Kaushik Das (Staff Exhibit 8). Mr. Das performs quantitative modeling of fluid dynamics and heat transfer, and his research includes reservoir mechanics, and fluid flow in engineered systems. *Id.* He has broad expertise in computational modeling of fluid flow. *Id.* Mr. Das performed the fluid dynamics calculations for the Topical Reports. CNWRA Testimony at A.9.

Patricia Swain is a Project Manager in the Low-Level Waste Branch in the Division of Waste Management and Environmental Protection, Office of Federal and State Materials and Environmental Management Programs (FSME). Ms. Swain is presently managing NRC activities at the Idaho National Laboratory, Idaho Nuclear Technology and Engineering Center Tank Farm Facility. Prior to becoming a Project Manager in the Low-Level Waste Branch, she

was a Project Manager in FSME's Division of Waste Management and Environmental Protection, which issued the Pa'ina EA. Statement of Professional Qualifications of Patricia Swain (Staff Exhibit 9). Ms. Swain has 26 years of experience in environmental compliance and policy for the government and private sector. *Id.* Ms. Swain provided support to the Staff in its issuance of the Final EA and FONSI. *Id.* She has also continued to coordinate the Staff's interaction with the CNWRA and Mr. Blevins after Mr. Blevins moved from the NRC to his current position at the Department of Energy.

II. Amended Environmental Contention 3

A. NEPA's "Hard Look" Standard

NEPA prescribes a process for federal government agencies to consider the environmental impacts of major federal actions. NEPA's "twin aims" are to ensure that an agency (1) considers "the significant aspects of the probable environmental consequences" resulting from a proposed action, and (2) informs the public that the agency has considered environmental concerns in its decisionmaking.³⁵ Rather than mandating particular results, NEPA imposes only procedural requirements that ensure agencies consider the environmental consequences of agency actions.³⁶

An agency prepares an EA to determine whether a major federal action will significantly affect the quality of the human environment.³⁷ An EA should be a "concise public document,"

³⁵ *San Luis Obispo Mothers for Peace v. NRC (SLOMFP)*, 449 F.3d 1016, 1020 (quoting *Baltimore Gas & Elec. Co. v. Natural Res. Def. Council, Inc.*, 462 U.S. 87, 97 (1983)); *Private Fuel Storage* (Independent Spent Fuel Storage Installation), CLI-02-25, 56 NRC 340, 348 (2002).

³⁶ *SLOMFP*, 449 F.3d at 1020 (citing *Dept. of Transp. v. Pub. Citizen*, 541 U.S. 752, 756 (2004)); See also *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989).

³⁷ 42 U.S.C. § 4332(2)(C); 10 C.F.R. § 51.21.

typically in the range of ten to fifteen pages.³⁸ Under the NRC's NEPA-implementing regulations—regulations that in this instance track regulations issued by the Council on Environmental Quality (CEQ), the federal agency responsible for providing NEPA guidance—an EA identifies the proposed action and includes:

- (1) A brief discussion of:
 - (i) The need for the proposed action;
 - (ii) Alternatives as required by section 102(2)(E) of NEPA;
 - (iii) The environmental impacts of the proposed action and alternatives as appropriate; and
- (2) A list of agencies and persons consulted, and identification of sources used.³⁹

If the NRC Staff determines there is a significant impact to the environment, it must prepare an EIS.⁴⁰ If it concludes there is no significant impact, the Staff will prepare a FONSI.⁴¹ Again, these requirements track the requirements applying to federal agencies generally.⁴²

As stated above, an agency preparing an EA must take a “hard look” at the

³⁸ *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations*, 46 Fed. Reg. 18,026 (March 23, 1981). Although the CEQ's guidance does not bind the Staff, the Commission generally assigns CEQ guidance substantial deference. *Dominion Nuclear North Anna, LLC* (North Anna ESP Site), CLI-07-27, 66 NRC 215, 222, n.21 (2007); see also *Pacific Gas & Elec. Co.* (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation), CLI-08-01, 67 NRC 1, 12 n.49 ([T]he applicability of the CEQ's regulations to our activities is not without limitation. While the Commission's 'policy [is] to take account of the regulations of the [CEQ] voluntarily' (10 C.F.R. § 51.10(a)), this policy is tempered by the Commission's overriding 'responsibility as an independent regulatory agency for protecting the radiological health and safety of the public' as the Commission conducts its licensing and associated regulatory functions (10 C.F.R. § 51.10(b)).

³⁹ 10 C.F.R. § 51.30.

⁴⁰ 10 C.F.R. § 51.31.

⁴¹ *Id.*; *Virginia Electric & Power Co.* (North Anna Power Station, Units 1 and 2), ALAB-790, 20 NRC 1450, 1452 n.5 (1984) (finding that the Staff is not required to prepare a complete environmental impact statement if, after performing an EA, it determines that the proposed action will have no significant impact).

⁴² See 40 C.F.R. §§ 1501.4, 1508.13.

environmental impacts of the proposed action.⁴³ A “hard look” under NEPA requires that an agency provide “[a] reasonably thorough discussion of the significant aspects of the probable environmental consequences[.]”⁴⁴ The hard look standard does *not* require that an agency address every conceivable environmental impact in its NEPA document.⁴⁵ For example, an agency need not discuss remote and highly speculative consequences.⁴⁶ Nor must an agency support every assertion in an EA with reference to data, authorities, or explanatory information. While an EA must contain more than conclusory statements,⁴⁷ the EA is adequate if, as a whole, it adequately references the data it relies on.⁴⁸

Nor does the hard look standard require that an agency consider non-environmental effects potentially linked to the proposed action. If the harm does not have a sufficiently close connection to the physical environment, NEPA does not apply.⁴⁹ As the Supreme Court has emphasized, the scope of the agency's inquiries must remain manageable if NEPA's goals are to be accomplished.⁵⁰

⁴³ *Baltimore Gas & Elec.*, 462 U.S. at 97 (citing *Kleppe v. Sierra Club*, 427 U.S. 390, 410 n.21 (1976)).

⁴⁴ *Trout Unlimited v. Morton*, 509 F.2d 1276, 1283 (9th Cir. 1974).

⁴⁵ *Ground Zero Ctr. for Non-Violent Action v. U.S. Dept. of the Navy*, 383 F.3d 1082, 1089-90 (9th Cir. 2004) (citing *NoGWEN Alliance of Lane County, Inc. v. Aldridge*, 855 F.2d 1380, 1385 (9th Cir. 1988)).

⁴⁶ *Trout Unlimited*, 509 F.2d at 1283.

⁴⁷ *Klamath-Siskiyou Wilderness Ctr. v. Bureau of Land Mgmt.*, 387 F.3d 989, 996 (9th Cir. 2004).

⁴⁸ *Western Watersheds Project v. BLM*, 552 F. Supp. 2d 1113, 1129–30 (D. Nev. 2008).

⁴⁹ *Metropolitan Edison Co. v. People Against Nuclear Energy*, 460 U.S. 766, 778 (1983); see also *Pa’ina Hawaii, LLC*, CLI-08-16, 67 NRC __ (August 13, 2008) (slip op. at 9) (explaining that “[t]o be encompassed by NEPA, there needs to be a reasonably close causal relationship between a change in the physical environment and the effect at issue Otherwise, the words ‘adverse environmental effects’ might embrace virtually any consequence of a proposed federal action that some one thought adverse.”) (citations and quotation marks omitted).

⁵⁰ *Metropolitan Edison Co.*, 460 U.S. at 776 (citing *Vermont Yankee Nuclear Corp. v. NRDC*, 435 U.S. (continued. . .))

The Board's role, "vis-à-vis NEPA, is to ensure that the agency has taken the requisite 'hard look' at the potential environmental effects of the proposed action and its reasonable alternatives . . . and 'to ensure that the agency has adequately considered and disclosed the environmental impact of its actions. . . .'"⁵¹ The reviewing Board may look beyond the face of the NEPA document at issue to the administrative record to determine whether the "Staff's underlying review was sufficiently detailed to qualify as 'reasonable' and a 'hard look,' under NEPA—even if the Staff's description of that review in the [NEPA document] was not."⁵² The Board's discussion of the disputed issues "adds necessary additional details and constitutes a supplement to the [NEPA document's]" review.⁵³

The preceding summary addresses the "hard look" standard generally. The Staff will next address particular issues courts frequently consider in determining whether an agency has satisfied the "hard look" standard.

1. Comment Responses

The NRC's regulations make circulation of a draft EA and draft FONSI discretionary for the Staff.⁵⁴ Although the Staff has an obligation to consider comments received on any draft

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519, 551 (1978).

⁵¹ *Exelon Generation Co. (Clinton ESP)*, LBP-04-821, 62 NRC 134, 151-52 (2005) (quoting *Coalition on Sensible Transp., Inc. v. Dole*, 826 F.2d 60, 66 (D.C. Cir. 1987) and citing *Louisiana Energy Serv. L.P.* (Claiborne Enrichment Center), CLI-98-3, 47 NRC 77, 87-88 (1998)).

⁵² *North Anna*, CLI-07-27, 66 NRC at 230.

⁵³ *Id.*

⁵⁴ 10 C.F.R. §§ 51.30, 51.33(a).

EA,⁵⁵ the NRC's NEPA-implementing regulations do not specifically address the manner in which the Staff should reply to public comments. Even in the case of an EIS, the NRC's regulations provide the Staff with substantial flexibility in deciding how to respond to public comments. NRC regulations provide that, in preparing a final EIS, Staff's "[r]esponses to comments may include:

- (i) Modification of alternatives, including the proposed action;
- (ii) Development and evaluation of alternatives not previously given serious consideration;
- (iii) Supplementation or modification of analyses;
- (iv) Factual corrections;
- (v) Explanation of why comments do not warrant further response, citing sources, authorities or reasons which support this conclusion."

10 C.F.R. § 51.91(a)(1). There is no requirement that each comment be discussed in the EIS itself.⁵⁶

While the NRC is not bound by CEQ regulations, the NRC often looks to these regulations for guidance.⁵⁷ CEQ regulations governing public involvement in the preparation of EAs are general in approach, and do not prescribe any fixed means for responding to comments on an EA. Nor, for that matter, do CEQ regulations require that an agency even include a comment response section in an EA. The critical issue is whether the agency considered significant public comments on the NEPA document in reaching its conclusions; how the agency responds to those comments is a matter of agency discretion.⁵⁸

⁵⁵ *National Parks & Conservation Ass'n v. Babbitt*, 241 F.3d 722, 736 (9th Cir. 2001).

⁵⁶ 10 C.F.R. § 51.91.

⁵⁷ *North Anna*, CLI-07-27, 66 NRC at 222, n.21; *see also* 10 C.F.R. § 51.10(a).

⁵⁸ *See National Parks & Conservation Ass'n v. Babbitt*, 241 F.3d 722, 736 (9th Cir. 2001) (addressing agency's responsibility to respond to comments and holding that a court must decide whether the agency considered conflicting expert testimony in preparing its EA and FONSI).

2. Expert Opinion

In determining whether an agency took a “hard look” at the environmental consequences of a proposed action, reviewing courts accord a high level of deference to the views of an agency’s experts. “When specialists express conflicting views, an agency must have discretion to rely on the reasonable opinions of its own qualified experts even if, as an original matter, a court might find contrary views more persuasive.”⁵⁹ A reviewing court must not “take sides in a battle of the experts” where the agency’s experts provide a reasoned explanation for their rejection of an opposing position.⁶⁰

Nor should the court attempt to resolve a dispute over the methodology an agency’s experts have applied to reach their conclusions. “NEPA does not require that [a reviewing court] decide whether an [EA] is based on the best scientific methodology available, nor does NEPA require [the court] to resolve disagreements among various scientists as to methodology.”⁶¹ A court “will not second-guess methodological choices made by an agency in its area of expertise;” but will defer to agency expertise on questions of methodology unless the agency has completely failed to address some factor, “consideration of which was essential to a truly informed decision whether or not to prepare an EIS.”⁶²

In a recent *en banc* decision, the Ninth Circuit overruled its prior decision in *Ecology*

⁵⁹ *Native Ecosystems Council v. United States Forest Serv.*, 428 F.3d 1233, 1243 (9th Cir. 2005) (quoting *Marsh v. Oregon Natural Res. Council*, 490 U.S. 360, 378 (1989); see also *NRDC v. Winter*, 518 F.3d 658, 688 (9th Cir. 2008).

⁶⁰ *Native Ecosystems Council*, 428 F.3d at 1244; *National Parks & Conservation Ass’n.*, 241 F.3d at 736 n.14.

⁶¹ *Greenpeace Action v. Franklin*, 14 F.3d 1324, 1333 (9th Cir. 1992) (quoting *Friends of Endangered Species, Inc. v. Jantzen*, 760 F.2d 976, 986 (9th Cir. 1985)).

⁶² *Inland Empire Pub. Lands Council v. Schultz*, 992 F.2d 977, 981 (9th Cir. 1993) (quoting *Foundation for N. Am. Wild Sheep v. United States Dep’t of Agric.*, 681 F.2d 1172, 1178 (9th Cir. 1982)).

Center v. Austin,⁶³ which had effectively required the United States Forest Service “to always ‘demonstrate the reliability of its scientific methodology’ or the hypotheses underlying the Service’s methodology with ‘on the ground analysis,’” when making projections about the likely impact of forest management projects.⁶⁴ Although the first part of the decision involved the National Forest Management Act rather than NEPA, this part of the decision is relevant because, under the Administrative Procedure Act, 5 U.S.C. § 701 *et seq.*, courts apply the same standard—the arbitrary and capricious standard—in determining whether an agency’s action violates either statute. The Ninth Circuit held that in *Ecology Center* it had “defied well-established law concerning the deference we owe to agencies and their methodological choices.”⁶⁵ The Ninth Circuit explained that, “essentially, we assessed the quality and detail of on-site analysis and made ‘fine-grained judgments of its worth.’”⁶⁶ The Ninth Circuit further explained that “It is not our proper role to conduct such an assessment. . . . Instead, our proper role is simply to ensure that the Forest Service made no ‘clear error of judgment’ that would render its action ‘arbitrary and capricious.’”⁶⁷

In the portion of *Lands Council* addressing NEPA specifically, the Ninth Circuit explained that, even in an EIS, an agency’s experts need not address every uncertainty regarding environmental impacts.⁶⁸ The court found that “none of NEPA’s statutory provisions or

⁶³ 430 F.3d 1057 (9th Cir. 2005).

⁶⁴ *Lands Council v. McNair*, No. 07-35000 (9th Cir. July 2, 2008) (slip op. at 8248), *available at* 2008 U.S. App. LEXIS 13998.

⁶⁵ *Id.* (slip op. at 8250).

⁶⁶ *Id.* (slip op. at 8252).

⁶⁷ *Id.* (slip op. at 852-53) (citing *Marsh v. Oregon Natural Res. Council*, 490 U.S. 360, 378 (1989)).

⁶⁸ *Id.* (slip op. at 8267).
(continued. . .)

regulations requires [an agency] to affirmatively present every uncertainty in its EIS. . . . Thus, we hold that to the extent our case law suggests that a NEPA violation occurs every time the [agency] does not affirmatively address an uncertainty in the EIS, we have erred.”⁶⁹ The court explained that to require an agency to affirmatively present every uncertainty in its NEPA document would be an “onerous requirement, given that experts in every scientific field routinely disagree;” and concluded that such a requirement might inadvertently prevent an agency from acting within its statutory mandate, due to the burden it would impose.⁷⁰

3. Connected Actions and Cumulative Impacts

Federal agencies are assigned the primary task of defining the scope of their NEPA reviews, and their determinations are given “considerable discretion.”⁷¹ At the same time, federal agencies have an obligation to consider “connected” or “cumulative” actions in a single NEPA review. The purpose of this requirement is to prevent an agency from “dividing a project into multiple ‘actions,’ each of which individually has an insignificant environmental impact, but which collectively have a substantial impact.”⁷² Under CEQ regulations, actions are “connected” if they:

- (i) Automatically trigger other actions which may require environmental impact statements.

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⁶⁹ *Id.*

⁷⁰ *Id.* (slip op. at 8267). The Ninth Circuit noted that “[a] number of our sister circuits agree that we are to conduct a ‘particularly deferential review’ of an ‘agency’s predictive judgments about areas that are within the agency’s field of discretion and expertise . . . as long as they are reasonable.’” *Id.* (slip op. at 8253) (citing *Earthlink, Inc. v. FCC*, 462 F.3d 1, 12 (D.C. Cir. 2006)).

⁷¹ *Wetlands Action Network v. United States Army Corps of Eng’rs*, 222 F.3d 1105, 1118 (9th Cir. 2000).

⁷² *Thomas v. Peterson*, 753 F.2d 754, 758 (9th Cir. 1985).

(ii) Cannot or will not proceed unless other actions are taken previously or simultaneously.

(iii) Are interdependent parts of a larger action and depend on the larger action for their justification.

40 C.F.R. § 1508.25(a). Applying this definition, courts have found actions “connected” where they are “inextricably intertwined,” such as where an agency has proposed both timber sales and the construction of a logging road to facilitate the timber sales,⁷³ or where the agency has proposed a development plan consisting of multiple phases.⁷⁴ Courts have found actions to *not* be “connected” where at least one of the actions has “independent utility;” that is, where one of the actions would have been taken even without the other action.⁷⁵

An agency may also have to consider any cumulative impacts resulting from multiple actions. “Cumulative impact” is defined in CEQ regulations as “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.” 40 C.F.R. § 1508.7. The focus is on the action’s “incremental impact.” To look at the “cumulative impacts” of a project “does not mean simply examining and adding up the ‘separate effects in each planning area,’ but instead goes to whether the ‘simultaneous development’ of these areas will in fact heighten the project’s overall impact.”⁷⁶ “In other words, cumulative impacts analysis considers whether the sum may be

⁷³ *Id.* at 759.

⁷⁴ See *Trout Unlimited*, 509 F.2d at 1285 (addressing when subsequent phases of development must be covered in an EIS on the first phase). Although *Trout Unlimited* was decided prior to the CEQ’s adoption of NEPA regulations in 1978, the rule established in this case continues to be applied in the Ninth Circuit. *E.g.*, *Wetlands Action Network*, 222 F.3d at 1118-19.

⁷⁵ See *Blue Ocean Preservation Soc. v. Watkins*, 754 F. Supp. 1450, 1458 (D. Haw. 1991) (holding that the inquiry under the “cannot or will not proceed” language in 40 C.F.R. § 1508.25(a)(ii) is directed not toward whether a later action could go forward without previous actions, but rather whether the earlier actions could go forward without the later action ever being completed).

⁷⁶ *Hydro Resources, Inc.* (P.O. Box 15910 Rio Rancho, NM), CLI-01-04, 53 NRC 31, 57–58 (2001) (citing (continued. . .))

greater than its parts. Not all projects will have cumulative impacts.”⁷⁷

B. The Staff Took a Hard Look at the Environmental Impacts of Licensing Pa’ina’s Irradiator

Applying the precedents discussed above, it should be clear that, when the Staff issued a license to Pa’ina on August 10, 2007, it had taken a “hard look” at the environmental consequences of licensing Pa’ina’s irradiator. The more limited issue before this Board, of course, is whether the Staff failed to take the requisite “hard look” for the reasons set forth in each of the admitted segments of amended environmental contention 3. The Staff will address each of those segments below.

The Staff will address the segments of amended environmental contention 3 by topic, rather than in the precise order in which they appear in the contention. The Staff will first address the segments in the first and third portions of the contention that relate to aircraft crashes. Next, the Staff will address the segments in the first and third portions that pertain to tsunamis, hurricanes or earthquakes. The Staff will then turn to the second portion of the contention, which alleges that the Staff failed to provide data, calculations or analysis to support certain conclusions in the EA. Finally, the Staff will separately address three segments in the first three portions relating to transportation impacts.⁷⁸

The Board also admitted one segment in the fourth portion of amended environmental contention 3, namely the Intervenor’s claim that the Staff failed to disclose data underlying its terrorism analysis for Pa’ina’s irradiator. In its Scheduling Order, the Board directed the Staff to

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Natural Resources Defense Council, Inc. v. Hodel, 865 F.2d 288, 297 (D.C. Cir. 1988)).

⁷⁷ *Id.* at 58.

⁷⁸ The Intervenor raises transportation-related issues in the tenth segment of the first portion of amended environmental contention 3, as well as in the fourth segment of the second portion and the ninth segment in the third portion.

file a *Vaughn* index in connection with that segment of the Intervenor's contention. The Staff filed a *Vaughn* index and supporting documentation on July 31, 2008. When it ruled on the Intervenor's terrorism-related contentions in March 2008, the Board stated that the *Vaughn* index would allow the Board to assess the adequacy of the data used by the Staff, and thus determine whether the Staff applied the "hard look" standard. Because the Board has not yet issued a ruling on the adequacy of the *Vaughn* index, the Staff will also briefly explain why the index warrants dismissing the remaining segment in the fourth portion of amended environmental contention 3.

1. The Staff Thoroughly Analyzed All Plausible Impacts Related to Aircraft Crashes and Fully Responded to the Intervenor's Comments in This Area.

In seven segments the Intervenor challenges the Staff's analysis of aircraft crashes. None of these segments raises a genuine issue under NEPA. As explained in the Staff's testimony, the Staff's experts applied well-established methodologies in determining that aircraft crashes do not pose a significant risk to Pa'ina's irradiator. In contrast, the Intervenor's purported experts apply numerous unrealistic assumptions both in estimating the risk an aircraft might strike Pa'ina's irradiator and in concluding a crash, if it were to occur, would cause significant environmental impacts.

(a) First Segment, First Portion

The Intervenor claims the Staff failed to respond to comments from Marvin Resnikoff, Ph.D., stating that the Draft Topical Report did not consider significant factors in evaluating the likelihood Pa'ina's irradiator will be involved in an aviation accident. That is incorrect. The Staff responded to Dr. Resnikoff's comments by verifying the Topical Report's data and analysis and concluding that Dr. Resnikoff's comments did not warrant changing any conclusion in the Topical Report or EA. CNWRA Testimony at A.15.

The Staff relied on the methodology in NUREG-0800, "Standard Review Plan for the

Review of Safety Analysis Reports for Nuclear Power Plants,” in determining that the probability of an aircraft crash involving Pa’ina’s irradiator is approximately 1 in 5000 annually.⁷⁹ CNWRA Testimony at A.15. NUREG-0800 provides an established methodology for determining aircraft crash probabilities and has been used by the Staff in numerous licensing actions.⁸⁰ In applying the methodology in NUREG-0800, the Staff took into account historical data on aircraft crashes at HNL that was provided by the HNL Airport Manager. CNWRA Testimony at A.15. The Staff also considered the orientation of specific runways at Honolulu International Airport with respect to Pa’ina’s facility. *Id.* The Staff calculated a separate crash probability for takeoffs and landings on each of the runways, thereby arriving at a cumulative probability of approximately 1 in 5000. *Id.* at A.17.

Dr. Resnikoff, in contrast, applied a methodology that grossly overstates the likelihood of a crash involving Pa’ina’s irradiator. Dr. Resnikoff applied a crash rate that relies on National Transportation Safety Board (NTSB) data for HNL, and which takes into account any fatal accident listed in the NTSB data. CNWRA Testimony at A.16. This methodology is flawed for numerous reasons. First, the NTSB data is not limited to aircraft crashes at HNL. *Id.* Rather, the NTSB includes fatalities involving any aircraft departing from or scheduled to arrive at HNL. *Id.* For example, a plane departing HNL and crashing approximately 45 miles north of Maui is captured by the NTSB data.⁸¹ Second, the data includes fatalities not resulting in

⁷⁹ *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants*, NUREG 0800 (Rev. 2--July 1981), §§ 2.2.1–2.2.2, “Identification of Potential Hazards in Site Vicinity,” and § 3.5.1.6, “Aircraft Hazards.”

⁸⁰ See e.g., *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), CLI-03-05, 57 NRC 279, 281 (2003).

⁸¹ In response to Dr. Resnikoff’s claim of an unusually high crash rate at HNL, Resnikoff Declaration (February 9, 2007) at ¶ 11. the Staff re-examined the NTSB data for HNL for 1975–2006. The Staff determined there was only one fatal accident involving an airplane crash at HNL during that period, (continued. . .)

destruction of the aircraft itself, such as a rough landing or a person being struck by an airplane. CNWRA Testimony at A.16. Third, the data takes into account crashes involving helicopters and seaplanes, aircraft that could not feasibly cause the type of accident that might damage Pa'ina's irradiator pool or sources. *Id.* Finally, Dr. Resnikoff's methodology fails to take into account the orientation of HNL's runways with respect to Pa'ina's facility, thereby assigning a crash probability even where it would be all but physically impossible for an aircraft to strike Pa'ina's facility. CNWRA Testimony at A.17.

In his comments Dr. Resnikoff also claimed the Draft Topical Report understated the number of current operations at HNL and failed to take into account a possible increase in the number of operations. In the Draft Topical Report the Staff had stated that flight operations at HNL would likely increase twenty percent during Pa'ina's ten-year license term. Draft Topical Report at 2-18; CNWRA Testimony at A.15. That was based on a Federal Aviation Administration (FAA) projection from 1998. CNWRA Testimony at A.15. In response to Dr. Resnikoff's comments, the Staff verified the number of operations at HNL, obtaining data from the for FAA the twelve month period ending November 21, 2005. *Id.* That data shows the number of operations at HNL actually decreased by more than 58,000 from the 1998 number. *Id.* Given this data, the Staff found there was substantial uncertainty over whether the number of operations will increase significantly during Pa'ina's ten-year license term. *Id.* The Staff therefore concluded it is highly uncertain whether operations for HNL will reach the FAA's 1998 projection, or even return to 1998 levels, by the end of Pa'ina's license term. *Id.* Although Dr. Resnikoff suggested in his comments that the decrease in operations at HNL was only a

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information that was confirmed by the HNL Airport Manager.

temporary response to the events of September 11, 2001, that was not supported by the FAA data for the year ending November 21, 2005, which still showed a decrease in operations of more than 58,000 from the 1998 numbers. *Id.* The Staff therefore revised language in the Draft Topical Report stating that the number of operations would likely increase by twenty percent during Pa'ina's license term to now state that "it is difficult to assess if the number of flight operations at Honolulu International Airport will increase during the 10-year period of the license application."⁸²

(b) Second Segment, First Portion and Fourth Segment, Third Portion

The Intervenor claims that the Staff failed to respond to Dr. Resnikoff's comments stating that the Draft EA should have quantified the impact of flying airplane and building debris following an aviation accident to determine if sources would be breached. The Intervenor also claims the Staff failed to consider scenarios in which an aircraft crash might damage the irradiator pool at or below the groundwater level, resulting in a loss of shielding water and possibly releasing contaminated water through a tear in the pool lining.

The Staff fully responded to Dr. Resnikoff's comments and explained why the scenarios he identified are not plausible. In Section 2.4 of the Topical Report, the Staff acknowledges that an airplane crash could damage Pa'ina's irradiator building and pool. CNWRA Testimony at A.19. However, as the Staff also explains in Sections 2.4 and 2.5, this would not be sufficient to breach the sources or cause radioactive contamination of the pool water. *Id.* The aircraft would most likely strike the building at an angle low to the ground, and it is highly unlikely any debris generated by the crash would be moving at the same speed the plane was moving prior to striking the irradiator building. *Id.* Even if airplane or building debris were to fall into the

⁸² Final Topical Report at 2-18.

irradiator pool, it is simply not plausible that the debris would simultaneously pierce the steel-and-concrete pool liner below the water table and damage the sources. *Id.* In any event, even if debris struck a source and the source's encapsulation were breached, the source would remain intact. *Id.* Accordingly, even if the source were damaged and the pool liner were breached below the water table, no radioactive material would be released into the environment. *Id.*

The Staff considered Dr. Resnikoff's comment that flying debris might somehow result in dispersal of a source and contamination of the pool water. *Id.* Cobalt-60 is a metal, however, and thus is not a readily dispersible material.⁸³ The Staff responds to Dr. Resnikoff's comments on page 1-3 of the Final Topical Report, where it explains that for pool contamination to occur, the source must corrode. Dispersal is simply not a plausible scenario. CNWRA Testimony at A.19.

(c) Fifth and Sixth Segments, Third Portion

The Intervenor argues that although the Staff considers the increase in radiation dosage associated with a six-foot loss of shielding water, it provides no justification for considering only this scenario. The Intervenor also argues that the Staff should have considered situations in which more shielding water is removed from the irradiator, either from the force of an explosion or through evaporation in a fuel fire.

The Staff thoroughly considered the scenarios raised by the Intervenor. In addition to considering a six-foot water loss, the Staff considered an eight-foot loss. Blevins Testimony at

⁸³ See CNWRA Testimony at 19; see also 10 C.F.R. § 36.21(a)(3), "Performance criteria for sealed sources" (stating that sealed sources installed after July 1, 1993 "must use radioactive material that is as nondispersible as practical"); see also *Licenses and Radiation Safety Requirements for Irradiators*, 58 Fed. Reg. 7715, 7716 (February 9, 1993) (explaining that "this final rule was written to require that irradiators use radioactive materials that are as insoluble and nondispersible as practical (typically cobalt-60)").

A.21. Because the water table is eight feet below the pool surface, this represents the maximum water loss from a breach in the pool liner. *Id.* The Staff also considered whether an explosion or fuel fire might remove water from the irradiator pool. CNWRA Testimony at A.22. The Staff concluded that neither scenario is plausible.

In response to the Intervenor's comments, the Staff re-examined NTSB data for HNL from 1976 to 2007. *Id.* There is no record of an exploding aircraft at HNL or, for that matter, in any flight departing from or scheduled to arrive at HNL. *Id.* The Staff also consulted the Airport Manager at HNL, who reported that there have been only two aircraft crashes at HNL since 1962, neither involving an explosion. *Id.* Given that there has not been an aircraft explosion associated with HNL in at least 45 years, it is simply not plausible that there would be an explosion directly above Pa'ina's irradiator pool, which measures only seven by eight feet at the surface. *Id.*

As explained in the Staff's testimony, even if an explosion above the pool were plausible, the force generated by an exploding aircraft would not remove a significant amount of water from the irradiator pool. *Id.* For an explosion to exert sufficient force to remove all 29 tons of water from the pool, the force would have to be directed straight down into the pool. *Id.* For that to occur, the object exerting the force would have to be directly above the pool. *Id.* This would prevent all but a small amount of water from leaving the pool. *Id.*

The Staff also considered whether a jet fuel fire at Pa'ina's facility might cause pool water to evaporate. *Id.* The Staff concluded it would not. *Id.* Because jet fuel is less dense than water, it would burn above the pool water, preventing water from evaporating until the fuel is almost depleted. *Id.* After that point, any water evaporation would be minimal. *Id.* The Staff explains its reasoning in Section 2.4 of the Final Topical Report, which was revised in light of comments received on the Draft Topical Report. *Id.* The Staff also explains why, even if a jet fuel fire reached the source assemblies, the fire would not cause a source to melt. *Id.* The Staff

provides its explanation in the second-to-last paragraph of Section 2.4 in the Topical Report, which was revised in its final version to address Dr. Resnikoff's claim that a fuel fire might cause a source to melt. *Id.*

Further, the Staff explains why a loss of shielding water would not, in itself, cause any significant environmental impact. That is because the increased dose rate at the pool surface would form a well-collimated beam directed at the space above the irradiator pool. The increased dose would not have a significant impact on workers or the general public. Blevins Testimony at A.20, A.22; CNWRA Testimony at A.20, 21.

(d) Seventh Segment, Third Portion

The Intervenor claims that the Staff inaccurately assumes pool water could become contaminated only if a source corroded, ignoring the potential for physical destruction or pulverization of the sources and contamination of pool water. That is incorrect. In Section 1.2 of the Final Topical Report, the Staff explains that the only way for cobalt-60 to contaminate the pool water is for Co-60 to corrode in the water. CNWRA Testimony at A.7. The Staff added Section 1.2 to the Final Topical Report in response to comments suggesting that other means of contamination were plausible. CNWRA Testimony at A.6, A.7. Based on the performance criteria for sealed sources, as well as the location of the sources—which will be under 12–18 feet of water, a plenum and one or more product bells—the Staff concluded it is not plausible that debris from an aircraft crash would breach a source. CNWRA Testimony at A.7.

Dr. Resnikoff suggests that “pulverizing” the sources could cause contamination of the pool water. But pulverizing the cobalt-60 sources is a highly unrealistic scenario. CNWRA Testimony at A.23. Cobalt-60 is a metal, and as such it is not a readily dispersible material. Even if Co-60 were somehow crushed at the bottom of the pool, it would remain intact. The Staff considered Dr. Resnikoff's comments, but it did not find any plausible scenario in which Co-60 could be pulverized. *Id.*

(e) Eighth Segment, Third Portion

The Intervenor argues that the Staff improperly dismissed the potential for significant impacts in the event an airplane crash destroyed all monitoring equipment or incapacitated irradiator personnel. That is not the case. Rather, the Staff found that any loss of emergency personnel or monitoring equipment would not necessarily result in any increased dose. CNWRA Testimony at A.25. The sources would still be fully shielded under 18 feet of water, and the dose rate when emergency workers arrive at Pa'ina's facility will be the normal rate, which is close to background. *Id.* Dr. Resnikoff suggests that the loss of personnel or monitoring equipment might be combined with a fuel fire or explosion, which could expose emergency personnel to higher doses.⁸⁴ However, as explained above, neither an explosion nor a fuel fire is a plausible scenario for removing shielding water. CNWRA Testimony at A.25. In any event, even if water were removed, emergency workers responding to an airplane crash at Pa'ina's facility would be well aware that the sources contain radioactive material.⁸⁵ CNWRA Testimony at A.25. And, even if they were not, workers would essentially have to remain directly above the pool for over 40 minutes to reach the NRC's occupational dose limit, assuming the pool water drained all the way down to the water table. *Id.* The Staff justifiably concluded that this is not a plausible scenario.

(f) Applying NEPA Law to the Staff's Analysis of Aircraft Crashes

As the Topical Report makes clear, the Staff thoroughly considered the "significant aspects of the probable environmental consequences" resulting from an aircraft crash involving

⁸⁴ Resnikoff Report at p.21 (February 7, 2007); Resnikoff Declaration at ¶ 19 (February 9, 2007); Resnikoff Declaration at ¶ 17 (August 24, 2008).

⁸⁵ Under its Operating Procedures, Pa'ina must provide training to Emergency Response Personnel (ERP), which includes "[r]epresentative members of the local Police Department, Fire Department, Rescue Squad, or similar organizations. The purpose of this training course is to assure that the ERP are familiar with what they can and cannot do in emergency situations." License Application at 22.

Pa'ina's irradiator. The Staff also considered a number of highly speculative scenarios raised by the Intervenor—an exploding aircraft, for example, or a jet fuel fire reaching the irradiator's sources—that the Staff was not required to address in the EA. To the extent the Intervenor suggests there are any remaining uncertainties relating to aircraft crashes that the Staff had to address in the EA, the Intervenor seeks to impose requirements beyond those found in NEPA.

There is ample reason for the Board to assign more weight to the views of the Staff's experts regarding the probability and consequences of an aircraft crash at Pa'ina's site. The Staff analyzed aircraft crashes using an established methodology that took into account factors specific to Pa'ina's site—the orientation of runways, for example—and which relied on recent data from HNL's Airport Manager, the FAA and the NTSB. CNWRA Testimony at A.15-A.17. Dr. Resnikoff, on the other hand, failed to take into account numerous factors relevant to determining the likelihood and consequences of an aircraft crash, as reflected in his assumption that fatalities listed in NTSB data for HNL can be used to derive a realistic crash rate for Pa'ina's irradiator.

There is, accordingly, ample reason for the Board to credit the opinions of the Staff's experts over those of Dr. Resnikoff in the area of aircraft crashes. Even if that were not clearly the case, there would still be no basis for finding that Staff's analysis of aircraft crashes failed to comply with NEPA. When reviewing the analysis of an agency's experts, it is not the court's role to scrutinize “the quality and detail of [that] analysis and ma[k]e fine-grained judgments of its worth.”⁸⁶ “[A]n agency must have discretion to rely on the reasonable opinions of its own qualified experts even if, as an original matter, a court might find contrary views more

⁸⁶ *Lands Council* (slip. op at 8252).

persuasive."⁸⁷ The court must not "take sides in a battle of the experts" where the agency's experts provide a reasoned explanation for their rejection of an opposing position.⁸⁸

As made clear in the Staff's testimony, the Staff fully considered the Intervenor's comments on the analysis of aircraft crashes in the Draft Topical Report and EA. The Staff responded by verifying its data and calculations, and the Staff revised certain sections of those documents in light of the Intervenor's comments. For example, the Staff added Section 1.2 and the second-to-last paragraph in Section 2.4 to the Final Topical Report. CNWRA Testimony at A.19, A.22. The Staff also re-examined the NTSB data upon which Dr. Resnikoff relies in his probability calculations and revised the last paragraph in Section 2.4, which addresses the potential for a future increase in operations at HNL. CNWRA Testimony at A.19, A.22. The Staff's consideration of the Intervenor's comments fully complied with NEPA.⁸⁹

2. The Staff Analyzed All Plausible Impacts from Natural Phenomena and Responded Appropriately to the Intervenor's Comments.

In nine segments the Intervenor challenges the Staff's analysis of risks to Pa'ina's irradiator from tsunamis, hurricanes and earthquakes. These challenges should be rejected. The Staff carefully analyzed risks from natural phenomena, employing conservative assumptions and finding that, even in the worst-case scenarios, such phenomena would not lead to significant environmental impacts. Further, the Staff supported its findings by referring to publicly available data from government agencies. The Intervenor's purported expert, Dr. Pararas-Carayannis, fails to put forth any plausible scenario where a natural phenomenon might cause a source or contaminated water to escape Pa'ina's irradiator. That is so even if one

⁸⁷ *Native Ecosystems*, 428 F.3d at 1243; *NRDC*, 518 F.3d at 688.

⁸⁸ *Native Ecosystems*, 428 F.3d at 1244.

⁸⁹ The Staff's response to comments would satisfy NRC requirements even if the Staff had been preparing an EIS. See 10 C.F.R. § 51.91(a)(1).

assumes the validity of the data used by Dr. Pararas-Carayannis, data which differ significantly from those published by Hawaii state agencies.

(a) Third Segment, First Portion and Second Segment, Third Portion

In the third segment in the first portion of amended environmental contention 3, the Intervenor argues that the Staff failed to respond to comments alleging that the Draft EA did not quantify hurricane storm surge and tsunami inundation runup potential. Then, in the second segment of the third portion, the Intervenor claims the Final EA fails "to quantify the risk of tsunamis and hurricanes through numerical modeling or, at a minimum, analyze the range of environmental impacts likely to result in the event of a major tsunami, including the impacts resulting from hurricane storm and tsunami inundation."

The Staff carefully evaluated whether tsunami or storm surge runup could potentially remove a source from Pa'ina's irradiator. The Staff performed computational fluid dynamics calculations, which showed that the vertical velocity necessary to remove a source would be generated by a shear velocity between 90 m/s (203 mph) and 180 m/s (406 mph). CNWRA Testimony at A.9. In other words, a wave moving slower than 90 m/s would not be sufficient to remove a source. Based on its review of publicly available data from federal and state agencies with expertise in monitoring natural phenomena, the Staff determined that 30 feet is a bounding value for the height of any wave that might reach the south shore of O'ahu, where Pa'ina's facility will be located. CNWRA Testimony at A.35. Because even a larger 32.8-foot wave would reach a velocity of only 13 m/s (29 mph), the Staff concluded it is not plausible a tsunami- or hurricane-generated wave would have any effect on the sources in Pa'ina's irradiator. *Id.*

Although Dr. Pararas-Carayannis argues that the Staff should have performed numerical modeling to determine how a wave might affect the sources in Pa'ina's irradiator, there was clearly no need for the Staff to use numerical modeling in this case. Numerical modeling could have been used to obtain a more accurate calculation if the Staff's initial calculations had not

made clear that a wave would be insufficient to displace the sources. CNWRA Testimony at A.39. In this case, however, there was no need for the Staff to perform a more refined calculation where the Staff found that a wave, whether generated by a tsunami or hurricane storm surge, could not attain a velocity anywhere near that required to lift a source out of Pa'ina's irradiator. *Id.*

(b) Fourth and Fifth Segments, First Portion and Third Segment, Third Portion

In the fourth and fifth segments of the first portion of the contention, the Intervenor claims the Staff failed to respond to comments stating that it needed to consider the effects on the irradiator pool of increases in buoyancy forces due to hurricane surge or tsunami inundation (fourth segment) and consider potential consequences of hurricane winds (fifth segment). These issues are raised again in the third segment of the third portion, where the Intervenor argues that the Staff failed to consider “numerous other potential impacts related to natural disasters, such as the potential for increased buoyancy due to hurricane storm surge or tsunami inundation to compromise the irradiator pool's integrity or allow shielding water to drain out, damage from hurricane-force winds, and liquefaction during an earthquake.”

The Staff considered the Intervenor's comments in all areas. With regard to buoyancy, the Staff understands Dr. Pararas-Carayannis to be suggesting that saltwater infiltration during a tsunami or hurricane might cause a source to float out of the irradiator pool, or the entire pool to float. CNWRA Testimony at A.38. The Staff concluded that because saltwater is only marginally denser than freshwater—saltwater has a density of 1.025; freshwater a density of 1.0—it is simply not plausible that there will be an increase in buoyancy sufficient to cause either a source or the concrete-and-steel pool to float. *Id.* The Staff also considered Dr. Pararas-Carayannis's comment that increased buoyancy might release radioactive effluence from the pool, presumably if the pool tilted to the side and spilled water. *Id.* The Staff

concluded that because the pool water is not radioactive, this is not a feasible scenario. *Id.*

The Staff also considered Pararas-Carayannis's comment that hurricane winds might uproot trees and convert grounded airplanes and other debris into projectiles that might damage Pa'ina's irradiator. The Staff found that while hurricane winds could potentially cause some damage to the irradiator building, the sources would not be damaged by any projectiles because the sources would remain at the bottom of the pool, covered by 12–18 feet of water. CNWRA Testimony at A.31. Even if a projectile pierced the pool liner and water drained out of the pool, there would not be any environmental impact because the pool water is not contaminated. *Id.*

(c) Sixth Segment, First Portion

In the sixth segment in this portion of contention, the Intervenor claims the Staff failed to respond to comments suggesting it should evaluate unique features of Ke'ehi Lagoon that might increase the potential for tsunami-related impacts. The Intervenor cites the Pararas-Carayannis Report, which states that the unique features of the Ke'ehi Lagoon could exacerbate tsunami-generated or hurricane surge runups and currents at the proposed site. Dr. Pararas-Carayannis suggests that maximum flooding of five to six feet could occur if a Category 3 or Category 4 hurricane makes landfall on O'ahu, near the time of highest astronomical spring tides. Dr. Pararas-Carayannis Report also cites past tsunami-generated wave heights of up to nine feet on south shores of O'ahu shores. The Staff considered Dr. Pararas-Carayannis's comments, but determined they did not warrant any revisions to the Final Topical Report. CNWRA Testimony at A.32. Even if the Staff were to assume the accuracy of the data Dr. Pararas-Carayannis presents,⁹⁰ the flooding he identifies would not come close to generating the high

⁹⁰ The data cited by Dr. Pararas-Carayannis conflict with widely-reported data from government agencies (continued. . .)

water velocities and large lifting forces necessary to remove the cobalt sources from the pool. CNWRA Testimony at A.32. In other words, the allegedly unique features of Ke'ehi Lagoon that Dr. Pararas-Carayannis identifies would in no way increase the potential for tsunami-related impacts involving Pa'ina's irradiator.

(d) Seventh Segment, First Portion

In the seventh segment, the Intervenor claims the Staff failed to respond to comments suggesting it should consider potential focusing effects of seismic energy on O'ahu. To the contrary, the Staff considered Dr. Pararas-Carayannis's comments in this area. However, the Staff found no evidence of focusing effects at or near Pa'ina's site. CNWRA Testimony at A.33. The Staff took into account data from the United States Geological Service (USGS) that is summarized in Figure 3-1 of the Final Topical Report. *Id.* The Staff also took into account other data that is summarized on page 3-3 of the Final Topical Report. *Id.* The Staff concluded that, if there were focusing effects, there would be much higher intensity values reported for areas affected by recent earthquakes. *Id.* The Staff also considered information provided by Dr. Pararas-Carayannis in support of his claim that there might be focusing effects near Pa'ina's site. Dr. Pararas-Carayannis cites focusing effects that were reported during an earthquake in California's San Fernando Valley. Given that the San Fernando Valley is approximately 2500 miles from Honolulu and in an area designated by the USGS as a "seismic zone"—Honolulu is *not* in a seismic zone—the Staff did not deem this information relevant to whether there may be focusing effects near Pa'ina's site. *Id.*

(. . .continued)

and, compared to the government data, suggest significantly higher waves have reached the south shore of O'ahu. The accuracy of Dr. Pararas-Carayannis's data would seem to be subject to question, as Dr. Pararas-Carayannis relies exclusively on sources he either authored or co-authored, most of which were published over thirty years ago. Pararas-Carayannis Report at 21–22.

(e) Eighth Segment, First Portion

In the eighth segment, the Intervenor claims the Staff did not respond to comments stating that it needed to evaluate the threat of liquefaction. The Staff considered the Intervenor's comments, which were made by Dr. Pararas-Carayannis, but concluded that the threat of liquefaction is purely speculative. The Staff reviewed seismic data for the Honolulu area and found no evidence of liquefaction in any past earthquake at or near Pa'ina's site. CNWRA Testimony at A.34. In arguing that the Staff should have further considered liquefaction, Dr. Pararas-Carayannis cites evidence of liquefaction during the 1994 Northridge Earthquake in San Fernando Valley. This is the same evidence Dr. Pararas-Carayannis cited in support of his claim that the Staff should have considered potential focusing effects. As explained above, the San Fernando Valley is in a seismic area, whereas Honolulu is not. The San Fernando Valley is also some 2500 miles from Honolulu. While the Northridge Earthquake might provide evidence that liquefaction can occur somewhere, it is of no relevance to assessing risks to Pa'ina's irradiator. *Id.*

Even though it is not a plausible scenario, the Staff considered how liquefaction might affect Pa'ina's irradiator. The Staff concluded that liquefaction would at most result in the irradiator pool being pushed out of the ground and tilted, causing some water to spill. *Id.* Because the sources would remain intact in the pool, partially shielded by water, there would be no radiological impact. *Id.* The Staff considered Dr. Pararas-Carayannis's comment that radioactive effluence could be released if liquefaction occurs. *Id.* The Staff found that this comment did not warrant further review because it rests on the incorrect assumption that the irradiator pool water is radioactive. *Id.*

(f) First Segment, Third Portion

In the first segment of the third portion of its contention, the Intervenor argues that the Staff failed to consider potential impacts associated with major flooding. As explained above,

the Staff performed fluid dynamics calculations to determine the wave velocity needed to remove a source from the irradiator pool. The Staff also analyzed historic data and conservatively assumed a storm surge much larger than can reasonably be expected to reach Pa'ina's facility. The Staff explains its methodology in Sections 3.2.2 and 3.3 of the Final Topical Report, summarizing publicly available data and studies from the National Oceanic and Atmospheric Administration (NOAA), the National Aeronautics and Space Administration, and the National Hurricane Center of the National Weather Service of NOAA. CNWRA Testimony at A.35. The Staff found that a wave velocity between 90 m/s and 180 m/s (203 and 406 mph) would be required to remove a source from the irradiator pool. *Id.* The Staff also found that even a historic-record 10-meter/33.8-foot wave would reach a velocity of only approximately 13 m/s (29 mph), far below the velocity required to remove a source.⁹¹

Dr. Pararas-Carayannis suggests the Staff erred by focusing on tsunami waves rather than major flooding storm surge inundation. In fact, the Staff considered both scenarios. The Staff concluded that, because a wave resulting from a storm surge will be traveling at a lower velocity than a tsunami wave, a storm surge will similarly be unable to remove a source from the irradiator pool. CNWRA Testimony at A.35. In other words, a historic-record 32.8-foot storm surge is *less likely* to exert the force necessary to remove a source than a 32.8-foot tsunami wave. For that reason, major flooding and storm surge inundation would not lead to the removal of cobalt sources. Dr. Pararas-Carayannis seems to acknowledge this, stating that “[o]ver land, there is no structured wave form, but rather a chaotic turbulent water mass that is unlikely to

⁹¹ Although Dr. Pararas-Carayannis claims a 31-foot wave reached the southern coast of O'ahu in 1946—a claim that appears to be based on his own research and which is contradicted by data from the State of Hawaii's Transportation Department—such a wave would not come close to the velocity required to remove a source from Pa'ina's irradiator pool. CNWRA Testimony at A.35.

create wave velocities sufficient to pull a cobalt-60 source assembly out of the irradiator pool.”⁹²

Dr. Pararas-Carayannis also claims, however, that the Staff “lack[s] an understanding of a tsunami’s terminal characteristics when it moves over land.” *Id.* That is not true. Rather, because wave velocities over land were bounded by the results of the fluid dynamics calculations, the Staff found no reason to perform a separate analysis. CNWRA Testimony at A.35.

The Intervenor also argues that the Topical Report fails to consider a loss of electricity, the destruction of backup generators, infiltration of saltwater into the irradiator pool, and buoyancy forces. Pararas-Carayannis Declaration at ¶ 15. In fact, the Staff considered all these scenarios. The Staff simply concluded that none would plausibly lead to radiological consequences, regardless of the extent of the flooding. CNWRA Testimony at A.37.

The Staff also considered other possible consequences of major flooding identified by Dr. Pararas-Carayannis. The Staff concluded that the failure of electricity or backup generators would have no impact on the sources. That is because the sources, which are contained in the source assembly, would remain at the bottom of the pool with full shielding, plus any additional shielding provided by flood waters. CNWRA Testimony at A.37. The Staff recognized that the pool water purification system could be rendered inoperable during a major flood, but found that this would not have any environmental impact as long as the system was repaired after the flooding subsided. *Id.* The Staff also considered Dr. Pararas-Carayannis’s comment that an environmental impact might result from mixing saltwater with the freshwater in the irradiator pool. The Staff found there was no plausible impact because the saltwater would provide shielding for the sources in the same way freshwater does. *Id.* For reasons discussed above,

⁹² Pararas-Carayannis Declaration at ¶ 30.

the Staff found that saltwater infiltration would have no foreseeable impact on buoyancy of either the sources or the irradiator pool itself. CNWRA Testimony at A.38.

(g) Applying NEPA Law to the Staff's Natural Phenomena Analysis

The Staff's analysis of risks to Pa'ina's irradiator from natural phenomena fully complies with NEPA. The Staff's experts used data from federal and state agencies responsible for monitoring such phenomena, such as NOAA and USGS. CNWRA Testimony at A.35. The Staff applied well-established methodologies and made a number of conservative assumptions in determining that a natural phenomenon would not plausibly result in significant environmental consequences. The Staff did more than what is required under NEPA, considering the potential impact from highly speculative scenarios, such as a historic-record wave or liquefaction affecting Pa'ina's irradiator. The well-supported conclusions of the Staff's experts would be entitled to deference even if there were some question about whether the Intervenor's purported expert, Dr. Pararas-Carayannis, applied a more appropriate methodology.⁹³ As the Ninth Circuit recently emphasized, to do otherwise would be to "def[y] well-established law concerning the deference we owe to agencies and their methodological choices."⁹⁴

The Staff would emphasize, however, that this is not case where the Board even needs to reach the issue of whether the opinions of the Staff's experts must be granted deference. The Staff submits that, even assuming the accuracy of the data upon which he relies, Dr.

⁹³ See *Native Ecosystems*, 428 F.3d at 1244 (explaining that a "reviewing court must not 'take sides in a battle of the experts' where the agency's experts provide a reasoned explanation for their rejection of an opposing position") (citation omitted); see also *NRDC*, 518 F.3d at 688 ("When specialists express conflicting views, an agency must have discretion to rely on the reasonable opinions of its own qualified experts even if, as an original matter, a court might find contrary views more persuasive.") (citation omitted); *Empire Pub. Lands Council v. Schultz*, 992 F.2d 977, 981 (9th Cir. 1993) (holding that "[a] court 'will not second-guess methodological choices made by an agency in its area of expertise'" (citation omitted)).

⁹⁴ *Lands Council* (slip op. at 8250).

Pararas-Carayannis simply fails to put forth a plausible scenario in which a natural phenomenon might cause significant environmental impacts. Dr. Pararas-Carayannis suggests a 31-foot wave might reach Honolulu, or that hurricane winds might result in projectiles striking Pa'ina's irradiator. Even if either scenario were to occur, it would not cause any release of radiological material. CNWRA Testimony at A.31, A.35. Nor would a loss of electrical power, saltwater infiltration of the irradiator pool, damage to the pool purification system, or liquefaction during an earthquake. CNWRA Testimony at A.37. Contrary to Dr. Pararas-Carayannis's claim, there is no radioactive effluence that might be spilled from the irradiator. Further, with regard to both liquefaction and focusing effects, there is no relevant data showing that either scenario might plausibly affect Pa'ina's irradiator. CNWRA Testimony at A.33, A.34. The fact that Dr. Pararas-Carayannis's relies on evidence of liquefaction and focusing effects during an earthquake in San Fernando Valley shows just how speculative those scenarios are with respect to Pa'ina's site. Accordingly, the Staff did not need to address either possibility in the EA. *See Trout Unlimited*, 509 F.2d at 1283 (holding that an agency need not discuss remote and highly speculative consequences).

The Staff considered Dr. Pararas-Carayannis's comments in drafting the Final Topical Report and EA. The Staff determined that most of his comments did not warrant revising those documents. This was an appropriate response.⁹⁵ Nonetheless, taking into account Dr. Pararas-Carayannis's comments, the Staff clarified certain areas of the Topical Report. For example, the Staff added Section 1.2, which explains which scenarios might plausibly lead to a loss of control over radioactive material. The Staff also verified its data and updated text in certain sections of the Topical Report, such as Section 3.3, which contains the Staff's analysis

⁹⁵ Cf. 10 C.F.R. § 51.91(a)(1) (addressing responses to comments on an EIS).

of hurricane risks.

3. The Staff's Analyses Are Well-Supported By Data, Analyses And Calculations.

In the second portion of amended environmental contention 3, the Board found that the Intervenor raised an issue as to whether the EA meets the "hard look" standard in twelve of twenty-five areas. In these areas the Intervenor claims the EA fails to provide certain information. As explained below and in the Staff's testimony, the allegedly missing information is in fact included in the EA. Further, with respect to a number of admitted segments, the Intervenor fails to show the allegedly missing information is related to any impact that the Staff had to consider in the Pa'ina EA.

(a) First, Second and Third Segments

In these segments the Intervenor claims that the Staff failed to meet NEPA's "hard look" standard because the EA does not provide:

[1] Any calculations, analysis or data substantiating its claim "it is unlikely that an employee could receive more than the occupational dose limit" or quantification of what it means by "unlikely";

[2] Any calculations, analysis or data regarding its evaluation of "expected dose rate" outside the irradiator; [and]

[3] Any calculations, analysis or data substantiating its claim "it is unlikely that a member of the public could receive more than the public limit" or quantification of what it means by "unlikely."

Contentions at 8–9 (citing Final EA at 8). The Intervenor's claims are easily refuted. Each claim refers to page 8 of the EA, the portion of the EA titled "Normal Operations." As explained in the Staff's testimony, the analysis in this portion of the EA addresses the situation where, as the section heading makes clear, Pa'ina's irradiator is operating under "normal" conditions. Blevins Testimony at A.12. This means that the irradiator and the equipment at Pa'ina's facility are functioning properly, and that Pa'ina is in compliance with all applicable regulatory criteria, as

well as any applicable orders and its license conditions. *Id.*

Contrary to the Intervenor's assertion in the first segment, the EA makes abundantly clear why it is unlikely an employee could receive more than the occupational dose limit. The cobalt-60 sources in Pa'ina's irradiator will be at the bottom of the irradiator pool, shielded by approximately 12–18 feet of water. Final EA at 2. The dose rate at the surface of the pool will be well below the occupational limit of 5 rem/year.⁹⁶ A radiation monitor over the surface of the pool will alert employees if the dose rate at the pool surface exceeds 1 mR/hr., also well below the occupational limit.⁹⁷ If the dose rate were to exceed 1 mR/hr, employees could easily add water to the irradiator pool, returning the dose rate to normal. These factors are all mentioned on page 8 of the EA, refuting the Intervenor's claim that the Staff's conclusion regarding occupational exposures under normal operations is unsupported by "calculations, analysis or data."⁹⁸

For these same reasons, the Intervenor's assertion in the second segment must fail. Under normal operations, the dose rate at 30 centimeters above Pa'ina's irradiator pool will be well below occupational limits, and also well below the public dose limits.⁹⁹ If the dose rate were to rise above 1 mR/hr, Pa'ina's employees would be alerted, water would be added to the irradiator, and the dose rate would be quickly returned to normal. The wall closest to the sources at Pa'ina's irradiator will be approximately 20–25 feet away. Given that the dose rate

⁹⁶ "Microshield Summary Sheet" (ADAMS Accession No. 063480296) (December 14, 2006); 10 C.F.R. § 20.1201.

⁹⁷ License Application at 56.

⁹⁸ The Staff's conclusions regarding the dose rate during normal operations is also supported by the report of an inspection at the cobalt-60 underwater irradiator operated by CFC Logistics. The CFC irradiator is identical in design to Pa'ina's irradiator. The CFC inspection included measurements of dose rates above the irradiator pool. Those dose rates were below 1 mR/hr. Blevins Testimony at A.12.

⁹⁹ 10 C.F.R. § 20.1301.

above the pool at Pa'ina's irradiator will be close to background, it logically follows that the dose rate outside the facility will be indistinguishable from background. Contrary to the Intervenor's assertion, the Staff's conclusion regarding the dose rate outside the irradiator is well supported by data, calculations and analysis. Blevins Testimony at A.14.

The Intervenor's third segment likewise fails to identify any deficiency in the Staff's review. As noted, under normal operations the dose rate above the pool at Pa'ina's irradiator will be well below the public dose limits in 10 C.F.R. § 20.1301. Further, the public will be protected by the same features—radiation monitors, alarm systems, the ability to easily add water—that protect Pa'ina's employees. These factors, all of which are cited in the EA, disprove the Intervenor's claim that the Staff failed to adequately support its statements regarding public dose rates. Blevins Testimony at A.14.

In the first and third segments, the Intervenor also claims the EA is lacking because the Staff does not quantify what it means by the word "unlikely." This argument is without merit. The Staff need not quantify a term where the term is used consistent with its common-sense, ordinary meaning.¹⁰⁰ Here, the Staff used "unlikely" to mean "a low probability of occurrence." Blevins Testimony at A.13. This is consistent with the common definition of "unlikely." The Staff did not have to provide further explanation or quantify that term.

(b) Fourth Segment

The Intervenor argues that the EA is deficient because the Staff fails to provide "any calculations, analysis or data substantiating its claim '[t]ransportation impacts from normal operations would be small.'" Contentions at 9 (citing Final EA at 8). The Staff will address this

¹⁰⁰ See *Pacific Gas and Electric Co.* (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation), CLI-08-01, 67 NRC 1, 11 (2008) (finding that "the context of the Staff's use of the term 'plausible' is consistent with the word's ordinary usage and with NEPA; because the Staff's usage is clear, no separate additional definition is required.>").

issue below in the context of the Intervenor's other claims regarding the EA's analysis of transportation impacts. The Staff respectfully refers the Board to that part of the Staff's discussion.

(c) Fifth Segment

The Intervenor claims that the EA lacks "any calculations, analysis or data substantiating its claim 'It]he proposed irradiator would potentially have small beneficial impacts to socioeconomics.'" Contentions at 9 (citing Final EA at 8). This is incorrect. On its face, the EA contains analysis supporting the Staff's conclusion. The Staff refers to three studies from the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS), all of which are cited in the EA on pages 12 and 13. Blevins Testimony at A.17. The APHIS studies demonstrate that irradiation could lead to lower costs and increased flexibility for importers of certain foods, which could benefit United States consumers through lower prices. *Id.* These studies provide data and information supporting the Staff's conclusion that Pa'ina's irradiator could potentially have small socioeconomic benefits.

In any event, the Staff was not required to address socioeconomic impacts in the Pa'ina EA. That is because any socioeconomic impacts from Pa'ina's irradiator will not be the result of a change in the physical environment.¹⁰¹ Further, as explained in the Staff's testimony, in reviewing Pa'ina's license application the Staff was not required to conduct a cost-benefit analysis to determine if socioeconomic or other benefits might outweigh any adverse

¹⁰¹ See *Metropolitan Edison Co. v. People Against Nuclear Energy*, 460 U.S. 766, 772 (1983) (NEPA's "theme . . . is sounded by the adjective 'environmental': NEPA does not require the agency to assess every impact or effect of its proposed action, but only the impact or effect on the environment").¹⁰¹ See also *Hydro Resources, Inc.*, CLI-01-04, 53 NRC at 49, n.6, ("Nor must all economic benefits be quantified. . . . NEPA 'does not require a particularized assessment of non-environmental impact'"); *Louisiana Energy Services, L.P.* (Claiborne Enrichment Center), CLI-98-3, 47 N.R.C. 77, 89 (1998) ("Determination of economic benefits and costs that are tangential to environmental consequences are within [a] wide area of agency discretion").

environmental impacts.¹⁰² In fact, the Staff identified no significant environmental impact from Pa'ina's irradiator.

(d) Sixth Segment

Here the Intervenor claims that the Staff failed to provide "any justification for focusing its review of potentially significant impacts on 'offsite consequences.'" Contentions at 9 (citing Final EA at 9). But that is not what the Staff said. Rather, the Staff said that it "focused its review on the release of radioactive material which could have off-site consequences." The Intervenor is arguing that the Staff should be required to justify a statement it never made. The Intervenor fails to identify a dispute with the Staff and, therefore, fails to present an issue warranting further litigation.

As explained in the Staff's testimony, focusing on a release which could have offsite consequences makes sense given that such a release could also have onsite consequences. Blevins Testimony at A.18. In other words, by focusing on the type of release that would affect a broader area, the Staff took into account impacts to the narrower onsite area. *Id.*

In any event, it should be readily apparent that in preparing the EA the Staff considered both offsite *and* onsite consequences. In the very same paragraph in which the Staff mentions offsite consequences, the Staff explains that "worker doses should not be significantly increased in the area around the pool" in the event of an aircraft crash or natural phenomena. Final EA at 9. Also in this paragraph, the Staff addresses the likelihood that debris from the aircraft crash would limit access to the irradiator pool. *Id.* This demonstrates that the Staff considered both offsite and onsite consequences.

(e) Seventh Segment

¹⁰² *Cf.* 40 C.F.R. § 1502.23 (addressing elements of an EIS, and requiring that a cost-benefit analysis be incorporated into an EIS under certain circumstances).

The Intevenor argues that the EA fails to provide “any calculations, analysis or data substantiating its claim ‘a loss of 6 feet of pool water would result in a dose of approximately 300 millirem/hour’ or justification of its assertion that ‘the increased dose rate will not be sufficient to have a significant environmental effect on the area around the proposed facility.’” Contentions at 9 (citing Final EA at 9). The Intervenor overlooks the MicroShield Summary Sheet, which is cited in the EA and which was included in the hearing file. This document contains calculations, analysis and data supporting the Staff’s conclusion. Blevins Testimony at A.19. To the extent the Intervenor is claiming that the Staff had to provide a narrative statement explaining the contents of the MicroShield Summary, the Intervenor seeks to impose requirements beyond those found in NEPA.¹⁰³

Although not required under NEPA, the Staff has provided an explanation of the MicroShield Summary Sheet results. Blevins Testimony at A.19. As explained in the Staff’s testimony, MicroShield is a computer program the NRC uses to analyze shielding and estimate exposure from gamma radiation. *Id.* The Staff uses MicroShield for assessing radiation exposure to workers and members of the public. *Id.* MicroShield allows the Staff to calculate dose rates by entering information on source type, source dimensions, dose points, shielding, and other factors. *Id.* In its testimony, the Staff describes the specific factors it used in calculating the six-foot water loss, factors that are also specified in the MicroShield summary sheet. As stated in the summary sheet, the Staff calculated a dose rate of approximately 300 mR/hr at the pool surface during normal operations.¹⁰⁴

¹⁰³ See *Western Watersheds Project*, 552 F. Supp. 2d at 1129–30 (holding that an EA is adequate if, as a whole, it adequately references the data it relies on).

¹⁰⁴ The MicroShield calculation is for the pool surface, rather than 30 centimeters above the pool surface. Thus, it is a conservative calculation of the dose rate that is relevant to determining whether Pa’ina meets the regulatory requirement at 10 C.F.R. § 36.25(b), which establishes a dose limit 30 centimeters above (continued. . .)

(f) Eighth Segment

The Intervenor claims that the Staff failed to provide “any justification for its decision to analyze only a 6-foot water loss, especially given that the depth of the water table is 2.4 m (8 feet) below the facility floor.” Contentions at 9 (citing Final EA at 9 and Final Topical Report at 1-2.) In fact, the Staff analyzed both a six-foot water loss and an eight-foot water loss. Blevins Testimony at A.20-21. The Staff analyzed an eight-foot water loss on May 9, 2007, while it was preparing the Final EA.¹⁰⁵ The MicroShield Summary Sheet relating to an eight-foot water loss, although not cited in the EA, was later added to the hearing file.¹⁰⁶ Accordingly, whether the Staff analyzed only a 6-foot water loss is no longer an issue in this proceeding.

(g) Ninth Segment

The Intervenor alleges that the Staff did not present “any calculations, analysis or data substantiating its claim ‘worker doses should not be significantly increased in the area around the pool’ in the event of a loss of shielding water or quantification of what it means by ‘significantly increased.’” Contentions at 9 (citing Final EA at 9). This is incorrect. The Staff’s conclusion is supported by the MicroShield calculations, which show the dose rate associated with a six-foot water loss, and by the fact that the radiation from the cobalt-60 source will form a well-collimated beam. This is explained in the Staff’s testimony. Blevins Testimony at A.19-21.

The Staff’s conclusion is also supported by its review of Pa’ina’s radiation safety procedures. As explained in the Staff’s testimony, Pa’ina’s radiation alarm will sound well

(. . .continued)

the surface of an underwater irradiator. Blevins Testimony at A.19–20.

¹⁰⁵ "MicroShield Summary—Pa’ina—Maximum Activity Loss of 8 Feet of Water Shielding" (May 9, 2007) (ADAMS Accession No. ML072630315), Staff Exh. 29.

¹⁰⁶ “NRC Staff’s Hearing File Update” (October 5, 2007) (ADAMS Accession No. ML072820692).

before the dose rate reaches 1 mR/hr, and employees could easily add water to return the dose rate to normal. Blevins Testimony at A.20. Even if an accident prevented workers from adding water immediately, and even if the six-foot water loss persisted for a period of time, the well-collimated beam would prevent the increased dose rate from having a significant environmental impact on the area around the facility. Blevins Testimony at A.20.

(h) Tenth Segment

According to the Intervenor, the Staff failed to provide “any analysis to justify its assumption that ‘debris around the pool’ would prevent ‘inadvertent access to the areas of elevated radiation directly above the pool.’” Contentions at 9 (citing Final EA at 9). That is not the case. The “debris” to which the Staff refers is debris resulting from an aircraft crash at the irradiator. Blevins Testimony at A.24. In order for the aircraft crash to cause elevated radiation directly above the pool, there would have to be a loss of pool water. That could occur only if debris pierced the irradiator pool. As explained in the Staff’s testimony, neither a fuel fire nor an exploding airplane would have any appreciable impact on the water level. CNWRA Testimony at A.22. If debris were to enter the pool, it would have to fall from either the aircraft or the irradiator building. In that case, it is simply not plausible that the pool opening, which is only seven by eight feet, would be clear of debris.¹⁰⁷ The Staff would note that, in arguing debris might pierce the irradiator pool and cause a loss of water, the Intervenor postulates a scenario in which the *entire aircraft* blocks the pool opening.¹⁰⁸ Sozen-Hoffman Report at 5 (February 1, 2007).

¹⁰⁷ The Intervenor suggests that, rather than preventing inadvertent access, an employee could be trapped by debris. But it is simply not plausible that an employee would be present in the area above the irradiator pool following an accident of the type necessary to pierce the pool liner. This is a highly speculative scenario that the Staff need not address in an EA. Blevins Testimony at A.24.

¹⁰⁸ Sozen and Hoffman Report (February 1, 2007) at 5.

(i) Twenty-Fourth Segment

The Intevenor argues that the Staff does not provide “any calculations, analysis or data substantiating its claim ‘[t]he likelihood of accidents involving exposure of workers to lethal doses from this specific irradiator design is expected to be low’ or quantification of what it means by a ‘low’ likelihood.” Contentions at 10 (citing Final EA at C-10).¹⁰⁹ There is ample support for the Staff’s statement, both in the EA itself and in the Staff’s testimony. The risk is low because an underwater irradiator uses passive shielding, in the form of pool water, such that the source is not exposed in a room that employees might inadvertently enter. Blevins Testimony at 25. The dose rate at the pool surface is far below regulatory limits under normal conditions and, even if there is a loss of water, the likelihood of any exposure above the Part 20 limits is low because of the well-collimated beam. The likelihood of an accident involving exposure of workers to lethal doses is also expected to be low for reasons noted in the comment response appearing at the top of page C-10: the irradiator design consists of multiple layers of steel and concrete, and there will be continuous monitoring systems in place to detect radioactivity in the pool. Blevins Testimony at A.25.

As explained in the Staff’s testimony, “low” is a qualitative term meant to convey that a lethal accident involving a worker is highly unlikely. *Id.* The Staff used this term consistent with its ordinary usage, and there was no need for the Staff to further define the term.¹¹⁰

(j) Twenty-Fifth Segment

The Intevenor claims the Staff failed to provide “any calculations, analysis or data to back up its speculation that ‘there is no reason to believe the irradiator would have any effect’

¹⁰⁹ The statement to which the Intervenor refers is in Appendix C, the section in which the Staff summarizes and specifically responds to public comments on the Draft EA.

¹¹⁰ See *Diablo Canyon*, CLI-08-01, 67 NRC at 11.

on tourism.” Contentions at 10 (citing Final EA at C-12). As explained in the Staff’s testimony, in this portion of the EA the Staff is responding to comments expressing concern about how tourism will be affected when tourists see the facility next to the airport. Blevins A.26. The comments implied that the impact to tourism will come from seeing the irradiator. *Id.* The Staff notes, however, that the irradiator “would be visually indistinguishable from other typical industrial buildings in the area.” *Id.* The Staff concluded that because a tourist would not know he or she is looking at an irradiator, there will be no impact to tourism from seeing an irradiator. *Id.* The Staff’s reasoning is fully explained on page C-12 of the EA.

In any event, to the extent the comments suggest tourists may choose not to visit Hawaii because of the fear of an accident involving Pa’ina’s irradiator, they do not identify any impact that the Staff must consider in its NEPA review. Rather than identifying an impact on the environment itself, the comments identify a psychological factor that is not connected to any environmental impact. This is not a factor an agency must consider in its NEPA review.¹¹¹

(k) Applying NEPA Law to the Intervenor’s Claims in the Third Portion of Amended Environmental Contention 3

Above, the Staff has identified NEPA precedent relevant to many of the Intervenor’s claims. For example, the Staff has explained why it did not need to further describe terms such as “unlikely” and “low” in the EA; the Staff has also explained why as a matter of law it did not have to consider non-environmental impacts such as tourism and socioeconomics in the Pa’ina EA. As for the other segments in the third portion of amended environmental contention 3, the Intervenor is simply wrong to the extent it asserts that the Staff had to include in the EA itself all

¹¹¹ See *Metropolitan Edison Co*, 460 U.S. at 772 (“NEPA does not require the agency to assess every impact or effect of its proposed action, but only the impact or effect on the environment”); *Pa’ina Hawaii, LLC*, CLI-08-16, 67 NRC __ (August 13, 2008) (slip op. at 9) (“[t]o be encompassed by NEPA, there needs to be a reasonably close causal relationship between a change in the physical environment and the effect at issue”) (citation omitted).

the data, calculations and analyses supporting the Staff's review. That would not be consistent with the purpose of an EA, which is to be a "concise public document" that provides a "brief discussion" in the required areas.¹¹² Further, federal courts have made it clear that, while an EA must contain more than conclusory statements, an EA is adequate if, as a whole, it adequately references the data upon which it relies. Such is the case here, where the allegedly missing information—to the extent it is not included in the EA itself—can be found in the Staff's references, which are listed on pages 14-15, C-17 and C-18.

4. The Staff Was Not Required to Address Transportation Impacts in the EA.

The Intervenor raises three challenges relating to the transportation of cobalt-60 sources to Pa'ina's irradiator. In the tenth segment in the first portion of amended environmental contention 3, the Intervenor argues that the Staff failed to respond to comments stating that it should examine transportation accidents. In the fourth segment in the second portion, the Intervenor claims that the Staff fails to provide any calculations, analysis or data substantiating the EA's statement that "[t]ransportation impacts from normal operations would be small." Then, in the ninth segment in the third portion, the Intervenor argues that the EA is deficient because, while the EA considers transportation impacts from normal operations, it does not examine the likelihood and consequences of accidents that might occur during the annual transport of cobalt-60 sources to and from Pa'ina's irradiator.

Each of the Intervenor's arguments must fail because the Staff was not required to analyze transportation impacts in the first instance. That is because transportation impacts, from both normal operations and accidents, have already been considered by both the NRC and

¹¹² Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. 18,026 (March 23, 1981); 10 C.F.R. § 51.30.

the U.S. Department of Transportation (DOT) during NEPA reviews conducted prior to each agency's issuance of regulations applying to the transportation of radioactive materials.

The NRC and DOT jointly regulate the transportation of radioactive material in the United States. A memorandum of understanding (MOU) between the NRC and DOT explains the agencies' respective roles in overseeing the transportation of radioactive materials.¹¹³ As the MOU explains, acting under authority of the Hazardous Materials Transportation Act (HTMA),¹¹⁴ DOT decides which materials should be designated as "hazardous" and issues regulations for the safe transportation of hazardous materials. 49 U.S.C. §§ 5103(a), (b)(1). DOT's hazardous materials regulations are contained at 49 C.F.R. §§ 171-179.A. The NRC, on the other hand, prescribes safety standards for the packaging of certain radioactive materials and requires NRC licensees to follow DOT's regulations for the transportation of such materials.¹¹⁵ The NRC's transportation regulations are at 10 C.F.R. Part 71, "Packaging and Transportation of Radioactive Material."

Both the NRC and DOT conducted NEPA reviews prior to adopting their regulations in 10 C.F.R Part 71 and 49 C.F.R Parts 171–179. The NRC's NEPA review is documented in "NUREG-0170: Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes" (December 31, 1977) (ADAMS Accession No. 022590265). Both the

¹¹³ *Memorandum of Understanding Between the U.S. DOT and the U.S. NRC for Regulation of Safety in the Transportation of Radioactive Materials*, 44 Fed. Reg. 38,690 (1979).

¹¹⁴ 49 U.S.C. § 1801 *et seq.* The HMTA authorizes the Secretary of Transportation "to protect the nation adequately against the risks to life and property which are inherent in the transportation of hazardous materials in commerce." 49 U.S.C. § 1801.

¹¹⁵ See 10 C.F.R. § 71.5(a) ("Each licensee who transports licensed material outside the site of usage . . . shall comply with the applicable requirements of the DOT regulations in 49 CFR parts 107, 171 through 180, and 390 through 397, appropriate to the mode of transport."); see also *Nuclear Information and Resource Service v. NRC*, 457 F.3d 941, 944–47 (9th Cir. 2006) (explaining respective roles of NRC and DOT in regulating transportation of radioactive materials).

NRC and DOT also regularly update their regulations applying to the transportation of radioactive materials, conducting NEPA reviews as appropriate. For example, in 2004 the NRC and DOT revised their regulations to make them compatible with new exemption values specified in regulations issued by the International Atomic Energy Agency.¹¹⁶ The NRC developed an EA for that rulemaking, upon which DOT relied in its own rulemaking.¹¹⁷

The NRC considered the environmental impacts of transporting cobalt-60 sources, during both normal operations and accidents, in preparing NUREG-0170. In fact, the NRC specifically considered the impacts of transporting large curie cobalt-60 sources to commercial irradiators. The NRC explained that “[i]rradiator sources, usually Co-60 or Cs-137, are used for research or in large-scale food sterilization operations and contain hundreds of thousands of curies. . . . They are shipped in large casks which, because of their weight, are transported by surface modes.” NUREG-0170 at 1-6.

The Intervenor argues that the licensing of Pa’ina’s irradiator and annual cobalt-60 shipments to the irradiator are “connected actions” such that the shipments must be considered in the Pa’ina EA. But the Intervenor misidentifies the “action” involved. Individual shipments of cobalt-60 to Pa’ina’s irradiator are not a federal action, any more than the irradiation of products at Pa’ina’s irradiator will be a federal action. Rather, the relevant federal action is the licensing and registration of radioactive materials carriers, who will be responsible for the cobalt-60 shipments.

¹¹⁶ See Compatibility with IAEA Transportation Safety Standards (TS-R-1) and Other Transportation Safety Amendments Final Rule, 69 Fed. Reg. 3,698 (Jan. 26, 2004) (to be codified at 10 C.F.R. Part 71) (NRC); Hazardous Materials Regulations; Compatibility with the Regulations of the International Atomic Energy Agency; Final Rule, 69 Fed. Reg. 3632 (Jan. 26, 2004) (codified at 49 C.F.R. pts. 171–78) (DOT).

¹¹⁷ “NUREG/CR-6711, Environmental Assessment of Major Revision of 10 CFR Part 71, Final Rule” (December 31, 2003) (ADAMS Accession No. 033430429); see *a/so* 69 Fed. Reg. at 3664 (explaining that DOT is relying on the EA prepared by the NRC).

The licensing of radioactive materials carriers and the licensing of Pa'ina's irradiator are not "connected actions" for purposes of NEPA. Under CEQ regulations, actions are "connected" only if they:

- (i) Automatically trigger other actions which may require environmental impact statements.
- (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously.
- (iii) Are interdependent parts of a larger action and depend on the larger action for their justification.

40 C.F.R. § 1508.25(a). There can be no serious claim that the licensing of Pa'ina's irradiator and the licensing of radioactive materials carriers meet either the first or third criterion above. Neither action "automatically trigger[s]" the other action. Moreover, there is no "larger action" of which these two actions can be considered parts and on which they both depend for their justification.

The only question meriting further discussion is whether the licensing of Pa'ina's irradiator and the licensing of radioactive materials carriers are "connected actions" because they meet the second criterion above. While it is likely true that Pa'ina would never have sought a materials license if could not depend on source shipments, this is not enough to satisfy the second criterion in 40 C.F.R. § 1508.25(a). In determining whether actions "[c]annot or will not proceed unless other actions are taken previously or simultaneously," courts apply an "independent utility" test that looks to whether *either* of the allegedly connected actions would have proceeded without the other action.¹¹⁸ This test applies in the Ninth Circuit as well.¹¹⁹ Under this test, the comprehensive regulatory schemes in 10 C.F.R. Part 71 and 49 C.F.R.

¹¹⁸ *Hudson River Sloop Clearwater*, 836 F.2d 760, 764 (2d Cir. 1988).

¹¹⁹ See *Blue Ocean Preservation Soc.*, 754 F. Supp. at 1458 (D. Haw. 1991) (holding that the inquiry under the "cannot or will not proceed" language in 40 C.F.R. § 1508.25(a)(ii) is directed not toward whether a later action could go forward without previous actions, but rather whether the earlier actions could go forward without the later action ever being completed).

Parts 171–179 obviously have “independent utility” because they would have proceeded regardless of whether or not Pa’ina’s irradiator is licensed. The licensing of Pa’ina’s irradiator and the licensing of radioactive materials carriers therefore are not “connected actions” such that the Staff had to consider them in the same NEPA document.

In arguing that the Staff had to consider the impact of source shipments to Pa’ina’s irradiator, the Intervenor relies solely on its argument that these shipments and the licensing of Pa’ina’s irradiator are connected actions. Contentions at 18 (citing 40 C.F.R. § 1508.25(a)). Because they are not, the Board should dismiss the three transportation-related segments in amended environmental contention 3.

In any event, NEPA did not otherwise require the Staff to address transportation impacts in the Pa’ina EA. Any environmental impacts associated with the annual shipments of cobalt-60 to Pa’ina’s irradiator have already been considered as part of the NRC’s and DOT’s prior NEPA reviews. As explained above, before issuing regulations applying to the transportation of radioactive materials, the NRC and DOT evaluated the potential environmental impacts associated with shipping a wide range of materials, including cobalt-60 sources for use in commercial irradiators. The NEPA documents associated with the Part 71 rulemakings, for example, show that the NRC considered transportation impacts, from both normal operations and accidents, prior to adopting regulations applying to the licensing of radioactive materials carriers. The NRC and DOT continue to examine the environmental impacts of transporting radioactive materials as they periodically update the regulations in 10 C.F.R. Part 71 and 49 C.F.R. Part 179. Because the NRC and DOT have already reviewed the environmental impacts of transporting cobalt-60 sources as a general matter, the Staff did not need to reconsider those impacts prior to licensing Pa’ina’s irradiator.

Moreover, there is no reason to believe that there may be any cumulative impact associated with issuing Pa’ina’s license. As the Commission explained in *Hydro Resources*,

Inc., when considering cumulative impacts, the relevant question is whether the "simultaneous development" in multiple areas will in fact heighten a project's overall impact. CLI-01-04, 53 NRC at 57–58. That might happen where "impacts . . . combine in such a fashion that will enhance the significance of their individual effects. *Id.* In the present case, it is difficult to see how the impacts associated with licensing Pa'ina's irradiator will either enhance, or be enhanced by, any impacts involving the transportation of sources. The operation of Pa'ina's irradiator will not make the transportation of sources either safer or less safe. Conversely, the transportation of sources according to NRC and DOT regulations will not negatively affect the operation of Pa'ina's irradiator. To the extent the Intervenor is alleging there is any cumulative impact from the licensing of Pa'ina's irradiator, the Intervenor has not explained what that impact might be.¹²⁰

As explained in the Staff's testimony, even though it was not required to do so, the Staff decided to consider the environmental impact of transporting cobalt-60 sources from the Port of Honolulu to Pa'ina's irradiator. The Staff analyzed these impacts in order to respond to public comments expressing concern about the transportation of sources within Hawaii.¹²¹ As explained in the comment response on page C-11 of the Final EA, the Staff used RADTRAN¹²² to estimate the maximum dose to a member of the public. The RADTRAN calculations, which are cited in the Final EA at pages 8 and C-11, show a dose from normal operations of 0.4

¹²⁰ See *Dept. of Transportation v. Public Citizen*, 541 U.S. 752, 764 (2004) (explaining that "[p]ersons challenging an agency's compliance with NEPA must 'structure their participation so that it . . . alerts the agency to the [parties'] position and contentions,' in order to allow the agency to give the issue meaningful consideration") (citation omitted).

¹²¹ See Final EA at C-11 (responding to "commenters express[ing] concern about how Co-60 is going to be transported to and from the facility and how it is going to be stored").

¹²² RADTRAN is a computer program that can be used to calculate risks from both incident-free transportation of radioactive materials and from accidents.

millirem/year, which is far below the 100 millirem/year dose limit for members of the public. Based on the RADTRAN reports, the Staff concluded that the impacts from transporting cobalt-60 to Pa'ina's irradiator under normal operations would be small. Blevins Testimony at A.16.

The Staff would emphasize that its analysis of transportation impacts was intended to provide only a snapshot of how cobalt-60 shipments might affect the environment. Cobalt-60 shipments to Pa'ina's irradiator will most likely originate thousands of miles away from Honolulu. In the present licensing action, the Staff did not consider transportation impacts for any portion of the shipment outside of Honolulu. The Staff limited its analysis to shipments between the Port of Honolulu and Pa'ina's irradiator because that was the focus of public concern. *Id.*

In its December 21, 2007 Order admitting the three transportation-related segments of the Intervenor's contention, the Board found that, "[h]aving introduced transportation impacts in the draft and final EA, the Staff cannot now fence off the subject from challenge."¹²³ The Board made its finding in the context of ruling on contention admissibility, concluding that, although the Staff cited the transportation GEIS when responding to the Intervenor's contentions, the Staff's response was "too little and too late to defeat the contention."¹²⁴ The issue presently before the Board, however, is not whether the Intervenor has raised a question about the need to consider transportation impacts in Pa'ina's EA. Rather, the issue is whether the Staff actually had to consider such impacts. The mere fact that the Staff discussed certain transportation impacts in the Final EA does not create any new legal requirement under NEPA.¹²⁵

¹²³ Order (Ruling on Admissibility of Intervenor's Amended Environmental Contentions) at 18.

¹²⁴ *Id.*

¹²⁵ See *Hudson River Sloop Clearwater, Inc.*, 836 F.2d at 764 (2d Cir. 1988) (explaining, "[T]hat the Navy may have done more than was necessary to comply with the [NEPA] regulation, however, is no reason to enlarge the regulatory requirements"). The Board should hold the same here, where the Staff discussed transportation impacts in order to respond to public concern about cobalt-60 shipments in Hawaii; see (continued. . .)

5. The Staff Has Disclosed the References Supporting its Analysis of Terrorism Risks to the Extent Required under FOIA

On July 31, 2008, the Staff submitted its *Vaughn* index in connection with the admitted segment within the fourth portion of amended environmental contention 3. In this segment, the Intervenor claimed that the Staff improperly failed to disclose data underlying the terrorism analysis in Appendix B of the Final EA. When admitting this segment, the Board suggested that, after the Staff submitted a *Vaughn* index, the Board would reconsider the admitted segment.¹²⁶ Because the Intervenor's contention was a contention of omission, and because the Staff has since provided the information sought by the Intervenor to the extent required under FOIA, the Staff respectfully submits that the Board should dismiss this segment of the Intervenor's contention.¹²⁷ In the event the Board does not rule on the terrorism-related segment prior to the hearing, however, or the Board decides this segment should remain admissible, the Staff is submitting its *Vaughn* index and associated affidavits as Staff exhibits.

The Staff will also briefly address one terrorism-related issue that was not addressed in the Board's March 4, 2008 Memorandum and Order. In the ninth segment in the first portion of amended environmental contention 3, the Intervenor argued that the Staff failed to respond to

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also Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements (the Green Book), Second Edition (2004) at 28 (explaining that "[b]ecause one purpose of NEPA analysis is to inform the public, consider analyzing an accident scenario in which the public has expressed a keen interest, even when the scenario is not reasonably foreseeable").

¹²⁶ Order (Ruling on Admissibility of Intervenor's Terrorism-Related Challenges) at 5 ("The Staff's submission of a *Vaughn* index will enable the Intervenor as well as this Board to assess the completeness and adequacy of the data used by the Staff, and thus, whether it applied the requisite 'hard look' standard.").

¹²⁷ See, e.g., *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 & 2, Catawba Nuclear Station, Units 1 & 2), CLI-02-28, 56 N.R.C. 373, 382-84 (2002) (explaining that "where a contention is 'superseded by the subsequent issuance of licensing-related documents'—whether a draft EIS or an applicant's response to a request for additional information—the contention must be disposed of or modified.") (citation omitted).

comments arguing that it did not thoroughly analyze terrorist threats. Contentions at 7. The Intervenor's comments, however, raised the exact same issues that the Intervenor presented in the fourth portion of amended environmental 3, where the Intervenor challenged the Staff's terrorism analysis in Appendix B. With the exception of the segment alleging that the Staff improperly withheld certain data, the Board dismissed this portion of the Intervenor's contention in its March 4, 2008 Memorandum and Order.¹²⁸ Accordingly, given that the Board has found the Intervenor's comments on the Staff's terrorism analysis do not raise issues warranting further litigation, the Board should also dismiss the Intervenor's claim that the Staff's failed to respond to those comments. The Board should also dismiss Intervenor's claim because the Staff clearly took into account the Intervenor's comments on the Draft Appendix B, as explained in the Staff's testimony. Although the Staff found no need to make substantive revisions to Appendix B, the responded to the Intervenor's comments by updating its list of references and adding one reference.

III. Amended Environmental Contention 4

A. NEPA Law Applying to the Consideration of Alternatives

In order to meet NEPA's "hard look" standard in the case of an EA, the NRC must "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources."¹²⁹ NEPA's requirement that an agency consider alternatives in an EA is subject to a "rule of reason."¹³⁰ In *North Anna*, the Commission explained that the "rule of reason" is a

¹²⁸ *Id.* at 5–6.

¹²⁹ NEPA § 102(2)(E), 42 U.S.C. § 4332(2)(E); 10 C.F.R. § 51.30(a)(1)(ii).

¹³⁰ *North Anna*, CLI-07-27, 66 NRC at 229 n.71 (citing *Natural Resources Defense Council v. Morton*, 458 F.2d 827, 834 (D.C. Cir. 1982) and *Vermont Yankee Nuclear Power Corp., v. Natural Resources Defense Council*, 435 U.S. 519, 551 (1978) (referring to the "notion of feasibility").
(continued. . .)

“judicial device to ensure that common sense and reason are not lost in the rubric of regulation.”¹³¹ The “‘rule of reason’ governs both *which* alternatives the agency must discuss, and the *extent* to which the agency must discuss them.”¹³²

1. NEPA Does Not Establish a Minimum Number of Alternatives for an Agency to Consider

NEPA’s requirement that an agency consider “appropriate” and “reasonable” alternatives does not dictate the minimum number of alternatives an agency must consider.¹³³ In *Native Ecosystems*, the Ninth Circuit found no fault with an EA that focused on only two alternatives—the no action alternative and the proposed alternative.¹³⁴ The court relied on evidence that the agency had in fact considered four other alternatives to some degree, but had not pursued those alternatives because they would not have advanced the purpose of the proposed project. The court rejected any claim that NEPA imposes a numerical floor on the number of alternatives to be considered, explaining that NEPA’s requirements are satisfied “[s]o long as ‘all reasonable alternatives’ have been considered and an appropriate explanation is provided as to why an alternative was eliminated.”¹³⁵ The court stated that it was “join[ing] our sister circuits in holding that an agency’s obligation to consider alternatives under an EA is a lesser one than under an

(. . .continued)

¹³¹ *Id.*

¹³² *City of Grapevine v. Dept. of Transp.*, 17 F.3d 1502, 1506 (D.C. Cir. 1994) (quoting *Citizens Against Burlington, Inc. v. Busey*, 938 F.3d 190, 195 (D.C. Cir. 1991), *cert. denied*, 502 U.S. 994 (1991)) (emphasis in original).

¹³³ *Native Ecosystems*, 428 F.3d at 1247.

¹³⁴ 428 F.3d at 1249.

¹³⁵ *Id.* at 1246.

EIS.” *Id.*

The Commission likewise applies a “sliding scale” to alternatives analyses and differentiates between the levels of analysis required in an EA and an EIS. The Commission has noted that where an action will have little environmental effect, it is unlikely any alternative to the proposed action would be materially advantageous.¹³⁶ This is a factor that must be taken into account in determining whether the Staff has considered a reasonable range of alternatives. Further, even if it is not clear on the face of an EA that an agency considered particular alternatives, an EA may be deemed adequate where it is obvious from the administrative record that the agency considered those alternatives in its decisionmaking process.¹³⁷

2. When Evaluating Alternatives, an Agency May Assign Substantial Weight to the Preferences of the Applicant

When an agency is asked to sanction a specific plan, “not as a proprietor, but to approve and support a project being sponsored by a . . . private applicant, the Federal agency is necessarily more limited” than when it is analyzing a plan the agency itself proposes.¹³⁸ In *Citizens Against Burlington*, the D.C. Circuit held that:

In commanding agencies to discuss “alternatives to the proposed action,” [], NEPA plainly refers to alternatives to the “major *Federal* actions significantly affecting the quality of the human environment,” and not to alternatives to the applicant’s proposal. NEPA § 102(2)(C), 42 U.S.C. § 4332(2)(C) (emphasis

¹³⁶ *Virginia Elec. & Power Co.* (North Anna Power Station, Units 1 & 2), ALAB-584, 11 NRC 451, 456-58 (1980); *Virginia Elec. & Power Co.* (North Anna Power Station, Units 1 & 2), LBP-85-34, 22 NRC 481, 491 (1985).

¹³⁷ *Save Our Cumberland Mtns. v. Kempthorne*, 453 F.3d 334, 347 (6th Cir. 2006) (“while the agency did not identify additional alternatives in so many words in the environmental assessment, it plainly considered alternatives during the administrative process.”).

¹³⁸ *Citizens Against Burlington*, 938 F.2d at 197; *Hydro Resources, Inc.* (P.O. Box 15910, Rio Rancho, NM 87174), CLI-01-04, 53 NRC 31, 55 (2001).

added). An agency cannot redefine the goals of the proposal that arouses the call for action; it must evaluate alternative ways of achieving *its* goals, shaped by the application at issue and by the function that the agency plays in the decisional process. Congress did expect agencies to consider an applicant's wants when the agency formulates the goals of its own proposed action. Congress did not expect agencies to determine for the applicant what the goals of the applicant's proposal should be.

938 F.2d at 199 (emphasis in original).¹³⁹ Additionally, the Commission has explicitly held that the agency "may take into account the economic goals of the project's sponsor."¹⁴⁰

Case law from the Ninth Circuit and other circuits supports the Commission on this point. An agency need only discuss those alternatives that are reasonable and "will bring about the ends" of the proposed action.¹⁴¹ "When the purpose is to accomplish one thing, it makes no sense to consider the alternative ways by which another thing might be achieved."¹⁴² An EA must include a reasonable range of alternatives, but NEPA does not require an agency to discuss "all proposed alternatives, no matter what their merit."¹⁴³ There is no need for an agency to analyze "the environmental consequences of alternatives it has in good faith rejected as too remote, speculative, or . . . impractical or ineffective."¹⁴⁴ Further, "the range of alternatives that the [agency] must consider decreases as the environmental impact of the

¹³⁹ Although *Citizens Against Burlington* involved an EIS, rather than an EA, the D.C. Circuit's reasoning is relevant regardless of what type of NEPA document the agency is preparing.

¹⁴⁰ *Hydro Resources, Inc.*, CLI-01-04, 53 NRC at 55 (citing *City of Grapevine v. Dept. of Transp.*, 17 F.3d 1502, 1506 (D.C. Cir. 1994) *cert. denied*, 513 U.S. 1043 (1994)).

¹⁴¹ *Trout Unlimited*, 509 F.2d at 1286.

¹⁴² *Hydro Resources, Inc.*, CLI-01-04, 53 NRC at 55 (citing *City of Angoon v. Hodel*, 803 F.2d 1016, 1021 (9th Cir. 1986) (per curiam), *cert. denied*, 484 U.S. 870 (1987)).

¹⁴³ See *La. Crawfish Producers Ass'n v. Rowan*, 463 F.3d 352, 356–57 (5th Cir. 2006).

¹⁴⁴ *Fuel Safe Wash. v. Fed. Energy Regulatory Comm'n*, 389 F.3d 1313, 1323 (10th Cir. 2004) (internal quotation marks omitted) (omission in original).

proposed action becomes less and less substantial”.¹⁴⁵ Alternatives that do not accomplish the purpose of an action are not reasonable.

The Intervenor relies on *Van Abbema v. Fornell*, 807 F.2d 633, 638 (7th Cir. 1986), for the proposition that the alternatives analysis should focus on the “*general* goal of an action,” not on “alternative means by which a particular applicant can reach his goals.”¹⁴⁶ But several Courts of Appeals have disagreed with the Seventh Circuit’s alternatives analysis in *Van Abbema*,¹⁴⁷ and the Commission has chosen to follow the other Circuits by determining that it is appropriate to “accord substantial weight to the preferences of the applicant and/or sponsor in the siting and design of the project.”¹⁴⁸

3. NEPA Section 102(2)(E) Generally Does Not Require that an Agency Consider Alternative Locations

There is typically no requirement that an agency consider alternative sites in an EA. This is because NEPA section 102(2)(E), which governs an agency’s obligation to consider alternatives, limits that obligation to “any proposal which involves unresolved conflicts concerning alternative uses of available resources.” Where the “available resource” is a particular parcel of land, construction of a building on an alternative site cannot be considered

¹⁴⁵ *La. Crawfish Producers*, 463 F.3d at 356–57.

¹⁴⁶ Intervenor Concerned Citizens of Honolulu’s Amended Environmental Contentions #3 Through #5, September 4, 2007.

¹⁴⁷ *Citizens Against Burlington*, 938 F.2d at 197; *Alliance for Legal Action v. FAA*, 69 Fed. Appx. 617, 622 (4th Cir. 2003) (per curiam) (“the project sponsor’s goals play a large role in determining how the purpose and need is stated”); *Colo. Environmental Coalition v. Dombeck*, 185 F.3d 1162, 1174–75 (10th Cir. 1999) (stating that an agency’s purpose and need statement must fall somewhere between the extremes of considering only the applicant’s preferred alternative and ignoring the applicant’s objectives).

¹⁴⁸ *Hydro Resources, Inc.*, CLI-01-04, 53 NRC at 55 (2001) (citing *Citizens Against Burlington*, 938 F.2d at 197).

an alternative for the resource in question.¹⁴⁹ Rather, for the particular resource at issue, it is simply equivalent to the no-action alternative. “To construe § 102(2)(E) as requiring analysis of alternatives to the proposed development as opposed to consideration of alternative uses of a given resource would, in effect, impose upon federal agencies the duty to prepare an EIS in connection with every proposed federal action, regardless of its size or the significance of its impact on the environment.”¹⁵⁰ The court in *Wicker Park* noted that the few decisions interpreting § 102(2)(E) as requiring consideration of alternative sites had limited their holdings to concededly major federal actions, or actions raising serious environmental questions; that is, to actions that would in any event require an EIS. As explained by the court, any broader reading of the obligations imposed by § 102(2)(E) “would impermissibly eliminate the distinctions among types of federal actions and the type of environmental review required that are implicit in NEPA and explicit in the regulations promulgated pursuant to NEPA.” *Id.*

B. The Staff’s Analysis of Alternatives is Consistent with NEPA’s Rule of Reason

In amended environmental contention 4, the Intervenor alleges that the Staff failed to consider reasonable alternatives to Pa’ina’s irradiator by (1) failing to consider alternate technologies, and (2) failing to consider alternate locations. Contrary to the Intervenor’s claims, the Staff thoroughly evaluated alternatives that were consistent with the purpose of Pa’ina’s proposal. The Staff considered a number of alternative technologies, but concluded that no other technology would meet the purpose of Pa’ina’s proposal. The Staff did not consider alternative locations, both because it was not required to do so under NEPA Section 102(2)(E), and because it considered a reasonable range of alternatives even without inquiring into

¹⁴⁹ *Wicker Park Historic Dist. Preservation Fund v. Pierce*, 565 F. Supp. 1066 (N.D. Ill. 1982).

¹⁵⁰ *Id.* at 1081.

alternative locations.

1. The Staff Thoroughly Evaluated Alternative Technologies

In the first portion of amended environmental contention 4, the Intervenor describes the Staff's analysis of alternative technologies as " cursory" and claims the discussion of methyl bromide gas and heat treatment in the EA did not "rigorously explore and objectively evaluate the relative environmental costs and benefits of using those technologies." Contentions at 31–32. The Intervenor also asserts that the Staff failed to consider the alternative technology of an electron-beam irradiator. Contentions at 32.

Contrary to the Intervenor's arguments, the Staff thoroughly considered alternative technologies when developing the Pa'ina EA. The alternatives to be considered for an EA are based on meeting the purpose and need of the proposed action. In the case of Pa'ina's irradiator, the Staff stated the "proposed irradiator would mainly be used for the production and research irradiation of food and cosmetic products" and that it would "satisfy several needs related to the control of invasive pest species." Final EA at 6. More specifically, the proposed irradiator would be used for "(1) centrally located treatment of Hawaiian products for export, (2) centrally located treatment of products for import to Hawaii, (3) sterilization of fruit fly pupae for preventative release programs, and (4) use as a research tool." *Id.*

The alternatives that the Staff discusses in the EA are the no-action alternative, methyl bromide fumigation, and various types of heat treatments. EA at 12. As explained in the EA and in the Staff's testimony, the Staff ultimately determined that these alternatives would not meet the purpose of the proposed action.¹⁵¹ The EA and the references upon which the Staff relied clearly show why methyl bromide fumigation and heat treatment technologies would not

¹⁵¹ Blevins Testimony at A.30–A.32.

be appropriate for the uses proposed by Pa'ina. Methyl bromide fumigation is not approved or recommended for the tropical fruits Pa'ina intends to treat at its facility. Also, methyl bromide is being phased out of use due to its damaging effects on the ozone layer, meaning the cost of methyl bromide treatment will increase. EA at 12; Blevins testimony at A.30. Hot-water immersion also is not approved for use on papayas and guavas, and it is not recommended for several other fruits, making it inappropriate for Pa'ina's intended use. *Id.*

Next, the Intervenor contends that the Staff failed to consider the use of electron-beam irradiation in the EA even though the Intervenor urged consideration of this alternative. Intervenor's Brief at 32. The Staff did in fact consider electron-beam technology quite extensively when developing the EA, but did not include its analysis in the Final EA. As explained in the testimony of Matthew Blevins, he did extensive research on the use of electron-beam irradiation and found that it could be used on the types of fruits for which Pa'ina plans to use the Co-60 irradiator, with results similar to those from gamma radiation. Blevins Testimony at A.31. The Staff determined, however, that the electron-beam irradiator was not a feasible alternative because of its economic uncertainty. *Id.* At the time Pa'ina filed its application, the primary manufacturer of electron-beam irradiators had recently filed for bankruptcy. When the Staff was researching alternatives for the EA, there was still considerable uncertainty in the industry as to whether electron-beam technology had long-term viability. *Id.* In addition, the Staff consulted Pa'ina regarding electron-beam technology while developing the EA. The Applicant stated that electron-beam technology was not economically feasible because of the recurring costs of electricity needed to generate the radiation in the electron-beam irradiator. *Id.* In contrast, a cobalt-60 irradiator does not require electricity to generate radiation. Based on the dubious future of electron-beam irradiation technology as well as the substantial electricity

costs associated with this technology, the Staff concluded that an electron-beam irradiator was not a feasible alternative to the proposed cobalt-60 irradiator.¹⁵²

The extent to which the Staff must consider alternatives is governed by NEPA's "rule of reason," which limits the Staff's examination of alternatives in an EA to those that are feasible for the proposed action. In a licensing action, it is entirely proper for the Staff to take into account the goals of the applicant. In the present case, the Staff found that there was no technological alternative to the proposed action that would allow Pa'ina to meet the goals of its proposed action.

Also important is that, in preparing the Draft EA and Topical Report, the Staff had not found any significant impact from the operation of a cobalt-60 underwater irradiator at Pa'ina's site. While the Staff's alternatives analysis in an EIS may be quite extensive and detailed, the Staff has a lesser obligation to analyze alternatives in an EA when, during the course of its NEPA review, it becomes apparent that the proposed action will not cause any significant environmental impact that might be avoided by selecting an alternative.¹⁵³

The Intervenor suggests that its comments regarding alternatives had to be explicitly included in the EA in order to make the EA adequate, citing *Oregon Natural Resources Council v. U.S. Forest Service*, 445 F.Supp.2d 1211, 1229 (D. Or. 2006). Contentions at 31. This case is inapposite. In *Oregon Natural Resources*, the Forest Service had been specifically ordered by the court in a previous proceeding to incorporate all comments regarding alternatives in its supplemental EAs because the court had found the EAs deficient in several respects. *Id.* at 1225. Neither NEPA nor the NRC's implementing regulations require the Staff to explicitly reply

¹⁵² Blevins Testimony at A.31; see also *Bering Strait Citizens for Responsible Development*, 524 F.3d 938, 955 (9th Cir. 2008).

¹⁵³ *Native Ecosystems Council*, 428 F.3d at 1247.

to comments on the Staff's alternatives analyses in an EA.¹⁵⁴

2. The Staff Did Not Have to Consider Alternative Locations for Pa'ina's Irradiator

In the second portion of Contention 4, the Intervenor argues that the Staff failed to consider alternative locations for the proposed irradiator that would "purportedly avoid or minimize the proposed irradiator's adverse impacts on the environment."¹⁵⁵ The Intervenor suggest that if Pa'ina were to select a site ten miles from its proposed site, this "would eliminate threats from tsunami runup and hurricane storm surges."¹⁵⁶

As explained above, Section 102(2)(E) requires that an agency consider alternatives only where there are "unresolved conflicts concerning alternative uses of available resources." To the extent there is an "unresolved conflict" in the present case, it concerns whether Pa'ina should be allowed to use a parcel of land next to HNL to operate an underwater irradiator. If the Staff were to consider alternatives sites for Pa'ina's irradiator, it would not be considering an alternative use of the "available resource"; that is, the land on which Pa'ina intends to build its irradiator. Rather, the Staff would be considering whether, as an alternative, Pa'ina might use other resources. Section 102(2)(E) does not require this type of analysis.¹⁵⁷ The Staff would note that the Intervenor fails to cite a single case holding that an agency has to consider

¹⁵⁴ See discussion above regarding response to public comments.

¹⁵⁵ December 26, 2007 Order, slip op. at 31; Intervenor's Brief at 33.

¹⁵⁶ Contentions at 33.

¹⁵⁷ The Intervenor has made no claim that the conflict between itself and Pa'ina is about anything other than the use of the land on which Pa'ina intends to build its irradiator. Indeed, the Intervenor has suggested that its conflict with Pa'ina might be resolved if Pa'ina were to choose a different location for its irradiator. Contentions at 33-34.

alternative locations in an EA.¹⁵⁸

Although the Staff discusses alternative locations in the context of early site permit applications involving power reactors, those discussions are required by NRC regulations to be included in an EIS, an extensive document prepared because the NRC has determined there is the potential for a significant environmental impact.¹⁵⁹ There is no parallel NRC requirement for an alternative locations analysis in an EA.

Even if Section 102(2)(E) could be interpreted as requiring an agency to consider alternative locations in certain circumstances, there was no need for the Staff to do so here. As explained in the EA and the Staff's testimony, the Staff did not find any significant environmental impact that might result from operating Pa'ina's irradiator at the proposed site. Therefore, the Staff was under no obligation to look at alternative locations.

The Intervenor claims that Pa'ina's location next to Ke'ehi Lagoon will leave the irradiator open to the effects of tsunami runup and hurricane storm surges. Contentions at 33. Even if Pa'ina's irradiator might be more prone to flooding at the proposed location than at inland locations, the Staff has demonstrated through its Topical Report and testimony that the flooding would cause no radiological effect at the proposed irradiator. The same is true for the Intervenor's claim that the irradiator's location may be susceptible to liquefaction during an earthquakes. Contentions at 33. The Staff found no evidence that liquefaction would occur during an earthquake at the proposed location, and even assuming liquefaction, the Staff

¹⁵⁸ The Intervenor cites *Lands Council*, 395 F.3d at 1027, which involved an EIS, not an EA, and thus is irrelevant to determining an agency's obligations under Section 102(2)(E). Contentions at 33. The Intervenor also cites *Soda Mountain Wilderness Council v. Norton*, 424 F.Supp. 2d 1241, 1264 (E.D. Cal. 2006). Contentions at 34. Although this case involved an EA, nowhere does the district court state that an agency must consider alternative locations in an EA; the court merely holds that an agency must consider a "reasonable range" of alternatives. *Id.*

¹⁵⁹ 10 C.F.R. § 51.18.

determined there would be no radiological impact. The Intervenor also claims that moving the irradiator ten miles from HNL would bring the threat of an airplane accident “within the limits the NRC generally deems acceptable for nuclear facilities.” Contentions at 33. There is no basis for this assertion. The Staff found the probability of an airplane accident at the proposed site to be low, and the Staff also found that, even in the event of an airplane craft, there would be no significant radiological impact.

It was appropriate for the Staff to consider the goals of the Applicant in defining the scope of the EA, and one of the goals was to have the irradiator located on O’ahu where it would be at a central hub for air and sea transportation, and at a location which would be centrally located for treating fruit while minimizing transportation costs. As stated above, it was proper for the Staff to consider the economic goals of the Applicant along with the purpose of the action as a whole.

The Staff would emphasize that, in arguing the Staff had to consider alternative sites for Pa’ina’s irradiator, the Intervenor relies almost exclusively on cases addressing alternatives requirements in an EIS.¹⁶⁰ As explained above, an agency’s duty to consider alternatives in an EIS is governed by statutory provisions that do not apply in the case of an EA: whereas NEPA section § 102(2)(C) applies to an EIS, it is section 102(2)(E) that applies in the case of an EA.

CONCLUSION

The Staff complied with NEPA by taking a “hard look” at the environmental impacts of licensing Pa’ina’s irradiator and by considering a reasonable range of alternatives. The Staff’s FONSI is based on the expert analyses of NRC and CNWRA Staff, analyses that are well-

¹⁶⁰ Contentions at 33–34. See also Intervenor’s Reply Brief (October 1, 2007) (citing *‘Ilio’ulaokalani Coalition v. Rumsfeld*, 464 F.3d 1083 (9th Cir. 2006); *Methow Valley Citizens Council v. Regional Forester*, 833 F.2d 810 (9th Cir. 1987)).

supported by calculations and data. Because the Staff fully complied with NEPA, the Board should dismiss the Intervenor's contentions and affirm the Staff's issuance of a license to Pa'ina.

Respectfully submitted,

/RA/

Michael J. Clark
Molly L. Barkman
Counsel for NRC Staff

Dated at Rockville, Maryland
This 26th day of August, 2008

August 26, 2008

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
PA'INA HAWAII, LLC	)	Docket No. 30-36974-ML
)	
(Materials License Application)	)	ASLBP No. 06-843-01-ML

NRC STAFF'S TESTIMONY OF MATTHEW D. BLEVINS CONCERNING
AMENDED ENVIRONMENTAL CONTENTIONS 3 AND 4

Q.1. Could you please state your name, occupation, and by whom you are employed?

A.1. My name is Matthew Blevins. I am Environment Team Lead for the Western Area Power Administration in Lakewood, Colorado. Western is one of four power marketing administrations within the Department of Energy whose role is to market and transmit electricity from multi-use water projects. My position involves coordinating environmental support to our Regional offices. I have been in this position since August 2007.

Prior to joining Western, I was with the NRC for seven years. Between 2004 and 2007, I was a Senior Project Manager in the Office of Nuclear Materials Safety and Safeguards (NMSS). Between 2000 and 2004, I was a Project Manager in NMSS. My job responsibilities during my time at the NRC are listed on my resume, which is attached to this testimony. Also listed are my education, my work experience prior to arriving at the NRC, and my relevant job-related training courses.

Q.2. Are you familiar with the Environmental Assessments and Topical Reports prepared in connection with the application for an underwater irradiator submitted by Pa'ina Hawaii, LLC?

A.2. Yes. I was the primary preparer of Draft and Final EAs. I became involved with the EA in the spring of 2006, around the time the NRC Staff entered into a settlement agreement with the Intervenor in this proceeding, Concerned Citizens of Honolulu. As part of that settlement agreement, the Staff agreed to prepare an EA for Pa'ina's irradiator. I was also Project Manager for the Draft and Final Topical Reports, which were incorporated into the Draft and Final EAs, and which were prepared to address any potential environmental impacts associated with aircraft crashes and various natural phenomena that could possibly affect Pa'ina's irradiator.

Q.3. Could you provide an overview of how you prepared the EA?

A.3. In brief, I reviewed the license application, obtained information from the applicant, and reviewed information generated as a result of analyses conducted by both the Staff and the Center for Nuclear Waste Regulatory Analysis (CNWRA), which prepared the Draft and Final Topical Reports. I also conducted research on topics such as irradiators generally, the need for this particular facility, and other forms of pest control. I considered the standard list of impact areas stated in NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." I also considered all public comments received during the course of this licensing action, including both written submittals and oral comments received at two public meetings in Honolulu.

Q.4. Were other NRC Staff involved in preparing the EAs?

A.4. Yes. Other Staff at NRC headquarters performed analyses and calculations that I incorporated in the EAs. Anita Turner-Gray, Ph.D., a Health Physicist in the NRC's Office of Federal and State Materials and Environmental Management Programs

(FSME), verified MicroShield calculations that I performed. Elaine Keegan, a Health Physicist in the NRC's Spent Fuel Project Office, assisted with RADTRAN calculations. The NRC's Office of Nuclear Security Incident Response (NSIR) had primary responsibility for preparing Appendix B to the Final EA, which contains the NRC's analysis of terrorism risks for Pa'ina's irradiator. Staff members from the NRC's Region IV office in Arlington, Texas were responsible for conducting the licensing review of Pa'ina's application. Although they did not have a direct role in preparing the EAs, I consulted with Region IV to obtain information on technical aspects of Pa'ina's proposed facility, which I incorporated into my analyses and calculations.

Q.5. Patricia Swain is listed as a contact person on the front of the Final EA. What was her role?

A.5. Patti did not have a direct role in preparing the EA. She was assigned the case around the time the Final EA was released. She was listed as a contact person because I was leaving for Western and would not be around to respond to inquiries on the EA.

Q.6. How were the Topical Reports prepared?

A.6. The NRC Staff contracted with the CNWRA to prepare the Topical Reports because the CNWRA has specialized expertise relevant to assessing potential risks associated with aircraft crashes, seismic events, and other issues discussed in the EA. At the time we contracted with the CNWRA, the Staff knew aircraft crashes and natural phenomena had previously been the subject of admitted contentions, so we wanted to be sure to fully address those issues in the EA. Jim Durham was Project Manager for the CNWRA. Also involved were the individuals listed on the cover of the Final Topical Report, including Amit Ghosh, John Stamatokos and Kaushik Das.

Q.7. Did anyone else have input into the EAs or Topical Reports?

A.7. The Staff also solicited input from the public. Region IV held a public outreach meeting in the summer of 2006, and I reviewed the transcript of that meeting in

preparing the EAs. In February 2007, the NRC held another public meeting to receive comments on the Draft EA and Topical Report. I personally attended that meeting, along with other NRC Staff. In addition, I considered written comments on the draft EA, including comments on the terrorism analysis in Appendix B. I fully considered these comments, along with any documents attached to the comments, as I prepared the Final EA.

Q.8. Are you familiar with the contentions submitted by the Intervenor challenging the Final EA?

A.8. Yes. I have reviewed the Intervenor's legal brief dated September 4, 2007, as well as all documents attached to that brief. I would note that, with the exception of the declaration from Marvin Resnikoff, Ph.D., dated August 24, 2007, I had previously reviewed all of the attached documents as I was preparing the Final EA.

Q.9. Are you also familiar with the decision of the Atomic Safety and Licensing Board in this proceeding, dated December 21, 2007, admitting certain segments of amended environmental contentions 3 and 4?

A.9. Yes. I have reviewed the Board's decision, and I understand that the Board admitted certain segments of amended environmental contentions 3 and 4, while rejecting other segments.

Q.10. At this time I would turn your attention to the first portion of amended environmental contention 3. The Intervenor argues that its experts submitted numerous comments on the draft EA that were not addressed in the Final EA. The Intervenor makes this claim on pages 7 and 8 of its contentions. Looking at the comments mentioned here, could you tell me which ones relate to your analysis in the EA?

A.10. There appear to be ten areas in which the Intervenor claims the Final EA does not respond to comments. The first eight areas relate to issues such as aircraft crashes and hurricanes, topics that are covered in the CNWRA's analysis. The ninth area relates

to terrorism risks, which was addressed by NSIR in Appendix B. In the tenth area, the Intervenor claims the Staff did not address transportation accidents.

I would note that almost every one of the Intervenor's comments relates to an area involved in the third portion of amended environmental contention 3, where the Intervenor argues that the Staff failed to adequately consider the impacts of natural disasters, aviation accidents, and transportation accidents. In making its arguments under the third portion of the contention, the Intervenor relies on various reports from its purported experts, while in the first portion the Intervenor is arguing that the Staff failed to respond to those same reports. Accordingly, there is substantial overlap between the issues raised in the first and third portions of the contention.

Q.11. You mentioned that most of the comments to which the Intervenor refers in the first portion of the contention actually relate to issues that were analyzed by the CNWRA. Do you know if the CNWRA considered these comments?

A.11. Yes. I forwarded all comments received on the Draft Topical Report to Jim Durham, Project Manager at the CNWRA, soon after I received them. This includes the Intervenor's comments and attached declarations and reports, as well as comments from other sources. Jim and I were in frequent contact as we were working to prepare the Final EA and Topical Report, and Jim made clear that the CNWRA was considering these comments, as well as other comments received on the Draft Topical Report.

Q.12. We'll now turn to the second portion of amended environmental contention 3. This portion begins on page 8 of the Intervenor's contentions, and continues to page 14. The Board admitted twelve of twenty-five segments in this portion of the contention. Specifically, the Board admitted segments one through ten, twenty-four, and twenty-five. We'll go in order here, starting with the first segment. The Intervenor alleges that the Final EA fails to include "any calculations, analysis or data substantiating its claim that it is unlikely an employee could receive more than the occupational dose limit" or

quantification of what it means by "unlikely." The language to which the Intervenor refers appears on page 8 of the Final EA. Could you address the Intervenor's claims?

A.12. Yes. At the outset, I would emphasize that this segment, as well as the next three segments of the Intervenor's contention, refer to the section of the EA titled "Construction and Normal Operations." "Normal Operations" means that Pa'ina's irradiator is functioning properly, all equipment is functioning properly, and Pa'ina is complying with all license conditions and procedures. In these circumstances, the dose rate above the irradiator pool—30 centimeters above the pool, to be exact—will not exceed 1 mR/hr. That is the threshold provided for in Pa'ina's radiation safety program. (Exhibit 10 at p. 56) 1 mR/hr is well below the annual occupational limit of 5 rem in 10 C.F.R. § 20.1201. Even if an employee were standing directly above the irradiator pool eight hours a day, five days a week, there is no way the employee would exceed the occupational limit under normal operations.

In practice, employees will be working at some distance from the irradiator pool, usually around 20–25 feet away, where the dose rate will be indistinguishable from background. We know that under normal operations the dose rate in regular work areas will be indistinguishable from background because the dose rate above the pool will not exceed 1 mR/hr and because radiation from the sources, which will be in a pool 18 feet deep with surface dimensions of approximately 7 by 8 feet, will form a well-collimated beam. (Staff Exhibit 25.) As a matter of health physics, the dose rate in work areas will be indistinguishable from background. Although I am not a health physicist, I discussed this issue with Jim Durham from the CNWRA and Dr. Anita Turner Gray from FSME. Both Jim and Anita are health physicists, and they confirmed that, given the dose rate above the surface and the well-collimated beam, dose rates in worker areas will be indistinguishable from background.

Even if the water level in the pool were to drop and the dose rate at the surface were to increase temporarily, this would not result in employee exposures above the occupational limit. Under normal operations, Pa'ina's irradiator will have multiple features to address any water loss. The radiation monitor above the irradiator pool will alert employees of the need to add water. A separate alarm will alert employees in the unlikely event there is any accumulation of radioactive material on the water filters. The pool will also have large water level markings that will provide a visual indicator if the water level is low. Employees will be able to see these markings without having to lean over the irradiator pool.

In analyzing dose rates to employees during normal operations, I also considered the results of MicroShield calculations I performed. My calculations showed a dose rate from normal operations of close to background. (Staff Exhibit 27.) This demonstrates that dose rates in worker areas will be indistinguishable from background. This rate is actually a conservative estimate of the dose during normal operations, because I calculated the dose rate at the pool surface, without taking into account a 30-centimeter air gap above the pool surface; 10 C.F.R. § 36.25(b) states that the radiation dose for an underwater irradiator may not exceed 2 mR/hr at a distance of 30 centimeters over the edge of the pool. I cited the MicroShield calculations on page 8 of the EA as "NRC 2006c." I would again emphasize that, even if a worker were standing directly above the irradiator pool for an entire work year—a physical impossibility given that product bells will be occupying that space—under normal operations the worker would not exceed the occupational dose limit.

In addition to performing Microshield calculations and reviewing Pa'ina's radiation safety procedures, I analyzed data from the NRC's inspection of an underwater irradiator operated by CFC Logistics in Quakertown, Pennsylvania. (Staff Exhibit 47.) The physical dimensions and source location of the CFC irradiator are the same as those to

be used at Pa'ina's irradiator. During the CFC inspection, NRC Staff found that the dose rate above the surface of CFC's irradiator pool and in the areas around the pool remained below 1 mR/hr. This inspection report contains additional data showing that it is unlikely a Pa'ina employee could receive more than the occupational dose limit during normal operations. I cited the CFC inspection report on page 8 of the EA as "NRC, 2003."

Q.13. The Intervenor also argues that the EA fails to quantify what it means by "unlikely." Could you address that?

A.13. As explained on page C-13 of the EA, "unlikely" is "a qualitative description of probability used to indicate a low probability of occurrence based on Staff experience and the scenarios involved." In this particular scenario, I stated that it is "unlikely" an employee could receive more than the occupational dose because, under normal operations, an employee will not receive more than 5000 mRem/year even if the employee is standing directly above the irradiator pool for the entire work year. In this context, "unlikely" really means "not plausible." I am not aware of any requirement that the Staff provide a quantitative description of probability in these circumstances. However, in this scenario, the probability could be quantified as "zero."

Q.14. In the second segment of this portion of the contention, the Intervenor alleges that the Staff fails to provide "any calculations, analysis or data regarding its evaluation of 'expected dose rate' outside the irradiator." The language to which the Intervenor refers appears in the second paragraph on page 8. Your response?

A.14. Again, this section of the EA addresses "Normal Operations." Under normal operations, the dose rate above the surface of the irradiator pool will be very close to background. This conclusion is supported by calculations and data, including the MicroShield calculations and the CFC inspection report. (Staff Exhibits 27 and 47.) Under normal operations, if the dose rate above the irradiator pool were to reach 1

mR/hr, workers will be alerted of the need to add water, and they would quickly reduce the dose rate to the rate noted in the MicroShield calculations, which is close to background. Given that the rate above the surface of the irradiator pool will be only approximately close to background, and given that the radiation above the pool will consist of a well-collimated beam, it follows that the dose rate outside the building will be indistinguishable from background.

Q.15. In the third segment of this portion of the contention, the Intervenor claims that the Staff fails to provide “any calculations, analysis or data substantiating its claim ‘it is unlikely that a member of the public could receive more than the public limit’ or quantification of what it means by ‘unlikely.’” We’ve already discussed the Staff’s use of the term “unlikely.” Could you respond to the remainder of the Intervenor’s claim?

A.15. Once again, this conclusion is supported by the calculations and data in the MicroShield summary and the CFC inspection report, as well as by an analysis of Pa’ina’s operating safety procedures. (Staff Exhibits 10, 27, 47.) Under normal operations, the dose rate above the irradiator pool will be approximately background. If the dose rate exceeds 1 mR/hr, alarms will alert employees of the need to add water to the irradiator pool. Even if we assume a 1 mR/hr rate, a member of the public would have to place himself 30 centimeters above the irradiator pool for 100 hours to reach the public dose limit in 10 C.F.R. § 20.1301(a)(1). That scenario is, of course, wholly implausible. For reasons explained above, the dose rates in areas where members of the public might reasonably be expected to be present, such as the loading dock, will be indistinguishable from background. So, it is not only “unlikely,” but simply not foreseeable, that a member of the public would exceed the dose limit during normal operations.

Q.16. In the fourth segment, the Intervenor argues that the Staff failed to include “any calculations, analysis or data substantiating its claim ‘[t]ransportation impacts from normal operations would be small.’” What is the Staff’s support for that statement?

A.16. That statement is supported by RADTRAN reports generated by Elaine Keegan, a health physicist in the NRC’s Spent Fuel Project Office. These reports are cited in the EA at page 8 and were disclosed to the Intervenor in the Staff’s January 12, 2007, Hearing File Update. Looking in ADAMS, it appears that only Elaine’s cover e-mail to me can be found at the accession number cited in the EA. Still, the cover e-mail explicitly mentions the RADTRAN runs, and the ADAMS accession numbers for those runs were included in the January 12, 2007 hearing file update in this proceeding. The RADTRAN runs contain data and calculations supporting the Staff’s claim that transportation impacts from normal operations would be small, showing a dose rate of 3.7×10^{-2} mrem/yr. (Staff Exhibit 54.)

Based on the estimate for the dose rate and the fact that the rate would be two orders of magnitude below public dose limits, the Staff concluded that any impacts would be “small” and would not come close to exceeding the regulatory threshold. On page C-13 of the EA, we explain that “small” is a term commonly used in NRC environmental review documents when environmental effects are either not detectable or are so minor that they will not destabilize or noticeably alter any important attribute of the resource. Based on the RADTRAN reports, the transportation impacts were appropriately described as “small.”

I would point out that the Staff’s discussion of transportation impacts was intended only to provide a snapshot of potential impacts in Hawaii itself. Specifically, we looked at the dose rate from normal operations on a route between the Port of Honolulu and Pa’ina’s facility. We included this discussion in order to respond to public comments regarding possible transportation impacts. We did not intend to comprehensively

address issues relating to the transportation of sources to Pa'ina's irradiator, sources which might be shipped from as far away as Canada or England.

I should also point out that the transportation of cobalt-60 sources is actually licensed separately from Pa'ina's irradiator. Transportation of radioactive materials generally is covered under the NRC's regulations at 10 C.F.R. Part 71. They are also regulated under Department of Transportation (DOT) regulations. My understanding is that the NRC regulates the packaging of radioactive materials for shipment, while DOT regulates other aspects of transporting radioactive materials. Both the NRC and DOT require that carriers be licensed and comply with applicable regulations. So, any carrier transporting sources to Pa'ina's irradiator will first have to be approved under 10 C.F.R. Part 71 and DOT regulations. We address this in the comment response section of the EA at page C-11.

Even though the licensing of radioactive materials carriers is covered under separate regulations, we decided to consider the transportation of sources to Pa'ina's irradiator because there was public concern over the transportation of sources in Hawaii. This issue was raised at the initial scoping meeting; it was also raised in the February 2007 public meeting on the Draft EA. Of course, it was also an issue the Intervenor raised in its comments. Based on the RADTRAN reports, the Staff concluded there would not be any significant impacts in Hawaii resulting from transporting cobalt sources to Pa'ina's irradiator.

Q.17. Next, the Intervenor claims that the Staff did not provide "any calculations, analysis or data substantiating its claim 'It]he proposed irradiator would potentially have small beneficial impacts to socioeconomics.'" This is the fifth segment of the second portion of amended environmental contention 3. How did you arrive at that conclusion?

A.17. The statement that the irradiator would potentially have small beneficial impacts to socioeconomics refers to benefits to the United States as a whole. This statement is

supported by three studies from the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS), all of which are cited in the EA. The citations are "APHIS 2003," "APHIS 2004" and "APHIS 2006" on pages 12 and 13. (Staff Exhibits 44–46.) The APHIS studies conclude that irradiation could lead to lower costs and increased flexibility for importers of certain foods, which could benefit United States consumers through lower prices. The 2003 APHIS study supported a USDA rulemaking that allowed irradiated sweet potatoes to enter the United States, and this study identifies potential "small" benefits to the United States market as a whole. The 2004 APHIS study pertains to the Hawaii market specifically and suggests the socioeconomic benefits to Hawaii might be somewhat greater. The 2006 APHIS study applies to fruits and vegetables and adds bananas to the list of fruits approved for irradiation. The 2006 study, like the 2003 study, refers to the United States market generally. These studies provide the data and information supporting the Staff's conclusion that Pa'ina's irradiator could "potentially" have small socioeconomic benefits. I stress the word "potentially" because that is all the EA says, and because this was not a case where the Staff concluded that beneficial socioeconomic impacts would counterbalance any adverse environmental impacts. In other words, because there were no adverse environmental impacts, the Staff's FONSI did not depend on the EA's conclusion regarding socioeconomic impacts.

Q.18. In the sixth segment, the Intervenor claims the EA lacks "any justification for focusing its review of potentially significant impacts on 'offsite consequences.'" This refers to page 9 of the Final EA. Could you address this claim?

A.18. The contention misquotes the EA. In fact, the EA says "the NRC staff focused its review on the release of radioactive material which could have off-site consequences." The focus is on the release of radioactive material. Such a release could have offsite consequences; it could also have onsite consequences. The Staff analyzed both

possibilities in the EA. In fact, in the very same paragraph where we mention offsite consequences, we state that “worker doses should not be significantly increased in the area around the pool” in the event of an aircraft crash or natural phenomena. We also address the likelihood that debris from the aircraft crash would block the space above the irradiator pool. These are obviously onsite consequences.

The Staff’s focus on the release of radioactive material which could have offsite consequences makes sense given that such a release could also have onsite consequences. In other words, by focusing on the type of release that would affect a broader area, the Staff necessarily considered impacts to the narrower onsite area. Again, that should be clear from the discussion of worker doses in this section of the EA.

Q.19. In the seventh segment the Intervenor alleges that the Staff fails to provide “any calculations, analysis or data substantiating its claim ‘a loss of 6 feet of pool water would result in a dose of approximately 300 millirem/hour’ or justification of its assertion that ‘the increased dose rate will not be sufficient to have a significant environmental effect on the area around the proposed facility.’” This again refers to page 9 of the EA.

A.19. The Staff’s conclusion regarding the dose rate from a six-foot water loss is supported by MicroShield calculations that are cited in the EA at page 9. (Staff Exhibit 28). MicroShield is a computer program used by the NRC to analyze shielding and estimate exposure from gamma radiation. The Staff uses the MicroShield program for assessing radiation exposure to workers and members of the public. The program allows you to calculate dose rates by entering information on source type, source dimensions, dose points, shielding, and other factors. The specific factors I used in calculating the six-foot water loss are stated in the MicroShield summary sheet. Under the section titled “Shields” on the right-hand side, the tin and nickel shields I’m referring to are the source encapsulation and the plenum. The calculated dose rate is stated at bottom of the page, in the far-right column. I would note that this rate is a conservative

estimate of the dose 30 centimeters above the irradiator pool, because I have not included an additional air gap as shielding. 10 C.F.R. § 36.25(b) states that, for an underwater irradiator, the dose rate is measured at 30 centimeters over the pool edge.

Q.20. What about the Intervenor's challenge to the Staff's conclusion that the increased dose rate resulting from a six-foot water loss "will not be sufficient to have a significant environmental effect on the area around the proposed facility"?

A.20. That conclusion is supported by the MicroShield calculations just described, and by the fact that the radiation from the Co-60 source will form a well-collimated beam. Given these factors, the radiation in the area around Pa'ina's irradiator will remain well below regulatory limits. Further, Pa'ina's radiation alarm will sound well before the dose rate reaches the rate associated with a six-foot water loss, and employees could easily add water to return the dose rate below 1 mR/hr. I recognize that, in the event of an aircraft accident, there may not be employees capable of adding water to lower the dose rate. However, in the event of such an accident, emergency workers would take appropriate steps to lower the dose rate. And, even if the six-foot water loss persisted for a period of time, the well-collimated beam would prevent the dose rate from having a significant environmental effect on the area around the facility.

Q.21. The eighth segment of the Intervenor's contention alleges that the Staff fails to provide "any justification for its decision to analyze only a 6-foot water loss, especially given that the depth of the water table is 2.4 m (8 feet) below the facility floor."

A.21. I originally performed MicroShield calculations assuming both full shielding and a six-foot water loss. Later, I determined the water table would in fact be eight feet below the surface of the irradiator pool. So, I re-ran the MicroShield numbers for an eight-foot loss of water. (Staff Exhibit 29.) Although I re-ran the numbers in May 2007, a citation to the MicroShield calculations for the eight-foot loss was inadvertently omitted from the Final EA. My understanding is that the MicroShield calculations for the eight-foot loss

were later verified by Dr. Anita Turner-Gray, a health physicist in FSME, and added to the hearing file. Looking at the MicroShield calculations in ADAMS, I see that the calculations I performed on May 9, 2007 were verified by Dr. Turner-Gray on September 17, 2007.

Q.22. In the ninth segment, the Intervenor claims the Staff does not provide “any calculations, analysis or data substantiating its claim ‘worker doses should not be significantly increased in the area around the pool’ in the event of a loss of shielding water or quantification of what it means by ‘significantly increased.’” The Intervenor is referring to page 9 of the Final EA. Could you address the Intervenor’s claim?

A.22. The MicroShield summary for an eight-foot water loss shows what the dose rate above the pool would be if there were a breach in the pool liner and the water level dropped to the water table. Taking into account that dose rate and the well-collimated beam, dose rates to workers would not be significantly increased in the area around the irradiator pool. I would note that the area “around the pool” refers to the normal work area, not the area directly above the pool.

Practically speaking, if an aircraft crash or natural phenomena were sufficient to cause an eight-foot water loss, it is not foreseeable that employees would remain on site. This would clearly be an emergency situation where employees would evacuate the building. To the extent an employee were not able to evacuate before the accident occurred, he or she would have been trained in radiation safety principles and would know not to approach the irradiator pool. Pa’ina’s operating procedures require radiation safety training for employees, as does 10 C.F.R. § 36.51. Even if an employee were not able to evacuate prior to or immediately after the accident, the dose to the employee would not be significantly increased unless he or she were directly above the pool and unable to move. That scenario is purely speculative. For example, it is simply not foreseeable that an airplane would crash through the irradiator building, the debris from

the crash would breach the irradiator pool, and that an employee would thereafter be incapacitated directly above the irradiator pool.

Q.23. The Intervenor also argues that the Staff should have quantified what the EA means when it says worker doses would not be “significantly increased.”

A.23. By this we mean that worker doses would not be increased to the point where they exceed the Part 20 dose limits. Given the numerous variables factoring into accident scenarios, it would be impossible to give a precise dose rate. However, based on the MicroShield calculations and the well-collimated beam, it is not foreseeable that the dose rate equivalent would exceed 5000 mrem/yr.

Q.24. In the tenth segment, the Intervenor challenges the EA’s conclusion that, in the wake of an aircraft crash, "debris around the pool" would prevent "inadvertent access to the areas of elevated radiation directly above the pool." Could you explain the analysis behind that conclusion?

A.24. This is just common sense. If an accident, such as an aircraft crash, were sufficient to cause a significant loss of shielding water, the accident would also cause debris that would prevent inadvertent access to the area of elevated radiation above the irradiator pool. The debris would prevent inadvertent access by acting as a physical barrier. The Intervenor suggests that, rather than preventing access, the debris might trap a worker. But it is not plausible a worker would be trapped by debris, because it is not plausible a worker would survive the type of event that causes the debris. I would note that the Intervenor itself raised the issue of debris in some of its supporting documentation, claiming that in the event of an aircraft crash, debris and fuel would fill the irradiator structure. This is alleged on page 5 of the Sozen-Hoffman Report, which is dated February 1, 2007. The depiction of a hypothetical aircraft crash appearing on that page, Figure 5, suggests that not just debris, but the entire aircraft, would block access to the area above the irradiator pool.

Q.25. We'll now skip to the next admitted segment in the second portion of amended environmental contention 3. In the twenty-fourth segment, the Intervenor claims the Staff fails to provide "any calculations, analysis or data substantiating its claim '[t]he likelihood of accidents involving exposure of workers to lethal doses from this specific irradiator design is expected to be low' or quantification of what it means by a 'low' likelihood." The language to which the Intervenor refers is in Appendix C, the portion of the EA addressing public comments, at page C- 10. What is the Staff's support for these statements?

A.25. First, "this irradiator design" refers to underwater irradiators, as opposed to panoramic irradiators. The statement is meant to convey that the risk of exposure to workers is both objectively low and low compared to the risk associated with panoramic irradiators. The risk is low because an underwater irradiator uses passive shielding, in the form of pool water, such that the source is not exposed in a room that employees might inadvertently enter. The history of the Part 36 rulemaking shows that the Commission considered accidents involving worker exposures at irradiators. Many of these accidents resulted from sources being stuck in an unshielded position, or employees inadvertently entering the radiation room when a source was unshielded. These accidents all occurred at panoramic irradiators. The underwater irradiator design eliminates or greatly minimizes both of these accident scenarios. I would note that the safety regulations at 10 C.F.R. § 36.23 contain numerous access control requirements directed toward panoramic irradiators. These are included in eight separate paragraphs, at 10 C.F.R. § 36.23(a)–(h). By contrast, only paragraph (i) pertains to underwater irradiators, establishing requirements for a personal access control barrier around the pool.

The likelihood of accidents involving exposure of workers to lethal doses from the underwater irradiator design is also expected to be low for reasons noted in the

comment response appearing at the top of page C-10. In that response, the Staff notes that the underwater irradiator will consist of multiple layers of steel and concrete, and Pa'ina will have continuous monitoring systems in place to detect radioactivity in and above the pool. In addition, Pa'ina will have source loading procedures, as well as general radiation safety procedures. All these factors combine to render the probability of a lethal accident low.

As for use of the word "low," this is a qualitative term meant to convey that a lethal accident involving a worker is highly unlikely. I believe the NRC used similar language in the Part 36 rulemaking. Although we are talking about environmental consequences in the EA rather than safety consequences, the Part 36 safety requirements and the conclusions drawn by the Commission in the Part 36 rulemaking are relevant to the issue of worker exposures, regardless of whether those exposures are considered a safety or environmental impact.

Q.26. In the last segment of this part of the contention, segment twenty-five, the Intervenor argues that the EA does not contain "any calculations, analysis or data to back up its speculation that 'there is no reason to believe the irradiator would have any effect' on tourism." The Intervenor is referring to a comment response at page at C-12 of the EA. Could you elaborate on the Staff's conclusion?

A.26. Here we are responding to comments expressing concern about how tourism will be affected when tourists see the facility next to the airport. The comments implied that the impact to tourism will come from seeing the irradiator. This is explained at the bottom of page C-11. The analysis the Intervenor seeks is contained in the third full paragraph on page C-12, where the Staff notes that the irradiator "would be visually indistinguishable from other typical industrial buildings in the area." In fact, the irradiator building will be next to a series of airport hangars, which will likely obscure the irradiator from view, depending on a person's viewing angle. In any event, because the irradiator

will be visually indistinguishable from other industrial buildings, a tourist is unlikely to know that he or she is looking at an irradiator. If the tourist does not know he is looking at an irradiator, there will be no impact to tourism from seeing an irradiator. Further, to the extent the comments suggest the impact to tourism will come from the fear of having an irradiator in Hawaii, rather than from any actual environmental impact, they are identifying a psychological factor that the Staff typically does not consider in its NEPA reviews.

Q.27. We'll now turn to the third part of amended environmental contention 3. Here the Intervenor argues that the EA fails to adequately consider the impact of natural disasters and aviation accidents on the irradiator, as well as transportation accidents involving the irradiator's cobalt sources. The Intervenor raises nine different issues here. Could you explain which issues you personally analyzed?

A.27. Most of these issues were analyzed by the CNWRA, as reflected in the Topical Report. In fact, all but two issues fall within the CNWRA's areas of expertise. The first issue is the Intervenor's claim that the EA provides no justification for calculating the dosage associated with a six-foot loss of shielding water but not considering other scenarios. The Intervenor raises this issue at pages 16–17 of its contentions, citing the August 24, 2007 Resnikoff Declaration at paragraph 13. This is essentially the same issue raised in the eighth segment of the second part of amended environmental contention 3. In fact, the Staff did analyze an eight-foot water loss, applying the methodology in the NRC's MicroShield program. This resulted in the dose rate specified in the May 9, 2007 MicroShield Summary Sheet. (Staff Exhibit 29.) For reasons stated above, the Staff concluded this dose would not have any significant environmental impact. The increased dose would be in the area directly above the pool, in a well-collimated beam, and it therefore would not significantly increase doses to workers or members of the public.

I would note that, in his August 24, 2007 Declaration, Dr. Resnikoff claims that an eight-foot water loss would result in a dose rate higher than that stated in the MicroShield Summary Sheet. The difference between the Staff's and Dr. Resnikoff's calculations appears to be because Dr. Resnikoff did not take into account shielding from the source encapsulation and the plenum. In performing the MicroShield calculations, I factored in a quarter-inch stainless steel end cap for the source and shielding from the plenum.

Q.28. You mentioned that there is one other issue that was not addressed by the Center. Which issue?

A.28. The last one. The Intervenor claims that although "the Final EA considers transportation impacts from normal operations, it fails to examine the likelihood and consequences of accidents that might occur during the annual transport of Co-60 sources to and from the proposed irradiator." I'm referring to page 18 of the Intervenor's contentions at 18, where the Intervenor cites the February 9, 2007 Resnikoff Declaration at paragraphs 24–25 and the August 24, 2007 Resnikoff Declaration at paragraph 16.

Q.29. Did the Staff analyze consequences related to potential transportation accidents?

A.29. As discussed above, the analysis in the EA was intended to address only transportation impacts during normal operations between the Port of Honolulu and Pa'ina's facility.

Q.30. In amended environmental contention 4, the Intervenor challenges the Staff's analysis of alternatives to licensing Pa'ina's irradiator. First, the Intervenor claims the Staff did not "rigorously explore and objectively evaluate" two alternative pest control technologies that are mentioned in the EA, methyl bromide fumigation and hot-water immersion. Could you address that?

A.30. Yes. In preparing the EA, I researched alternative methods of pest control, including methyl bromide fumigation and hot-water immersion. I read numerous articles

on these methods, including reports posted on the EPA's and the USDA's websites. In particular, APHIS had a good deal of relevant information.

I believe that the analysis in the last two paragraphs on page 12 of the EA and in the first paragraph on page 13 explains why neither methyl bromide fumigation nor hot-water immersion would meet the purpose of the proposed action. As stated on pages 1 and 6 of the EA, in the EA's Introduction and in the section titled "Need for the Proposed Action," Pa'ina's intends to operate a facility suitable for the phytosanitary treatment of a wide range of fruits, vegetables, pharmaceutical products and cosmetics. Neither methyl bromide gas nor hot-water immersion can be used on the entire range of products Pa'ina intends to treat at its facility. In fact, both forms of treatment are either not approved, or not recommended, for several types of fruits Pa'ina will likely treat at its facility, such as papayas. In addition, due to concerns over its impact on the Earth's ozone layer, methyl bromide is being phased out for uses other than phytosanitary treatment and, as a result, the cost of methyl bromide fumigation treatment will likely increase significantly. This conclusion is supported by the 2004 APHIS report that I cite in the EA. (Staff Exhibit 46.)

Q.31. The Intervenor also argues that the Staff failed to consider the use of an electron-beam irradiator. Did you consider this form of treatment?

A.31. Yes. The electron-beam irradiator was raised in various comments on the Draft EA. It was also raised in the Intervenor's contentions, which I reviewed. I conducted quite a bit of research into the electron-beam irradiator. The problem with the electron-beam irradiator was not that it would be inappropriate for certain products Pa'ina intends to treat at its facility. Although an electron beam itself cannot be used on certain fruits, if additional equipment is used, the electron beams can be converted to x-rays, which will have essentially the same effect on food as the gamma rays produced by a cobalt-60 source. The problem with the electron beam irradiator is economic uncertainty. There is

presently one electron-beam irradiator in Hawaii. That irradiator was manufactured by a company called Sure-Beam, which is the main manufacturer of the electron-beam irradiator. In 2004, the year before Pa'ina filed its application with the NRC, Sure-Beam filed for bankruptcy. In 2006 and 2007, at the time I was researching alternatives for purposes of the EA, there were still numerous articles questioning whether the electron-beam technology had long-term viability.

When I was conducting research on alternatives, I e-mailed Pa'ina's President, Michael Kohn, asking him to provide information on alternatives. Our e-mail communication was included as part of the hearing file in this case. (Staff Exhibit 26.) Mr. Kohn stated that an electron-beam irradiator would not be a feasible alternative, in part because of the cost associated with providing additional electricity to the facility. Based on my subsequent research, I confirmed it made sense that an electron-beam irradiator would generate more recurring costs for electricity than a cobalt irradiator, which does not require electricity to generate radiation.

Based primarily on the economic uncertainty surrounding the future of electron-beam technology, but also because of the additional costs associated with that technology, I concluded that the electron-beam irradiator would not be a feasible alternative.

There was one other reason I did not address the electron-beam alternative in the EA itself. When I was conducting research on the electron-beam technology, the Staff and the Center already had a good sense of the risks and potential impacts associated with a cobalt-60 irradiator at Pa'ina's proposed site. The Intervenor cites the October 3, 2005 Thompson Declaration at paragraph VI-2, which suggests that irradiation by means other than cobalt-60 could limit the potential environmental impacts of the irradiator. However, we already had a very good idea that irradiation using cobalt-60 would not present a foreseeable risk of any significant environmental consequences.

Given the significant uncertainties and potential costs associated with the electron-beam irradiator, I saw no need to discuss this fifth alternative in the EA itself.

To summarize, I considered the electron-beam irradiator as an alternative, but I removed this alternative from consideration before finalizing the EA.

Q.32. You mentioned the Thompson Declaration, which the Intervenor cites in support of its claim that the Staff did not properly consider alternatives to the proposed action. Could you address that Declaration?

A.32. Yes, the Thompson Declaration is from October 2005, approximately two years before we released the Final EA. This Declaration merely states that the Staff should have considered non-irradiative methods of treating products and irradiation that does not involve Co-60. The Declaration notes that there is presently an electron-beam irradiator in Hawaii. The Declaration provides no information contradicting the Staff's conclusion that methyl bromide fumigation, hot-water immersion and an electron-beam irradiator are not feasible alternatives because they would not meet the purpose of Pa'ina's proposal.

Q.33. Next, the Intervenor argues that the Staff improperly failed to consider alternative sites for Pa'ina's irradiator. Was that something you considered?

A.33. The Staff does not typically consider alternative sites in an EA. I am not aware of any other EA where the Staff has done so. Where an EIS is involved, that is something the Staff does consider. My understanding is that, in the case of an EA, if there are no significant impacts associated with the proposed site—as we found in the case of Pa'ina's irradiator—there is no need to consider alternative sites. So the answer is no, we did not consider alternative sites.

Q.34. That brings us to the end of the Intervenor's contentions. Is there anything you would like to add?

A.34. I would note that this EA was unique for several reasons. First, it was the result of a settlement agreement. Irradiators are categorically excluded under 10 C.F.R. Part 51 because the NRC has concluded they generally do not pose a significant threat to the environment. I believe our EA here confirms that, even in the case of Pa'ina's irradiator, the categorical exclusion was appropriate. Second, our EA for Pa'ina's irradiator is comprehensive. Including the Topical Report, which is obviously part of the document, the Final EA is over 90 pages. This far exceeds the CEQ recommendation, which is that an EA be approximately 10–15 pages. Third, the EA considers accident scenarios in considerable detail. Accident scenarios are not something the Staff typically considers in an EA because they are, by their nature, quite speculative. Finally, I would note that this was a case where the applicant was not required to submit an environmental report. For that reason, the Staff had to generate much of the data underlying the Final EA. In my view, this shows that the Staff independently analyzed the environmental impacts of licensing Pa'ina's irradiator and, consistent with NEPA, took a "hard look" at those impacts.

Q.35: Does this conclude your testimony?

A.35: Yes.

August 26, 2008

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
PA'INA HAWAII, LLC	)	Docket No. 30-36974-ML
)	
(Materials License Application)	)	ASLBP No. 06-843-01-ML
)	

AFFIDAVIT OF MATTHEW D. BLEVINS

I, Matthew D. Blevins, do hereby declare under penalty of perjury that my statements in the foregoing testimony and my statement of professional qualifications are true and correct to the best of my knowledge and belief.

/Original Signed By/

Matthew D. Blevins

Executed in Lakewood, Colorado
this 26th day of August, 2008

August 26, 2008

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
PA'INA HAWAII, LLC)	Docket No. 30-36974-ML
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(Materials License Application))	ASLBP No. 06-843-01-ML

NRC STAFF'S TESTIMONY OF JAMES DURHAM, AMITAVA GHOSH, JOHN STAMATAKOS
AND KAUSHIK DAS CONCERNING AMENDED ENVIRONMENTAL CONTENTION 3

Q.1. Please state your name, occupation and employer.

A.1. My name is James Durham. I am employed by the Southwest Research Institute in San Antonio, Texas. I am a principal engineer and project manager in the performance assessment group of the Center for Nuclear Waste Regulatory Analyses (CNWRA), in the Geosciences and Engineering Division. A statement of my professional qualifications is attached to my testimony. (Staff Exhibit 6.)

Q.2. What is the CNWRA's role?

A.2. Founded in 1987, the CNWRA is a federally funded research and development center sponsored by the Nuclear Regulatory Commission. The CNWRA is managed by the non-profit Southwest Research Institute located in San Antonio, Texas. It provides dedicated, free-from-conflict-of-interest, independent and high-quality technical assistance and research support to the NRC. The CNWRA, however, serves no regulatory function.

Q.3. Please explain the CNWRA's role and your own duties in connection with the Staff's environmental review of the license application submitted by Pa'ina Hawaii, LLC.

A.3. (J. Durham) In 2006, the CNWRA entered into a contract with the NRC to review natural and aircraft hazards potentially affecting the irradiator proposed by Pa'ina Hawaii, LLC. The CNWRA conducted a review that included a site visit, review of material provided in Pa'ina's

license application, and the use of independent confirmatory technical analyses. The CNWRA prepared draft and final versions of its “Topical Report on the Effects of Potential Aviation Accidents and Natural Phenomena at the Proposed Pa’ina Hawaii, LLC, Irradiator Facility” (Topical Report) (Staff Exhibits 13 and 14). The results from the Draft and Final Topical Reports were incorporated into the NRC Staff’s Draft and Final Environmental Assessments (EAs) for the Pa’ina irradiator. (Staff Exhibits 11 and 12.) I was project manager for the Draft and Final Topical Reports. As project manager, I directed, coordinated, and reviewed work performed by Amit Ghosh, John Stamatakos, and Kaushik Das in their respective areas of expertise. Cynthia Dinwiddie, whose name also appears on the cover of the Final Topical Report, was a technical reviewer who provided extensive comments on the nomenclature used in the Draft Topical Report, primarily in the sections associated with aviation accidents. At the NRC, I worked closely with Matt Blevins, who was the NRC technical project manager for the EA.

Q.4. What is the purpose of your testimony?

A.4. (J. Durham) The purpose of the CNWRA’s testimony is to respond to portions of the Intervenor’s amended environmental contention 3. Specifically, the CNWRA will address the portions of amended environmental contention 3 challenging the analysis of aviation accidents and natural phenomena in the Final Topical Report.

Q.5. Before turning to the Intervenor’s contention, could you explain how you determined the scope of the topical report?

A.5. (J. Durham) The NRC Staff contracted with the CNWRA to develop a topical report in mid-2006, after the Staff entered into a settlement agreement with the Intervenor. As part of that agreement, the Staff agreed to prepare an EA for the proposed Pa’ina irradiator. The NRC asked the CNWRA to prepare a topical report analyzing the potential impacts of aviation accidents and natural phenomena. This report was to be used for the development of a Draft EA. As stipulated in the Statement of Work, we reviewed the license application and supporting reports submitted by Pa’ina; collected and reviewed information related to the proposed site and

its environs, natural phenomena and aviation accidents, including information provided by the NRC technical project manager. The CNWRA then prepared a draft topical report on the effects of natural phenomena, including tsunamis, hurricanes, and seismic hazards, and aircraft crash hazards on the Pa'ina irradiator. The Statement of Work also stipulated that the topical report was to be consistent with NUREG-0800, Section 3.5.1 (Aircraft Hazards) to the extent practical. The report focused on credible and reasonable scenarios and provided some background on scenarios that were not credible. After receiving comments from the Intervenor and other members of the public, we considered the comments and revised the draft report as a Final Topical Report that would be incorporated into a Final EA.

Q.6. Could you elaborate on how the CNWRA considered comments received on the Draft EA and Topical Report?

A.6. (J. Durham) In preparing the Final Topical Report, the CNWRA considered public comments submitted in response to the Draft Topical Report and EA. As described in more detail below, in light of the comments, the CNWRA verified its data, methods, and conclusions. In some instances, the CNWRA changed certain portions of the Topical Report in order to clarify areas of concern. However, the CNWRA's underlying conclusion—that a loss of control of radioactive material is not a foreseeable consequence of an aircraft crash or natural phenomenon involving the Pa'ina irradiator—did not change even after we considered all comments.

In addition, after considering the comments, the CNWRA decided that certain areas of analysis in the Topical Report could be explained more clearly. For example, the CNWRA added Section 1.2, "Scenarios To Be Considered," to explain what consequences could possibly lead to a loss of control of radioactive material in the irradiator. We decided to add this section at the beginning of the Final Topical Report because it identified a key factor underlying our analyses of aviation accidents and natural phenomena. We also added this section because a number of the public comments suggested that certain other scenarios could lead to

a loss of control of radioactive material. For the reasons set forth in Section 1.2 of the Final Topical Report—reasons that we elaborate on in other sections of the Topical Report—we concluded that those other scenarios simply were not plausible.

Q.7. What are the events that might cause a loss of control of radioactive material?

A.7. (J. Durham) As stated in Section 1.2, loss of control of radioactive material could occur if the sources are physically removed from the irradiator pool or if the pool water became contaminated by destruction of a source capsule and the source material corroded. The CNWRA did not identify any forces, either from an aviation accident or from natural phenomena, strong enough to dislodge a source from the bottom of the pool and lift it out of the pool. This will be discussed in more detail below as we address each segment of the Intervenor's contentions.

For a cobalt source to corrode, its inner and outer containment capsules must be breached, and the nickel plating surrounding the cobalt slugs must also be breached. Then, the exposed cobalt must remain in the pool water for years. Only under these circumstances could the pool water become contaminated. If contaminated water then escaped through a breach in the pool's concrete-and-steel liner, there could be offsite consequences. However, the CNWRA found no plausible scenario to damage a cobalt source to the point where corrosion could occur and the source would remain to corrode in the pool water. In the event of an aircraft crash or natural phenomenon involving the irradiator, it is not plausible that a damaged source would remain in a damaged pool long enough for water to be released into the environment. I should mention that the pool's liner consists of two layers of steel and an intermediate layer of concrete that is six inches thick. So, you would need an accident so severe that it breaches both the source and the pool liner, and you would need for the damaged pool and source to be left unattended for a significant period of time. Therefore, the CNWRA concluded that a release of contaminated water into the environment simply is not a plausible scenario for the proposed irradiator.

Some of the public comments also suggested that loss of control of radioactive material could occur if the sources were dislodged from the irradiator, either through a wave, storm surge, or seismic event. The CNWRA analyzed each of these scenarios and concluded that none was plausible. Specifically, the CNWRA performed fluid dynamics calculations and analyzed seismic data to determine whether any of these scenarios could occur. For reasons stated in Sections 3.1 and 3.2.2 and summarized in Section 4 of the Final Topical Report, the CNWRA concluded there was no potential for loss of radioactive material from any of these scenarios.

Q.8. How long would it take for a cobalt source to corrode to the point where it might contaminate the pool water?

A.8. (J. Durham) In Section 1.2 of the Final Topical Report, we explain that cobalt has a very low corrosion rate of 108 $\mu\text{m}/\text{yr}$ (0.004 in/yr) in acid. In water, the corrosion rate is expected to be at least one order of magnitude smaller. It would take at least two and a half years for one mil of the surface to corrode, and most of the corrosion products would remain adhered to the cobalt. Thus, it would take a very long time for the source material to corrode enough to contaminate the water. (Staff Exhibit 18.) This small amount of corrosion would then be diluted in the large volume of water and probably would not be detectable for several more years.

Q.9. The CNWRA concluded it was not plausible that a source might be removed from the irradiator pool by a wave resulting from a tsunami or hurricane. Why is that?

A.9. (J. Durham) The CNWRA performed a computational fluid dynamics analysis to determine the wave velocity required to remove a source. That analysis showed that a source could not be removed at a wave velocity below 200 mph, which far exceeds the velocity of any wave that might plausibly strike the Pa'ina irradiator. The CNWRA summarizes its analysis in Section 3.2.2 of the Final Topical Report. Kaushik Das performed the fluid dynamics calculations, and he will further explain his calculations in the context of responding to the Intervenor's contentions.

Q.10. At this time we'll turn to the Intervenor's contentions. In amended environmental contention 3, the Intervenor alleges that the final EA does not comply with NEPA because the Staff failed to take a "hard look" at the potential environmental impacts of the proposed irradiator. Could you explain which parts of this contention relate to the analysis in the CNWRA's analysis in the Final Topical Report?

A.10. (J. Durham) The CNWRA's role in preparing the EA was to analyze risks and impacts associated with aircraft crashes and various natural phenomena that could potentially affect the Pa'ina irradiator. Accordingly, most of the first and third portions of amended environmental contention 3 relate to the CNWRA's analysis. I say "most" of these portions relate to the CNWRA's analysis because there are a few issues in each portion that do not relate directly to aircraft crashes or natural phenomena, such as the Intervenor's claims that the NRC did not respond to comments regarding terrorism and transportation accidents. The second portion of the Intervenor's contention relates to the Staff's analysis in the EA, and the fourth and fifth portions of amended environmental contention 3 likewise do not involve issues that were addressed in the Topical Report. Nor does amended environmental contention 4, which challenges the alternatives analysis in the EA, involve issues that were addressed in the Topical Report.

Q.11. For the sake of clarity, I'm going to summarize the issues raised by the Intervenor in the first and third portions of amended environmental 3 that appear to relate to the CNWRA's analysis of aircraft crashes and natural phenomena.

In the first portion of contention 3, the Intervenor claims that the Final EA does not respond to its comments on the draft EA. In those comments the Intervenor claimed the Draft EA failed to:

[1] consider significant factors in evaluating the likelihood the proposed irradiator would be involved in an aviation accident;

[2] quantify the impact of flying airplane and building debris following an aviation accident to determine if sources would be breached;

- [3] quantify hurricane storm surge and tsunami inundation runup potential;
- [4] consider the effects on the irradiator pool of increases in buoyancy forces due to hurricane surge or tsunami inundation;
- [5] consider potential consequences of hurricane winds;
- [6] evaluate unique features of Ke'ehi Lagoon that might increase the potential for tsunami-related impacts;
- [7] consider potential focusing effects of seismic energy on O'ahu; [and]
- [8] evaluate properly the threat of liquefaction[.]

The Intervenor makes these arguments on pages 7 and 8 of its amended environmental contentions. According to the Intervenor, the comments are set forth in the following documents: the February 8, 2007 Earthjustice Letter, with enclosed expert reports; the Sozen/Hoffmann Report; the February 7, 2007 Resnikoff Report; the Pararas-Carayannis Report; the Thompson Declaration; the July 9, 2007 Earthjustice Letter, with enclosed reports; the July 6, 2007 Resnikoff Report; and the August 24, 2007 Resnikoff Declaration.

In the third portion of amended environmental contention 3, the Intervenor claims the EA fails to adequately consider the impact of natural disasters and aviation accidents on the Pa'ina irradiator. Specifically, the Intervenor claims:

- [1] The Final EA fails to consider potential impacts associated with major flooding;
- [2] The Final EA fails to quantify the risk of tsunamis and hurricanes through numerical modeling or, at a minimum, analyze the range of environmental impacts likely to result in the event of a major tsunami, including the impacts resulting from hurricane storm and tsunami inundation;
- [3] The Final EA fails to consider numerous other potential impacts related to natural disasters, such as the potential for increased buoyancy due to hurricane storm surge or tsunami inundation to compromise the irradiator pool's integrity or allow shielding water to drain out, damage from hurricane-force winds, and liquefaction during an earthquake;
- [4] The Final EA failed to consider credible scenarios under which an aircraft crash might result in exposures above regulatory limits, including, but not limited to, damage to the irradiator pool structure at or below the groundwater level,

resulting in a loss of vital pool shielding water, and release of water contaminated with radioactive cobalt through a tear in the pool lining, contaminating groundwater and nearby Ke'ehi Lagoon;

[5] Although the Final EA presents the results—but not the underlying data—of calculations regarding the increase in radiation dosage associated with a six-foot loss of shielding water, it provides no justification for considering only this scenario, which dramatically understates potential impacts;

[6] The Final EA was obliged to evaluate situations in which more shielding water is removed from the irradiator, either from the force of an explosion or through evaporation in a fuel fire, which would result in far higher radiation doses;

[7] The Final EA inaccurately assumes the irradiator pool water could become contaminated only if the Co-60 sources were allowed to corrode following a breach in the source encapsulation. The analysis ignores the potential for physical destruction of the sources to contaminate pool water or allow dispersal of pulverized Co-60 via breaches in the pool lining.

[8] The Final EA improperly dismisses the potential for significant impacts in the event an airplane crash destroys all monitoring equipment or incapacitates irradiator personnel.

The Intervenor raises these issues on pages 15 through 18 of its contentions, citing various reports or declarations from George Pararas-Carayannis, Ph.D., and Marvin Resnikoff, Ph.D.

I'll refer to these issues as the "segments" of the first and third portions of amended environmental contention 3. Does this cover all of the segments relating to the CNWRA's analysis?

A.11. (J. Durham) Yes. Obviously, the NRC Staff may have relied on our analysis in parts of the EA that are challenged in other portions or segments of the Intervenor's contentions.

However, the segments identified above are the ones that relate directly to the Topical Report.

Q.12. The Topical Report addresses aircraft crashes and natural phenomena in separate sections, and the segments of contention 3 alleging deficiencies in the Topical Report can be grouped according to which part of the report they challenge. Therefore, instead of going through those segments in numerical order, we'll first obtain testimony on the segments that relate to the CNWRA's aircraft crash analysis. Then, we'll turn to the segments alleging deficiencies in the CNWRA's analysis of natural phenomena.

A.12. (J. Durham) That's fine. For the segments pertaining to aircraft crashes, Amitava Ghosh and I will be giving testimony. For the segments pertaining to natural phenomena, John Stamatakos, Kaushik Das and I will provide the testimony.

Q.13. Please state your name, occupation, and by whom you are employed.

A.13. My name is Amitava Ghosh. I am employed as a Staff Scientist for the Center for Nuclear Waste Regulatory Analyses in the Geosciences and Engineering Division of the Southwest Research Institute. I have attached a statement of my professional qualifications.

Q.14. Did you have a role in preparing the Final Topical Report for the Pa'ina irradiator?

A.14. (A. Ghosh) Yes. I prepared the analysis in Section 2 of the Topical Report, which pertains to aircraft crashes. In analyzing aircraft crash scenarios, I estimated the annual frequency of aircraft crashes at the Pa'ina irradiator by considering realistic crash scenarios at the Honolulu International Airport, which I'll refer to by the Federal Aviation Administration code "HNL." As described in detail at pages 2-1 through 2-18 of the Final Topical Report, I analyzed the most likely crash events that might occur during takeoff or landing. I looked at the potential for landing or takeoff crashes for each of the runways, and I estimated the frequency of crashes using the methodology in NUREG-0800, (NRC, 1981, pages 3.5.1.6-1 through 3.5.1.6-7) (Staff Exhibit 56). NUREG-0800 employs a methodology under which the probability of an aircraft crashing into a facility is determined by considering the product of three factors: the probability per square mile of an aircraft crash, the number of aircraft performing landings or takeoffs per year, and the effective area of the facility.

Q.15. Starting with the first segment in the first portion of the contention, the Intervenor claims that the Staff failed to consider significant factors in evaluating the likelihood the Pa'ina irradiator will be involved in an aviation accident. The Intervenor cites three sources that dispute the NRC's analyses regarding the likelihood of aircraft crashes: the February 7, 2007 Resnikoff Report; the July 6, 2007 Resnikoff Report; and the August 24, 2007 Resnikoff Declaration. Did the CNWRA respond to the comments in those documents?

A.15. (A. Ghosh) Yes. It is Dr. Resnikoff who claims the CNWRA failed to consider significant factors in arriving at the likelihood the Pa'ina irradiator might be involved in an aircraft crash. First, Dr. Resnikoff claims we improperly relied on the methodology for determining aircraft crash probabilities stated in NUREG-0800, which was published in 1981. He suggests the airplane crash data in NUREG-0800 are obsolete and states that we should have used the Department of Energy's methodology, which he used in his calculations. I am referring to paragraph 10 of his February 9, 2007 Declaration.

In response to Dr. Resnikoff's claim, I analyzed the probability of a crash at the airport using both methodologies when preparing the analysis in the Final Topical Report. I found that the probability of an aircraft crash involving the Pa'ina irradiator obtained by using the Department of Energy (DOE) methodology is similar to the probability we obtained by using NUREG-0800. While the probability of a crash during takeoffs and landings on certain runways is slightly higher under the DOE methodology, the probability of a crash during takeoffs and landings on other runways is lower. I have attached calculations comparing the rates using both methodologies. (Staff Exhibit 30.) The cumulative probability for takeoffs and landings on all runways is not significantly different, regardless of which methodology is used. Additionally, Dr. Resnikoff has acknowledged that the "DOE standard is similar to the NRC methodology" (Resnikoff report at page 1 and February 9, 2007 Declaration at paragraph 9). I would note that Dr. Resnikoff used the NRC method in the proceedings associated with the Private Fuel Storage Facility at Skull Valley Utah. (Resnikoff report at page 1 and February 9, 2007 Declaration at paragraph 9).

Second, Dr. Resnikoff claims HNL has an unusually high crash rate, which the CNWRA failed to consider. He makes this claim in paragraph 11 of his February 9, 2007 Declaration. However, I learned from Ben Schlapak, HNL's Airport Director, that there have been only two major aircraft accidents at HNL in recent memory, one in 1962, and the other in the mid-90s.

Mr. Schlapak's e-mail response is attached (Staff Exhibit 31). It was also added as a reference in the Final Topical Report, at the bottom of page 5-3.

Also in response to Dr. Resnikoff's claim that HNL has an unusually high crash rate, I re-examined all data from the National Transportation Safety Board (NTSB) for HNL since 1976. I had originally looked at these data when preparing the Draft Topical Report, but I re-examined the NTSB data in response to Dr. Resnikoff's claim. The NTSB data is attached to my testimony. (Staff Exhibit 22.) These data show that there has been only one fatal aircraft crash at HNL since 1976, an accident occurring in 1994. I would note that the NTSB data also shows there have been a number of fatal aircraft crashes and aviation-related fatalities associated with HNL since 1976. However, with the exception of the 1994 accident, which involved a general aviation aircraft, these fatal accidents did not involve airplanes crashing at HNL. The NTSB data includes all flights originating at HNL, as well as all flights for which HNL is the destination. So, for example, a fatal crash involving a flight departing from HNL and crashing approximately 45 miles north of Maui is captured by the NTSB data. That happened in 1992 and involved five fatalities. Helicopter and seaplane crashes are also included, as are accidents in which the fatality resulted from an accident not actually causing the aircraft to be destroyed—a rough landing, for example, or a person on the ground being struck by an aircraft.

In his February 9, 2007 Declaration, and again in his August 24, 2007 Declaration, Dr. Resnikoff also claims the Draft Topical Report understates the number of current operations and fails to take into account a possible increase in the number of operations at HNL. For current operations, we provided numbers from three different sources in Table 2-2 of the Final Topical Report, at page 2-5. The numbers are essentially the same regardless of which source is used. As for a potential increase or decrease in the number of flights, in the Draft Topical Report we stated that flight operations at HNL would likely increase twenty percent during Pa'ina's ten-year license term. That was based on an FAA projection from 1998. However, as we explain on page 2-18 of the Final Topical Report, recent data show that the number of operations at HNL

actually decreased by more than 58,000 from the 1998 number. This creates substantial uncertainty over whether the number of operations will increase significantly during Pa'ina's ten-year license term.

In paragraph 14 of his February 9, 2007 Declaration, Dr. Resnikoff suggests the recent decrease in operations at HNL was limited to a few years immediately following the events of September 11, 2001, and he states that the number of operations has begun to increase. For the Final EA, we considered the most recent available data from three separate sources. As explained on page 2-6, we used FAA data in our calculations because it is publicly available data from a recognized authority. (Staff Exhibit 19.) Information from the FAA obtained recently shows the same number of flights. (Staff Exhibit 20.) In any event, the numbers from our other sources were very similar to the FAA data. The FAA data are for the twelve month period ending November 21, 2005. These were the most recent data available, and it still showed 58,000 fewer operations than in 1998. We therefore concluded that it is highly uncertain whether operations for HNL will reach the FAA's 1998 projection, or even return to 1998 levels, by the end of Pa'ina's license term.

Staff Exhibit 21 shows the variation of operations (both takeoffs and landings) at HNL using information provided by the State of Hawaii, Department of Transportation. This data is also presented in Table 2-2 of the Final Topical Report. The claim by Dr. Resnikoff regarding an increase in aircraft operations at HNL in recent years is not substantiated by the information provided by the State of Hawaii, Department of Transportation. Additionally, Staff Exhibit 23 shows the difference in operations at HNL from the previous year. Again, information from the State of Hawaii, Department of Transportation, has been used. This exhibit again does not substantiate the claim of Dr. Resnikoff regarding a recent increase in operations at HNL.

Dr. Resnikoff also advocated using current operational levels in determining the probability of an aircraft crash involving Pa'ina's facility. (February 9, 2007 Declaration at paragraph 14.) However, Dr. Resnikoff himself does not use the most recent data. Instead, he

uses FAA operational data for the 30-year period between 1975 and 2005. (Resnikoff Report at page 3.) Moreover, Dr. Resnikoff incorrectly states the average number of operations during that period. As reflected in Table 1 of his report (page 5), the average number of operations for the past 30 years is 329,756. This number is lower than 356,772, which is the number he used in his calculations. In any event, Dr. Resnikoff does not use more recent data, as he advocated in his declaration.

Q.16. The CNWRA finds that the annual probability of an aircraft crash involving the Pa'ina irradiator is 2.1×10^{-4} , or approximately 1 in 5000. Dr. Resnikoff asserts that, using HNL-specific crash rates, the probability is 5.69×10^{-4} , or approximately 1 in 1757. I'm referring to paragraph 10 of his February 9, 2007 Declaration, as well as paragraph 5 of his August 24, 2007 Declaration. What accounts for the difference?

A.16. (A. Ghosh) Dr. Resnikoff appears to arrive at his much higher estimate by assuming an accident rate for HNL that is much higher than that for accidents potentially affecting the Pa'ina irradiator. I'm referring to pages 4–10 of his February 9, 2007 Report, where he explains this part of his methodology. First, he takes into account any accident at HNL between 1975 and 2005 that is listed in NTSB data as resulting in a fatality. As I explained above, this includes accidents that did not occur at HNL, but which merely involved aircraft departing from or scheduled to arrive at HNL. Second, Dr. Resnikoff also includes fatalities from accidents that did not result in the aircraft being destroyed, such as rough landings. Third, his definition takes into account helicopter crashes. Helicopters and seaplanes have a higher crash rate than airplanes, and there are a number of fatal helicopter and seaplane accidents listed in the NTSB data. However, due to numerous factors—size, weight, fuel capacity and flight speed among them—it is not feasible that a helicopter or seaplane would cause the type of accident that might damage the Pa'ina irradiator pool or sources. At most, a helicopter or seaplane might damage the building that houses the irradiator.

As I mentioned above, there have been only two fatal airplane crashes at HNL since 1962. This is supported by both the NTSB data and the communications with Ben Schlapak, HNL's Airport Director. By defining "fatal accident" to broadly include accidents that would not pose any threat to the Pa'ina facility, Dr. Resnikoff obtains an unjustifiably high HNL-specific crash rate.

Q.17. Is there anything else that might account for the difference between your numbers and those of Dr. Resnikoff?

A.17. (A. Ghosh) Yes. Dr. Resnikoff apparently failed to take into account the angles at which aircraft will take off from and land at HNL. In Table 2-8, I provide crash probabilities for both takeoff and landing for each of the eight runways near the Pa'ina irradiator. In all, there are sixteen separate calculations. The reason I did this is because, for takeoffs or landings from certain runways, it will be all but impossible for a plane to accidentally strike the Pa'ina building at sufficient speed to cause damage. For example, on Runway 8L, planes exit at taxiway S or H. Nearly all narrow-body aircraft would exit the runway at either taxiway L or G, as described in the Final Topical Report, page 2-13. A photo of this runway is marked as Staff Exhibit 15. An aircraft landing at this runway would have to exit the runway at the opposite side of the terminals and skid toward the proposed facility while decelerating. It must pass through a wooded area and the control tower facility, then cut across two runways, two taxiways and several other structures to reach the facility. A photo is attached as Staff Exhibit 16. The probability of an aircraft crashing into the proposed facility while attempting to land at this runway is, therefore, negligible. Similarly, a plane taking off from Runway 26R (other side of Runway 8L) would pass the Pa'ina building soon after it begins its acceleration. At that point it has to almost turn back and go through the runways, wooded area, and the control tower facility to reach the Pa'ina facility. It is therefore not feasible that a plane would strike the building on takeoff from this runway. Nor is it feasible that a plane would strike the Pa'ina facility immediately after takeoff, because the flight pattern takes the plane directly forward, over the

ocean. For these reasons, I assigned an insignificant probability to an accident involving a plane taking off from Runway 26R and landing at Runway 8L and striking the Pa'ina facility.

Similarly, a plane taking off from Runway 26L would pass the Pa'ina facility soon after acceleration. At that point, it has to travel almost in the backward direction to the right to reach Pa'ina's building, possibly passing through a lagoon in between the runway and the buildings. An aircraft landing at Runway 8R (other side of Runway 26L) would have to travel almost two miles from the runway threshold to reach the facility while passing through a taxiway and other structures, and possibly a lagoon. A photo of these runways has been attached as Exhibits 15 and 17. For these reasons, I assigned an insignificant probability to an aircraft crashing into the proposed facility while landing at Runway 8L and taking off from Runway 26L.

On pages 2-13 through 2-15, I address the strike potential for planes taking off from, and landing on, each runway. Figures 2-2 through 2-5 of the Final Topical Report show the orientation of each runway and the Pa'ina facility. I have also provided photographs showing the runways and the Pa'ina building. This analysis affects the crash rate probability in the Topical Report. This type of analysis appears to be lacking from Dr. Resnikoff's Report.

Q.18. Is there anything else you'd like to add on this issue?

A.18. (A. Ghosh) I would emphasize that the probability of an aircraft crash into the Pa'ina facility does not reflect the potential for loss of control of radioactive material. We say this on page 2-23 of the Topical Report. This is important because any disagreement over accident probability rates should not obscure the fact that, even in the event of an accident, it is not foreseeable that there would be a loss of control. In other words, even if we assume there is an accident, it is not foreseeable that there will be significant environmental consequences.

Q.19. In the second segment of the first portion of contention 3, the Intervenor claims the NRC failed to quantify the impact of flying airplane and building debris following an aviation accident to determine if sources would be breached. This is similar to the issue raised in the fourth segment of the third portion, where the Intervenor claims the Staff "failed to consider credible

scenarios under which an aircraft crash might result in exposures above regulatory limits, including, but not limited to, damage to the irradiator pool structure at or below the groundwater level, resulting in a loss of vital pool shielding water, and release of water contaminated with radioactive cobalt through a tear in the pool lining, contaminating groundwater and nearby Ke'ehi Lagoon." The Intervenor cites the February 7, 2007 Resnikoff Report at page 20, the February 9, 2007 Resnikoff Declaration at paragraphs 17-18, the August 24, 2007 Resnikoff Declaration at paragraphs 9 and 13-15; and the February 9, 2007 Pararas-Carayannis Declaration at paragraph 31. Did you address these issues?

A.19. (A. Ghosh) Yes. As we explain in Section 2.4 of the Topical Report, in the event of an aircraft crash at the Pa'ina facility, a portion of the force generated by the crash might damage the irradiator building and the pool structure. Most likely, the aircraft would strike the building at an angle low to the ground, an angle of approximately 5-8°; it is not feasible that an aircraft would nose-dive directly into the 7' by 8' pool opening. After the aircraft strikes the building, it is possible that airplane or building debris could fall into the irradiator pool. However, it is highly unlikely this debris will be moving at the same speed the plane was moving prior to striking the irradiator building, and any debris falling into the pool will be limited in size by the pool opening. Even if we assume that debris falls into the irradiator pool, it is simply not feasible that airplane or building debris would simultaneously pierce the steel-and-concrete pool liner below the water table and damage the sources to the extent where Co-60 could escape through the breach in the liner. If the debris pierces the pool liner, it will not thereafter have sufficient force to damage a source; most likely, the debris will be embedded in the pool liner.

I would emphasize that, even if debris struck a source and the source's encapsulation was breached, the source would remain intact. For that reason, even if the pool liner were breached below the water table, no radioactive material would be released into the environment. Contrary to Dr. Resnikoff's suggestion, it is simply not plausible that flying debris would disperse a source. Co-60 is a metal, and thus is not a readily dispersible material. The CNWRA

responds to Dr. Resnikoff's claims on page 1-3 of the Final Topical Report, where we state that for pool contamination to occur, the source must corrode. Dispersal of Co-60 is not a plausible consequence of an aircraft crash.

Q.20. If an aircraft crash resulted in water escaping the pool, wouldn't there be an increased dose rate above the pool surface?

A.20. (J. Durham) We concluded that if debris from an aircraft crash somehow pierced the steel-and-concrete liner, the water level could drop to the water table, which is eight feet below the pool surface. In that case, there would be an increased dose rate above the pool. But the increased dose rate would take the form of a well-collimated beam above the pool. We did not consider the resulting dose rate to be a significant environmental impact because it would affect only a small area above the pool and it would not cause any long-term impacts. The only part of the environment affected would be the open air above the irradiator. The sources would remain in position, and employees or emergency workers could easily shield the sources with water, dirt or other material. We also considered the possibility of skyshine—radiation scattered from the beam—but based on my experience as a health physicist, I concluded that any skyshine associated with the well collimated beam would be minimal.

Q.21. Could you elaborate on what you mean by a "well-collimated beam"?

A.21. (J. Durham) A visual depiction might help. Staff Exhibit 25 provides a representation of a collimated beam. What I've done is depict the beam over the cross-sectional drawing of the irradiator pool that appears in Figure A-2 on page A-3 of the Final EA.

Q.22. In the fifth segment of the third portion of the contention, the Intervenor argues that although the Final EA considers the increase in radiation dose associated with a six-foot loss of shielding water, it provides no justification for considering only this scenario. Then, in the sixth segment of the third portion, the Intervenor argues that the Staff "was obliged to evaluate situations in which more shielding water is removed from the irradiator, either from the force of an explosion or through evaporation in a fuel fire, which would result in far higher radiation

doses.” The Intervenor relies on the February 7, 2007 Resnikoff Report at page 21, as well as the August 24, 2007 Resnikoff Declaration at paragraphs 13 and 14. Did the CNWRA consider the situations raised by the Intervenor?

A.22. (J. Durham) Yes. First, it is my understanding that the NRC considered not only a six-foot loss of water, but also an eight-foot loss. I believe this is an issue Matt Blevins will be addressing in his testimony. Second, the CNWRA concluded that an explosion or fuel fire would not plausibly lead to more than an eight-foot water loss. It is not foreseeable that an aircraft would explode directly above the irradiator pool. In response to the Intervenor’s comments, the CNWRA re-examined the NTSB data from 1976 to 2007. We did not find any evidence of an exploding aircraft involving any flight either departing from or scheduled to arrive at HNL. We also considered an e-mail from Ben Schlapak, the Airport Manager at HNL, reporting that there have been only two fatal aircraft crashes at HNL since 1962. Neither accident involved an explosion. Given that there has not been an aircraft explosion anywhere at HNL in at least 45 years, it is simply not plausible that there would be an explosion directly above the Pa’ina irradiator pool, which measures only seven by eight feet at the surface.

I would note that, even if an explosion above the pool were plausible, the force generated by an exploding aircraft would not remove a significant amount of water from the irradiator pool. For an explosion to exert sufficient force to remove all water—the pool, when full, will contain 1036 cubic feet of water, or approximately 29 tons—the force would have to be directed straight down into the irradiator pool. But in that case, the object causing the force would be directly above the pool, preventing all but a small amount of water from leaving the pool.

There is no support for Dr. Resnikoff’s claim that an explosion could remove all water from the irradiator pool, resulting in a dose of 107,000 R/hr at the pool surface. For this to happen, the explosion would have to leave the pool liner largely intact; if the liner were breached below the water table, the pool would refill with ten feet of water. Dr. Resnikoff

appears to be suggesting that an explosion could both remove all water and, at the same time, keep the pool liner intact, such that the pool would not be refilled. This scenario is wholly implausible. Further, even if such an event could occur, the resulting dose would be in a well-collimated beam directly above the irradiator pool. This well-collimated beam would not have a significant impact on the environment, and the dose could easily be returned to normal levels, given that the irradiator pool would be intact.

The CNWRA also looked at the possibility of a fuel fire at the facility, as explained in Section 2.4 of the Final Topical Report. Jet fuel is less dense than water; therefore, jet fuel would burn above the pool water, preventing water from evaporating until the fuel is almost depleted, at which point water evaporation would be minimal. The CNWRA concluded that a fuel fire would not cause a significant environmental impact because water evaporation would be minimal, dose rates would not increase significantly, and, in any event, the elevated area of radiation would be directly above the irradiator pool.

In addition, after considering the Intervenor's comments, the CNWRA looked at the worst-case scenario of all water being removed from the pool, such that the plenum is completely exposed to the air. As explained above, there would be a high dose of radiation emitted, but it would be in a well-collimated beam directly above the irradiator pool. This radiation would not affect any person or any significant portion of the environment. Even doses to workers very near the edges of the pool would not increase significantly because of the collimated nature of the radiation beam.

Q.23. In the seventh segment of the third portion of the contention, the Intervenor argues that the Staff "inaccurately assumes the irradiator pool water could become contaminated only if the Co-60 sources were allowed to corrode following a breach in the source encapsulation. The analysis ignores the potential for physical destruction of the sources to contaminate pool water or allow dispersal of pulverized Co-60 via breaches in the pool lining." The Intervenor cites the

February 7, 2007 Resnikoff Report at pages 20–21 and the August 24, 2007 Resnikoff Declaration at paragraph 9. Could you address this claim?

A.23. (J. Durham) As stated above, and as explained in Section 1.2 of the Final Topical Report, the only way for Co-60 to contaminate the pool water is for Co-60 to corrode in the water. This could occur only if the outer and inner containment of a Co-60 source were breached and the source plating, which is nickel and thus non-corrosive, were also breached. In addition, the source would have to be exposed to water for an extended period of time. (Staff Exhibit 18.) Considering these factors, as well as the location of the sources—the sources will be under 12 to 18 feet of water—the CNWRA concluded it is highly speculative that any debris from an aircraft crash would breach a Co-60 source. Further, the CNWRA found that, even if a damaged source were left in the pool for the period of time required for the Co-60 to corrode and contaminate the water, this contamination would not cause offsite consequences unless there was also a breach in the pool’s steel-and-concrete liner.

Dr. Resnikoff suggests that “pulverizing” the sources would cause contamination of the pool water. This is incorrect. “Pulverizing” the Co-60 sources is all but impossible. Co-60 is a metal, not a salt or other readily dispersible material. Even if Co-60 were somehow crushed at the bottom of the pool, because it is a metal, it would remain intact. The CNWRA did not find any feasible scenario in which Co-60 could be pulverized. Even if a projectile fell directly into the pool, the water in the pool would stop or slow the projectile so that it would not damage the plenum to the point that the source would be crushed.

Q.24. What about an engine component falling into pool, a scenario Dr. Resnikoff identifies in his Declarations and Report?

A.24. (J. Durham) It is not feasible that an engine component would fall into the pool, exert enough energy to breach the pool liner, and thereafter fall to the bottom of 18 feet of water with enough energy to significantly damage the sources, which will still be encapsulated and underneath the plenum. In the first instance, it is not credible that an aircraft component would

pierce the pool liner. Such a component would be falling from the airplane, not moving at the same speed the airplane was moving prior to contact with the irradiator building. If a component were to strike the pool liner below the water level, it would do so only after falling through at least eight feet of water. It is highly unlikely the component would be moving fast enough to breach the pool liner. Further, it is simply not plausible that, after piercing the pool liner, the component would then exert sufficient force to “pulverize” the sources. In fact, it is not plausible that they would exert enough force to significantly damage the sources. The sources Pa’ina will use are designed to withstand a two-kilogram steel weight dropped from a height of one meter in air. This is a requirement in 10 C.F.R. § 36.21(d). Dr. Resnikoff claims this is insufficient to guard against damage to the sources. However, as the CNWRA notes in language at page 1-2 of the Final Topical Report, Pa’ina will be using sources that have also passed ANSI test E65646, which includes a 20-kilogram weight dropped from a height of one meter.

In any event, damage to the source should not be equated with “pulverization,” which is what Dr. Resnikoff suggests could occur. A metal will not shatter like glass. Although a metal may become more brittle at temperatures well below zero degrees Celsius, it will not shatter or catastrophically fail at room temperatures. It is not foreseeable that an aircraft crash would cause the temperature in the irradiator pool to drop significantly. In any event, that is not a claim that Dr. Resnikoff makes.

Q.25. In the eighth segment of the third portion of the contention, the Intervenor claims that the Staff improperly dismissed the potential for significant impacts in the event an airplane crash destroyed all monitoring equipment or incapacitated irradiator personnel. The Intervenor cites the February 7, 2007 Resnikoff Report at page 21, the February 9, 2007 Resnikoff Declaration at paragraph 19, and the August 24, 2007 Resnikoff Declaration at paragraph 17. Did you consider these possibilities?

A.25. (J. Durham) First, the loss of emergency personnel and monitoring equipment would not necessarily result in any increased dose. The sources would still be fully shielded under 12–18

feet of water. Emergency workers would likely respond promptly to an aircraft crash at the Pa'ina facility, which is adjacent to HNL, and the dose rate when they arrive would be the normal rate, which is close to background. The Intervenor seeks to bolster its arguments by suggesting that the loss of personnel and monitoring equipment would be combined with a fuel fire or explosion, which could expose emergency personnel to higher doses. However, a fuel fire simply is not a credible scenario for removing shielding water. An explosion is also not a credible scenario because the force necessary to remove water would come from directly above the pool, which would prevent water from escaping. In any event, even if water were removed, emergency workers responding to an aircraft crash at the Pa'ina facility would be well aware that the source is radioactive. Pa'ina's operating procedures specifically provide for training of emergency response personnel, including representatives from local police, fire and rescue departments. That is on page 22 of Pa'ina's license application. In any event, workers and emergency responders would essentially have to linger directly above the pool for an extended period of time to even reach the NRC's dose limits, assuming a loss of eight feet of water. That is not a plausible scenario.

Q.26. We'll now turn to the segments of the contention 3 in which the Intervenor challenges the CNWRA's analysis of risks associated with natural phenomena. Please state your name, occupation and employer.

A.26. My name is John Stamatakos. I am employed as the Assistant Director of the Washington Technical Support Office in the Geosciences and Engineering Division of the Southwest Research Institute.

Q.27. Please explain your duties in connection with the Staff's environmental review of the license application submitted by Pa'ina Hawaii, LLC.

A.27. (J. Stamatakos) I wrote Section 3 of the topical report, "Natural Phenomena," which documents my analysis of the potential effects of earthquakes, tsunamis, and hurricanes on the proposed irradiator.

Q.28. What is the purpose of your testimony?

A.28. (J. Stamatakos) My testimony will address the segments of the Intervenor's contention that challenge the Staff's analysis of the potential effects of natural phenomena on the proposed irradiator. Specifically, I will address segments 3–8 in the first portion of contention 3, as well as segments 1–3 in the third portion. I would note that a number of these segments raise similar issues and rely on the same documents from the Intervenor's purported experts.

Q.29. Before turning to the specific segments involved here, could you explain in general how the CNWRA responded to the comments alleging deficiencies in the Draft Topical Report's analyses of natural phenomena?

A.29. (J. Stamatakos) The CNWRA reviewed the comments submitted by the Intervenor and its experts on the Draft Topical Report while we were preparing the Final Report. As explained in Section 1.2 of the Final Topical Report, and as I'll discuss in more detail below, the CNWRA did not find that any of the scenarios identified by the Intervenor's experts would result in a cobalt source being removed from the irradiator pool. The CNWRA also concluded that none of those scenarios would result in a damaged source corroding, contaminating pool water, and then being released into the environment. While some of the scenarios identified by the Intervenor's experts could possibly lead to damage to the irradiator building, or a loss of water from the pool, the pool water is not contaminated, so there would not be a radiological impact. As explained in Jim Durham's testimony above, in a situation where there is a loss of pool water, the increased dose would be in a collimated beam directly above the pool, and for that reason it would not significantly affect any person or the environment.

Q.30. Starting with the third segment in the first portion of contention 3, the Intervenor argues that the Staff failed to respond to comments alleging that the Draft EA did not quantify hurricane storm surge and tsunami inundation runup potential. Then, in the second segment of the third portion, the Intervenor claims the Final EA fails "to quantify the risk of tsunamis and hurricanes through numerical modeling or, at a minimum, analyze the range of environmental impacts likely

to result in the event of a major tsunami, including the impacts resulting from hurricane storm and tsunami inundation." The Intervenor relies on the February 9, 2007 Pararas-Carayannis Declaration at paragraphs 12-18 and 29. Did the CNWRA consider these issues?

A.30. (J. Stamatakos) Dr. Pararas-Carayannis suggests we should have evaluated tsunami and storm surge runup through numerical modeling. Numerical modeling could have been used to obtain a more accurate calculation if our initial calculations had not been clear as to the effect a wave might have on the Pa'ina irradiator. In this case, however, we determined that 30 meters is a bounding value for wave heights and that the velocity generated by that wave height would have no effect on the sources in the Pa'ina irradiator. There was no need for a more complicated calculation because we found that a wave, whether generated by a tsunami or hurricane storm surge, would not attain the velocities needed to lift a source out of the Pa'ina irradiator and cause environmental impacts.

Q.31. In the fourth and fifth segments of the first portion of the contention, the Intervenor claims the Staff failed to respond to comments stating that it needed to consider the effects on the irradiator pool of increases in buoyancy forces due to hurricane surge or tsunami inundation (fourth segment) and consider potential consequences of hurricane winds (fifth segment). These issues are raised again in the third segment of the third portion, where the Intervenor argues that the Staff failed to consider "numerous other potential impacts related to natural disasters, such as the potential for increased buoyancy due to hurricane storm surge or tsunami inundation to compromise the irradiator pool's integrity or allow shielding water to drain out, damage from hurricane-force winds, and liquefaction during an earthquake." The Intervenor relies on the February 9, 2007 Pararas-Carayannis Report at pages 10–11 and 17–20. Did the CNWRA consider the factors identified by the Intervenor?

A.31. (J. Durham) With regard to buoyancy, the Intervenor appears to be suggesting a scenario where saltwater replaces the freshwater in the pool, making anything in the pool more buoyant. While saltwater is denser than freshwater, it is only marginally denser. Whereas

freshwater has a density of 1.0, saltwater has a density of 1.025; in other words, the density is only 2.5% greater. Given this marginal increase, it is not plausible that saltwater would cause sources to float out of the pool. Even if the pool were completely filled with saltwater, a source would not float.

Dr. Pararas-Carayannis also appears to suggest saltwater infiltration could cause the irradiator pool itself to become buoyant, tilt on its side, and release “radioactive effluent.” I’m referring to his February 9, 2007 Report, at the top of page 11. This is incorrect. The effluence to which he refers is pool water, which is not radioactive. Again, unless the sources were dislodged, there would not be any loss of control of radioactive material. Increased buoyancy, whether of the sources or the pool itself, would not cause such a loss of control.

As for hurricane winds, Dr. Pararas-Carayannis appears to be concerned with winds uprooting trees and converting grounded airplanes and other debris into projectiles that might damage the Pa’ina irradiator. While wind-generated projectiles could potentially damage the irradiator building, the sources would not be damaged by these projectiles. That is because the sources would remain at the bottom of the pool, covered by 12–18 feet of water. The sources would also be covered by the plenum and possibly by one or more product bells. Any projectile falling into the pool would be slowed or stopped by the pool water and would not damage the source. In the unlikely event that a projectile pierced the pool below the water level, water could drain out of the pool. There would not be any environmental impact, however, because the pool water would not be contaminated.

Q.32. In the sixth segment in the first portion of contention 3, the Intervenor claims the Staff failed to respond to comments suggesting it should evaluate unique features of Ke’ehi Lagoon that might increase the potential for tsunami-related impacts. Did you consider those comments?

A.32. (J. Stamatakos) Yes. The Intervenor is referring to the Pararas-Carayannis Report, which states that the unique features of the Ke’ehi Lagoon could exacerbate tsunami-generated

or hurricane surge runups and currents at the proposed site. In the Pararas-Carayannis Report, the authors conclude that potential runups and coastal flooding could be more significant than historical values we referred to from past events. For example, the Pararas-Carayannis Report concludes that maximum flooding of 5 to 6 feet will occur if a Category 3 or Category 4 hurricane makes landfall on O'ahu, near the time of highest astronomical spring tides, in contrast to the 2.6 feet surge produced by Hurricane Iniki. The Pararas-Carayannis Report also cites the past tsunami-generated wave heights of up to 9 feet on the south shore of O'ahu. While these wave heights remain in debate given the data we cite in the Topical Report, we did not address them in the revision because, even if such flooding were to take place, it would not generate the high water velocities and large lifting forces necessary to remove the cobalt sources from the pool. The details of the calculations used to support this conclusion are provided in subsequent answers to questions on the next pages of this testimony. However, I'll note that the CNWRA conducted extensive research into the historical data relating to tsunamis, storm surges and wave heights that might be relevant to assessing hazards to Pa'ina's irradiator. (Staff Exhibits 49, 51, 57.)

Q.33. In the seventh segment in the first portion of the contention, the Intervenor claims the Staff failed to respond to comments suggesting it should consider potential focusing effects of seismic energy on O'ahu. Did you consider potential focusing effects?

A.33. (J. Stamatakos) I considered the Intervenor's comments regarding focusing effects on O'ahu. However, looking at the available data, I found no evidence of focusing effects at or near the Pa'ina irradiator. If there were focusing effects, the seismic records would show higher intensity values reported for areas affected by recent earthquakes. There are very few intensity values higher than Modified Mercalli Intensity Force V reported for O'ahu. Force VI damage occurred a few miles south of Honolulu during a 1948 earthquake, but this was a small earthquake and the damage was limited to the area nearest the epicenter. I addressed the relevant data on page 3-3 of the Final Topical Report. I also relied on the United States

Geological Survey data presented in Figure 3-1, which depicts ground accelerations for O'ahu based on firm rock conditions. The data I reviewed includes that identified or summarized in Staff Exhibits 48, 52–53, 56 and 59.

Dr. Pararas-Carayannis suggests there might be focusing effects with very high intensities that could affect the irradiator site. This suggestion is doubly speculative. First, he is speculating that there might be focusing effects; second, he is speculating that those focusing effects might have markedly higher intensities. Dr. Pararas-Carayannis presents no data to refute the CNWRA's conclusions. Instead, he cites focusing effects that were reported in California's San Fernando Valley, which is approximately 2500 miles from Honolulu. Moreover, this earthquake is an inappropriate analog for seismicity on O'ahu. The tectonic conditions and resulting thrust faulting that led to the San Fernando Valley earthquake are very different from the hot-spot generated earthquakes in Hawaii.

Q.34. In the eighth segment of the first portion, the Intervenor claims the Staff did not respond to comments stating that it needed to evaluate the threat of liquefaction. Did you consider those comments?

A.34. (J. Stamatakos) The CNWRA considered the possibility of liquefaction during an earthquake, but we dismissed this scenario as speculative because there is no evidence of liquefaction from past earthquakes at or near the Pa'ina site. (Staff Exhibits 48, 52–53, 56.) I would note that, in suggesting that liquefaction is a possibility, Dr. Pararas-Carayannis relies on evidence of liquefaction during the 1994 Northridge Earthquake in San Fernando Valley. The San Fernando Valley is in a "seismic area," which is defined at 10 C.F.R. § 36.2 to mean "any area where the probability of a horizontal acceleration in rock of more than 0.3 times the acceleration of gravity in 250 years is greater than 10 percent, as designated by the U.S. Geological Survey." Honolulu, on the other hand, is not in a seismic area. Dr. Pararas-Carayannis fails to explain why evidence of liquefaction in a seismic area some 2500 miles from Honolulu is relevant to assessing whether liquefaction will occur at the Pa'ina site.

As noted in the Final Topical Report, Pa'ina will follow International Building Code requirements and conduct soil stability testing before setting the foundation for its irradiator. This will ensure that, when constructing the irradiator, Pa'ina takes into account any factors that could increase the potential for liquefaction. Even assuming that liquefaction were to occur, this would at most result in the irradiator pool being pushed out of the ground and tilted, causing some water to spill. Due to the weight of the pool—the pool will have a concrete-and-steel liner and contain 29 tons of water—that is highly improbable. In any event, the sources would remain intact in the pool, partially shielded by water, so there would be no radiological impact. I would note that Dr. Pararas-Carayannis seems to suggest radioactive effluence could be released if liquefaction occurs. This is incorrect, because the irradiator water will not be radioactive. The source itself would have to be dislodged, which is completely implausible.

Q.35. In the first segment of the third portion of its contention, the Intervenor argues that the Staff failed to consider potential impacts associated with major flooding. The Intervenor relies on the February 9, 2007 Pararas-Carayannis Declaration at paragraphs 15–16 and 18. Can you address this claim?

A.35. (J. Stamatakos) Major flooding would not result in Co-60 sources being removed from the irradiator pool. The CNWRA based its analysis on historical data, and we conservatively assumed a storm surge much larger than can reasonably be expected to affect the Pa'ina facility. As explained in Section 3.3 of the Final Topical Report, we considered publicly available data and studies by the National Oceanic and Atmospheric Administration (NOAA), the National Aeronautics and Space Administration, and the National Hurricane Center of the National Weather Service of NOAA. This data shows a maximum water-level rise of only 0.78 meters/2.6 feet at O'ahu since the 1950s. I cite this data on page 3-11 of the Final Topical Report. Even so, I conservatively assumed a much larger storm surge might affect the Pa'ina facility. I assumed a 10-meter/33.8-foot wave, which bounds any plausible wave height for O'ahu. I would note that, although Dr. Pararas-Carayannis claims a 31-foot wave reached the

southern coast of O'ahu in 1946, he appears to be citing his own research. I'm referring to the February 9, 2007 Pararas-Carayannis Declaration at paragraph 25. Dr. Pararas-Carayannis does not cite any publicly available data. In fact, he disputes Hawaii Department of Transportation reports that the south shore of O'ahu has not sustained more than a 3-foot wave since 1837.

In any event, even if we assume a 33-foot wave covered the Pa'ina facility, this would not cause a loss of control of radioactive material. That is because the storm surge would not have sufficient velocity to remove a source from the irradiator pool. This conclusion is supported by the computational fluid dynamics calculations performed by Kaushik Das. As explained in Section 3.2.2 of the Final Topical Report, those calculations show that for a cylinder equivalent to a full-sized source assembly, a vertical velocity of 0.9 m/s (2 mph) is required to induce a drag force sufficient to lift the assembly. This vertical velocity could only be generated by a shear velocity of between 90 m/s (203 mph) and 180 m/s (406 mph).

As stated in Section 3.2.2 of the Final Topical report, tsunami waves up to 10 m/32.8 ft can reach velocities up to 13 m/s, or 29 mph. This is far below the minimum velocity needed to remove a source from the irradiator pool. Because a wave resulting from a storm surge will be traveling at a lower velocity than a tsunami wave, a storm surge will similarly be unable to remove a source from the irradiator pool. In other words, a 32.8-foot storm surge is less likely to exert the force necessary to remove a source than a 32.8-foot tsunami wave. For that reason, major flooding and storm surge inundation would not lead to the removal of cobalt sources. Dr. Pararas-Carayannis acknowledges this in paragraph 30 of this Declaration, where he states that "[o]ver land, there is no structured wave form, but rather a chaotic turbulent water mass that is unlikely to create wave velocities sufficient to pull a cobalt-60 source assembly out of the irradiator pool." This is correct. But Dr. Pararas-Carayannis is wrong in stating that the CNWRA "lack[s] an understanding of a tsunami's terminal characteristics when it moves over

land.” Rather, the CNWRA simply took a conservative approach, knowing that wave velocities over land would be bounded by the results of our fluid dynamics calculations.

Q.36. At this point, maybe the CNWRA can provide more information on how you determined it would take a wave velocity of between 203 and 406 mph to lift a source assembly from the irradiator pool. Could you provide an overview of the methodology underlying the CNWRA’s computational fluid dynamics calculations?

A.36. (K. Das) Certainly. By way of introduction, my name is Kaushik Das. I am a research engineer in the hydrology group of the CNWRA, in the Geosciences and Engineering Division. A statement of my professional qualifications is attached.

The CNWRA’s calculations modeled a single cylindrical source lying at the bottom of the pool. The weight, diameter, and length of an actual source were included in the modeling. I calculated the force needed to lift the source from the bottom of the pool to the top of the pool, and then calculated the wave velocity required to deliver that force. I found the required circulation velocity to be 0.9 m/s (2 mph). I then calculated the velocity of a wave passing over the top of the irradiator pool that would produce a lifting velocity of 0.9 m/s (2 mph). When a water wave passes over a pool of water, it will generate circulation inside the pool. This is analogous to blowing across the top of a straw to cause the liquid level in the straw to rise. The velocity near the bottom of the pool is one to two order of magnitude less compared to the driving velocity depending on specific configuration. My calculations determined that the velocity of the wave passing across the top of the pool must be between 90 m/s (203 mph) and 180 m/s (406 mph) in order to produce a circulation velocity of 0.9 m/s (2 mph) in the pool. (Staff Exhibit 58.)

Q.37. Does the Intervenor identify any other potential impacts associated with major flooding?

A.37. (J. Durham) The Intervenor also argues that the Topical Report fails to consider a loss of electricity, the destruction of backup generators, infiltration of saltwater into the irradiator pool, and buoyancy forces. I’m referring to paragraph 15 of the Pararas-Carayannis Declaration. In

fact, the CNWRA considered all of these scenarios. We simply concluded that none would plausibly lead to loss of control of radioactive material, regardless of the extent of the flooding.

In the event of major flooding, the failure of electricity or backup generators would have no impact on the sources. The sources, which are contained in the source assembly, would remain at the bottom of the pool, and they would actually have additional shielding. Although the pool water purification system could be rendered inoperable during a major flood, this would not have any short-term environmental impact, and we can assume that the system would be repaired after the flooding subsides. Second, mixing saltwater with the freshwater in the irradiator pool would not have any environmental impact. The saltwater would function as a slightly more effective shield than freshwater because of its slightly higher density as stated earlier. After the flooding subsided, the Licensee would be required to replace the saltwater with freshwater, but there would be no environmental impact from the saltwater infiltration.

Q.38. What about buoyancy forces?

A.38. (J. Durham) For reasons stated above, it is not plausible that major flooding would cause either the sources or the irradiator pool to become buoyant such that there would be any environmental impact. Even if saltwater completely replaced the freshwater in the pool, the marginal increase in density would not cause sources to float out of the pool. Nor, for that matter, would there be an increase in buoyancy sufficient to cause the pool to lift and tilt, thereby spilling water. And, even if it did so, the pool would not release radioactive effluence, as Dr. Pararas-Carayannis suggests in his February 9, 2007 Report, at the top of page 11. Unless the sources are removed, there will not be any loss of control of radioactive material, and increased buoyancy is not going to remove the sources.

Q.39. In paragraph 29 of his February 9, 2007 Declaration, Dr. Pararas-Carayannis argues that the NRC should have quantified tsunami and storm surge runup potential with a proper numerical modeling study. Why didn't the CNWRA do such a study?

A.39. (J. Durham) As explained above, numerical modeling is useful where there is uncertainty that might be resolved with more precise information. In this case, there is no uncertainty over whether a tsunami or hurricane might cause a loss of control of radioactive material. Even if we assume that a historic record 33-foot tsunami wave strikes the Pa'ina facility, the wave will not come close to the velocity necessary to remove a source from the pool. Accordingly, the wave will not result in the loss of control of radioactive material. There was simply no reason to perform numerical modeling where the results would not have aided our analysis.

August 26, 2008

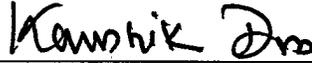
UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
PA'INA HAWAII, LLC	)	Docket No. 30-36974-ML
)	
(Materials License Application)	)	ASLBP No. 06-843-01-ML
)	

AFFIDAVIT OF KAUSHIK DAS

I, Kaushik Das, do hereby declare under penalty of perjury that my statements in the foregoing testimony and my statement of professional qualifications are true and correct to the best of my knowledge and belief.



Kaushik Das

Executed in San Antonio, Texas
this 26th day of August, 2008

August 26, 2008

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
PA'INA HAWAII, LLC	)	Docket No. 30-36974-ML
)	
(Materials License Application)	)	ASLBP No. 06-843-01-ML
)	

AFFIDAVIT OF JAMES DURHAM

I, James Durham, do hereby declare under penalty of perjury that my statements in the foregoing testimony and my statement of professional qualifications are true and correct to the best of my knowledge and belief.


James Durham

Executed in San Antonio, Texas
this 26th day of August, 2008

August 26, 2008

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
PA'INA HAWAII, LLC	)	Docket No. 30-36974-ML
)	
(Materials License Application)	)	ASLBP No. 06-843-01-ML
)	

AFFIDAVIT OF AMITAVA GHOSH

I, Amitava Ghosh, do hereby declare under penalty of perjury that my statements in the foregoing testimony and my statement of professional qualifications are true and correct to the best of my knowledge and belief.



Amitava Ghosh

Executed in San Antonio, Texas
this 26th day of August, 2008

August 26, 2008

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
PA'INA HAWAII, LLC	)	Docket No. 30-36974-ML
)	
(Materials License Application)	)	ASLBP No. 06-843-01-ML
)	

AFFIDAVIT OF JOHN STAMATAKOS

I, John Stamatakos, do hereby declare under penalty of perjury that my statements in the foregoing testimony and my statement of professional qualifications are true and correct to the best of my knowledge and belief.

/Original Signed By/

John Stamatakos

Executed in Rockville, Maryland
this 26th day of August, 2008

August 26, 2008

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
PA'INA HAWAII, LLC	)	Docket No. 30-36974-ML
)	
(Materials License Application)	)	ASLBP No. 06-843-01-ML

NRC STAFF'S TESTIMONY OF PATRICIA SWAIN CONCERNING
AMENDED ENVIRONMENTAL CONTENTIONS

Q.1. Could you please state your name, occupation and employer?

A.1. My name is Patricia Swain. I am a Project Manager in the Low-Level Waste Branch in the NRC's Office of Federal and State Materials and Environmental Management Programs (FSME). I manage the NRC's activities at the Idaho Nuclear Technology and Engineering Center Tank Farm Facility, which is part of Idaho National Laboratory. Specifically, I manage activities relating to NRC requirements for monitoring disposal actions taken by the Department of Energy pursuant to the Ronald Reagan National Defense Authorization Act for FY 2005. In addition, I am responsible for responding to various stakeholder concerns regarding low-level waste. Prior to being a Project Manager in the Low-Level Waste Branch, I was a Project Manager in the FSME Environmental Review Branch, which issued the Pa'ina EA. I joined the NRC from private industry in January 2007. A copy of my professional qualifications is attached.

Q.2. Did you have a role in preparing the Draft or Final EA issued by the Staff in connection with Pa'ina Hawaii, LLC's application for a materials license?

A.2. Not a direct role. I was assigned to the Pa'ina project when Matt Blevins left the NRC in August 2007. I reviewed the Final EA before it was issued, and I provided comments to Matt before a Notice of Availability was published in the Federal Register.

Q.3. You are listed as the contact person for the Final EA. Did anyone contact you about the EA?

A.3. One person called me to ask how she could get a copy of the Final EA. I directed the person to the NRC's website, where she could obtain a copy of the EA.

Q.4. What are your current responsibilities with respect to the Pa'ina Hawaii licensing action?

A.4. After Matt Blevins left the NRC, I assumed responsibility as the Technical Project Manager for the Task Order that the NRC has with the Center for Nuclear Waste Regulatory Analyses. In that capacity I have performed administrative duties such as monitoring monthly expenditures and ensuring the availability of technical staff and funding.

Q.5. Are there any other NRC Staff who are currently assigned to this project?

A.5. Not at NRC headquarters. The NRC issued Pa'ina its license in August 2007. The NRC's Regional Office in Arlington, Texas is responsible for overseeing that license.

Q.6. Does this conclude your testimony?

A.6. Yes.

August 26, 2008

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
PA'INA HAWAII, LLC	)	Docket No. 30-36974-ML
)	
(Materials License Application)	)	ASLBP No. 06-843-01-ML
)	

AFFIDAVIT OF PATRICIA SWAIN

I, Patricia Swain, do hereby declare under penalty of perjury that my statements in the foregoing testimony and my statement of professional qualifications are true and correct to the best of my knowledge and belief.

Original Signed By

Patricia Swain

Executed in Rockville, Maryland
this 26th day of August, 2008

August 26, 2008

Thomas S. Moore
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Anthony J. Baratta
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Paul Abramson
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

In the Matter of
PA'INA HAWAII, LLC
(Honolulu, Hawaii Irradiator Facility)
Docket No. 30-36974-ML; ASLBP No. 06-843-01-ML

Dear Administrative Judges:

Pursuant to 10 C.F.R. §§ 2.336 and 2.1203, the Staff informs the Board and the parties that there are no additional updates to the Staff's hearing file index in this proceeding. Attached please find an affidavit from Patricia Swain, the Pa'ina Project Manager in the NRC's Office of Federal and State Materials and Environmental Management Programs, affirming that the hearing file is complete.

Sincerely,

/RA/mjc

Michael J. Clark
Molly L. Barkman
Counsel for the NRC Staff

Enclosures: As stated

cc w/encls: David L. Henkin Michael Kohn Office of Commission
Fred Paul Benco Office of the Secretary Appellate Adjudication
Johanna Thibault Lauren Bregman

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
PA'INA HAWAII, LLC	)	Docket No. 30-36974
)	
Materials License Application	)	ASLBP No. 06-843-01

AFFIDAVIT OF PATRICIA SWAIN

I, PATRICIA SWAIN, do hereby state as follows:

1. I am employed as a Project Manager in the Low-Level Waste Branch in the NRC's Office of Federal and State Materials and Environmental Management Programs (FSME). I am currently Project Manager for the environmental review associated with Pa'ina Hawaii, LLC's application for an underwater irradiator license.
2. I have reviewed the hearing file updates and mandatory disclosures filed in this proceeding. To the best of my knowledge, there are no materials to be added to the hearing file.
3. I therefore certify that all relevant materials required to be disclosed pursuant to 10 C.F.R. § 2.336 and 10 C.F.R. § 2.1203 have been disclosed, and that the disclosures are accurate and complete as of the date of this certification.
4. I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge, information and belief.

/Original Signed By/

Patricia Swain

Executed in Rockville, Maryland
this 26th day of August, 2008

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
PA'INA HAWAII, LLC	)	Docket No. 30-36974-ML
)	
Material License Application	)	ASLBP No. 06-843-01-ML

CERTIFICATE OF SERVICE

I hereby certify that the "NRC STAFF'S INITIAL STATEMENT OF POSITION AND INITIAL WRITTEN TESTIMONY," with supporting exhibits, and the "NRC STAFF'S HEARING FILE UPDATE" have been served on the recipients listed below by express mail; through deposit in the Nuclear Regulatory Commission's internal system as indicated by an asterisk (*), and by electronic mail as indicated by a double asterisk (**) on this 26th day of August, 2008.

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/RA/mjc

Michael J. Clark
Molly L. Barkman
Counsel for NRC Staff