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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
	)	ASLBP No. 06-843-01-ML
Material License Application	)	
	)	

INTERVENOR CONCERNED CITIZENS OF HONOLULU'S SUPPLEMENTAL STATEMENT OF POSITION

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February 2, 2009

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Pursuant to the Atomic Safety and Licensing Board's ("Board's") December 4, 2008 order, intervenor Concerned Citizens of Honolulu hereby submits a full factual and substantive written statement of position (including written testimony with supporting affidavits and exhibits in support of its position) rebutting and responding to the presentations of the Nuclear Regulatory Commission ("NRC") Staff and applicant Pa'ina Hawaii, LLC regarding the admitted segments of amended environmental contentions 3 and 4.[1]

I. INTRODUCTION

In this proceeding, Concerned Citizens challenges the adequacy of the final environmental assessment ("Final EA") the Staff prepared for a commercial pool-type industrial

[1] The presentations to which the Board instructed Concerned Citizens to respond are as follows: NRC Staff's Initial Statement of Position on Amended Environmental Contentions 3 and 4 (Aug. 26, 2008); Licensee Pa'ina Hawaii, LLC's Trial Brief on the Law (Aug. 26, 2008); NRC Staff's Rebuttal Statement of Position and Testimony (Sept. 15, 2008); and Licensee Pa'ina Hawaii, LLC's Rebuttal Memorandum in Opposition to Intervenor Concerned Citizens of Honolulu's August 26, 2008 Initial Written Statement of Position and in Response to NRC Staff's Initial Statement of Position and Initial Written Statement (Sept. 15, 2008). See 12/4/08 Board Order at 2 n.6.

irradiator using cobalt-60 ("Co-60") sources that Pa'ina Hawaii, LLC proposes to construct and operate at a site immediately adjacent to active runways at Honolulu International Airport that also lies within a tsunami evacuation zone and is vulnerable to hurricane storm surge. The Board admitted for hearing portions of amended environmental contentions 3 and 4, which challenge the Staff's failure to comply with its obligations under the National Environmental Policy Act ("NEPA"), 42 U.S.C. §§ 4321 et seq., to take the requisite "hard look at the effects from proceeding with" Pa'ina's proposed irradiator and to consider reasonable alternatives to construction and operation of a nuclear irradiator at a site subject to aviation accidents and natural disasters and that presents an attractive target for terrorist attack. Klamath-Siskiyou Wilderness Center v. Bureau of Land Management, 387 F.3d 989, 1001 (9th Cir. 2004); see also 12/21/07 Board Order (Ruling on Admissibility of Intervenor's Amended Environmental Contentions); 3/4/08 Board Order (Ruling on Admissibility of Intervenor's Terrorism-Related Challenges).

The admitted segments of the amended environmental contentions all involve claims the final EA omitted information the Staff was obliged to provide to satisfy NEPA. The Board admitted four portions of amended environmental contention 3, each of which alleges a separate major deficiency in the Staff's EA. The first admitted portion challenges "the Staff's failure to respond to [Concerned Citizens'] detailed comments regarding the shortcomings of the draft EA," which the Board found "presents a contention of omission." 12/21/07 Board Order at 10-11. The Board also admitted as "a contention of omission" the portion of amended environmental contention 3 that "lists the twelve instances in the final EA in which the Staff failed to provide sufficient substantiated analyses regarding the potential impacts of the proposed irradiator." Id. at 14. The third admitted portion challenges the Staff's failures "to provide more

than general statements about possible risks associated with natural disasters and aviation accidents and ... to consider transportation accidents involving the cobalt sources," which constitute "an omission of any meaningful consideration of potential risks associated with the proposed irradiator and thereby preclude the type of informed decision-making required by NEPA." Id. at 16; see also id. at 17 ("this portion of the Intervenor's contention ... is effectively a contention of omission"). Finally, the Board admitted Concerned Citizens' challenge to the Staff's analysis of potential terrorist attacks "to the extent it alleges that the Staff 'failed to disclose data underlying [its] terrorism analysis' of the proposed irradiator in the Final EA and its Appendices and thereby failed to meet the NEPA-mandated 'hard look' standard." 3/4/08 Board Order at 5 (citations omitted).

The Board admitted amended environmental contention 4 in its entirety, characterizing it as including "two distinct NEPA 'alternatives' challenges." 12/21/07 Board Order at 25. The first challenge "is aimed at the Staff's treatment of alternative quarantine technologies," asserting "the Staff failed to quantify the relative costs and benefits of the two pest control technologies mentioned in the Final EA and omitted any consideration of the electron beam technology proposed in the Intervenor's comments on the draft EA." Id. at 25-26; see also id. at 28 (admitting this portion of amended environmental contention 4 as a "contention of omission"). The second admitted portion of amended environmental contention 4 challenges the final EA's omission of "any consideration of reasonable alternative locations that would purportedly avoid or minimize the proposed irradiator's adverse impacts on the environment." Id. at 30-31; see also id. at 32,("Intervenor's contention presents a legal issue contention of omission").

For the reasons set forth below, Concerned Citizens respectfully submits the Board should conclude the Staff's EA failed to comply with NEPA on the grounds set forth in the

admitted portions of amended environmental contentions 3 and 4. Accordingly, the Board should instruct the Staff to prepare a revised EA that complies fully with Congress's command to "put on the table, for the [NRC's] and the public's view, a sufficiently detailed statement of environmental impacts and alternatives so as to permit informed decision making" regarding Pa'ina's proposed irradiator. Lands Council v. Powell, 395 F.3d 1019, 1027 (9th Cir. 2005); cf. 10 C.F.R. §§ 51.31(a) (NRC Staff prepares EA "for proposed actions other than those involving a standard design certification or a manufacturing license under part 52 of this chapter").

II. FACTUAL BACKGROUND[2]

Pursuant to a stipulation that resolved Concerned Citizens' two initial environmental contentions, the Staff put out for public review and comment a draft EA for Pa'ina's proposed irradiator in December 2006. Concerned Citizens Exh. 1: Draft Environmental Assessment Related to the Proposed Pa'ina Hawaii, LLC Underwater Irradiator in Honolulu, Hawaii (ADAMS Accession No. ML063470231);[3] see also 71 Fed. Reg. 78,231 (Dec. 28, 2006); 3/20/06 Joint Stipulation and Order Regarding Resolution of Concerned Citizens' Environmental Contentions; 4/27/06 Board Order (Confirming Oral Ruling Granting Motion to Dismiss Contentions).

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[2] The facts of this case have been set forth in detail several times. Accordingly, Concerned Citizens will focus here on only those facts most relevant to the admitted environmental contentions.

[3] In the interest of avoiding burdening the Board and parties with unnecessary additional paper, Concerned Citizens will not resubmit copies of the exhibits and declarations previously filed with its Initial Written Statement of Position (Aug. 26, 2008) or Rebuttal to NRC Staff's Statement of Position (Sept. 16, 2008).

On February 8, 2007, Concerned Citizens timely submitted comments on the draft EA, including numerous expert reports pointing out deficiencies in the Staff's analysis. Concerned Citizens Exh. 2: 2/8/07 Earthjustice Letter, with enclosed expert reports.[4]

On February 9, 2007, Concerned Citizens timely filed environmental and safety contentions, with supporting expert declarations, relating to matters discussed in the draft EA. See Concerned Citizens Exh. 3: 2/9/07 Concerned Citizens' Contentions Re: Draft Environmental Assessment And Draft Topical Report (ML070510116). Concerned Citizens filed a reply in support of its contentions, with supporting expert declarations, on March 19, 2007. See Concerned Citizens Exh. 4: 3/19/07 Concerned Citizens' Reply In Support Of Its Contentions Re: Draft Environmental Assessment And Draft Topical Report (ML070870154).

On May 8, 2007, the Staff posted on ADAMS the Final Topical Report on the Effects of Potential Natural Phenomena and Aviation Accidents at the Pa'ina Hawaii, LLC Irradiator Facility ("Final Topical Report") (ML071280833), which presented information the Staff later incorporated into the final EA. Concerned Citizens Exh. 5: Final Topical Report.

On June 1, 2007, Concerned Citizens timely filed amended safety contentions, with supporting expert declarations, challenging the adequacy of the Final Topical Report's analysis

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[4] For reasons unknown, the version of this comment letter available on ADAMS (at ML070470615) omits several attachments, including the resumes of Concerned Citizens' experts. Concerned Citizens' Exhibit "2" includes all attachments, including an April 13, 2005 press release from the National Nuclear Security Administration regarding terrorist risk from a Co-60 irradiator at the University of Hawai'i, a March/April 2002 study from the Federation of American Scientists regarding dirty bombs, a February 2007 assessment by Dr. George Pararas-Carayannis of natural disaster risks for Pa'ina's proposed irradiator ("Pararas-Carayannis Report"), a February 7, 2007 analysis by Dr. Marvin Resnikoff of the probability of an aircraft impact into Pa'ina's proposed irradiator ("2/7/07 Resnikoff Report"), a February 1, 2007 analysis by Professors Mete Sozen and Christoph Hoffmann of the effect of an aviation accident on a steel structure similar to the proposed irradiator ("Sozen/Hoffmann Report"), an October 3, 2005 declaration from Dr. Gordon Thompson regarding terrorist threats to the proposed irradiator, and a September 29, 2005 declaration from Professor William Au regarding health impacts of consuming irradiated food.

of threats to Pa'ina's proposed facility from aviation accidents and natural disasters. See Concerned Citizens Exh. 6: 6/1/07 Concerned Citizens' Amended Safety Contentions #13 And #14 (ML071620236). Concerned Citizens filed replies in support of its amended safety contentions, with supporting expert declarations, on July 3, 2007. See Concerned Citizens Exh. 7: 7/3/07 Concerned Citizens' Reply To Pa'ina's Answer To Amended Safety Contentions #13 And #14 (ML071910217); Concerned Citizens Exh. 8: 7/3/07 Concerned Citizens' Reply To Staff's Answer To Amended Safety Contentions #13 And #14 (ML071910319).

On June 1, 2007, the Staff released a supplemental appendix to the draft EA discussing, for the first time, terrorist attacks on Pa'ina's proposed irradiator ("Appendix B"). Concerned Citizens Exh. 9: Draft Appendix B (ML071290585).

On July 9, 2007, Concerned Citizens timely submitted comments on Appendix B, including an expert critique from Dr. Marvin Resnikoff. Concerned Citizens Exh. 10: 7/9/07 Earthjustice letter, with 7/6/07 Resnikoff Report (ML071940241); see also 72 Fed. Reg. 31,866 (June 8, 2007).

On August 13, 2007, the Staff served its final EA and associated finding of no significant impact. Concerned Citizens Exh. 11: Final Environmental Assessment Related to the Proposed Pa'ina Hawaii, LLC Underwater Irradiator in Honolulu, Hawaii (ML071150121). Four days later, the Staff issued NRC License No. 53-29296-01 to Pa'ina for possession and use of sealed sources in its proposed irradiator. See Concerned Citizens Exh. 12: Pa'ina License (Aug. 17, 2007) (ML072320269).

III. STATUTORY FRAMEWORK

NEPA is "our basic national charter for protection of the environment." 40 C.F.R. § 1500.1(a). In enacting NEPA, Congress sought to ensure that all federal agencies – including the

NRC – would factor environmental concerns into their decision-making. See 42 U.S.C. § 4332. NEPA's procedures are designed to "insure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. 40 C.F.R. § 1500.1(b) (emphasis added); see also Citizens for Better Forestry v. U.S. Dep't of Ag., 341 F.3d 961, 970-71 (9th Cir. 2003).

To achieve Congress's goals, NEPA requires an environmental impact statement ("EIS") for all "major Federal actions significantly affecting the quality of the human environment." 42 U.S.C. § 4332(2)(C). "In order to determine whether an EIS is required, the federal agency concerned prepares an environmental assessment [("EA")]." Bob Marshall Alliance v. Hodel, 852 F.2d 1223, 1225 (9th Cir. 1988), cert. denied, 489 U.S. 1066 (1989). An EA "shall identify the proposed action and include:"

> (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.

10 C.F.R. § 51.30(a); see also 40 C.F.R. § 1508.9. "Based on that assessment the agency may conclude that the action will not significantly affect the environment and issue a 'Finding of No Significant Impact' ('FONSI') in lieu of an EIS." Bob Marshall Alliance, 852 F.2d. at 1225; see also 10 C.F.R. § 51.31(a); 40 C.F.R. §§ 1508.9(a)(1), 1508.13.

Whether an EA or an EIS is prepared, NEPA obliges the NRC to take "a 'hard look' at the potential environmental consequences of the proposed action." Klamath-Siskiyou Wilderness Center, 387 F.3d at 993; see also Ocean Advocates v. U.S. Army Corps of Engineers, 402 F.3d 846, 864 (2005). Moreover, "consideration of alternatives is critical to the goals of

NEPA even where a proposed action does not trigger the EIS process." Bob Marshall Alliance, 852 F.2d at 1228-29; see also Highway J Citizens Group v. Mineta, 349 F.3d 938, 960 (7th Cir. 2003) ("inquiry into consideration of reasonable alternatives is 'independent of the question of environmental impact statements, and operative even if the agency finds no significant environmental impact'").

In enacting NEPA, Congress understood that "public scrutiny" is "essential" to ensuring "high quality" information regarding the potential impacts of proposed undertakings "is available to public officials ... before decisions are made and before actions are taken." 40 C.F.R. § 1500.1(b). Accordingly, NEPA's implementing regulations mandate that federal agencies:

- "Make diligent efforts to involve the public in preparing and implementing their NEPA procedures;"
- Notify the public regarding "the availability of environmental documents so as to inform those persons and agencies who may be interested or affected;" and
- "Solicit appropriate information from the public."

Id. § 1506.6(a)-(b), (d).

The Ninth Circuit has emphasized that "NEPA's public comment procedures are at the heart of the NEPA process," playing a vital role in "ensur[ing] that an agency is cognizant of all of the environmental trade-offs that are implicit in a decision." California v. Block, 690 F.2d 753, 770-71 (9th Cir. 1982); see also Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 349 (1989) (making information available to public "provides a springboard for public comment"). In our democratic system, the disclosures that NEPA documents provide also play a vital role in assuring the public "the agency 'has indeed considered environmental concerns in its decisionmaking process.'" Id. (quoting Baltimore Gas and Elec. Co. v. Natural Resources

Defense Council, 462 U.S. 87, 97 (1983)); see also San Luis Obispo Mothers for Peace v. Nuclear Regulatory Comm'n, 449 F.3d 1016, 1034 (9th Cir. 2006), cert. denied sub nom, Pacific Gas & Elec. Co. v. San Luis Obispo Mothers for Peace, 127 S. Ct. 1124 (2007) (one of NEPA's purposes to ensure public "can access the information that is made public")

IV. BURDEN OF PROOF

"It is ... settled that the NRC has the burden of complying with NEPA" Duke Power Co. (Catawba Nuclear Station, Units 1 and 2), CLI-83-19, 17 NRC 1041, 1048 (1983). Thus, "[i]n the end, it is the NRC Staff that 'bears the ultimate burden of demonstrating that environmental issues have been adequately considered.'" Duke Energy Corp. (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-28, 56 NRC 373, 385 (2002) (quoting Louisiana Energy Services, L.P. (Claiborne Enrichment Center), CLI-98-3, 47 NRC 77, 89 (1998)).

V. STANDARD OF REVIEW

Pa'ina devotes its entire rebuttal memorandum to faulting Concerned Citizens for failing to mention the Ninth Circuit's decision in The Lands Council v. McNair, 537 F.3d 981 (9th Cir. 2008) (en banc), arguing that the case "announced a 'sea change' in the manner by which [the Ninth Circuit] would review agency decisions." Pa'ina Rebuttal at 1-2. Pa'ina ignores that this proceeding involves Board review of the Staff's actions, not review of the NRC's actions by an Article III court. Commission case law, not the Ninth Circuit's, defines the standard the Board applies in reviewing the Staff's compliance with NEPA.[5]

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[5] In its initial statement, the Staff likewise erroneously cites case law regarding the standard of review applicable to Article III courts, rather than the Board. See Staff Statement at 23-25.

The Commission has held that, "when resolving contentions litigated through the adversary process," licensing boards must "bring their own 'de novo' judgment to bear." Exelon Generation Co., LLC (Early Site Permit for Clinton ESP Site), CLI-05-17, 62 NRC 5, 39 (2005); see also id. at 38 (licensing boards' "review of a contested issue is quite different from their review of an uncontested one, and that this difference is reflected, to a considerable extent, in the depth of the boards' review (i.e., de novo or not)"). In this proceeding, since Concerned Citizens has challenged the adequacy of the Staff's EA, the Board "must decide, based on governing regulatory standards and the evidence submitted," whether the Staff has met its burden of proof. Id. at 39; see also Exelon Generation Co., LLC (Early Site Permit for Clinton ESP Site), LBP-04-821, 62 NRC 134, 151-52 (2005) (Board's role "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'"). The Board resolves these "contested issues" regarding the Staff's compliance with NEPA "as a de novo matter." Exelon Generation Co., CLI-05-17, 62 NRC at 36.

VI. THE BOARD'S DECISION NOT TO ADMIT CONCERNED CITIZENS' SAFETY CONTENTIONS DOES NOT RELIEVE THE STAFF OF ITS OBLIGATION TO DEMONSTRATE COMPLIANCE WITH NEPA

Pa'ina's argument that this Board's decision not to admit various safety contentions means there is no longer any need to address the merits of Concerned Citizens' environmental contentions mixes apples and oranges. See Pa'ina Statement at 2-4. In the case of the safety contentions, the Board concluded Concerned Citizens had not satisfied the Commission's "newly prescribed and rigorous safety contention admissibility standard with respect to irradiator siting." 6/19/08 Board Memorandum and Order (Ruling on Admissibility of Amended Safety Contention

7) at 1. Because the Board determined Concerned Citizens had not carried its heavy burden of identifying "the specific manner by which ... offsite consequence will occur, as a result of a specified phenomenon, so as to create a unique threat scenario outside the parameters for irradiators already generically approved in the promulgation of 10 C.F.R. Part 36," it declined to admit the safety contentions. 4/2/08 Board Memorandum and Order (Dismissing Outstanding Safety Contentions and Permitting Submission of New Safety Contentions) at 4 (emphasis omitted); see also 6/19/08 Board Order at 4-5.[6]

In contrast, to resolve the admitted environmental contentions, the Board focuses on whether the Staff, not Concerned Citizens, has satisfied its duty under NEPA to take a "hard look" at the potential impacts associated with construction and operation of a nuclear irradiator at Pa'ina's proposed location. Klamath-Siskiyou Wilderness Center, 387 F.3d at 1001. As noted above, "[i]t is ... settled that the NRC has the burden of complying with NEPA." Duke Power Co. (Catawba Nuclear Station, Units 1 and 2), CLI-83-19, 17 NRC at 1048. Thus, "[i]n the end, it is the NRC Staff that 'bears the ultimate burden of demonstrating that environmental issues have been adequately considered.'" Duke Energy Corp. (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-28, 56 NRC at 385. That the Board concluded Concerned Citizens came up short in supporting its safety contentions does not relieve the Staff of its burden to demonstrate it fully discharged its obligations under NEPA.

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[6] The Board's rulings on the admissibility of Concerned Citizens' safety contentions did not constitute affirmative findings "there will be no significant ... impacts from Pa'ina's irradiator," as Pa'ina asserts. Pa'ina Statement at 3. Rather, they merely reflect the Board's conclusion Concerned Citizens had not presented adequate evidence of such impacts to overcome the "general expectation ... that the NRC would not need to conduct a special safety review of facility siting" for irradiators. Commission Memorandum and Order, CLI-08-03, 67 NRC __, slip op. at 18 (Mar. 17, 2008).

To determine whether the Staff took the requisite "'hard look' at the potential environmental impact" of Pa'ina's proposed irradiator, the Board must evaluate whether the Staff "suppl[ied] a 'convincing statement of reasons' to explain why [the] project's impacts are insignificant." Blue Mountains Biodiversity Project v. Blackwood, 161 F.3d 1208, 1212 (9th Cir. 1999) (quoting Save the Yaak Comm. v. Block, 840 F.2d 714, 717 (9th Cir. 1988)). It is well-established in the Ninth Circuit that the Staff cannot discharge its NEPA obligations by offering only "generalized conclusory statements that the effects are not significant." Klamath-Siskiyou Wilderness Center, 387 F.3d at 996. Moreover, the Staff was obliged to "respond to public comments concerning the project." Sierra Nevada Forest Protection Campaign v. Weingardt, 376 F.Supp.2d 984, 991 (E.D. Cal. 2005); see also Foundation for N. Am. Wild Sheep v. U.S. Dep't of Ag., 681 F.2d 1172, 1179 (9th Cir. 1982). The important questions about the Staff's compliance with NEPA contained in the admitted portions of amended environmental contentions 3 and 4 do not disappear merely because the Board rejected Concerned Citizens' safety contentions.

Moreover, even assuming for the sake of argument the Board had concluded Pa'ina's irradiator would not result in significant environmental impacts, the Staff still could not get away with a deficient analysis in its EA, as Pa'ina suggests. To resolve Concerned Citizens' environmental contentions 1 and 2, the Staff stipulated to "prepare an environmental assessment for the Applicant's proposed irradiator," a commitment the Board then entered as an order. 3/20/06 Joint Stipulation and Order Regarding Resolution of Concerned Citizens' Environmental Contentions at ¶ 1; see also 4/27/06 Board Order (Confirming Oral Ruling Granting Motion to Dismiss Contentions). The order expressly reserves Concerned Citizens' right to "challeng[e]

the adequacy of any NEPA document that the NRC prepares regarding the Applicant's proposed irradiator." 3/20/06 Joint Stipulation and Order at ¶ 6.

To be adequate, the Staff's EA must "[a]id an agency's compliance with [NEPA] when no environmental impact statement [('EIS')] is necessary." 40 C.F.R. § 1508.9(a)(2). Since NEPA demands that "high quality" environmental information – not unsubstantiated assertions – be "available to public officials and citizens before decisions are made and before actions are taken," the Board would still have to ensure the Staff's analysis was thorough and sound, even in the absence of any potential for significant impacts. Id. § 1500.1(b); see also Blue Mountains Biodiversity Project, 161 F.3d at 1216 (EIS required "whenever 'substantial questions are raised was to whether a project may cause significant [environmental] degradation"). Likewise, since "consideration of alternatives is critical to the goals of NEPA even where a proposed action does not trigger the EIS process," the Board would still have to review the adequacy of the EA's discussion of alternatives. Bob Marshall Alliance, 852 F.2d at 1228-29; see also Highway J Citizens Group, 349 F.3d 938 at ("inquiry into consideration of reasonable alternatives is 'independent of the question of environmental impact statements, and operative even if the agency finds no significant environmental impact'").

VII. THE BOARD'S REVIEW IS LIMITED TO THE INFORMATION PRESENTED IN THE EA

Implicitly conceding its EA falls short of satisfying NEPA, the Staff argues the 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.'" Staff Statement at 21 (quoting Dominion Nuclear North Anna,

LLC (North Anna ESP Site), CLI-07-27, 66 NRC 215, 230 (2007)) (emphasis added). The Staff's reliance on North Anna to argue that "[t]he Board's discussion of the disputed issues" can "add[] necessary additional details" to cure defects in the EA is misplaced. Id. (quoting North Anna, CLI-07-27, 66 NRC at 230). Unlike this proceeding, which is being conducted pursuant to the subpart L hearing regulations, North Anna involved a subpart G proceeding. See 68 Fed. Reg. 67,489, 67,489 (Dec. 2, 2003) ("The Board will conduct the hearing in accordance with subpart G of 10 CFR part 2"). The Commission's regulations expressly provide for the Board to modify the Staff's environmental review – whether an EA or an EIS – "[w]hen a hearing is held on the proposed action under the regulations in subpart G." 10 C.F.R. § 51.102(c) (emphasis added); see also id. § 51.34(b) (finding of no significant impact ("FONSI") "subject to modification" when hearing held "under the regulations in subpart G").[7]

In contrast, the Commission's regulations do not authorize the Board to modify the Staff's review in this subpart L irradiator licensing proceeding. See United States v. Terrence, 132 F.3d 1291, 1294 (9th Cir. 1997) ("Under the doctrine of 'inclusio unius est exclusio alterius' ..., '[w]hen a statute limits a thing to be done in a particular mode, it includes a negative of any other mode'"); Longview Fibre Co. v. Rasmussen, 980 F.2d 1307, 1313 (9th Cir. 1992) ("No sensible person accustomed to the use of words in laws would speak so narrowly and precisely of particular statutory provisions, while meaning to imply a more general and broad coverage than the statutes designated"). Rather, the regulations flatly state that, in run-of-the-mill proceedings like this, the Staff prepares the final EA and FONSI; the Board does not modify them. 10 C.F.R. §§ 51.31(a), 51.34(a). Rather, should the Board conclude the EA fails to satisfy NEPA, the

[7] The regulations also authorize the Board to modify the Staff's environmental analysis in proceedings involving the proposed issuance of a manufacturing license or amendment and "when the action can only be taken by the Commissioners acting as a collegial body," neither of which is the case here. Id. § 51.102(c); see also id. § 51.31(c)(4).

proper remedy would be to instruct the Staff to prepare a revised document that resolves the deficiencies, precisely the remedy a reviewing court would provide. See, e.g., Blue Mountains Biodiversity Project, 161 F.3d at 1216 (remanding to agency "for further proceedings consistent with this opinion"); National Parks & Conservation Ass'n v. Babbitt, 241 F.3d 722, 739-40 (9th Cir. 2001) (same).[8]

Limiting the Board's review to the analysis presented in the EA is consistent with well-established Ninth Circuit precedent. In Blue Mountains Biodiversity Project, the Court squarely rejected the U.S. Forest Service's suggestion that supporting data in the 3,000-page administrative record could cure the "cursory and inconsistent treatment of sedimentation issues" in the EA for a timber salvage sale. 161 F.3d at 1214. Noting that "[t]he EA contains virtually no references to any material in support of or in opposition to its conclusion," the Court held that the text of the EA itself "is where the Forest Service's defense of its position must be found." Id.; see also National Parks & Conservation Ass'n, 241 F.3d at 732 (same); cf. Presidio Golf Club v. National Park Service, 155 F.3d 1153, 1164 (9th Cir. 1998) ("litigation affidavits and 'post hoc' rationalizations" generally irrelevant to review of NEPA compliance).

While the Ninth Circuit recognizes a limited exception to the general prohibition on considering litigation affidavits where an agency seeks to explain "what the EA refers to when it uses [various] term[s]," in this case, the lion's share of the testimony the Staff seeks to introduce does not provide additional explanation about terms or other matters that were presented in the EA. Presidio Golf Club, 155 F.3d at 1164. Rather, the Staff seeks to introduce voluminous

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[8] Even if the Board were otherwise justified in looking beyond the EA to determine whether the Staff took the requisite "hard look" at potential impacts and reasonable alternatives, North Anna states that the scope of the Board's review is limited to "the administrative record." CLI-07-27, 66 NRC at 230. Here, the Staff seeks to introduce testimony that presents information and analyses found nowhere in the record that was before the Staff at the time it finalized the EA.

testimony addressing issues that were never mentioned in the EA in the first place. For example, Matthew Blevins' testimony describes his "research into the electron-beam irradiator" and his reasons for concluding it "would not be a feasible alternative." See Blevins Testimony at A.31. Unlike Presidio Golf Club, where the agency listed the alternative in question among the "Alternatives Considered but Rejected" and "[s]everal reasons were given [in the EA] for rejecting that alternative," the EA for Pa'ina's irradiator nowhere mentions the Staff ever considered the electron-beam irradiator as an alternative. Presidio Golf Club, 155 F.3d at 1161. As far as the public knew, that alternative simply did not exist.

The proffered testimony addresses many other matters on which the EA is completely silent, including:

1. The potential impacts associated with an eight-foot loss of shielding water from the irradiator pool (Blevins Testimony at A.21, A.27; Center for Nuclear Waste Regulatory Analyses ("CNWRA") Testimony at A.20);
2. Whether an explosion associated with an aviation accident could lead to loss of more than eight feet of vital shielding water (CNWRA Testimony at A.22, A.25);
3. The potential impacts associated with "the worst case scenario of all water being removed from the pool, such that the plenum is completely exposed to the air" (id.);
4. Whether the impact from an airplane accident could pulverize the Co-60 sources, contaminating the pool water (id. at A.23-A.24);
5. The potential impacts to emergency responders in the event an airplane crash destroys all monitoring equipment or incapacitates irradiator personnel (id. at A.25);

6. The effects on the irradiator pool of increases in buoyancy forces due to hurricane surge or tsunami inundation (id. at A.31, A.37-A.38);

7. The unique features of Ke'ehi Lagoon that might increase the potential for tsunami-related impacts (id. at A.32);

8. The potential focusing effects of seismic energy on O'ahu (id. at A.33);

9. The threats posed by liquefaction (id. at A.34); and

10. The potential impacts associated with major flooding (id. at A.37).

The Staff's post hoc testimony regarding these matters does not seek to "explain[] the [Staff's] prior analyses." Presidio Golf Club, 155 F.3d at 1165. Rather, it seeks to introduce entirely new information and analyses to make up for the EA's complete failure to address these topics. Since "the [Staff's] defense of its position must be found" in the text of the EA itself, the proffered post hoc testimony is irrelevant to resolving the pending environmental contentions. Blue Mountains Biodiversity Project, 161 F.3d at 1214

In this case, allowing the Staff to cure defects in the EA with information that – until the Staff filed its initial statement – was hidden from the public would contravene Congress's intent in enacting NEPA "to ensure that an agency is cognizant of all the environmental trade-offs that are implicit in a decision." Block, 690 F.2d at 771. As noted above, "[t]o effectuate this aim, NEPA requires ... public participation in the evaluation of [a project's] environmental consequences." Id.; see also 40 C.F.R. § 1500.1(b) ("public scrutiny [is] essential" to ensuring the environmental information available to decision-makers is "of high quality"). Allowing the Staff to buttress its analysis with information that was unavailable during the public comment period on the EA would "insulate[] its decision-making process from public scrutiny," "render[ing] NEPA's procedures meaningless." Block, 690 F.2d at 771; see also Idaho Sporting

Cong. v. Thomas, 137 F.3d 1146, 1150 (9th Cir. 1998) ("ISC I") (when agency prepares EA, "NEPA requires that the public receive the underlying environmental data from which [an agency] expert derived her opinion").

Moreover, allowing the Staff to justify its issuance of a license to Pa'ina based on previously undisclosed information would undermine one of NEPA's central purposes: to "insure that environmental information is available to ... citizens before decisions are made and before actions are taken." 40 C.F.R. § 1500.1(b) (emphasis added). The Staff's decision to keep its data and analysis hermetically sealed until forced to reveal them in the course of this proceeding makes a mockery of the statute's "informational role." Department of Transportation v. Public Citizen, 541 U.S. 752, 768 (2004).[9] Citizens should not have to seek Board review to find out whether the Staff "has indeed considered environmental concerns in its decisionmaking process;" the information in the EA itself is supposed to provide those assurances. Public Citizen, 541 U.S. at 768 (quoting Baltimore Gas and Electric Co., 462 U.S. at 97).

VIII. THE FINAL EA'S LENGTH IS IRRELEVANT TO ITS ADEQUACY

The Staff cites the statement in the Council on Environmental Quality's ("CEQ's") "Forty Most Asked Questions" publication that EAs are "typically in the range of ten to fifteen pages" to argue that, by dint of its greater length (when appendices are included), the final EA must be adequate. See Staff Statement at 19 n.38, 57 n.112; see also Staff Exh. 1: Blevins Testimony at A.34. As the Ninth Circuit emphasized in Friends of the Earth v. Hintz, 800 F.2d

[9] Notably, the Staff failed to include many of its exhibits in the hearing file, violating its duty under 10 C.F.R. § 2.336(b)(3) to disclose "[a]ll documents ... supporting the NRC staff's review of the application or proposed action that is the subject of the proceeding." See, e.g., Staff Exhs. 30 (NRC and DOE Comparison of Crash Rates), 58 (Scientific Notebook, Kaushik Das). Moreover, as discussed herein, virtually none of the responses to comments provided in the written testimony the Staff submitted with its initial statement were included in the final EA.

822 (9th Cir. 1986), however, "courts uniformly have held that the CEQ forty questions document is not a regulation, but merely an informal statement and is not controlling authority." Id. at 837 n.15. Unlike the CEQ's regulations, the "Forty Questions" publication is neither binding nor entitled to substantial deference. Id.; cf. Private Fuels Storage, LLC (Independent Spent Fuel Storage Installation), CLI-02-25, 56 NRC 340, 348 n.22 (2002) (NRC gives "CEQ regulations ... 'substantial deference'") (emphasis added).

In the more than quarter century since the CEQ issued its "Forty Questions," a substantial body of case law has established the minimum requirements for a legally adequate EA, none of which are related to its length. See Sierra Club v. Marsh, 769 F.2d 868, 875 (1st Cir. 1985) (Breyer, J.) ("simple facts of EA length ... do not by themselves show that the EAs' conclusion – 'no significant impact' – is correct, nor do they show it is incorrect") As detailed in Concerned Citizens' prior submittals and herein, the EA fails to comply with NEPA's command to take a hard look at the impacts associated with Pa'ina's proposed irradiator and at reasonable alternatives that "might be pursued with less environmental harm." Lands Council, 395 F.3d at 1027.

IX. AMENDED ENVIRONMENTAL CONTENTION 3: THE FINAL EA FAILS TO SATISFY NEPA'S MANDATE TO TAKE A "HARD LOOK" AT POTENTIAL ENVIRONMENTAL IMPACTS

NEPA requires the Staff to take a "hard look" at the environmental consequences of Pa'ina's proposed irradiator and prepare an up-front, coherent, comprehensive environmental analysis. Center for Biological Diversity v. U.S. Forest Serv., 349 F.3d 1157, 1166 (9th Cir. 2003). Environmental review must be conducted as early as possible in the decision-making process because NEPA procedures are meant to "ensure informed decision making to the end that the agency will not act on incomplete information, only to regret its decision after it is too

late to correct." Churchill County v. Norton, 276 F.3d 1060, 1072-73 (9th Cir. 2001). An EA "must be 'prepared early enough so [it] can serve practically as an important contribution to the decisionmaking process and will not be used to rationalize or justify decisions already made.'" Idaho Sporting Cong. v. Alexander, 222 F.3d 562, 567 (9th Cir. 2000) ("ISC II") (citations omitted). By issuing a license to Pa'ina based on the final EA's deficient analysis, the Staff failed to satisfy NEPA's command to "involv[e] environmental considerations in the initial decisionmaking process." Metcalf v. Daley, 214 F.3d 1135, 1145 (9th Cir. 2000).

A. The Final EA Failed To Respond To Comments Regarding The Draft EA's Deficiencies.

During the public comment period on the draft EA, Concerned Citizens and its experts submitted voluminous comments pointing out deficiencies in the Staff's analysis of potential impacts. See generally 2/8/07 Earthjustice Letter, with enclosed expert reports. The experts noted, among other things, the draft EA's failure to consider significant factors in evaluating the likelihood the proposed irradiator would be involved in an aviation accident, to quantify the impact of flying airplane and building debris following an aviation accident to determine if sources would be breached, to quantify hurricane storm surge and tsunami inundation runup potential, to consider the effects on the irradiator pool of increases in buoyancy forces due to hurricane surge or tsunami inundation, to consider potential consequences of hurricane winds, to evaluate unique features of Ke'ehi Lagoon that might increase the potential for tsunami-related impacts, to consider potential focusing effects of seismic energy on O'ahu, and to evaluate properly the threat of liquefaction. See Sozen/Hoffmann Report; 2/7/07 Resnikoff Report; Pararas-Carayannis Report. In addition, Concerned Citizens noted the failure to examine

accidents involving transportation of Co-60 sources to and from the proposed irradiator. 2/8/07 Earthjustice Letter at 5-6.

Rather than respond to these significant questions, the Staff ignored them "or, at best, shunted [them] aside with mere conclusory statements." Foundation for N. Am. Wild Sheep, 681 F.2d at 1179; see also 12/21/07 Board Order at 12 ("the Staff does not claim that it responded in the final EA to the Intervenor's comments on the listed deficiencies in the draft EA"). For example, while the Staff mentions in passing Dr. Resnikoff's comment that "the '[p]otential for airplane crash estimates given in the EA' are too low" and Dr. Pararas-Carayannis's critique of the draft EA's failure to consider "effects from increased buoyancy, forceful winds, and fires" associated with hurricanes, the final EA does not provide any substantive response. Final EA at C-14, C-16; see also id. at C-17. Other comments, such as the critique of the Staff's failure to examine transportation accidents, were ignored entirely.

Pa'ina does not offer any substantiated argument the Staff responded adequately to the comments Earthjustice and its experts submitted regarding the draft EA's deficiencies, but, instead, asserts broadly that "lesser public input is generally required for preparing an EA." Pa'ina Statement at 11. For its part, the Staff observes that "[t]he NRC's regulations make circulation of a draft EA and draft FONSI discretionary for the Staff." Staff Statement at 21. Both Pa'ina and the Staff ignore that, on March 20, 2006, the Staff lodged a stipulation – which, at the Staff's and Concerned Citizens' joint request, the Board subsequently entered as a order – that expressly mandated substantial opportunities for the public to provide input. The stipulation provides, "[p]ursuant to 10 C.F.R. § 51.33," that, "prior to making any final finding of no significant impact for the Applicant's proposed irradiator, the NRC staff shall prepare and issue a draft finding of no significant impact for public review and comment." 3/20/06 Joint Stipulation

and Order at ¶ 2. The stipulation further obliged the Staff to "hold at least one public meeting in Honolulu, Hawai'i" regarding its draft finding, "at which the public will have the opportunity to offer comment on the record." Id. at ¶ 3.

While the NRC's and CEQ's NEPA regulations may not "specifically address the manner in which the Staff should reply to public comments," Staff Statement at 22, case law in the Ninth Circuit is clear that, "[t]o be adequate," the final EA must provide meaningful responses. Sierra Nevada Forest Protection Campaign, 376 F.Supp.2d at 991; see also Oregon Natural Resources Council Action v. U.S. Forest Service, 445 F.Supp.2d 1211, 1229 (D. Or. 2006) ("the agency must respond to any comments which were addressed to the inadequacy of the [supplemental EAs' ("SEAs'")] alternatives analysis in the course of preparing its supplemental SEAs, or, if it chooses, in new EAs or EISs").[10] The Staff cannot lawfully ignore those comments or "shunt[] [them] aside with mere conclusory statements." Foundation for N. Am. Wild Sheep, 681 F.2d at 1179. Rather, in the final EA, the Staff was obliged to respond to comments, including "adverse opinions held by respected scientists" like the experts Concerned Citizens retained. Western Watersheds Project v. Bureau of Land Management, 552 F. Supp. 2d 1113, 1129 (D. Nev. 2008).[11]

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[10] There is no support for the Staff's claim the holding in Oregon Natural Resources Council Action is limited to the facts of that case. See Staff Statement at 73. Rather, the court's holding relied on settled Ninth Circuit precedent that an agency cannot use non-NEPA documents "to present information and analysis that it was required, but ... failed to include in its original NEPA documents." ISC II, 222 F.3d at 567.

[11] While the Staff's counsel speaks disparagingly of Concerned Citizens' experts' credentials, the NRC's actions belie the Staff's litigation position. See, e.g., Staff Statement at 28 (referring to "Intervenor's purported experts"). For example, Dr. George Pararas-Carayannis, who critiqued the Staff's analysis of impacts associated with natural disasters, authored the "Catalog of Tsunamis in Hawaii, Revised and Updated," on which the Center for Nuclear Waste Regulatory Analyses ("CNWRA") relied in preparing the final topical report the Staff used as the basis for its EA. See Final Topical Report at 3-4, 5-3. Dr. Pararas-Carayannis has also served as a consultant to the NRC on nuclear plant siting, hurricane and hurricane surge effects, and other

The Staff's failure to do so contravened "the paramount Congressional desire to internalize opposing viewpoints into the decision-making process to ensure that [the NRC] is cognizant of all the environmental trade-offs that are implicit in a decision" to license Pa'ina's proposed irradiator. Block, 690 F.2d at 771. Moreover, the final EA's "omission of any meaningful consideration of [the] fundamental factors [raised in the comments of Concerned Citizens and its experts] precludes the type of informed decision-making mandated by NEPA." Foundation for N. Am. Wild Sheep, 681 F.2d at 1178.

The "failure to address public comments" was clearly far from "harmless." Pa'ina Statement at 12. The Board should remand the matter to the Staff to prepare a revised EA that fully addresses these comments. See Foundation for N. Am. Wild Sheep, 681 F.2d at 1183.

B. The Final EA Contains Insufficient Evidence And Analysis Regarding Potential Impacts.

Even with respect to the potential impacts it purports to address, the EA's discussion is far too cursory satisfy the document's basic purposes: to "provide sufficient evidence and analysis for determining whether to prepare an [EIS] or a [FONSI]" and to "[a]id [the NRC's] compliance with [NEPA]" in the event no EIS is prepared. 40 C.F.R. § 1508.9(a)(1), (2). The EA devotes less than five pages to potential impacts unrelated to terrorism, in which it offers

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matters. See Concerned Citizens Exh. 31: Dr. Pararas-Carayannis' resume at 2. Purdue University Professor of Structural Engineering Mete Sozen, who critiqued the Staff's analysis of the consequences of an aviation accident involving Pa'ina's proposed irradiator, likewise has served as a consultant to the NRC, in his case on projects concerned with structural safety and damage. See Concerned Citizens Exh. 39: Professor Sozen's resume at 2.

nothing more than "generalized conclusory statements that the effects are not significant." Klamath-Siskiyou Wilderness Center, 387 F.3d at 996; see also Final EA at 7-12.[12]

For example, the EA fails to 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" (Final EA at 8);
2. Any calculations, analysis or data regarding its evaluation of "expected dose rate" outside the irradiator (Id.);
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" (Id.);
4. Any calculations, analysis or data substantiating its claim "[t]ransportation impacts from normal operations would be small" (Id.);
5. Any calculations, analysis or data substantiating its claim "[t]he proposed irradiator would potentially have small beneficial impacts to socioeconomics" (Id.);
6. Any justification for focusing its review of potentially significant impacts on "off-site consequences" (Id. at 9);
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 for its assertion that "the increased dose rate will not be

[12] The Board has determined that, for security reasons, challenges to "the adequacy of the Staff's treatment of terrorism in the final EA" – which is presented in Appendix B – are inadmissible. 3/4/08 Board Order at 3.

sufficient to have a significant environmental effect on the area around the proposed facility" (Id.);

8. Any justification for its decision to disclose the effects of 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 (Id.; see also Final Topical Report at 1-2);[13]

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" (Final EA at 9);

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" (Id.);

11. 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 (Id. at C-10); and

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[13] Notably, in preparing the EA, the Staff calculated, but then failed to disclose, the potential radiation dose associated with a loss of shielding water to the eight-foot depth of the surrounding water table. See Concerned Citizens Exh. 13: 9/20/07 NRC Staff's Response to Intervenor Concerned Citizens of Honolulu's Amended Environmental Contentions #3 Through #5 at 10 (ML072670495). That the Staff knew an eight-foot loss of shielding water threatens to expose workers and emergency responders to a radiation dose of 8,465 millirems/hour – over twenty-eight times the dose from a six-foot water loss – and then made a conscious decision to keep that information from the public makes a mockery of NEPA's command to disclose fully the potential impacts of allowing Pa'ina to operate its proposed irradiator. Compare Concerned Citizens Exh. 14: "Microshield Summary Sheet for Loss of 8 Feet of Water Shielding" (run date May 9, 2007) (ML072630315) with Final EA at 9.

12. 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 (Id. at C-12).

The Staff "cannot avoid preparing an EIS by making conclusory assertions that an activity will have only an insignificant impact on the environment." Ocean Advocates, 402 F.3d at 864. Moreover, the Staff cannot invoke agency expertise to justify its failure to provide the requisite information and analysis. See, e.g., id. at C-13 ("use of 'unlikely' is ... based on staff experience"). It is well-established that that "NEPA documents are inadequate if they contain only narratives of expert opinions." Klamath-Siskiyou Wildlands Center, 387 F.3d at 996. The Ninth Circuit has explained that allowing a federal agency "to rely on expert opinion without hard data either vitiates a plaintiff's ability to challenge an agency action or results in the courts second guessing an agency's scientific conclusions," neither of which is acceptable. ISC I, 137 F.3d at 1150. Because public scrutiny of an agency's analysis is vital to accomplishing NEPA's goals, "NEPA requires that the public receive the underlying environmental data from which [the Staff's experts] derived [their] opinion[s]." Id.; see also 40 C.F.R. §§ 1500.1(b), 1500.2(d). The EA fails to comply with this mandate.

The EA's constant refrain that potential impacts are "described in more detail in the Safety Topical Report" and its citation to internal agency documents do not remedy this fatal flaw. Final EA at 9-11. While NEPA permits agencies to incorporate material by reference, they may not do so if it would "imped[e] agency and public review of the action," which is vital to accomplish NEPA's basic purposes. 40 C.F.R. § 1502.21; see also id. § 1500.1(b) ("expert agency comments, and public scrutiny are essential to implementing NEPA"). Thus, 40 C.F.R. § 1502.21 expressly prohibits incorporation by reference when the materials are not "reasonably

available for inspection by potentially interested persons within the time allowed for comment." Id. § 1502.21; see also NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs," §1.6.4 (2003) (same).

The EA's incorporation by reference of material which was not "reasonably available for inspection" does not pass legal muster. 40 C.F.R. § 1502.21. For example, a member of the public concerned about radiation exposure from "normal operations" transporting Cobalt-60 sources to the irradiator would have no reasonable means to locate the data or analysis on which the Staff based its finding of no significant impact. Final EA at 8. Even if the concerned citizen knew to look on ADAMS to find the cited reference ("NRC, 2006d," a December 6, 2006 email entitled "Pa'ina Irradiator SER Input") and could figure out how to navigate ADAMS – no mean feat for the uninitiated – to locate the document, she would still find absolutely nothing to shed any light on how the Staff reached its conclusion. The document merely states the "draft ser input" is attached – but no data is, in fact, attached to the version of the document on ADAMS – and promises that "supporting information" would be provided the next week. Concerned Citizens Exh. 15: 12/6/06 Email from E. Keegan to M. Blevin (ML063480301).

Likewise, a member of the public concerned about the impacts associated with a loss of irradiator pool shielding water in the event of an aviation accident or natural disaster would have no way to evaluate the accuracy or adequacy of the Staff's analysis of radiation doses. See Final EA at 9. The source cited ("NRC, 2007," a March 28, 2007 document entitled "Microshield Summary Sheet for Loss of 6 Feet of Water at Pa'ina Irradiator") is not available on ADAMS. As with many other referenced documents, the EA fails to "indicate where [this reference is] available for public review," violating the Staff's own guidance. NUREG-1748, § 1.6.4; see also Final EA at 14-15, B-8 (listing references without indicating where they can be found).

The Final Topical Report – on which the EA relies substantially – suffers from the same defect. The report's detailed discussion of the data and formulae used to evaluate the likelihood of an airplane crashing into Pa'ina's proposed irradiator contrasts sharply with the complete absence of any calculations or other meaningful analysis regarding the force that flying aircraft or building debris would exert on the Co-60 sources to quantify the conditions under which radioactive material would be dispersed and assess the likelihood of that occurring. Compare Final Topical Report at 2-5 to 2-17 with id. at 2-17. Having been provided the analytical data on which the Staff based its conclusions about airplane crash frequency, Concerned Citizens – through its expert, Dr. Resnikoff – was able to prepare an extensive critique of the data and methodology the Topical Report used, pointing out the failure to assess accurately the risk involved in proceeding with Pa'ina's proposed irradiator. See generally 2/7/07 Resnikoff Report; see also 40 C.F.R. § 1500.1(b) ("public scrutiny ... essential to implementing NEPA). No similarly detailed review of the Staff's analysis of the consequences of aviation or building debris destroying the Co-60 sources was possible, since the report contained only "generalized conclusory statements that the effects are not significant," Klamath-Siskiyou Wildlands Center, 387 F.3d at 996, rather than "the underlying environmental data" from which the Staff derived its conclusions, as NEPA requires. ISC I, 137 F.3d at 1150.[14]

The Final Topical Report likewise fails to set forth the bases for the EA's conclusions that various natural disasters involving the irradiator would not cause significant impacts. While the report states that "a stylized fluid dynamic calculation" was conducted to assess potential impacts associated with tsunamis and notes the conclusions reached, it does not actually set forth

[14] Review of the hearing file reveals the Staff failed to perform any calculations regarding the force that crashing aircraft or building debris might exert to determine whether the Co-60 sources' performance standards would be adequate to ensure against radioactive releases. Thus, there was no "underlying environmental data," but, rather, only bald speculation.

for public review the calculations that were performed. Final Topical Report at 3-5. For all other threats involving natural phenomena, the report does not even claim any calculations were performed, even though, as Concerned Citizens' expert Dr. Pararas-Carayannis pointed out during the Staff's preparation of the EA, such analysis would be necessary to reach any meaningful conclusions about potential impacts. Concerned Citizens Exh. 3: 2/9/07 Pararas-Carayannis Decl. ¶¶ 11, 18-19, 28-31, 34; Concerned Citizens Exh. 4: 3/15/07 Pararas-Carayannis Supp. Decl. ¶¶ 4, 8; see also Written Testimony and Declaration of George Pararas-Carayannis, Ph.D. ("Pararas-Carayannis Testimony") at A4-A9 (filed herewith).

Life of the Land v. Brinegar, 485 F.2d 460 (9th Cir. 1973), the case on which Pa'ina relies to defend the Staff's cursory discussion of tourism-related impacts, is easily distinguished from the facts of this proceeding. See Pa'ina Statement at 10. In Life of the Land, the EIS was completely silent regarding "the effect of the Reef Runway project upon the population of Honolulu and Hawaii." Id. at 469. Noting the lack of any "empirical data in the record" that "an increase in Honolulu's tourism" – a primary goal of the project – "will result in an increase in that city's permanent population," the Court held the EIS did not need to address those potential impacts. Id.

Here, in contrast, the EA is not silent regarding potential impacts on tourism associated with Pa'ina's proposed irradiator. Rather, the EA affirmatively states "there is no reason to believe the irradiator would have any effect" on tourism. Final EA at C-12. Unlike Life of the Land, where the issue was whether NEPA required that a potential impact be addressed, the question here is whether, having acknowledged the need to address potential impacts on tourism, the Staff can get away with "making conclusory assertions that an activity will have only an insignificant impact on the environment." Ocean Advocates, 402 F.3d at 864; see also 40 C.F.R.

§ 1508.8 (agency must consider economic and social impacts, "whether direct, indirect, or cumulative").[15]

The answer in the Ninth Circuit is clear: "NEPA documents are inadequate if they contain only narratives of expert opinions." Klamath-Siskiyou Wildlands Center, 387 F.3d at 996. Thus, even if the Staff possessed the necessary expertise to analyze the impacts of a disruption to tourism due to a release from Pa'ina's irradiator (and it does not),[16] the NRC may not "rely on expert opinion without hard data." ISC I, 137 F.3d at 1150. Because public scrutiny of an agency's analysis is vital to accomplishing NEPA's goals, "NEPA requires that the public receive the underlying environmental data from which [the Staff's experts] derived [their] opinion[s]." Id.; see also 40 C.F.R. §§ 1500.1(b), 1500.2(d). The EA's cursory mention of tourism-related impacts fails to comply with this mandate.

The Staff's failure "to meet its NEPA requirements for public disclosure of information" regarding potential impacts renders the EA inadequate and mandates preparation of a new NEPA document. ISC I, 137 F.3d at 1154.

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[15] Since Pa'ina's proposed facility would be immediately adjacent to active runways at Honolulu International Airport, the prime gateway for tourists to Hawai'i, it goes without saying that a release of radiation from the facility "could reasonably be projected to have an effect upon" tourism, requiring such impacts to be addressed in the EA. Life of the Land, 485 F.2d at 470.

[16] The Staff's initial statement indicates the analysis of impacts on tourism was conducted by former Office of Nuclear Materials Safety and Safeguards Senior Project Manager Matthew Blevins. See Staff Statement at 56; Blevins Testimony at A.1. Mr. Blevins' resume makes clear he has no background or other expertise in analyzing impacts on tourism. See Staff Exh.4. There is no "agency expertise" regarding this topic to which deference would be due. National Parks & Conservation Ass'n v. United States Dep't of Trans., 222 F.3d 677, 682 (9th Cir. 2000) (deferring to Federal Aviation Administration's expertise in aviation forecasting).

C. The Final EA Fails To Consider Potentially Significant Impacts From Natural Disasters and Aviation Accidents.

While the EA purports to consider impacts from natural disasters and aviation accidents, it fails to analyze many potential consequences, violating NEPA's command to take a "hard look at the effects from proceeding with [the proposed irradiator]." Klamath-Siskiyou Wilderness Center, 387 F.3d at 1001. For example, although the EA mentions (albeit only briefly and without quantification) minor flooding due to hurricane surges, it fails completely to consider potential impacts associated with major flooding. As discussed in Concerned Citizens' February 9, 2007 contentions, which were before the Staff as it prepared the EA, hurricane storm surge could cause flooding of up to seven feet at the proposed irradiator site, and storm surge deposits at the proposed irradiator site confirm that major flooding has happened in the past. 2/9/07 Contentions at 10; see 2/9/07 Pararas-Carayannis Decl. ¶¶ 15-16. Potential hurricane surge heights can be accurately predicted and quantified using mathematical models, yet the EA failed to quantify this risk, depriving the NRC and the public of the environmental information they need to make an informed decision about Pa'ina's proposal. 2/9/07 Pararas-Carayannis Decl. ¶ 18; Pararas-Carayannis Testimony at A4, A7; see 40 C.F.R. § 1500.1(b), (c).

The EA's analysis of tsunami risks is similarly deficient. As Dr. Pararas-Carayannis pointed out to the Staff, there is a 100% statistical probability that a future major Pacific-wide tsunami will impact the Hawaiian Islands, and the proposed site is in a tsunami evacuation zone. 2/9/07 Pararas-Carayannis Decl. ¶ 23. Even if the Staff disagreed with Dr. Pararas-Carayannis, it was obliged either to quantify this risk through numerical modeling or, at a minimum, analyze in the EA "the range of environmental impacts likely to result in the event" of a major tsunami. San Luis Obispo Mothers for Peace, 449 F.3d at 1034; see also Pararas-Carayannis Testimony at A4-A5, A7; 40 C.F.R. § 1502.22(b). Instead, it focuses solely on the improbable (a wave lifting

a Co-60 source out of the pool irradiator), ignoring the potential threats identified in expert comments on the draft EA. See Pararas-Carayannis Report at 12-18; Pararas-Carayannis Testimony at A4, A7.

Dr. Pararas-Carayannis similarly urged the Staff to use numerical modeling to quantify runup potential for both hurricane storm surge and tsunami inundation. 2/9/07 Pararas-Carayannis Decl. ¶ 29; Pararas-Carayannis Testimony at A4. The Staff, however, neither undertook such a study or nor justified its failure to do so. "General statements about possible effects and some risk do not constitute a hard look absent a justification regarding why more definitive information could not be provided." Klamath-Siskiyou, 387 F.3d 989 at 994 (quoting Neighbors of Cuddy Mountain v. United States Forest Service, 137 F.3d 1372, 1380 (9th Cir 1998)). If it is possible objectively to quantify an impact, NEPA requires that the agency do so. Id. Without the benefit of numerical modeling in the EA, the NRC is improperly left to speculate about the risks of a hurricane or tsunami, using inaccurate and inadequate data.

As noted above, the 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. See Pararas-Carayannis Report at 10-11, 17-20; Pararas-Carayannis Testimony at A5-A6, A8-A9. To comply with its obligations under NEPA, the Staff was required to assess these potential impacts thoroughly. The Staff "cannot avoid preparing an EIS by making conclusory assertions that an activity will have only an insignificant impact on the environment." Ocean Advocates, 402 F.3d at 864.

For both aviation accidents and natural disasters, the EA failed to analyze various scenarios which 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. See 2/7/07 Resnikoff Report at 20; Concerned Citizens Exh. 3: 2/9/07 Resnikoff Decl. ¶¶17-18; 2/9/07 Pararas-Carayannis Decl. ¶ 31; Pararas-Carayannis Testimony at A4-A5, A8; Written Rebuttal Testimony and Declaration of Marvin Resnikoff, Ph.D ("Resnikoff Rebuttal Testimony") at 3-4 (filed Sept. 16, 2008). While the 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 the Staff knew dramatically understates potential impacts. See Final EA at 9. Since the depth of the water table is eight feet below the facility floor, the EA should have discussed the potential for a rupture in the pool lining causing shielding water to drain to that level, which the Staff's own calculations – which it illegally withheld from the public – show would result in a dose of 8,465 millirems/hour, over twenty-eight times the dose from a six-foot water loss and well above the annual occupational dose limit of 5,000 millirem/year. See Final Topical Report at 1-2; Final EA at 8-9; "Microshield Summary Sheet for Loss of 8 Feet of Water Shielding" (run date May 9, 2007).

The EA was also obliged to, but failed to, evaluate situations in which more shielding water might be removed from the irradiator, either from the force of an explosion or through evaporation in a fuel fire, potentially resulting in far higher radiation doses. 2/7/07 Resnikoff Report at 21; Supplemental Written Testimony and Declaration of Marvin Resnikoff

("Supplemental Resnikoff Testimony") at A.8 (filed herewith); see also Final EA at 10 (asserting, without supporting analysis or quantification, jet fuel fire would cause "minimal water evaporation"). Moreover, the Staff improperly failed to consider any scenarios for contamination of the irradiator pool water other than through long-term corrosion of the Co-60 sources. See Final EA at 9. The Staff should have, but failed to, perform the calculations necessary to determine whether the force of falling aircraft or building debris could destroy the sources, allowing dispersal of pulverized Co-60 via breaches in the pool lining. 2/7/07 Resnikoff Report at 20-21; Resnikoff Rebuttal Testimony at 3-4; Supplemental Resnikoff Testimony at A.9. If, upon completion of its analysis, the Staff concluded significant impacts were unlikely, the proper course would be to disclose the data on which it based its ultimate conclusions. The Staff could not, however, satisfy NEPA's mandate to take a hard look at potential impacts "by making conclusory assertions that [Pa'ina's proposed irradiator would] have only an insignificant impact on the environment" and calling it a day. Ocean Advocates, 402 F.3d at 864.

Moreover, the EA improperly dismisses the potential for significant impacts in the event an airplane crash destroys all monitoring equipment or incapacitates irradiator personnel. Even if, as the EA asserts, the loss of operating monitoring equipment during an accident would not lead to the loss of control of radioactive material (and the Staff failed to cite any analysis to back up this assertion), the inability to implement necessary emergency procedures would threaten to put first responders and the general public in harm's way. Final EA at 9; 2/7/07 Resnikoff Report at 21; 2/9/07 Resnikoff Decl. ¶ 19; Supplemental Resnikoff Testimony at A.5; Written Testimony And Declaration Of Mete A. Sozen, S.E. (IL), Ph.D ("Sozen Testimony") at A.3 (filed herewith). The EA fails to evaluate such potential consequences.

D. The Final EA Fails To Consider Potentially Significant Impacts From Transportation Of Cobalt Sources To And From Pa'ina's Proposed Irradiator.

While the EA considers (albeit in a conclusory and incomplete fashion) "[t]ransportation impacts from normal operations," it fails completely 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. Final EA at 8; see also 2/9/07 Resnikoff Decl. ¶¶ 24-25.[17] This Board has already squarely rejected the Staff's claim it "was not required to analyze transportation impacts" in the EA for Pa'ina's proposed irradiator because such impacts "have already been considered" in other NEPA reviews, including a generic EIS ("GEIS") the NRC prepared in 1977. Staff Statement at 57-58. In admitting Concerned Citizens' amended safety contention 3, the Board noted that "[n]either the draft nor the final EA cite this GEIS, much less summarize in the final EA the issues and reasoning of the generic study as is required when incorporating such environmental documents." 12/21/07 Board Order (Ruling on Admissibility of Intervenor's Amended Environmental Contentions) at 18-19. The Staff gives the Board no reason to question its earlier decision, which is well-grounded in NEPA's requirements.

As the Board correctly concluded in its earlier order, the mere existence of an EIS discussing potential impacts from transportation of radioactive materials would not, as the Staff asserts, excuse its failure to address such impacts in the EA. While NEPA allows agencies to "tier" environmental analyses, to comply with the tiering regulations, the EA would have had to "summarize the issues discussed in the broader statement and incorporate statements from the

[17] Notably, the Staff now acknowledges it examined only "the dose rate from normal operations on a route between the Port of Honolulu and Pa'ina's facility" (a distance of only a few miles), a significant fact the EA failed to disclose. Blevins Testimony at A.16; see also id. at A.29. A concerned member of the public reading the EA would have no way to know the Staff's conclusory statement that "the proposed irradiator would have no significant impacts from transportation," EA at 8, was "not intend[ed] to comprehensively address issues relating to the transportation of sources to Pa'ina's irradiator." Blevins Testimony at A.16.

broader statement by reference," concentrating on the transportation-related issues specific to Pa'ina's proposed irradiator. 40 C.F.R. § 1502.20; see also id. § 1508.28. The EA did not do this. It made no mention of either of the EISs the Staff now invokes (not even in the references), failed to disclose the calculations and data underlying its conclusion that "[t]ransportation impacts from normal operations would be small," and included no discussion at all of transportation impacts from abnormal operations (i.e., accidents). Final EA at 8 (emphasis added).

The draft EA likewise was silent regarding the EISs the Staff now claims are relevant, which means that, during the public comment period, the public, including Concerned Citizens, was unaware of their existence and alleged relevance to evaluating Pa'ina's proposal. See Draft EA at 8. Consequently, no one was in a position to comment on whether either EIS adequately analyzes issues related to transporting Co-60 to and from Hawai'i. Because NEPA recognizes the vital role the public plays in ensuring agencies do not sweep important considerations under the rug, if the Staff had intended to rely on these EISs, it was required to state, in the draft EA, "where the earlier document[s were] available." 40 C.F.R. § 1502.20. Likewise, the NRC's guidance for preparing EAs provides that "[t]he new environmental document must identify the document from which it is tiered and both documents must be available for public review." NUREG-1748, § 1.6.2. The Staff failed to comply with any of these requirements.

The Staff's other justification for failing to address transportation impacts – that transportation of Co-60 sources to allow Pa'ina's irradiator to operate allegedly does not constitute a "connected action" – is equally unsupported. As the Board previously observed:

> Because the Applicant's proposed facility cannot operate without regular shipments of Co-60 sources, the transportation of the radioactive sources shipped to and from the facility, along with the transportation accidents that are an

> inevitable fact of life, appear to be connected and intertwined actions whose potential impacts may need to be examined in the final EA.

12/21/07 Board Order at 18. Again, the Board's original legal reasoning is sound.

NEPA requires the Staff to include within the scope of its environmental review all actions "connected" to the activity for which Pa'ina seeks a license. 40 C.F.R. § 1508.25(a)(1). In this case, Pa'ina's proposed facility cannot operate without regular shipments of Co-60 sources. See Final EA at 8. Those Co-60 shipments would not occur if there were no irradiator to receive them, and, likewise, the irradiator "would not be built but for the contemplated [shipments of Co-60 sources]." Thomas v. Peterson, 753 F.2d 754, 758 (9th Cir. 1985). The transportation of radioactive material to and from the proposed irradiator is "inextricably intertwined" with the operation of the facility, making them "'connected actions' within the meaning of [NEPA's] regulations," whose potential impacts the Staff was obliged to, but failed to, examine in the EA. Id. at 759.

Pa'ina's argument that the transportation of Co-60 sources to the irradiator is "a separate licensing matter" whose impacts need not be analyzed before allowing Pa'ina's irradiator to proceed, Pa'ina Statement at 9, ignores "that it would be irrational, or at least unwise, to undertake the first phase" – construction of the irradiator – "if subsequent phases" – transportation of fresh sources to the facility and removal of depleted sources – "were not also undertaken." Northwest Resources Information Center v. Oregon Natural Resources Council, 56 F.3d 1060, 1068 (9th Cir. 1995) (quoting Trout Unlimited v. Morton, 509 F.2d 1276, 1285 (9th Cir. 1974)). The construction and operation of the irradiator and the transportation of Co-60 sources "present a 'links in the same bit of chain' scenario" that obliged the Staff to consider all impacts in the EA. Id.

That other parties would have to seek coverage under a separate license to transport sources to and from Pa'ina's irradiator does not alter the analysis.[18] The Commission resolved a similar question in Louisiana Energy Services, LLP (National Enrichment Facility), CLI-06-15, 63 NRC 687 (2006), which involved claims the Staff was obliged to examine impacts associated with the disposal of depleted uranium before deciding whether to license a uranium enrichment facility. The Commission emphasized the pending proceeding was "to license a uranium enrichment facility, not a proceeding to license a near-surface waste disposal facility." Id. at 690. The Commission nonetheless recognized NEPA required the Staff "to consider the reasonably foreseeable environmental impacts of a proposed action, even if they are only indirect effects" and concluded that "[d]epleted uranium disposal from the proposed National Enrichment Facility would be an indirect effect." Id.

There was no question in Louisiana Energy Services that the Staff needed to discuss depleted uranium disposal in its NEPA analysis, even though licensing of a disposal facility was not involved. Id. at 698 ("NEPA requires ... that we consider 'reasonably foreseeable' indirect effects of the proposed licensing action"). Likewise, in this case, the Staff was obliged to include in its EA an adequate analysis of potential impacts associated with transporting Co-60 to and from the irradiator.

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[18] There is no support for Pa'ina's bald assertion there would be "[s]erious due process considerations" if the Board were to require the Staff to evaluate transportation-related impacts "without the presence of the transporting party." Pa'ina Statement at 9 n.2. It is well-established in the Ninth Circuit that "the federal government is the only proper defendant in an action to compel compliance with NEPA." Churchill County v. Babbitt, 150 F.3d 1072, 1082, as amended by 158 F.3d 491 (9th Cir. 1998). The transporting party has no "significantly protectable" interest in [the Staff's] compliance or noncompliance with NEPA," and, thus, there are no conceivable due process concerns from determining whether the Staff must consider transportation-related impacts in its EA without the participation of whoever would transport the Co-60 sources should Pa'ina be permitted to proceed with its irradiator. Id.

The Staff's related argument that "the comprehensive regulatory schemes in 10 C.F.R. Part 71 and 49 C.F.R. Parts 171-179 obviously have 'independent utility'" is a legal non sequitur. Staff Statement at 60-61. The question is not whether the regulatory schemes governing shipments of radioactive materials would cease to function if Pa'ina's irradiator were not built, but, rather, whether the specific shipments necessary to operate the irradiator would travel from their origin in Canada (if from MDS Nordion) or England (if from REVISS Services) to and from Honolulu, subject to "the transportation accidents that are an inevitable fact of life." 12/21/07 Board Order at 18; see also Staff Exh. 10: 6/20/05 Pa'ina Application for Material License at 3 (identifying source manufacturers). Clearly, they would not. These actions are "connected" – triggering the Staff's obligation to analyze all impacts – for the common sense reason "that it would be irrational, or at least unwise, to undertake the first phase" of building Pa'ina's irradiator if the "subsequent phases" of transporting fresh sources to the facility and removing depleted sources "were not also undertaken." Northwest Resources Information Center, 56 F.3d at 1068 (quoting Trout Unlimited, 509 F.2d at 1285).

Finally, Pa'ina's reliance on Public Citizen is misplaced. See Pa'ina Statement at 9-10. In that case, the Court affirmed the Federal Motor Carrier Safety Administration ("FMCSA") was obliged to evaluate "the impact on the environment which results from the incremental impact" of implementing its regulations governing safety-monitoring of Mexican motor carriers (such as increases in emissions and noise "from the increase in the number of roadside inspections ... due to the proposed regulations"), even though the Court recognized FMCSA "has no statutory authority to impose or enforce emissions controls or to establish environmental requirements unrelated to motor carrier safety." Public Citizen, 541 U.S. at 759, 761, 769 (quoting 40 C.F.R. § 1508.7). Likewise, in this case, the Staff was obliged to evaluate the

incremental impact of the additional shipments of Co-60 to and from Pa'ina's proposed irradiator, an incremental change resulting from a decision to grant Pa'ina's license application. Indeed, the case for requiring the Staff to evaluate transportation-related impacts is even stronger than in Public Citizen since the NRC has regulatory authority over licenses to transport Co-60 sources, and, thus, there are no potential issues related to "limited statutory authority over the relevant actions." Id. at 770; see also 10 C.F.R. pt. 71.

E. The Final EA Fails To Identify And Disclose Non-Safeguards Information Underlying Its Terrorism Analysis.

In Pacific Gas & Elec. Co. (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation), CLI-08-01, 67 NRC ___ (Jan. 15, 2008), the Commission noted that, pursuant to NEPA section 102(2)(C), the Staff may lawfully "withhold public disclosure of any NEPA document, in whole or in part, under the authority of [a Freedom of Information Act (FOIA)] exemption," such as FOIA exemption 1 (permitting withholding classified information) and FOIA exemption 3 (which supports withholding safeguards material). Id., slip op. at 16-17 (quoting Weinberger v. Catholic Action of Hawaii, 454 U.S. 139, 143 (1981); emphasis omitted). The Commission emphasized, however, that:

> "Ordinarily," when access to documents is disputed in FOIA litigation, "the government must submit detailed public affidavits identifying the documents withheld, the FOIA exemptions claimed, and a particularized explanation of why each document falls within the claimed exemption."

Id., slip op. at 17 (quoting Lion Raisins Inc. v. United States Dep't of Ag., 354 F.3d 1072, 1082 (9th Cir. 2004)). The Commission further stressed that, even if certain documents "include safeguards information or classified information," the Staff is required to consider whether they "might be redacted, with [non-sensitive] portions released." Id., slip op. at 18.

Based on the Commission's Diablo Canyon decision, the Board admitted the segment of Concerned Citizens' amended environmental contention 3 regarding terrorism impacts "to the extent it alleges that the Staff failed 'to disclose data underlying [its] terrorism analysis' of the proposed irradiator in the final EA and its Appendices and thereby failed to meet the NEPA-mandated 'hard look' standard." 3/4/08 Board Order at 5 (citations omitted). In so doing, the Board squarely rejected "the Staff's blanket argument that it may, without more, withhold even the identify of the documents it used to prepare its terrorism analysis in the final EA because such information is sensitive." Id. To "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," the Board ordered the Staff to "prepare a Vaughn index, including supplemental materials, for all documents it has relied on in reaching its conclusion regarding the potential effects of the creation of dirty bombs using the Cobalt-60 from the proposed irradiator" and to "turn over all releasable documents to the Intervenor." Id. at 5 & n.24. Pursuant to the Board's subsequent scheduling order, the Staff finally turned over those materials on July 31, 2008. See Concerned Citizens Exh. 16: 7/31/08 NRC Staff's Vaughn Index And Updates To Disclosures (ML082130703); see also 7/17/08 Board Order at 2.

Review of the Staff's July 31, 2008 submittal confirms the EA fails to comply with NEPA. Initially, the Staff concedes the EA's list of references omitted at least one document on which the Staff relied in preparing its analysis of terrorism-related impacts: "Decision-Making Framework for Materials and Research and Test Reactor Vulnerability Assessments, SECY-04-0222" (hereinafter "SECY-04-0222"). 7/31/08 NRC Staff's Vaughn Index And Updates To Disclosures at 1. While the Staff alleges it "refer[red] to this framework on pages B-4 and B-5 of the Pa'ina EA," there would be no way for a member of the public reviewing the EA to know

that, as the document is neither cited in Appendix B's text nor included in the list of references. Id.; see also Final EA at B-4 to B-5, B-8.

In Diablo Canyon, the Commission specified that, "[i]f the existence of a document is classified, such that disclosure of the title and a description of the contents would also be classified, then ... FOIA exemption 1 would apply and even limited information, such as the title of the document, could be withheld." CLI-08-01, slip op. at 17 n.71. That is clearly not the case here, where the Staff publicly announced SECY-04-0222's identity in its July 31, 2008 disclosures and has not otherwise "identified [any] applicable FOIA exemption(s) to justify excluding [SECY-04-0222] from the reference list." Id., slip op. at 18. The EA's failure to disclose the Staff's reliance on SECY-04-0222 and to provide at least "a general summary or description of [its] contents," id., slip op. at 17, violated NEPA's requirements to cite material incorporated by reference and to "make explicit reference by footnote to the scientific and other sources relied upon." 40 C.F.R. § 1502.24; see also id. § 1502.21.

In addition, the Staff's belated public release of redacted versions of SECY-04-0222 and another document on which Appendix B relied – the Sandia National Laboratory's "Draft Vulnerability Assessment of Material Facilities" ("Sandia Report") (ML082130714) – proves the Staff illegally withheld information from the public during the comment period on the draft EA. See 7/31/08 NRC Staff's Vaughn Index And Updates To Disclosures at 2. As the Commission stressed in Diablo Canyon, even if documents related to the analysis of terrorism-related impacts contain safeguards information or classified national security information, the Staff is obliged to disclose any "releasable portions" of those documents. CLI-08-01, slip op. at 18. The Staff violated this duty, unlawfully relying on documents not "reasonably available for inspection by

potentially interested persons within the time allowed for comment." 40 C.F.R. § 1502.21; see also NUREG-1748, § 1.6.4 (2003) (same).

The Staff's failure to make redacted versions of SECY-04-0222 and the Sandia Report available during the comment period on the draft EA precluded the "public scrutiny" that "is essential to implementing NEPA." 40 C.F.R. § 1500.1(b). Because the public had no access to the releasable portions of these documents, it was unable to point out serious flaws in the Appendix B analysis, including, for example the failure to examine:

1. the vulnerability of underwater irradiators (Concerned Citizens Exh. 17: Sandia Report at 6 (only panoramic irradiators reviewed));

2. the consequences of attacks on irradiators in highly urbanized settings like Honolulu (id. at 26-28 (all panoramic irradiators reviewed located in semi-rural or suburban settings));

3. the consequences to individuals, such as irradiator employees or emergency responders, who may be located less than "100 [meters] from the release point" (id. at 30);

4. the specific meteorology at Pa'ina's proposed site (id. at 32 ("public health and land contamination consequences from the use of [a radiological dispersal device ("RDD")] is [sic] dependent upon meteorology at the location at the time of event"));[19] and

5. the vulnerabilities of information technology systems at any irradiator (Sandia Report at 55).[20]

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[19] The Staff's observation that the Sandia Report "is concerned not with the meteorology at the irradiator site (the site from which RDD materials are taken) but with the meteorology 'at the location at the time of the event' (the 'event' being detonation of the RDD)" ignores that the irradiator site itself – located at the transportation hub for the entire state of Hawai'i, in a highly urbanized area, and near symbolic and military targets like Pearl Harbor and Hickam Air Force Base – would be a prime location for dispersing the radioactive material proposed to be stored at the site. Staff Rebuttal at 10-11 (quoting Sandia Report at 32); see also Supplemental Resnikoff Testimony at A.10; Thompson Decl. ¶¶ V-2, VI-3; 8/24/07 Resnikoff Decl. ¶¶ 18-25. Having received comments on the draft of Appendix B raising these concerns, the Staff should have, but failed to, consider the specific meteorology at Pa'ina's proposed site to assess the potential for detonation of an RDD to expose the public and environment to radiation. Since "public health and land contamination consequences from the use of an RDD [are] dependent upon meteorology at the location at the time of event," the Staff's concession it failed analyze this key factor confirms it did not take the requisite "hard look" at potential terrorism-related impacts. Sandia Report at 32.

While security concerns may justify withholding from the public certain aspects of the analysis of terrorism-related impacts, the Staff may not lawfully "prevent the public from contributing information to the decision-making process." San Luis Obispo Mothers for Peace, 449 F.3d at 1034. To permit the public to participate effectively in the NEPA process, the Staff was obliged to disclose the publicly releasable portions of "the underlying environmental data from which [its experts] derived [their] opinion[s]." ISC I, 137 F.3d at 1150. The Staff's withholding of SECY-04-0222 and the Sandia Report went to "the heart of the NEPA review process," unlawfully "insulat[ing the Staff's] decision-making process from public scrutiny" and depriving the public of information needed "to participate intelligently in the [NEPA] process." Block, 690 F.2d at 770-72; see also 40 C.F.R. §§ 1501.4(b) (agency shall involve ... the public ... in preparing [environmental] assessments"), 1502.21 (incorporation by reference may not "imped[e] agency and public review of the action;" material must be "reasonably available for inspection by potentially interested persons within the time allowed for comment").

Finally, the Staff's July 31, 2008 submittal confirms it failed to comply with NEPA's command to take a "hard look" at the consequences of licensing Pa'ina's proposed irradiator. If it had, in addition to the publicly available discussion in Appendix B, there ought to be other, non-public documents that contain the Staff's site-specific analysis of the potential terrorist threats associated with operating Pa'ina's proposed irradiator at the Honolulu International Airport, in the middle of urban O'ahu and adjacent to numerous military installations, allowing "the NRC Staff (and the Commission, on review) [to] perform[] the evaluation the Ninth Circuit

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[20] In listing these examples, Concerned Citizens does not, as the Staff claims, seek "to raise issues outside the scope of the admitted segment." Staff Rebuttal at 8. Concerned Citizens is merely providing examples of the essential public input that was precluded by the Staff's failure to disclose during the public comment period the non-sensitive information underlying its Appendix B analysis.

directed." Pacific Gas & Elec. Co., CLI-08-01, slip. op. at 9; see also id. at 25 n.98 (Commission "ultimately will review the range of terrorist events considered by the Staff"). There is, however, no indication in the EA's list of references – as supplemented by the July 31, 2008 disclosures – the Staff actually performed this site-specific analysis.

In its rebuttal statement, the Staff confirmed there are no "other documents underlying the Staff's terrorism analysis" – not a single report, memorandum, spreadsheet, or even email – containing the mandatory hard look at potential terrorism-related impacts associated with Pa'ina's proposed irradiator, much less the separate, classified appendix NUREG-1748 requires. Staff Rebuttal at 6; see also NUREG-1748, § 1.8 ("where an EA or EIS is required for a proposed action that is classified[,] ... [t]hese documents should be organized so that classified information is included in an appendix that is not made publically [sic] available while unclassified portions can be made available to the public "); 40 C.F.R. § 1507.3(c). All the Staff prepared is the cursory, conclusory discussion of potential terrorist threats set forth in Appendix B.[21] With no documentation of the Staff's analysis, there is no way for the Board to act "as a check upon the reasonableness of the NRC Staff's approach." Pacific Gas & Elec. Co., CLI-08-01, slip. op. at 25 n.98; see also Weinberger, 454 U.S. at 146 (federal agency "must consider environmental consequences in its decisionmaking process, even if it is unable to meet NEPA's public disclosure goals"). Appendix B's "generalized conclusory statements that the [potential terrorism-related impacts] are not significant or will be effectively mitigated" do not satisfy NEPA. Klamath-Siskiyou Wilderness Center, 387 F.3d at 996.

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[21] Thus, for example, there is no documentation explaining the Staff's conclusion "the assumptions used in these generic security assessments regarding irradiator design and the source term (amount of radioactive material) were representative, or conservative, relative to the design of the Pa'ina irradiator." Final EA at B-5.

F. The Staff's Failure To Disclose During The Public Comment Period The Non-Sensitive Data Underlying The EA's Analysis Violated NEPA.

The Staff's claim that its belated disclosure of the documents on which it based Appendix B's terrorism analysis somehow cured its failure to release that information during the public comment period ignores the crucial role of public scrutiny in ensuring agencies are "cognizant of all the environmental trade-offs that are implicit in a decision" to allow Pa'ina to construct and operate its proposed irradiator. Block, 690 F.2d at 771; see Staff Statement at 64; Staff Rebuttal at 6; see also 40 C.F.R. § 1500.1(b) ("public scrutiny [is] essential" to ensuring the environmental information available to decision-makers is "of high quality"). As the Ninth Circuit emphasized in San Luis Obispo Mothers for Peace, "that the public cannot access the resulting information does not explain the NRC's determination to prevent the public from contributing information to the decisionmaking process." 449 F.3d at 1034. For public review to serve NEPA's purposes, references like the documents the Staff belatedly released must be "reasonably available for inspection by potentially interested persons within the time allowed for comment." 40 C.F.R. § 1502.21. The Staff cannot cure its prior omission by releasing documents over a year after the close of the public comment period on Appendix B. See 72 Fed. Reg. 31,866 (June 8, 2007) (public comment period on Appendix B closed July 9, 2007).

As detailed above, if the public had access to these documents during the comment period on the draft EA, it would have had the opportunity to highlight many deficiencies, prompting the Staff to improve upon its analysis, as NEPA intended. Providing improperly withheld documents to Concerned Citizens long after the close of the public comment period cannot cure the Staff's violations of its obligations to "[m]ake diligent efforts to involve the public in preparing and implementing [its] NEPA procedures" and to inform all "persons and agencies who may be interested" in Pa'ina's irradiator proposal. 40 C.F.R. § 1506.6(a), (b). The

prejudice caused by the Staff's failure to disclose these documents to the public at large can be cured only by a new public comment period on remand, following a Board ruling the Staff violated NEPA.

Moreover, while some of the information related to the Staff's analysis of terrorism impacts is protected from public disclosure due to the sensitive, security-related matters involved, the same cannot be said of the large volume of information regarding more mundane matters like aviation accidents and natural disasters that the Staff likewise withheld from the public during the comment period on the draft EA and subsequently failed to disclose in the final EA. Had Concerned Citizens not challenged the adequacy of the EA, the Staff would never have disclosed, among other information:

1. the CNWRA's responses to Dr. Marvin Resnikoff's critique of its estimate of the likelihood Pa'ina's proposed irradiator would be involved in an aviation accident (Staff Statement at 28-31; Staff Exh. 2: CNWRA Testimony at A.15-A.17; Staff Exh. 30: NRC and DOE Comparison of Crash Rates);
2. the CNWRA's response to Dr. Resnikoff's claim the Staff needed to quantify the impact of flying airplane and building debris following an aviation accident to determine if sources would be breached (Staff Statement at 31-32; CNWRA Testimony at A.19);
3. the calculations the Staff performed for the potential radiation dose associated with a loss of shielding water from the irradiator pool to the level of the

surrounding groundwater (i.e., an eight-foot loss) (Staff Statement at 32-33, 53; Blevins Testimony at A.21);[22]

4. the CNWRA's response to Dr. Resnikoff's claim an airplane explosion could remove shielding water from the irradiator pool (Staff Statement at 33; CNWRA Testimony at A.22);

5. the CNWRA's response to Dr. Resnikoff's claim the force of falling airplane or building debris could pulverize Co-60 sources, allowing dispersal of radioactive contamination through a breach in the pool lining (Staff Statement at 34; CNWRA Testimony at A.23-A.24);

6. the CNWRA's response to Dr. Resnikoff's claim the loss of personnel and monitoring equipment from an aviation accident could result in increased radiation exposures to facility personnel and emergency responders (Staff Statement at 35; CNWRA Testimony at A.25);

7. the CNWRA's justification for failing to evaluate tsunami and hurricane-related storm surge runup through numerical modeling and to take into account unique features of Ke'ehi Lagoon that might amplify potential runup (Staff Statement at 38-41; CNWRA Testimony at A.30-A.39);

8. the fluid dynamics calculations the CNWRA performed to evaluate the potential for removal of a Co-60 as the result of a tsunami or hurricane-generated wave

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[22] The EA discusses only the potential radiation dose associated with a six-foot loss of shielding water, which is more than an order of magnitude less than the potential dose associated with an eight-foot loss. Compare Concerned Citizens Exh. 14: "Microshield Summary Sheet for Loss of 8 Feet of Water Shielding" (run date May 9, 2007) (ML072630315) with Final EA at 9; see also Staff Statement at 53 (admitting calculations of impact of loss of shielding water to the level of the surrounding groundwater were revealed only after EA finalized).

(Staff Statement at 38; CNWRA Testimony at A.36; Staff Exhibit 58: K. Das Scientific Notebook);

9. the CNWRA's response to Dr. Pararas-Carayannis' critique of the failure to consider the impact of tsunami- or hurricane-induced flooding, including, but not limited to, increases in irradiator pool buoyancy (Staff Statement at 39-40, 42-45; CNWRA Testimony at A.35 to A.38);[23]

10. the CNWRA's response to Dr. Pararas-Carayannis' critique of the failure to consider potential focusing effects of seismic energy on O'ahu (Staff Statement at 41; CNWRA Testimony at A.33);

11. the CNWRA's response to Dr. Pararas-Carayannis' critique of the failure to consider the threat of liquefaction (Staff Statement at 42; CNWRA Testimony at A.34);

12. the Staff's explanation for its conclusions regarding likely occupational and public dose rates under situations involving normal operations (Staff Statement at 47-49; Blevins Testimony at A.12-A.11); and

13. the Staff's explanation for its conclusions regarding likely occupational and public dose rates in the event of a loss of shielding water or other accidents (Staff Statement at 53-55; Blevins Testimony at A.19-A.25).

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[23] Dr. Pararas-Carayannis' critique focused on only the Staff's failure to consider the significant increase in "buoyancy pressure at the foundation level ... under hurricane surge [and tsunami-induced] flooding conditions" and the need to perform a "buoyancy assessment of the proposed irradiator pool for various flooding levels ... to ensure the pool (1) will maintain its integrity (i.e., not be breached) and (2) will not tilt, losing vital shielding water and possibly damaging the Cobalt-60 sources." Concerned Citizens Exh. 2: 2/07 Pararas-Carayannis Report at 9; see also id. at 11, 17-18; Pararas-Carayannis Testimony at A5. Dr. Pararas-Carayannis did not suggest flooding could "cause a source to float out of the irradiator pool," as the Staff claims. Staff Statement at 39; see also Pararas-Carayannis Testimony at A5.

There is no excuse for the Staff's decision to withhold from the public this vital information, which violated NEPA's mandate "that the public receive the underlying environmental data from which [the Staff's experts] derived [their] opinion[s]." ISC I, 137 F.3d at 1150; see also 40 C.F.R. § 1502.21 (material on which Staff's analysis relied must be "reasonably available for inspection by potentially interested persons within the time allowed for comment").

This case is easily distinguished from Western Watersheds Project, which the Staff cites for the proposition that an agency need not "support every assertion in an EA with reference to data, authorities, or explanatory information." Staff Statement at 20. In Western Watersheds Project, the plaintiff had failed to identify "any specific portion of the EA that is not supported by scientific research." 552 F. Supp. 2d at 1129. Here, in contrast, Concerned Citizens' contentions detailed the specific aspects of the EA where the Staff's statements or implicit assumptions are unsupported by reference to any data or calculations.

Moreover, unlike Western Watersheds Project, where "the EA include[d] a lengthy list of references" that led the court to conclude "the EA meets the minimum requirement necessary," the EA for Pa'ina's irradiator failed to give the public any leads to track down the data and analyses on which the Staff now claims it based its conclusions. Id. at 1129-30.[24] Even if the Staff did, in fact, conduct the inquiry it now describes in its testimony (the adequacy of which Concerned Citizens will address below), its failure to disclose any of this information during the EA process precluded the public scrutiny on which NEPA relies. See 40 C.F.R. § 1500.1(b). Moreover, the Staff's failure to incorporate any details of its analysis in the EA defeated NEPA's "informational role." Public Citizen, 541 U.S. at 768.

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[24] Notably, even though the Western Watersheds Project court concluded the EA met minimum standards, it still cautioned that, "to avoid possible [NEPA] violations in the future," the defendant agency should "make explicit reference to the scientific and other sources relied upon for conclusions in the environmental document." Id. at 1130.

G. The Staff's Post Hoc Defense Fails To Remedy The EA's Deficiencies.

As discussed above, under well-settled Ninth Circuit law, the Board should reject the Staff's post hoc attempts to address the EA's deficiencies, since the EA itself "is where the [Staff's] defense of its position must be found." Blue Mountains Biodiversity Project, 161 F.3d at 1214. Even if the Board could consider the Staff's testimony, it should still find the Staff failed to comply with NEPA's command to take a hard look at the potential impacts of Pa'ina's proposed irradiator. Like the EA, the Staff's testimony reflects an unlawful reliance on "conclusory statements unsupported by data, authorities, or explanatory information." Western Watersheds Project, 552 F. Supp. 2d at 1129.

As discussed in the testimony of Professor Sozen and Drs. Pararas-Carayannis and Resnikoff, the Staff improperly asks the Board to accept on its experts' say-so, with no supporting data or calculations, that:

1. in the event of an airplane crash involving Pa'ina's proposed irradiator, debris "would prevent inadvertent access to the area of elevated radiation above the irradiator pool ... by acting as a physical barrier" (Blevins Testimony at A.24);[25]

[25] As Professor Sozen explains, the simulation he prepared with Professor Christoph Hoffmann "does not purport to predict the state of aircraft and building debris after impact in the specific scenario analyzed, much less the nearly infinite possible accident permutations that might involve the proposed irradiator." Sozen Testimony at A.3. Consequently, Mr. Blevins' reliance on that simulation to establish that access to areas of elevated radiation adjacent to the irradiator pool would be blocked by debris "is unjustified." Id.

Moreover, as Dr. Resnikoff notes, Mr. Blevins fails to account for the fact that, "even if debris initially did block access to the irradiator pool following an accident, it is only reasonable to expect that irradiator workers and emergency responders would eventually remove that debris so they could access the pool and inspect it for damage" and, in so doing, run the risk of exposure to excessive radiation. Supplemental Resnikoff Testimony at A.4.

2. "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" (CNWRA Testimony at A.16);[26]

3. "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," (CNWRA Testimony at A.19);[27]

4. "[i]f the debris pierces the pool liner, it will not thereafter have sufficient force to damage a source" (CNWRA Testimony at A.19);[28]

5. "even if debris struck a source and the source's encapsulation was breached, the source would remain intact" and, thus, "no radioactive material would be released into the environment" (CNWRA Testimony at A.19);[29]

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[26] The CNWRA staff asserts its conclusion relies on "numerous factors," such as "size, weight, fuel capacity and flight speed," but does not actually present any analysis of those factors. Id. As Dr. Resnikoff explains, the CNWRA's "unsubstantiated assertions would never stand up to peer review." Resnikoff Rebuttal Testimony at 2.

[27] As Dr. Resnikoff explains, had the CNWRA staff performed the necessary calculations, it would have found it requires little force to pierce the irradiator pool liner, allowing vital shielding water to escape. Resnikoff Rebuttal Testimony at 3 & Exh. 22; cf. Asarco, Inc. v. United States Environmental Protection Agency, 616 F.2d 1153, 1160 (9th Cir.1980) ("to determine whether the agency took into consideration all relevant factors," reviewing court may "look[] outside the record to determine what matters the agency should have considered but did not"); Animal Defense Council v. Hodel, 840 F.2d 1432, 1436 (9th Cir. 1988) (inquiry outside record appropriate "to explain technical terms or complex subject matter involved in the agency action"). As Professor Sozen emphasizes, "categorically rul[ing] out the potential for the irradiator pool and sources to be breached and for radioactive Cobalt-60 to be introduced into the human environment without first performing detailed calculations of the forces involved ... is scientifically indefensible." Sozen Testimony at A.4

[28] Dr. Resnikoff's calculations demonstrate that, in fact, the impact associated with an aviation accident would far exceed the standards applicable to the Co-60 sources Pa'ina proposes to use. Resnikoff Rebuttal Testimony at 3-4 & Exh. 23; see also Sozen Testimony at A.4.

6. "[i]t is not foreseeable that an aircraft would explode directly above the irradiator pool" (CNWRA Testimony at A.22);[30]

7. "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" (CNWRA Testimony at A.22);[31]

8. "if the liner were breached below the water table, the pool would refill with ten feet of water" (CNWRA Testimony at A.22);[32]

9. in the event of a fuel fire following an aviation accident, "water evaporation would be minimal" and "dose rates would not increase significantly" (CNWRA Testimony at A.22);

10. even if all water were removed from the irradiator pool, "doses to workers very near the edges of the pool would not increase significantly" (id.);[33]

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[29] As Dr. Resnikoff notes, the CNWRA staff "simply has not performed the calculations necessary to back up [its] assertions." Resnikoff Rebuttal Testimony at 4.

[30] As discussed in Dr. Resnikoff's testimony, the CNWRA staff had no basis for reaching this conclusion based on the mere fact "there has not been an aircraft explosion anywhere at [Honolulu International Airport] in at least 45 years." Id.; see also Resnikoff Rebuttal Testimony at 5-6 & Exh. 27.

[31] As Dr. Resnikoff explains, determining how much water could be removed from the irradiator pool in the event of an explosion involves a complicated analysis the CNWRA apparently has not performed. See Supplemental Resnikoff Testimony at A.8.

[32] The CNWRA staff's analysis relies on unsubstantiated assumptions about the speed with which groundwater would refill the pool through a breach in the pool liner. See Resnikoff Rebuttal Testimony at 6. Moreover "even if inflows of groundwater did refill the pool, Dr. Durham ignores that a drop in shielding water to the level of surrounding groundwater still poses threats of excessive radiation exposures to irradiator personnel and emergency responders," with emergency responders receiving doses in excess of Part 20 limits in less than 43 seconds. Id.; see also id. at 3; Supplemental Resnikoff Testimony at A.3.

[33] As an initial matter, even though the CNWRA conceded that removal of all water from the pool would result in "a high dose of radiation emitted," it never quantifies what that dose would be. Id. Moreover, it fails to justify its assumption that doses to workers near the edges of

11. "'pulverizing' the Co-60 sources is all but impossible" and, "[e]ven 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" (CNWRA Testimony at A.23);[34]

12. "[i]t 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" (CNWRA Testimony at A.24);[35]

13. "[i]t is highly unlikely the component would be moving fast enough to breach the pool liner" (CNWRA Testimony at A.24);[36]

14. "[i]ncreased buoyancy, whether of the sources or the pool itself, would not cause ... a loss of control" of radioactive material (CNWRA Testimony at A.31);[37]

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the pool would not increase significantly. See Resnikoff Rebuttal Testimony at 4-5 & Exhs. 24-25; Supplemental Resnikoff Testimony at A.3-A.5.

[34] As Dr. Resnikoff explains, the CNWRA has no basis for its statement, since it failed to perform any calculations of the force with which falling aircraft debris would strike the plenum. Resnikoff Rebuttal Testimony at 3-4. In contrast, Dr. Resnikoff did perform such calculations, which show the impact associated with an aviation accident would far exceed the standards the Co-60 must meet. Id. at 4 & Exh. 23; see also Supplemental Resnikoff Testimony at A.9.

[35] As noted previously, the CNWRA did not perform any calculations to back up its claim, which Dr. Resnikoff's calculations disprove. See Resnikoff Rebuttal Testimony at 4 & Exh. 23.

[36] Dr. Resnikoff's calculations demonstrate that the impact of airplane debris could easily breach the pool liner. See Resnikoff Rebuttal Testimony at 3 & Exh. 22.

[37] As Dr. Pararas-Carayannis explains, "[t]he CNWRA and NRC Staff should have, but failed to, perform a buoyancy assessment of the proposed irradiator pool for various flooding levels to ensure the pool (1) will maintain its integrity (i.e., not be breached) and (2) will not tilt, losing vital shielding water and possibly damaging the Co-60 sources." Pararas-Carayannis Testimony at A5. "A prudent and thorough analysis of the safety of a critical structure such as an irradiator should not merely assume away these potential risks, as the CNWRA apparently did." Id.

15. "the possibility of liquefaction during an earthquake is ... speculative" (CNWRA Testimony at A.34);[38]

16. compliance with International Building Code requirements will ensure "Pa'ina takes into account any factors that could increase the potential for liquefaction" (CNWRA Testimony at A.34);[39] and

17. in the event of major flooding, there would not "be an increase in buoyancy sufficient to cause the pool to lift and tilt, thereby spilling water" (CNWRA Testimony at A.38).[40]

These mere "narratives of expert opinions," bereft of supporting data or calculations, are "inadequate" to satisfy NEPA. Klamath-Siskiyou Wildlands Center, 387 F.3d at 996.

The Staff's failure to back up its "generalized conclusory statements that the effects are not significant" is most striking when the Staff concedes the potential for radiation exposures and then fails to quantify those potential impacts. Id. To justify its FONSI, the EA relies on the Staff's assertion that, even if an aviation accident or natural disaster caused vital shielding water to escape from the irradiator pool, any increased dose rate would be "in a well collimated beam

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[38] As Dr. Pararas-Carayannis notes, the extremely low blow counts in Pa'ina's geotechnical report indicate "a substantial risk of liquefaction from an earthquake," even a relatively small one. Pararas-Carayannis Testimony at A9. Since the CNWRA did not conduct a proper soil analysis and plasticity study, "there is no scientifically defensible basis to conclude the site is safe from liquefaction." Id. In general, the CNRWA's discussion of earthquake risks "is at odds with basic principles pertaining to seismology and to Hawai'i's seismic potential and history." Id. at A8.

[39] Dr. Pararas-Carayannis explains why "mere compliance with whatever building code happens to be in effect is no guarantee of safety." Pararas-Carayannis Testimony at A10. Rather, "[d]etailed analysis of the soil conditions at the specific site Pa'ina proposes" – which was not performed – "is vital to assess whether public safety would be threatened in the event of an earthquake." Id.

[40] As noted above, because the CNWRA failed to conduct any buoyancy assessment of the proposed irradiator pool for various flooding levels, there is no basis for this assertion. Pararas-Carayannis Testimony at A5.

directly above the pool," avoiding any "significant environmental effect on the area surrounding the proposed facility." Final EA at 9. The CNWRA staff acknowledges, however, "the possibility of skyshine," which would result in "radiation scattered from the [well collimated] beam," raising the obvious question what those increased radiation doses might be. CNWRA Testimony at A.20.[41] Rather than perform the necessary calculations to quantify the extent to which skyshine would result in increased radiation exposures, the CNWRA staff baldly asserts it "would be minimal." CNWRA Testimony at A.20; see also Resnikoff Rebuttal Testimony at 5. "General statements about possible effects and some risk do not constitute a hard look absent a justification regarding why more definitive information could not be provided." Klamath-Siskiyou, 387 F.3d at 994 (quoting Neighbors of Cuddy Mountain, 137 F.3d at 1380. If it is possible objectively to quantify an impact, NEPA requires that the agency do so. Id. The Staff failed to comply with this mandate.

In addition to containing conclusory statements, the testimony the Staff proffers to address the EA's deficiencies is grounded in assumptions that fly in the face of common sense and experience. For example, the Staff's claim irradiator personnel and emergency responders would not be exposed to the beam of high-level radiation emitting from the pool following a loss of shielding water assumes that, in the wake of an accident or natural disaster, responders would at all times remain back from the edge of the pool and would never bend over the 42-inch lip.

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[41] Since (1) a loss of shielding water to the level of the surrounding water table would result in a dose at the pool's edge of approximately 8.5 rem/hour, (2) the maximum dose for members of the public is only 0.1 rem/year, (3) an individual standing next to the irradiator pool following a loss of shielding water to the level of groundwater would exceed the maximum dose for members of the public in less than 43 seconds, and (4) emergency responders are considered "members of the public" for purposes of regulating radiation exposures, the potential for excessive doses from "skyshine" is clear. See Resnikoff Rebuttal Testimony at 5; Supplemental Resnikoff Testimony at A.3; 10 C.F.R. §§ 20.1003 (definition of "member of the public"), 20.1301(a)(1), (b) (dose limits for individual members of the public).

See Staff Exh. 25: Schematic Collimated Beam; Resnikoff Rebuttal Testimony at 4. These are completely unrealistic assumptions since irradiator personnel and emergency responders would be inspecting the irradiator for damage and seeking to restore the shielding water, activities that inevitably would involve exposures to the collimated beam. Resnikoff Rebuttal Testimony at 4; Supplemental Resnikoff Testimony at A.4; Sozen Testimony at A.3.

Furthermore, the CNWRA's analysis assumes the irradiator lip would remain intact following a catastrophic aviation accident. As Gray*Star Vice President and Chief Operating Officer Russell N. Stein previously explained, however, the pool lip is made of only ¼-inch stainless steel and is designed to be "sacrificial" in a disaster scenario. Concerned Citizens Exh. 24: 3/5/07 Stein Decl. at 6. Following an aviation accident, there likely would be no lip to block any portion of the collimated beam, which consequently would be substantially wider than as depicted in the Staff's schematic. See Concerned Citizens Exh. 25: Modified Schematic Collimated Beam; Resnikoff Rebuttal Testimony at 5; Supplemental Resnikoff Testimony at A.3.[42] Anyone approaching the pool following an accident would likely be exposed to excessive radiation. See Resnikoff Rebuttal Testimony at 5; Supplemental Resnikoff Testimony at A.3.[43] "[P]lain common sense indicate[s] that it was hardly 'reasonable' for [the Staff] to conclude, without further study, that the environmental impact of [such accidents would] be insignificant." City of Davis v. Coleman, 521 F.2d 661, 675 (9th Cir. 1975).

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[42] Even if the pool lip somehow survived the impact of the crash, the CNWRA staff fail to justify its assumption no additional radiation would pass through the ¼-inch lip, resulting in heightened radiation exposures. Resnikoff Rebuttal Testimony at 5.

[43] If the shielding water were to drain to the level of the surrounding water table, the dose at the irradiator pool's edge would be approximately 8.5 rem/hour. Supplemental Resnikoff Testimony at A.3. In only thirty-five minutes, any irradiator personnel on the scene would be subjected to more than the annual occupational dose limit of 5,000 millirem/year. Id. Emergency responders – who, as noted above, are considered members of the public for regulatory purposes – would exceed the 0.1 rem/year maximum dose in less than 43 seconds. Id.

The CNWRA staff made similarly illogical assumptions in assessing situations in which increased buoyancy from flooding or liquefaction in an earthquake causes the irradiator pool to tilt. The CNWRA staff acknowledges that, even if such natural disasters did not cause the irradiator pool to rupture, the tilting alone could allow vital shielding water to escape. CNWRA Testimony at A.31, A.34. It nonetheless asserts that, since the sources would remain "partially shielded by water, ... there would be no radiological impact." Id. at A.34.

The CNWRA staff ignores that, if the irradiator pool were to tilt, the collimated beam of radiation would no longer point primarily skyward. Resnikoff Rebuttal Testimony at 7. Rather, as the pool tilts, the beam would be directed increasingly parallel to the ground, increasing the risk of exposing facility personnel and emergency responders to the increased levels of radiation resulting from the loss of shielding water. Id.; see also Concerned Citizens Exh. 28: Schematic Collimated Beam with Tilting. Because the CNWRA staff neglected this logical consequence of tilting, it failed to perform any calculations regarding the potential change in angle of the collimated beam due to tilting of the pool or to quantify the potential radiation doses that facility personnel or emergency responders exposed to that modified beam might receive, rendering completely unsubstantiated its assertion there is no potential for radiological impact. Resnikoff Rebuttal Testimony at 7; Pararas-Carayannis Testimony at A5.

As Dr. Pararas-Carayannis explains in his testimony, the Staff's analysis of potential impacts associated with natural disasters suffers from additional deficiencies that were not remedied by its post hoc testimony, including failures to conduct numerical modeling of tsunami and storm surge runup and to evaluate the unique features of Ke'ehi Lagoon that could increase the potential for tsunami- or hurricane storm surge-related impacts. See Pararas-Carayannis Testimony at A4, A7. In addition, the CNWRA's analysis of risks from earthquakes, which the

Staff incorporated into its EA, was based on faulty assumptions about potential focusing effects of seismic energy on O'ahu, the potential for liquefaction, and risks of damage from enhanced ground motions even in the absence of liquefaction, which are "at odds with basic principles pertaining to seismology and to Hawai'i's seismic potential and history." Id. at A8; see also id. at A9.

In reviewing the Staff's EA, the Board must "ensure that the agency has adequately considered and disclosed the environmental impact of its actions." Exelon Generation Co., LBP-04-821, 62 NRC at 151-52 (quoting Coalition on Sensible Transportation, Inc. v. Dole, 826 F.2d 60, 66 (D.C. Cir. 1987)); see also Marsh v. Oregon Natural Resources Council, 490 U.S. 360, 378 (1989) (court makes "searching and careful" inquiry to ensure the Staff's decision is "founded on a reasoned evaluation 'of the relevant factors'"). The testimony the Staff submitted with its initial statement is neither reasoned nor considers all relevant factors, since it fails to support with hard data its conclusory assertions regarding vital issues and ignores real world factors threatening excessive radiation exposures in the event of a loss of shielding water. It falls far short of providing the requisite hard look at potential impacts.

H. The Staff Unlawfully Failed To Back Up Its Speculation The Irradiator Would Not Impact Tourism.

Even if the Board could properly look beyond the EA for evidence the Staff took a hard look at tourism-related impacts, the testimony of former Office of Nuclear Materials Safety and Safeguards Senior Project Manager Matthew Blevins would not cure the EA's deficiencies. See 40 C.F.R. § 1508.8 (agency must consider economic and social impacts, "whether direct, indirect, or cumulative"). Review of Mr. Blevins' resume reveals he has no education, background or other expertise that would enable him to perform a reliable analysis of the

potential economic and social impacts resulting from a disruption of tourism. See Staff Exh.4. The Board therefore has no basis to conclude his uninformed assessment of those impacts satisfied the Staff's obligation to provide "'a convincing statement of reasons' ... why [Pa'ina's] project's impacts are insignificant." Blue Mountains Biodiversity Project, 161 F.3d at 1212 (quoting Save the Yaak Comm., 840 F.2d at 717).

In addition, there is no indication Mr. Blevins actually performed any rigorous analysis of the issue; his testimony suggests he simply eyeballed the situation and wrote down whatever struck him as sensible. See Blevins Testimony at A.26. NEPA requires far more than that, mandating agencies to "identify any methodologies used and ... make explicit reference by footnote to the scientific and other sources relied upon for [their] conclusions." Western Watersheds Project, 552 F. Supp. 2d at 1129. Even if Mr. Blevins possessed the necessary expertise (and he does not), his unsupported, "generalized conclusory statements that the effects are not significant" would not pass muster. Klamath-Siskiyou Wilderness Center, 387 F.3d at 996.

Apparently recognizing the deficiencies of Mr. Blevins' analysis, the Staff argues that, even if inadequate, it is immaterial because NEPA does not require examination of "a psychological factor that is not connected to any environmental impact." Staff Statement at 56. While the Staff may have limited its inquiry to the potential that "tourists may choose not to visit Hawaii because of the fear of an accident involving Pa'ina's irradiator," that is only one aspect of the issue. Id. Many public comments on the draft EA focused on the potential disruption of Hawai'i's main economic engine – tourism – in the event of an accident at Pa'ina's irradiator that forced the closure of runways at Honolulu International Airport, the primary gateway to the state. See, e.g., Concerned Citizens Exh. 2: 2/8/07 Earthjustice Letter at 6 ("accident [involving

Pa'ina's irradiator] would have significant economic impacts, disrupting the major port of entry to the entire state of Hawai'i"); Concerned Citizens Exh. 10: 7/6/07 Resnikoff Report at 5 ("A closure of vital runways could ... disrupt Hawai'i's main economic engine, tourism"); Concerned Citizens Exh. 29: 2/1/07 Transcript at 87:20-88:17 (raising concerns about threats to "billion dollar tourist business" in event of "accidents, leaks, spills, et cetera"). Since there would be a "close causal relationship between a change in the physical environment" resulting from an accident involving Pa'ina's irradiator that shut down runways at Honolulu International Airport and the social and economic impacts from disrupting Hawai'i's tourist trade, the Staff was obliged to take a hard look at those potential impacts in its EA. Metropolitan Edison Co. v. People Against Nuclear Energy, 460 U.S. 766, 774 (1984). It failed to do so.

X. AMENDED ENVIRONMENTAL CONTENTION #4: THE FINAL EA FAILS TO CONSIDER REASONABLE ALTERNATIVES

In enacting NEPA, Congress intended that all federal agencies, including the NRC, would consider in their review of project proposals "choices or alternatives that might be pursued with less environmental harm." Lands Council, 395 F.3d at 1027. "[C]onsideration of alternatives is critical to the goals of NEPA even where a proposed action does not trigger the EIS process." Bob Marshall Alliance, 852 F.2d at 1228-29; see also 40 C.F.R. § 1508.9(b); Sierra Club v. Watkins, 808 F. Supp. 852, 871 (D.D.C. 1991) (40 C.F.R. § 1508.9(b) "is an independent requirement of an EA, separate from its function to provide evidence that there is no significant impact"). Accordingly, the Ninth Circuit has held agencies must consider in their EAs "all possible approaches to a particular project ... which would alter the environmental impact and the cost-benefit balance." Bob Marshall Alliance, 852 F.2d at 1228 (quoting Calvert Cliffs' Coordinating Comm., Inc. v. United States Atomic Energy Comm'n, 449 F.2d 1109, 1114

(D.C. Cir. 1971)); see also Soda Mountain Wilderness Council v. Norton, 424 F. Supp. 2d 1241, 1263 (E.D. Cal. 2006) (EA's discussion of alternatives "enables an agency, and the public it serves, to evaluate whether the government has other options it could take that might be less damaging to the natural environment").[44]

"[T]he evaluation of 'alternatives' mandated by NEPA is to be an evaluation of alternative means to accomplish the general goal of an action; it is not an evaluation of the alternative means by which a particular applicant can reach his goals." Van Abbema v. Fornell, 807 F.2d 633, 638 (7th Cir. 1986); see also Muckleshoot Indian Tribe v. U.S. Forest Serv., 177 F.3d 800, 812 (9th Cir. 1990) (quoting City of Carmel-by-the-Sea v. U.S. Dep't of Trans., 123 F.3d 1142, 1155 (9th Cir. 1997)) ("the stated goal of a project necessarily dictates the range of reasonable alternatives"). The scope of alternatives is defined by "what is 'reasonable' rather than on whether the proponent or applicant likes or is itself capable of carrying out the particular alternative." 46 Fed. Reg. 18,026, 18,027 (Mar. 23, 1981); see also Save Our Cumberland Mountains v. Kempthorne, 453 F.3d 334, 345 (6th Cir. 2006) (NEPA "prevents federal agencies from effectively reducing the discussion of environmentally sound alternatives to a binary choice between granting or denying an application."). Thus, while Pa'ina may prefer to operate a nuclear irradiator and locate it at the airport, the EA's analysis of alternatives must focus on the general goal of the undertaking: to treat "fresh fruit and vegetables bound for the mainland from

[44] While "an agency's obligation to consider alternatives under an EA" may be "a lesser one than under an EIS," that does not mean that, in preparing the EA for Pa'ina's proposed irradiator, the Staff was free to ignore reasonable alternatives or to present a deficient analysis of the alternatives it did consider. Native Ecosystems Council v. United States Forest Service, 428 F.3d 1233, 1246 (9th Cir. 2005). "[W]hether an agency is preparing an EIS or an EA, ... NEPA 'requires that alternatives ... be given full and meaningful consideration.'" Id. at 1245 (quoting Bob Marshall Alliance, 852 F.2d at 1229). Thus, while the Ninth Circuit may not demand that an EA consider any minimum number of alternatives, it has held that NEPA requires "an appropriate explanation ... as to why an alternative was eliminated." Id. at 1246.

the Hawaiian Islands and similar products being imported to the Hawaiian Islands." 71 Fed. Reg. at 78,231.

Even if the Board concludes it should follow the D.C. Circuit's approach in Citizens Against Burlington v. Busey, 938 F.2d 190 (D.C. Cir. 1991), in which an agency "must evaluate alternative ways of achieving [the applicant's] goals," id. at 199, it is clear NEPA requires the Staff to evaluate different ways to achieve "the purposes of the project." Trout Unlimited v. Morton, 509 F.2d 1276, 1286 (9th Cir. 1974); see also Hydro Resources, Inc., CLI-01-04, 53 NRC 31, 55 (2001) (reasonable alternatives are ones that "satisfy the goals of the project"). The EA broadly defines the project's purposes as "satisfy[ing] several needs related to the control of invasive pest species:"

- Centrally located treatment of Hawaiian products for export,
- Centrally located treatment of products for import to Hawaii,
- Sterilization of fruit fly pupae for preventative release programs, and
- Use as a research tool.

Final EA at 6. These purposes are broadly defined and do not dictate consideration of only one technology and one location, which is effectively all the EA evaluated.[45]

The EA violates NEPA's command to consider reasonable alternatives that would avoid potential impacts inherently associated with Pa'ina's preferred technology (a Co-60 irradiator) and location (a site subject to aviation accidents and natural disasters, located adjacent to attractive terrorist targets). It leaves members of the public concerned about Pa'ina's proposed

[45] With respect to location, this case is easily distinguished from Hydro Resources, in which the Commission found it was proper, in identifying reasonable alternatives for a proposed in situ leach mining project, to take into account the locations where the applicant "owns land" and "the ore body is located." CLI-01-04, 53 NRC at 55. Pa'ina not only does not own the land where it proposes to locate its irradiator, but has not yet even secured a lease for the property. See 2/2/09 Pa'ina Lease Update. Moreover, the record makes clear there are alternate sites where Pa'ina could locate its irradiator, including ones that might have "commercial advantages" over the currently proposed site. Concerned Citizens Exh. 20: 8/28/06 Email from Michael Kohn (Pa'ina) to Jack Whitten (NRC) at 1 (ML062770248).

irradiator completely in the dark regarding why the Staff refused to evaluate these alternatives, defeating Congress' intent in enacting NEPA to "put on the table, for the [NRC's] and the public's view, a sufficiently detailed statement of environmental impacts and alternatives so as to permit informed decision making." Lands Council, 395 F.3d at 1027.[46]

A. The Final EA Fails Adequately To Consider Alternate Technologies.

The Staff's claim the few lines the EA devotes to methyl bromide fumigation and heat treatment – the only alternate quarantine control technologies the EA mentions – "thoroughly considered" those alternatives begs the question what, in the Staff's mind, would constitute an inadequate analysis. Staff Statement at 71. The EA's cursory mention of these control technologies provides no information, for example, quantifying the potential impact on the Earth's ozone layer of the quantities of methyl bromide that would be needed to treat Hawaiian fruits or identifying any potential adverse effects associated with the use of heat treatment. See Final EA at 12. The EA's alternatives analysis fails to "[r]igorously explore and objectively evaluate" the relative environmental costs and benefits of using these technologies in lieu of building and operating a Co-60 irradiator. Morongo Band of Mission Indians v. Federal Aviation Admin., 161 F.3d 569, 575 (9th Cir. 1998) (quoting 40 C.F.R. § 1502.14). The EA neither "fosters informed decision-making" nor "informed public participation," violating

[46] Save Our Cumberland Mountains does not, as the Staff claims, establish a broad rule that an EA need not discuss alternatives as long as "it is obvious from the administrative record that the agency considered those alternatives in its decisionmaking process." Staff Statement at 67. Noting its "reluctan[ce] to excuse procedural violations of a procedural statute," the Sixth Circuit found the unique facts before it – in which the EA "identified considerable other information that normally would fall under the heading of 'alternatives'" – made the case "one of those rare instances in which it is appropriate." Save Our Cumberland Mountains, 453 F.3d at 348 (emphasis added). To the extent Save Our Cumberland Mountains does not require an EA to consider "all reasonable alternatives" and provide "an appropriate explanation ... as to why an alternative was eliminated," it is inconsistent with binding Ninth Circuit precedent. Native Ecosystems Council, 428 F.3d at 1246.

NEPA's basic purpose. Morongo Band, 161 F.3d at 575 (quoting City of Angoon v. Hodel, 803 F.2d 1016, 1020 (9th Cir. 1986)); see also 40 C.F.R. § 1500.1(b) ("Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA").

Implicitly recognizing the deficiency of its analysis, the Staff now claims it "ultimately determined that these alternatives would not meet the purpose of the proposed action," a statement that appears nowhere in the EA. Staff Statement at 71. Since the EA itself "is where the [Staff's] defense of its position must be found," the Board should refuse to consider this post hoc argument. Blue Mountains Biodiversity Project, 161 F.3d at 1214.

Even if the Board were to reach the merits of the Staff's newly minted claim, it should reject it. While methyl bromide and heat treatment may not be appropriate for all fruits Pa'ina might want to treat, an agency cannot "disregard alternatives merely because they do not offer a complete solution to the problem." Natural Resources Defense Council v. Hodel, 865 F.2d 288, 296 n.4 (D.C. Cir. 1988) (Bader Ginsberg, J.); see also City of Carmel-by-the-Sea, 123 F.3d at 1159 (agency must consider alternatives that do not "fulfill[] all goals completely"). The extent to which an alternative can accomplish the project's goals is merely one factor in selecting the best course of action. See Natural Resources Defense Council, 865 F.2d at 296 n.4.[47]

The Staff's claim the only two alternate control technologies the EA mentioned are "inappropriate for Pa'ina's intended use" serves only to highlight the impropriety of its failure to discuss in the EA the only alternate technology it knew "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

[47] The EA fails to identify the "certain Hawaiian tropical fruits" that cannot be treated with methyl bromide or analyze the percentage of the total product volume Pa'ina plans to treat that such fruits represent, deficiencies that render it impossible to assess the extent to which using methyl bromide would limit accomplishing the project's goals. Final EA at 12. Whether the difference between using methyl bromide and Co-60 irradiation in accomplishing the stated goals is de minimus or significant is never discussed.

radiation:" an x-ray, electron-beam irradiator. Staff Statement at 72. The EA's lack of any explanation – much less "an appropriate explanation" – "as to why [the x-ray irradiator] alternative was eliminated" is fatal. Native Ecosystems Council, 428 F.3d at 1246; see also Soda Mountain Wilderness Council, 424 F. Supp. 2d at 1264 ("For those alternatives not selected for detailed study [in an EA], the agency is required to 'briefly discuss the reasons for their having been eliminated'").

As the EA acknowledges, such an x-ray, electron-beam irradiator is currently in operation on Hawai'i Island, performing the identical tasks Pa'ina plans to carry out. Final EA at 6. Moreover, in preparing the EA, the Staff recognized that "alternative technologies" such as "electron beam" merited consideration. Concerned Citizens Exh. 18: 2/14/07 Email from Matthew Blevins (NRC) to Michael Kohn (Pa'ina) (ML070600583). Using a non-nuclear technology would eliminate potential impacts associated with releases of radioactive material and exposure to unshielded sources, and, thus, consideration of such an alternative "would alter the environmental impact and the cost-benefit balance," as NEPA requires. Bob Marshall Alliance, 852 F.2d at 1228; see also Concerned Citizens Exh. 1: Thompson Decl. ¶ VI-2; Supplemental Resnikoff Testimony at A.7. Despite comment from Concerned Citizens urging consideration of this reasonable alternative, the EA does not even mention it, rendering its analysis "inadequate." Morongo Band, 161 F.3d at 575; see 2/8/07 Earthjustice Letter at 8; see also Soda Mountain Wilderness Council, 424 F. Supp. 2d at 1264 (EA must discuss agency's reasons for eliminating alternative); Oregon Natural Resources Council Action v. U.S. Forest Service, 445 F.Supp.2d 1211, 1229 (D. Or. 2006) (agency must respond to comments on inadequacy of alternatives analysis).

Having failed to mention the x-ray, electron-beam irradiator alternative in its EA, the Staff now tries to make up for the deficiency with a post hoc description of the "extensive research on the use of electron-beam irradiation" it allegedly conducted while developing the EA. Staff Statement at 72. Its untimely explanation cannot cure the omission since the failure to disclose its reasoning during the public comment period on the EA precluded the "public scrutiny" that is "essential to implementing NEPA." 40 C.F.R. § 1500.1(b).[48] Moreover, as noted previously, "the [Staff's] defense of its position must be found" in the EA itself, not in testimony submitted long after the final EA's issuance. Blue Mountains Biodiversity Project, 161 F.3d at 1214; see also Motor Vehicle Manuf. Ass'n v. State Farm Mut. Auto. Insur. Co., 463 U.S. 29, 50 (1983) ("an agency's action must be upheld, if at all, on the basis articulated by the agency itself").

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[48] In his testimony, Mr. Blevins claims that, "at the time [he] was researching alternatives for purposes of the EA, there were still numerous articles questioning whether the electron-beam technology had long-term viability." Blevins Testimony at A.31. He further asserts his "subsequent research" confirmed "an electron-beam irradiator would generate more recurring costs for electricity than a cobalt irradiator." Id. Since the Staff has not disclosed any of the articles or other research on which Mr. Blevins purportedly based his analysis, there is no way for the public to scrutinize the Staff's analysis. Accordingly, even if it were appropriate to consider the Staff's post hoc testimony, it still falls far short of satisfying NEPA, which "requires that the public receive the underlying environmental data from which [the Staff's experts] derived [their] opinion[s]." ISC I, 137 F.3d at 1150.

For the same reason, the Staff cannot rely on the testimony of Michael Kohn that Pa'ina submitted with its rebuttal statement to justify its refusal to consider a non-nuclear irradiator. Mr. Kohn's testimony is rife with unsubstantiated assertions about why an x-ray, electron-beam would allegedly be uneconomical. See, e.g., Kohn Testimony at A.3 (claiming his financial calculations show x-ray, electron-beam irradiator "too high a price"), A.4 (alleging "substantial added cost" for skilled workers), A.5 (assertions about required throughput for "break even point"), A.9 (claims about minimum throughput for profitability for Co-60 versus x-ray irradiator). Pa'ina's failure to provide the calculations and projections on which Mr. Kohn bases his testimony makes it impossible for the public or the Staff to assess independently the accuracy of his analysis, as NEPA requires. See Supplemental Written Testimony and Declaration of Eric. D. Weinert ("Supplemental Weinert Testimony") at A.4 (filed herewith); ISC I, 137 F.3d at 1150 (agency cannot "rely on expert opinion without hard data").

Even if the Board were to consider the Staff's extra-record testimony, it is clear the Staff did not rigorously explore the electron-beam irradiator alternative. According to Mr. Blevins, the only person he contacted for information on alternatives was Pa'ina's president, Michael Kohn. Blevins Testimony at A.31. Accepting an applicant's alternatives analysis "at face value" does not satisfy the Staff's obligation to take a "hard look" at alternatives. North Anna, CLI-07-27, 66 NRC at 230.

To satisfy its duty to take a hard look at the electron-beam technology, the Staff should have, at a minimum, contacted representatives from Hawaii Pride, the company that has been successfully operating a commercial x-ray, electron-beam irradiator on the island of Hawai'i since 2000. See Written Rebuttal Testimony and Declaration of Eric D. Weinert ("Weinert Rebuttal Testimony") at 1-2 (filed Sept. 16, 2008). Testimony from Hawaii Pride's Vice-President, Eric Weinert, confirms that, had the Staff contacted him, it would have received important information debunking its erroneous assumptions about the cost-effectiveness and feasibility of this alternate technology. See generally Weinert Rebuttal Testimony; Supplemental Weinert Testimony; see also Asarco, 616 F.2d at 1160 (reviewing court may "look[] outside the record to determine what matters the agency should have considered but did not"); Animal Defense Council, 840 F.2d at 1437 (extra-record evidence proper in NEPA case where plaintiff alleges agency "failed adequately to discuss some reasonable alternative"). As discussed in Mr. Weinert's testimony, SureBeam's bankruptcy in 2004 did not affect in any way the ability of a company like Pa'ina to acquire a reliable x-ray, electron-beam irradiator; to this date, systems identical to the one Hawaii Pride has successfully and reliably operated for years are available for sale, as are replacement parts and maintenance support. Weinert Rebuttal Testimony at 3; Supplemental Weinert Testimony at A.5, A.8-A.11. Moreover, Mr. Kohn's claims that

electricity costs and labor costs render the x-ray technology economic infeasible are unfounded. Supplemental Weinert Testimony at A.5. Even with far higher electricity costs on Hawai'i Island (as compared to O'ahu), Hawaii Pride's x-ray, electron-beam irradiator has consistently made a profit, even when operating at only fifteen percent of capacity. Weinert Rebuttal Testimony at 3; Supplemental Weinert Testimony at A.4, A.5, A.7.[49]

Even without talking to Mr. Weinert, the Staff had no valid reason to omit from its EA discussion of an x-ray, electron-beam irradiator alternative. The fact that such an electron-beam irradiator has been operating commercially in Hawai'i since 2000, performing the precise tasks Pa'ina seeks to undertake, establishes this non-nuclear technology as a reasonable alternative the Staff was obliged to – but failed to – analyze in its EA

B. The Final EA Failed To Consider Alternate Locations.

The EA's failure to consider alternate locations for the proposed irradiator further violates NEPA. The EA's statement of need emphasizes the importance of "[c]entrally located treatment of products" for export from, and import to, Hawai'i and claims that locating a treatment facility on O'ahu is preferred, since it is "the central hub for air and sea transportation." Final EA at 6. Even if limiting alternatives to O'ahu would be reasonable, nothing in the EA suggests the parcel Pa'ina has selected at the airport is the sole possible location on the island for a treatment facility.[50]

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[49] Notably, even Mr. Kohn concedes that, despite "excessively high transportation costs," a pilot program in which he participated "had no problems selling irradiated, high quality and tree-ripened papayas" in Chicago, New Jersey and New York. Kohn Testimony at A.2. His testimony that the market can bear high production costs undermines his claim that the allegedly higher costs associated with use of an x-ray irradiator render it economically infeasible.

[50] At the February 1, 2007 hearing on the draft EA, virtually every fruit producer who testified and indicated a desire to use Pa'ina's irradiator came from Hawai'i Island. See, e.g., Concerned Citizens Exh. 19: 2/1/07 Hearing Tr. at 43-45 (ML070590710). Since there are many

The EA's purpose is "broadly framed in terms of service to the public benefit" and "is not, by its own terms, tied to a specific parcel of land." Methow Valley Citizens Council v. Regional Forester, 833 F.2d 810, 815 (9th Cir. 1987), rev'd on other grounds, 490 U.S. 332, aff'd on remand, 879 F.2d 705, 706 (9th Cir. 1989) (emphasis in original). Thus, there was "no tenable reason for [the Staff] to be wedded exclusively" to locating the proposed irradiator at only Pa'ina's preferred airport location, and, even had Concerned Citizens and its experts not emphasized in their comments the need to consider other locations, "it should have been obvious that investigation was warranted to determine whether the [irradiator] could be pursued at alternative sites." Id.; see also City of Alexandria, Va. v. Slater, 198 F.3d 862, 868 (D.C. Cir. 1999) ("When the proposed action is an integral part of a coordinated plan to deal with a broad problem, the range of alternatives that must be evaluated is broadened"). To allow the NRC and the public to consider "alternatives that might be pursued with less environmental harm," the EA was obliged to consider alternate sites. Lands Council, 395 F.3d at 1027.

Had the EA done so, it likely would have highlighted the environmental inferiority of Pa'ina's chosen site. As Concerned Citizens' experts emphasized during the EA process and in their hearing testimony, sites located inland and away from Ke'ehi Lagoon would eliminate threats from tsunami runup and hurricane storm surges. 2/9/07 Pararas-Carayannis Decl. ¶ 13; Pararas-Carayannis Testimony at A.13; Supplemental Resnikoff Testimony at A.7. Sites on solid ground, rather than unconsolidated fill, would lay to rest concerns about liquefaction during earthquakes. 2/9/07 Pararas-Carayannis Decl. ¶ 13; Pararas-Carayannis Testimony at A.13; Supplemental Resnikoff Testimony at A.7. Sites a mere ten miles from Honolulu International

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daily flights from airports on Hawai'i Island to the continental United States, reasonable alternatives clearly include locating a second treatment facility on that island, which would save the transportation costs of flying fruit to O'ahu for treatment prior to export.

Airport's runways would reduce the threat of an airplane accident by a factor of 1,000. 2/9/07 Resnikoff Decl. ¶ 26; Supplemental Resnikoff Testimony at A.7; cf. Sozen Testimony at A.4.[51] Moving out of urban Honolulu, away from strategic military bases, and far from Hawai'i's transportation and financial hubs would reduce the risks of terrorist attack. 2/9/07 Resnikoff Decl. ¶¶ 20-23; Thompson Decl. ¶ VI-3; Supplemental Resnikoff Testimony at A.10. The EA improperly fails to consider these reasonable alternatives, depriving the NRC and the public of vital information about "choices or alternatives that might be pursued with less environmental harm." Lands Council, 395 F.3d at 1027; see also 40 C.F.R. § 1500.2(e) (commanding federal agencies to use NEPA process "to identify and assess the reasonable alternatives to proposed actions that will avoid or minimize adverse effects of these actions upon the quality of the human environment").[52]

That the "NRC has no authority to prescribe a different location" does not excuse the EA's failure to consider reasonable alternate sites. Final EA at C-8; see 40 C.F.R. § 1502.14(c) (agency cannot reject alternative because it is "not within the jurisdiction of the lead agency"). The NRC likewise cannot force Pa'ina to use non-nuclear food treatment technology, but that did not preclude the Staff from evaluating in the EA (albeit inadequately) alternate technologies. Cf. Exelon Generation Co., LLC (Early Site Permit for Clinton ESP Site), CLI-05-29, 62 NRC 801,

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[51] As Dr. Resnikoff discusses in his testimony, in the mid-1990's, an airplane was destroyed when it crashed into a warehouse located only ¼-mile north of Honolulu International Airport, confirming "that the risk of aviation accidents involving facilities located in close proximity to the runways at Honolulu International Airport is not at all speculative." Supplemental Resnikoff Testimony at A.7. As he further notes, "[i]t is only prudent to consider alternate locations where the risk of a catastrophic aviation accident could be all but eliminated." Id.

[52] The hearing file makes clear the Staff knew that alternate locations, "further from an active runway and further from the ocean," would be feasible. 8/28/06 Kohn Email at 1. Indeed, alternate locations might even have "commercial advantages" over the currently proposed site. Id.

807 (2005) ("NRC Staff ... examined various power sources as alternatives to Exelon's proposed nuclear plant – including fossil, solar, wind, and 'combined' technologies"). The Staff's concession that it routinely considers alternate locations in proceedings involving EISs – where it has no greater power to force applicants to choose alternate sites – confirms there is no valid reason for its failure to do so here. Final EA at C-8.

In defending its refusal to consider alternate locations for Pa'ina's proposed irradiator, the Staff claims "[t]here is typically no requirement that an agency consider alternative sites in an EA." Staff Statement at 69. The sole authority the Staff offers for that proposition is Wicker Park Historic Dist. Preservation Fund v. Pierce, 565 F. Supp. 1066 (N.D. Ill. 1982), a district court case from outside the Ninth Circuit that has not been cited for that proposition by any court since the opinion was issued over a quarter century ago. Eight years after Wicker Park was decided, the same district court held that, even where an EA concludes "the impact upon the environment will not be significant, the agency nevertheless is required to consider feasible alternative sites to determine whether an alternative site might serve the agency's purpose with even less environmental impact." Village of Palatine v. United States Postal Service, 742 F. Supp. 1377, 1386 (N.D. Ill. 1990) (emphasis added). The Village of Palatine court further held "[t]he evaluation of alternatives mandated by section 102(2)(E) is an evaluation of alternative means to reach a general goal" and requires evaluation of "alternative sites." Id. at 1392. Thus, Wicker Park's holding does not even hold sway in the Northern District of Illinois.

In cases from both the Ninth Circuit and other circuits, courts routinely examine EAs to determine whether they have adequately considered a reasonable range of alternate sites. See, e.g., Friends of Endangered Species v. Jantzen, 760 F.2d 976, 987-88 (9th Cir. 1985) (alternate sites for proposed development); Lee v. United States Air Force, 354 F.3d 1229, 1239-40 (10th

Cir. 2004) (alternate locations for basing training aircraft); South Carolina v. O'Leary, 64 F.3d 892, 899-900 (4th Cir. 1995) (alternate sites for storage of spent nuclear fuel rods); North Carolina v. Federal Aviation Admin., 957 F.2d 1125, 1134-35 (4th Cir. 1992) (alternate locations for Navy targets); Monarch Chemical Works, Inc. v. Thone, 604 F.2d 1083, 1088 (8th Cir. 1979) (alternate sites for prison). None of these cases suggests an agency can refuse to consider alternate sites merely because an EA, rather than an EIS, is being prepared.

Pa'ina's reliance on Morongo Band to justify the Staff's failure to evaluate alternate locations for the proposed irradiator is misplaced. See Pa'ina Statement at 6-7. The portion of the decision Pa'ina cites has nothing to do with the Staff's obligation to discuss alternatives in an EA, the only issue in dispute here, or, for that matter, any other duty arising under NEPA. The text Pa'ina cites involves a National Historic Preservation Act ("NHPA") claim that the Federal Aviation Administration ("FAA") "did not make a reasonable effort to identify property eligible for the National Register" that might be adversely affected by a flight path over an Indian reservation. Morongo Band, 161 F.3d at 582. Based on "the FAA's noise, land use, and visual impact studies," the Court upheld the agency's finding that flights occurring 16,000 feet above ground level could not possibly cause adverse impacts to historic sites and, accordingly, the FAA was not obliged to "identify specific potential sites or properties" that might be eligible for the National Register. Id. The cited portion of the opinion did not address analysis of alternative sites under NEPA, as Pa'ina's alteration of the quote from the opinion misleadingly suggests, but, rather, identification of potentially eligible sites under the NHPA.

While the portion of Morongo Band that Pa'ina cites is irrelevant, an earlier portion of the opinion is germane and refutes Pa'ina's claim "it is the current NEPA law in the 9th Circuit that where there are no significant impacts, alternative sites need not be studied." Pa'ina

Statement at 6. The plaintiff Indian tribe in that case contended the FAA had violated NEPA "by failing to evaluate or develop alternative routes" for airplanes flying into Los Angeles International Airport that would avoid flying over the tribe's reservation. Morongo Band, 161 F.3d at 575. Had the Court agreed with Pa'ina that EAs need not examine alternate sites for proposed activities, it would have summarily dismissed the plaintiff's claims on that ground. Instead, the Court stressed that, under NEPA, it is the agency that "has the responsibility to 'study, develop, and describe appropriate alternatives.'" Id. at 576 (quoting 42 U.S.C. § 4332(2)(E)). The Court then found the FAA had "fulfilled that requirement" precisely because it had "develop[ed] and discuss[ed] a number of alternatives," including alternate routes "that would have bypassed the Reservation" altogether. Id.

Unlike Morongo Band, where "[t]he FAA thoroughly discussed alternatives that would have bypassed the Reservation, but found them unsuitable for accomplishing the primary purpose of the project," the Staff failed to consider any alternate locations for Pa'ina's proposed irradiator. Id. It is not as if the Staff were unaware such alternatives existed. The record shows the Staff knew potential locations "further from an active runway and further from the ocean" were feasible, but it still refused to consider any of them. 8/28/06 Email from Michael Kohn (Pa'ina) to Jack Whitten (NRC) at 1. On these facts, the Board cannot find the Staff "fulfilled its obligation under NEPA to '[r]igorously explore and objectively evaluate all reasonable alternatives.'" Morongo Band, 161 F.3d at 576 (quoting 40 C.F.R. § 1502.14).

The Board should also reject the Staff's claim that, 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," since it "did not find any significant environmental impact that might result from operating Pa'ina's irradiator at the proposed site."

Staff Statement at 75. Not surprisingly, the Staff finds no authority to support this proposition. By definition, any EA that does not trigger the preparation of an EIS involves a situation in which the agency has concluded there is no possibility of a significant impact. Blue Mountains Biodiversity Project, 161 F.3d at 1216 (EIS required "whenever 'substantial questions are raised was to whether a project may cause significant [environmental] degradation"). The Ninth Circuit has made clear that "consideration of alternatives is critical to the goals of NEPA even where a proposed action does not trigger the EIS process." Bob Marshall Alliance, 852 F.2d at 1228-29. As discussed above, even if "the impact upon the environment will not be significant, the agency nevertheless is required to consider feasible alternative sites to determine whether an alternative site might serve the [project's] purpose with even less environmental impact." Village of Palatine, 742 F. Supp. at 1386. The Staff unlawfully failed to do so here.

While the Ninth Circuit may not demand that an EA consider any minimum number of alternatives, it has held that NEPA requires "an appropriate explanation ... as to why an alternative was eliminated." Native Ecosystems Council, 428 F.3d at 1246. In this case, the EA failed even to mention alternate locations for Pa'ina's proposed irradiator or the use of a non-nuclear, electron-beam irradiator, much less justify why the Staff refused to consider these alternatives. The flimsy post hoc rationalizations the Staff and Pa'ina proffer do not cure this fundamental defect. "The [EA's] failure to adequately select and analyze a reasonable range of alternatives" – alternate technologies and locations – "requires that [the Staff's] action be set aside." Soda Mountain Wilderness Council, 424 F. Supp. 2d at 1264.

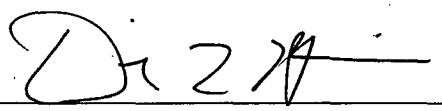
XI. CONCLUSION

For the foregoing reasons, Concerned Citizens respectfully submits that, when the Board "consider[s] the purposes that NEPA was designed by Congress to serve," it should conclude

"what was done here is inadequate." Lands Council, 395 F.3d at 1027. The Staff failed to comply with NEPA's command to "put on the table, for the [NRC's] and the public's view, a sufficiently detailed statement of environmental impacts and alternatives so as to permit informed decision making" regarding Pa'ina's proposed irradiator. Id. Accordingly, Concerned Citizens respectfully submits the Board should instruct the Staff to prepare a revised EA that complies fully with NEPA on remand.

Dated at Honolulu, Hawai'i, February 2, 2009.

Respectfully submitted,



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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of Pa'ina Hawaii, LLC Material License Application	)))))	Docket No. 30-36974-ML ASLBP No. 06-843-01-ML

WRITTEN TESTIMONY AND
DECLARATION OF GEORGE PARARAS-CARAYANNIS, Ph.D.

I, George Pararas-Carayannis, declare under penalty of perjury that the contents of the following Written Testimony and Declaration of George Pararas-Carayannis, Ph.D. are true and correct to the best of my knowledge:

Q1: Please state your name, occupation, employer, and business address.

A1: My name is George Pararas-Carayannis. I received a Ph.D. in Marine Sciences from the University of Delaware, an M.S. in Oceanography from the University of Hawai'i, and a B.S. in Chemistry-Mathematics and an M.S. in Chemistry from Roosevelt University. I have considerable experience in mathematical modeling and field studies of natural disasters, environmental engineering, coastal engineering, geology, seismology, volcanology, geophysics, risk analysis, disaster planning/mitigation, real time data systems, and hazard reduction. A copy of my resume is attached to this testimony as Exhibit "31."

I am currently self-employed as a consultant. My business address is 1741 Ala Moana Blvd. #70, Honolulu, HI 96815.

Q2: Please briefly describe your background as it relates to your review of Pa'ina Hawaii, LLC's application for a material license to operate a Cobalt-60 irradiator.

A2: I have served as an oceanographer/geophysicist or consultant to a number of government agencies including the State of Hawai'i, the Nuclear Regulatory Commission ("NRC"), the United States Army, the National Oceanic and Atmospheric Administration, the Environmental Protection Agency, the Smithsonian Institute, and numerous United Nations organizations.

I played a key role in the pioneering U.S. tsunami research efforts, when, with the late Professor Doak Cox, I developed the tsunami evacuation zones for the State of Hawai'i. These tsunami evacuation zones are still used by the Hawai'i State Civil Defense today. My work has contributed significantly toward advances in tsunami research and tsunami warning technology around the world.

From 1974 to 1992, I was the Director of the United Nations Educational Scientific and Cultural Organization's Intergovernmental Oceanographic Commission International Tsunami Information Center in Honolulu.

As oceanographer of the U.S. Army Corps of Engineers Coastal Engineering Research Center in Washington, D.C., I advised the NRC on nuclear power plant siting, evaluation of hurricanes and hurricane surge effects on nuclear power plants, and reviews of environmental impact statements.

I assisted the NRC with the licensing of units 2 and 3 of the San Onofre nuclear power plant in California, where both coastal hazards and earthquakes were concerns, and evaluated the potential effects of Gulf hurricanes and surges at the Crystal River Nuclear Power Plant in Florida.

As a member of the American Nuclear Society, I co-authored the Society's National and International Environmental Standards for Nuclear Power Plants.

I serve as president of the International Tsunami Society and editor of the international journal "Science of Tsunami Hazards." I am also editorial reviewer of several other journals, including, among others, "the Coastal Engineering Journal," "the Journal of Natural Hazards," and "Springer Scientific Publications."

Q3: Are you familiar with the NRC Staff's Initial Statement of Position on Amended Environmental Contentions 3 and 4, which was filed in the Pa'ina Hawaii, LLC licensing proceeding on August 26, 2008?

A3: I have reviewed the testimonies of James Durham, Amitava Ghosh, John Stamatakos, and Kaushik Das, which discuss, among other things, a report and declarations I prepared evaluating the deficiencies of the Center for Nuclear Waste Regulatory Analysis ("CNWRA's") draft and final topical reports for Pa'ina's proposed irradiator, as well as the Staff's environmental assessment ("EA") for that proposed facility. Concerned Citizens has previously submitted true and correct copies of my report and my February 9, 2007 and March 15, 2007 declarations as Exhibits "2" through "4," respectively. True and correct copies of my September 12, 2007 and October 5, 2007 declarations are attached hereto as Exhibits "32" and "33," respectively. These analyses accurately reflect my views regarding the potential threats to public health and safety, as well as the natural environment, associated with construction and operation of the proposed irradiator at Pa'ina's preferred location.

Q4: At this time, please turn your attention to paragraph A.30 of Dr. Stamatakos' testimony, which appears on page 24, where he states there was no need to evaluate tsunami and storm surge runup through numerical modeling 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." Do you agree with Dr. Stamatakos' conclusion?

A4: Not at all. As discussed in my declarations, which the CNWRA staff claim to have reviewed, the CNWRA's focus on whether a tsunami- or hurricane-generated wave could lift a Co-60 source out of the irradiator pool reflects a lack of understanding of how such waves move over land. Over land, there is no structured wave form, but rather a chaotic turbulent water mass. It is not surprising, therefore, that the CNWRA concluded a tsunami- or hurricane-generated wave would not create wave velocities sufficient to pull a Co-60 source assembly out of the irradiator pool.

To assess potential tsunami and hurricane impacts, the CNWRA should not have ended its inquiry after performing stylized fluid dynamic calculations. Rather, it should have taken a hard look at the consequences of tsunami- and hurricane-related flooding, particularly increases in buoyancy pressure at the foundation level that could damage the irradiator pool's integrity and/or cause lifting or tilting of the pool. In the event of either damage to the pool integrity or lifting/tilting of the pool structure, vital shielding water could drain below the minimum level needed to shield the Co-60 sources.

Dr. Stamatakos admits numerical modeling would have permitted "a more accurate calculation" of tsunami and storm surge runup. CNWRA's failure to perform that modeling precluded it from conducting an accurate assessment of potential impacts.

Q5: Please turn your attention to paragraph A.31, which begins at the bottom of page 24, in which Dr. Durham states that "[i]ncreased buoyancy, whether of the sources or the pool itself, would not cause … a loss of control" of radioactive material. Do you agree with that assessment?

A5: No. As a threshold matter, Dr. Durham misconstrues my contention regarding buoyancy as focusing on whether saltwater intrusion into the irradiator pool would cause Co-60 sources to float out. I have never suggested that is likely or faulted the CNWRA or NRC Staff for failing to evaluate that scenario.

Rather, what the topical reports and EA failed to evaluate is the potential external impact of buoyancy to the irradiator pool itself which may be caused by partial subterranean rise of sea level and of the water table due to hurricane surge or a tsunami. Although the rise in sea level and ground water table level would likely be of relatively short duration, it could increase the external buoyancy of the casing of the pool itself (more so if not filled to the top), particularly since Pa'ina's preferred location for its irradiator would put the pool within layers of unconsolidated sediments of relatively new reclaimed land. As noted previously, even if increased buoyancy did not result in Co-60 sources escaping the pool, it could crack the pool lining and/or lift

and tilt the pool structure, resulting in a loss of vital shielding water. Irradiator personnel and/or emergency responders on the scene could be exposed to elevated radiation doses.

The CNWRA and NRC Staff should have, but failed to, perform a buoyancy assessment of the proposed irradiator pool for various flooding levels to ensure the pool (1) will maintain its integrity (i.e., not be breached) and (2) will not tilt, losing vital shielding water and possibly damaging the Co-60 sources. Because no such analysis was performed, Dr. Durham has no basis for asserting in paragraph A.38 of his testimony that "it is not plausible that major flooding would cause ... the irradiator pool to become buoyant such that there would be any environmental impact" and that the pool could not "lift and tilt, thereby spilling water." A prudent and thorough analysis of the safety of a critical structure such as an irradiator should not merely assume away these potential risks, as the CNWRA apparently did.

Q6: At this time, please turn your attention to the end of paragraph A.31, where Dr. Durham states that, even if a hurricane wind-generated projectile "pierced the pool below the water level," allowing water to drain out of the pool, "[t]here would not be any environmental impact ... because the pool water would not be contaminated." Do you agree with that conclusion?

A6: No. Dr. Durham's analysis ignores that any drop in shielding water below the facility floor level risks exposing irradiator personnel and emergency responders to elevated radiation doses. Thus, even if wind-generated projectiles did not damage the Co-60 sources and contaminate the pool water that escapes, there are potentially significant effects on the worker health.

In addition, while Dr. Durham asserts that wind-generated projectiles could not damage the Co-60 sources, he provides no calculations to back up that claim. Proper risk assessment is backed up by calculations, not conjecture.

Q7: I now turn your attention to paragraph A.32, in which Dr. Stamatakos explains why the CNWRA did not address your claims that potential runups and coastal flooding could be more significant than historical values. Does this explanation satisfy you?

A7: No. As discussed in my February 2007 report and subsequent declarations, both the construction of the Reef Runway and the deepening of Ke'ehi Lagoon through dredging – which did not begin until 1973 – altered the conditions in Ke'ehi Lagoon, making reliance on historical values that pre-date those alterations unjustified. Those changes to Ke'ehi Lagoon could increase resonance effects and cumulative pile-up of a tsunami or hurricane storm surge at the apex of the basin, which is at the end of Palekona Street, where Pa'ina proposes to place its irradiator. By his own admission, Dr. Stamatakos did not conduct any numerical modeling, which is the only accepted means to reveal the full effects of dredging the lagoon and altering the shoreline.

Likewise, by relying exclusively on past historical hurricane run-up data, Dr. Stamatakos improperly omitted consideration of the fact that future storms could pass closer to the island of O'ahu and could have different geometries of approach, or distribution and focusing of maximum winds and wave energies. In a semi-enclosed basin like Ke'ehi Lagoon, coastal morphology, direction of hurricane approach, radius of maximum winds, coastal configuration, and geometry of the basin substantially affect water level rise and the degree of surge flooding. A recent illustration of this is hurricane Katrina, which resulted in a higher surge approaching from Lake Pontchartain, rather than from the Gulf of Mexico, causing New Orleans levees to overtop and fail.

In addition, Dr. Stamatakos appears to overlook that the proposed irradiator site lies within the designated Civil Defense tsunami evacuation zone. He also mistakenly asserts my February report cites "past tsunami-generated wave heights of up to 9 feet on the south shore of O'ahu." The data cited on pages 13-14 of my report, which is from reliable historical records, refer to tsunami runup, not wave heights.

To justify the failure to consider any of these critical factors, Dr. Stamatakos relies on the stylized fluid dynamic calculations that demonstrated that tsunami- or hurricane-related flooding would not "generate the high water velocities and large lifting forces necessary to remove the cobalt sources from the pool." As discussed previously, whether Co-60 sources would be lifted out of the pool is a red herring, distracting attention from credible threats associated with flooding resulting in increased buoyancy. The CNWRA and NRC Staff failed completely to evaluate these impacts.

Q8: Please turn your attention to paragraph A.33, in which Dr. Stamatakos discusses his analysis of potential focusing effects of seismic energy on O'ahu. Does his explanation allay your concern about the potential for such effects?

A8: No. With all due respect, Dr. Stamatakos' response is at odds with basic principles pertaining to seismology and to Hawai'i's seismic potential and history.

Initially, Dr. Stamatakos claims the available data provide "no evidence of focusing effects at or near the Pa'ina irradiator," claiming that, "[i]f there were focusing effects, the seismic records would show higher [Modified Mercalli] intensity values for areas affected by recent earthquakes."

Dr. Stamatakos overlooks that the Modified Mercalli Intensity scale expresses descriptively only the effects and damage caused by an earthquake, rather than its size or energy release. Unlike magnitude, which represents a single quantity of an earthquake's energy at the source, intensity does not have one single value for a given earthquake and can vary significantly from place to place depending on substrata soil conditions. The seismic records do not show intensity, and there are no known accelerometer readings for O'ahu generally or the Pa'ina site specifically. Therefore, Dr. Stamatakos has no basis to claim that all areas of O'ahu, including the recently reclaimed land underlain with unconsolidated silts and sediments where Pa'ina

proposes to locate its irradiator, cannot experience intensities greater than V, VI or more.

Second, Dr. Stamatakos provides no justification for basing his analysis on U.S. Geological Survey data for "firm rock conditions." The proposed irradiator site consists of reclaimed land, not firm rock.

Third, Dr. Stamatakos has no basis for failing to consider the potential for unusually high ground accelerations like those experienced during the 17 January 1994 Northridge Earthquake. That the San Fernando Valley is "approximately 2500 miles from Honolulu" is irrelevant. All areas with unconsolidated soils, whether in California's San Fernando Valley, in China's Sichuan Province, or on O'ahu, usually experience higher seismic intensities when earthquakes occur. While different earthquakes at different areas may differ in the level of seismic energy release, the focusing effects and potential for ground liquefaction are the same everywhere.

Dr. Stamatakos' statement that "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" likewise is inaccurate. High ground accelerations and intensities are not generated by only thrust faulting. Normal faulting and lateral faulting can generate extremely high intensities. For example, the 1976 Tangshan earthquake in China that killed close to 650,000 people and destroyed 90% of the city occurred along a strike-slip fault that ruptured only a five-mile (8 km) section of a 25-mile long fault.

Moreover, while Hawai'i does experience earthquakes along volcanic rifts that are hot-spot related, it has also, throughout its geologic history, experienced tectonic events and large-scale flank failures. Such events occurred in 1868 and 1975, and, most recently, in the October 2006 event, which resulted from tectonic subsidence of a large block of the Hualalai volcano.

The 1948 event, which was quite far from O'ahu, had an estimated magnitude of only 4.6, but still created strong enough ground motions to cause cracks and other damage in many Honolulu buildings. Similarly, the 1871 earthquake near Lana'i caused damage to every building on the Punahou School campus in Honolulu. The October 2006 earthquake was strongly felt on O'ahu and caused power failures, even though the epicenter of the earthquake was located hundreds of miles away and, contrary to the patently erroneous statements in the CNWRA's topical report, O'ahu's power grid is completely independent from the grid on Hawai'i Island.

The historic record makes clear that a future earthquake has the potential to amplify ground motions within unconsolidated sediments such as those present at the proposed irradiator site. The CNWRA and NRC Staff failed to perform any calculation to back up their claim the irradiator pool could withstand these ground motions, avoiding all cracks and potential leakage.

Q9: I now turn your attention to paragraph A.34, in which Dr. Stamatakos explains why he concluded "the possibility of liquefaction during an earthquake is ... speculative." Does that testimony adequately address concerns about damage from liquefaction?

A9: No. Dr. Stamatakos' testimony inaccurately suggests earthquakes in Hawai'i behave differently than earthquakes in other parts of the world, where it is well documented that facilities built on reclaimed land are vulnerable to liquefaction. For example, maximum damage in the Marina District of San Francisco occurred from liquefaction effects during the 1989 Loma Prieta earthquake on land that had been reclaimed along San Francisco Bay after the 1906 San Francisco earthquake. Because no liquefaction had occurred in that area in nearly a century it was erroneously believed to be safe from the effects of liquefaction. Similarly, just because no liquefaction has occurred in the few decades since the land where Pa'ina proposes to place its irradiator was reclaimed does not establish the site is safe from such impacts.

On the contrary, review of Pa'ina's September 14, 2005 geotechnical report reveals the recorded Standard Penetration Test blow counts are far from adequate to ensure against damage from liquefaction. The site Pa'ina has proposed for its irradiator is on reclaimed land that has been filled with non-homogeneous, unconsolidated alluvial material, most of which was dredged from the existing waterway of Ke'ehi Lagoon. The density of material, the granular composition, silt content, and the particle size distribution vary, as well as the degree of settling. This is why the blow count values presented in the geotechnical report vary so much, with values ranging from 4 to 120. Excerpts from a true and correct copy of the geotechnical report are attached hereto as Exhibit "34."

Many of the blow count values were below 15, indicating a substantial risk of liquefaction from an earthquake. Indeed, with such low blow counts, an earthquake would not have to be particularly significant to cause liquefaction. Depending on the epicenter, depth and directional focusing, even a relatively small event could result in liquefaction, presenting significant safety concerns since, in addition to the low blow count values, the site has groundwater only a few feet below the surface. The material below the Pa'ina site (silty sands and gravel) is supersaturated with water, and there could be at least partial – if not total – liquefaction at the toe of any structure built on such a site.

The geotechnical report's estimate of maximum allowable bearing values of 1,400 pounds per square foot for foundation resistance appears reasonable under normal (i.e., non-liquefaction) conditions. However, if liquefaction occurs during an earthquake, the bearing resistance will not be the same. There is a fundamental difference between static stability and seismic stability. The bearing values in the geotechnical report refer only to the static stability of the landfill material at Pa'ina's preferred site, not to its seismic stability. Regardless of the safety factor added to the static stability values, one cannot determine whether construction of an irradiator at the site would be safe without a proper seismic stability analysis and discussion of associated risks. This was

not done, precluding an informed decision about safety of the proposed irradiator in the event of liquefaction during an earthquake.

Notably, even in the absence of liquefaction, enhancement of ground motions could occur in alluvial deposits like those underlying the Palekona Street site. Thus, damage to the structure could occur with full liquefaction, partial liquefaction or no liquefaction at all. Liquefaction may result in the settling, sinking, tilting and/or cracking of the entire structure or in its separation from the superstructure above it. Damage could occur from strong ground motions caused by the seismic surface waves, which travel much like sea waves. The rupture geometry of the seismic source region can affect the directivity and frequency of the surface seismic waves. Furthermore, the surface waves could separate into trains of certain periods.

Waves of certain periods could enhance the ground accelerations – both vertical and horizontal – in the alluvial sediments of the Palekona Street site, causing significant damage. For example, I conducted the survey of Mexico City following the catastrophic 1985 earthquake and found that most of the damage was due to maximum ground accelerations caused by a single monochromatic surface seismic wave traveling within a 30-foot layer of sediments. Similar conditions exist at the site Pa'ina has proposed for its irradiator.

I strongly disagree with Dr. Stamatakos' claim there would be no potential for harm if liquefaction were to occur, lifting and tilting the pool and allowing shielding water to escape. He inaccurately assumes a Co-60 source would have to be dislodged from the irradiator pool before harm could result. As discussed with respect to increased buoyancy, removing vital shielding water from the irradiator pool threatens to expose irradiator personnel and emergency responders to elevated radiation levels.

Given Dr. Stamatakos' admission that liquefaction can result in a loss of shielding water, a hard look at the potential for such impacts should have, but was not, undertaken. The CNWRA should also have evaluated the likelihood that ground liquefaction would crack the pool lining, allowing additional shielding water to escape.

To determine whether Pa'ina's proposed site is safe from liquefaction, a proper soil analysis and plasticity study is required. Neither was prepared. In the absence of such studies, there is no scientifically defensible basis to conclude the site is safe from liquefaction. Borings alone, cone penetration tests or blow counts – even when closely spaced – are not sufficient. If anything, blow counts of such diversity as those presented in the geotechnical report indicate highly non-homogeneous and potentially unsafe soil conditions that may be particularly susceptible to liquefaction.

Q10: Please now take a look at the portion of paragraph A.34 at the top of page 28, where Dr. Stamatakos states that compliance with International Building Code requirements will ensure "Pa'ina takes into account any factors that could increase the potential for liquefaction." Do you agree with that assessment?

A10: No. One cannot assume, as Dr. Stamatakos apparently does, that compliance with building codes ensures adequate protection from future earthquakes. In California, the building codes were upgraded after the Long Beach earthquake of 1933 destroyed schools in the area. The codes were upgraded again in California after the destructive 1971 San Fernando Valley earthquake. Everyone had a false sense of safety and believed the 1971 codes were adequate, until the 1994 Northridge earthquake struck, with devastating effects.

The lesson is that mere compliance with whatever building code happens to be in effect is no guarantee of safety. Detailed analysis of the soil conditions at the specific site Pa'ina proposes is vital to assess whether public safety would be threatened in the event of an earthquake. Neither the CNWRA nor the NRC Staff performed this necessary analysis.

Q.11: In paragraph A.35, Dr. Stamatakos says there has been "a maximum water-level rise of only 0.78 meters/2.6 feet at O'ahu since the 1950's." Is that accurate?

A.11: No. The value of 0.78 meters/2.6 feet above mean sea level for Hurricane Iniki that Dr. Stamatakos cites as being the maximum on O'ahu is based on a National Oceanic and Atmospheric Administration tide gauge record. Since tide gauges filter out short period waves and are usually located in sheltered areas, reliance on tide gauge recordings as evidence of low storm surge runup is improper.

Actual observations and measurements on O'ahu have recorded storm surge flooding with water-level rise far in excess of 0.78 meters. For example, the hurricane surge flooding of Iniki (combined with wave action) reached the second floor of apartment buildings along the Wai'anae Coast of O'ahu.

It is important to note that the testimony from Drs. Stamatakos, Durham and Das attempts to render any degree of flooding due to a tsunami or hurricane as irrelevant to public safety. All three focus almost exclusively on whether a tsunami- or hurricane-generated wave would reach the velocity necessary to remove a Co-60 source from the irradiator pool. As discussed previously, in focusing narrowly on this one potential impact, the CNWRA ignored the far more credible threats posed by increased buoyancy.

Q.12: Also in paragraph A.35, Dr. Stamatakos says that you claim "a 31-foot wave reached the southern coast of O'ahu in 1946." Is that accurate?

A.12: No. In both my February 2007 report and my February 9, 2007 declaration, I note that a 1946 tsunami reached a maximum <u>runup</u> on O'ahu's southern coast of 31 feet. Runup is not the same as wave height.

The 31 ft run-up along an eastern segment of the southern coast of O'ahu by the 1946 tsunami was not documented by "research," as Dr. Stamatakos assumes, but by an actual, original survey measurement made by a team of scientists from the University

of Hawai'i and Scripps Institution of Oceanography, which I and others scientists subsequently verified. The record of this extreme run-up measurement can be found in Civil Defense and University of Hawai'i public domain reports.

Q.13: Does this conclude your testimony?

A.13: I have just one additional observation. As in the EA and topical reports, the new CNWRA testimonies conclude erroneously that the potential impact from any natural hazard on Pa'ina's proposed irradiator would be negligible and could not possibly affect public safety because the irradiator's engineering and design would preclude any radiological leakage, regardless of the severity of the hazard's impact. These testimonies fail to recognize that even the best engineered structures are prone to potential failures or malfunctions if located in areas that are vulnerable to natural hazards. The historical record attests to such failures and to engineering short-sightedness from not anticipating such impacts. Even assuming good engineering design and practices, common sense alone dictates that siting a critical structure in such a vulnerable environment as the low-lying, reclaimed land area of Ke'ehi Lagoon represents a substantial risk that need not be taken, particularly when safer locations – outside the tsunami evacuation zone, away from threats of hurricane storm surge, and on solid ground – exist that would minimize or entirely avoid the risks, assuring greater protection of public health and safety.

I declare under penalty of perjury that I have read the foregoing Written Testimony and Declaration of George Pararas-Carayannis, Ph.D. and know the contents thereof to be true of my own knowledge.

Dated at Honolulu, Hawai'i, January 9, 2009.

GEORGE PARARAS-CARAYANNIS, Ph.D.

George Pararas-Carayannis, Ph.D.
1741 Ala Moana Blvd. #70
Honolulu, Hi 96815

EDUCATION

1954, Lycee Leonin, Athens, Greece (top of class - awarded scholarship, University of Montpellier, France)
1959, B.S. Chemistry-Mathematics, Roosevelt University, Chicago, U.S.A.
1963, M.S. Chemistry, Roosevelt University, Chicago
1967, M.S. Oceanography, University of Hawaii
1975, Ph.D. Marine Sciences, University of Delaware, Newark, Delaware (Received Ph.D with 4.0 grade point average - First Ph.D. awarded by the Un. of Delaware in Marine Sciences.)

Other specialized training on Environmental Engineering. Coastal Engineering, Geology, Seismology, Volcanology and Geophysics, at:
* Massachusetts Institute of Technology (MIT);
* University of Michigan, Ann Arbor;
* Loyola University, Chicago;
* Hawaii Institute of Geophysics, Hawaii;
* Coastal Engineering Research Center, Washington D.C.

EMPLOYMENT

* Director, International Tsunami Information Center, of UNESCO-IOC (United Nations Educational Scientific and Cultural Organization- Intergovernmental Oceanographic Commission), (1974 to 1992).
* Tsunami Advisor, State of Hawaii, Civil Defense Agency (1974-1992)(Volunteer Community Service).
* Oceanographer, U.S. Army, Coastal Engineering Research Center (CERC), Washington, D.C.(1972-1974).
* Oceanographer for the New York District of the U.S. Army Corps of Engineers (1970-1972).
* Technical Director and Geologist, Mermex S.A. Mining Corporation, Mexico (1970).
* Director, World Data Center A-Tsunami; Oceanographer, International Tsunami Information Center (ITIC), National Ocean Survey (1967-1970).
* Geophysicist, Hawaii Institute of Geophysics, University of Hawaii (1963-1967).
* Research Chemist, Joanna Western Mills Company, Chicago, Illinois (1959-1963).

SPECIAL ASSIGNMENTS (A few examples)

* Chief Scientist and Consultant to UNDP (United Nations Development Program) on Southwest Pacific Mission to Develop a Regional Five Year Plan for Disaster Mitigation.
* Consultant to Intergovernmental Oceanographic Commission / Marine Sciences Section of UNESCO.
* Consultant to UNDRO (United Nations Disaster Relief Organization), Geneva; Special training programs in developing countries in South America.

EXHIBIT 31

* Member: Special UNESCO Committee which developed the program of implementation for the Secretary General of the United Nations on the International Decade for Natural Disaster Mitigation (IDNDR).
* Consultant: Nuclear Regulatory Commission and predecessor agency, the Atomic Energy Commission, on nuclear plant siting, Hurricane and hurricane surge effects, review of Environmental impact statements, and other varied assignments.
* Co-author of American Nuclear Society National and International Environmental Standards for Nuclear Power Plants, safety, and siting. Participant: President's Council on Environmental Quality (CEQ) (1973).

SPECIAL EXPERTISE

* Extensive experience on mathematical modeling of hurricanes, hurricane surges, and tsunamis.
* Coastal and Ocean Engineering.
* Extensive experience in environmental work (Effects of ocean dumping; coastal processes).
* Applied tsunami research, including: Focal mechanisms of earthquakes and tsunamis (with NSF support);
* Development of methodology for studying tsunami propagation and terminal effects;
* Historical documentation of tsunamis in Hawaii, Alaska, the Pacific and Atlantic Oceans;
* Quantitative surveys of the most important tsunamis to strike Hawaii for the last fifty years;
* Development of tsunami inundation limits for coastal evacuation and zoning;
* Development of mathematical modeling for tsunami travel times and paths;
* Development of methodology for fast earthquake epicenter determinations; real time assessment of the tsunami hazard for warning purposes.
* Earthquake, Tsunami, and Hurricane Surveys.
* Environmental Impact Statements.
* Risk analysis.
* Development of a multi phase approach to environmental hazard vulnerability reduction and preparedness.
* Planning and preparedness for environmental hazard risk reduction. * Standard Operating Plans for Civil Defense Agencies.

INTERNATIONAL SCIENTIFIC LEADERSHIP

Organized and chaired or co-chaired several international conferences, symposia, and workshops, on disasters and mitigation of disasters in United States, Canada, Chile, Peru, Mexico, China, Philippines, Ecuador, former Soviet Union, and elsewhere. The following are a few examples:

* Co-Chairman: International Tsunami Workshop, August 1989, Novosibirsk, Siberia, USSR
* Co-Chairman / Keynote Speaker: Fourth International Conference on Natural Disaster Mitigation, August 1991, Perugia, Italy.
* Chairman: Third International Conference on Disaster Mitigation, Scripps Institution of Oceanography, University of California La Jolla, California, and at CICESE, Ensenada, Mexico,1988.

* Chairman: XI Session of the International Tsunami Warning System in the Pacific, UNESCO-IOC, September 1987, Beijing, China.

AWARDS

Numerous awards and commendations. Among them:

In 1988, nominated and was one of the two finalists for the prestigious United Nations (UNDRO-Sasakawa) award for international contributions to disaster mitigation (award given to the Prime Minister of Fiji).

In September, 1993, at an International Conference in Tokyo, Japan, a gold plaque was awarded for numerous contributions to the Intergovernmental Oceanographic Commission of UNESCO, over an 18-year period as Director of the International Tsunami Information Center.

Award (2002) of the International Tsunami Society for original and outstanding contributions to the Science of Tsunami Hazards
http://www.sthjournal.org/award.htm

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of Pa'ina Hawaii, LLC Materials License Application	)))))	Docket No. 30-36974-ML ASLBP No. 06-843-01-ML

DECLARATION OF GEORGE PARARAS-CARAYANNIS, Ph.D.
IN SUPPORT OF CONCERNED CITIZENS OF
HONOLULU'S CONTENTIONS RE: STAFF SAFETY REVIEW

Under penalty of perjury, I, Dr. George Pararas-Carayannis, hereby declare that:

1. I have a Ph.D. in Marine Sciences from the University of Delaware, a M.S. in Oceanography from the University of Hawai'i, and both a B.S. in Chemistry-Mathematics and an M.S. in Chemistry from Roosevelt University. I have considerable experience in mathematical modeling and field studies of natural disasters, environmental engineering, coastal engineering, geology, seismology, volcanology, geophysics, risk analysis, disaster planning/mitigation, real time data systems, and hazard reduction.

2. I previously filed declarations in support of Concerned Citizens of Honolulu's Contentions Re: Draft Environmental Assessment And Draft Topical Report. My credentials to discuss the potential effects of natural phenomena and other technical issues related to Pa'ina Hawaii, LLC's proposed irradiator were stated in my prior declarations and will not be repeated here.

3. I have reviewed Pa'ina Hawaii, LLC's materials license application and related documents on file in this proceeding, including the Nuclear Regulatory

EXHIBIT 32

Commission Staff's August 17, 2007 Safety Evaluation Report ("SER") (ADAMS Accession No. ML072260186).

4. Based on my review of documents related to the proposed irradiator, I prepared an independent assessment of the natural hazard risk to the facility at the Palekona Street site Pa'ina has selected. A true and correct copy of my report, entitled "Assessment of Natural Disaster Risks for the Proposed Site of Pa'ina Hawaii, LLC's Cobalt-60 Irradiator Facility At 192 Palekona Street, Honolulu, Hawai'i," is attached hereto as Exhibit "5" and incorporated herein by reference.

5. For the reasons discussed in my report, my opinion is that hurricanes, tsunamis, and earthquakes involving the proposed irradiator may have significant impacts that merit much more rigorous review than the Staff had performed. Unfortunately, the SER reveals the Staff still has failed to perform the additional review needed to ensure Pa'ina satisfies all applicable safety requirements, including 10 C.F.R. § 30.33(a)(2)'s requirement that Pa'ina establish its proposed irradiator would be "adequate to protect health and minimize danger to life or property." The SER contains no analysis whatsoever of potential safety risks related to tsunamis and hurricanes, to which the site is particularly susceptible due to its location adjacent to Ke'ehi Lagoon and within the tsunami evacuation zone. Moreover, as discussed below, the SER's cursory discussion of seismic risks is inadequate to ensure against damage from earthquakes.

6. In my report, I noted that Pa'ina proposes to build its irradiator on unconsolidated alluvial sediments (i.e., silty gravel and sand), where liquefaction can occur. In discussing this important safety issue, the SER states merely that "the factor of safety against liquefaction would be in an acceptable range as long as the Standard

Penetration Test (SPT) blowcount from the soil boring was of an adequate value." While this statement is accurate as a general proposition, the SER *fails to consider whether, in* fact, the SPT blow count is "of an adequate value." Review of Pa'ina's September 14, 2005 geotechnical report (ADAMS Accession No. ML053460276) reveals the recorded blow counts are far from adequate to ensure against damage from liquefaction.

7. The geotechnical report's estimate of maximum allowable bearing values of 1,400 pounds per square foot for foundation resistance appears reasonable under normal (i.e., non-liquefaction) conditions. However, if liquefaction occurs during an earthquake, the bearing resistance will not be the same. There is a fundamental difference between static stability and seismic stability. The bearing values in the geotechnical report refer only to the static stability of the landfill material at Pa'ina's preferred site, not to its seismic stability. Regardless of the safety factor added to the static stability values, the Staff cannot determine whether construction of an irradiator at the site would be safe without a proper seismic stability analysis and discussion of associated risks. This was not done, precluding an informed decision about safety of the proposed irradiator in the event of liquefaction during an earthquake.

8. Most of the damage to even new buildings in downtown Mexico City in the 1985 earthquake occurred because of liquefaction. Downtown Mexico City is the location of an old dry lake underlain by about 30 feet of sediments. Although Mexico City was about 300 km away from the earthquake epicenter, a focused monochromatic seismic surface wave that reached the 30-foot sediment layer amplified the seismic accelerations and caused the liquefaction that destroyed high rise buildings at sites where SPTs had been performed and foundation resistance tests had been considered adequate.

The same type of liquefaction destroyed buildings and highway overpasses in San Fernando Valley in California when the moderate 1994 Northridge earthquake struck. All buildings and structures that were destroyed had been built in accordance to earthquake building codes (revised and upgraded after the 1971 San Fernando earthquake) and at sites that prior engineering studies and SPT's had considered "safe."

9. The site Pa'ina has proposed for its irradiator is on reclaimed land that has been filled with non-homogeneous, unconsolidated alluvial material, most of which was dredged from the existing waterway of Ke'ehi Lagoon. The density of material, the granular composition, silt content, and the particle size distribution vary, as well as the degree of settling. This is why the blow count values presented in the geotechnical report vary so much, with values ranging from 4 to 120.

10. Many of the geotechnical report's blow count values were below 15, indicating a substantial risk of liquefaction from an earthquake. Indeed, with such low blow counts, an earthquake would not have to be particularly significant to cause liquefaction. Depending on the epicenter, depth and directional focusing, even a relatively small event could result in liquefaction, presenting significant safety concerns since, in addition to the low blow count values, the site has groundwater only a few feet below the surface. The material below the Pa'ina site (silty sands and gravel) is supersaturated with water, and there could be at least partial – if not total – liquefaction at the toe of any structure built on such a site. Consequently, the SER's apparent assumption that the blow counts at the site are "of an adequate value" to ensure against liquefaction lacks any basis.

11. The SER's conclusion that the six-inch separation between the sides of the irradiator pool and the building slab "should provide adequate isolation" in the event of an earthquake is similarly unsubstantiated. The SER bases this finding on inaccurate assumptions about what constitutes "a seismic event typical of the area." As explained in my report, the Staff has improperly trivialized the potential intensity of ground motions at the proposed irradiator site, inaccurately assuming that the Modified Mercalli Intensity V estimated for the island of O'ahu for the October 2006 earthquake is the maximum earthquake ground force that can be expected at the proposed site. The Lana'i earthquake of 1871, the Maui earthquake of 1938, and the 1948 earthquake offshore of Honolulu all produced greater than Force V Intensities, with the 1871 event reported to have caused damage to every building at the Punahou School Campus.

12. Unlike magnitude, which represents a single quantity of an earthquake's energy release, intensity does not have one single value for a given earthquake. Rather, it can vary significantly from place to place depending on substrata soil conditions. There is no evidence the Modified Mercalli Intensity estimate on which the Staff relied took into account the properties of unconsolidated sediments like those found at the irradiator site. Similarly, the potential horizontal seismic ground motions on which the Staff relied represent statistical estimates for the southern coast of O'ahu which may not be valid for the alluvial material at the proposed facility site. In addition, the Staff failed to consider the potential focusing effects of seismic energy on O'ahu. Due to the flaws in the underlying analysis, there is, accordingly, no basis for the SER's assumption about what constitutes "a seismic event typical of the area," casting serious doubt on its conclusion the irradiator design would provide "adequate isolation" in the event of an earthquake.

13. Without a proper soil analysis and plasticity study, the Staff has no scientifically defensible basis to conclude the site is safe from liquefaction. Borings alone, cone penetration tests or blow counts – even when closely spaced – are not sufficient. If anything, blow counts of such diversity as those presented in the geotechnical report indicate highly non-homogeneous and potentially unsafe soil conditions that may be particularly susceptible to liquefaction. Due to the variability and uncertainty of the data in the geotechnical report, the Staff's interpretation is erroneous and provides a misleading assessment of the liquefaction hazard at Pa'ina's preferred site.

14. In my opinion, additional analysis is needed to assess whether the proposed irradiator would be safe in the event of an earthquake, including whether the factor of safety against liquefaction is in an acceptable range. Either the Staff or Pa'ina must perform this analysis, as well as a thorough review of safety risks associated with tsunamis and hurricanes, before one could make an informed decision about whether Pa'ina's proposed irradiator would be "adequate to protect health and minimize danger to life or property," as 10 C.F.R. § 30.33(a)(2) requires.

I declare under penalty of perjury that the factual information provided above is true and correct to the best of my knowledge and belief, and that the professional opinions expressed above are based on my best professional judgment.

Executed at Honolulu, Hawai'i on this 12th day of September, 2007.

Dr. George Pararas-Carayannis

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of Pa'ina Hawaii, LLC Materials License Application	)))))	Docket No. 30-36974-ML ASLBP No. 06-843-01-ML

SUPPLEMENTAL DECLARATION OF GEORGE PARARAS-CARAYANNIS, Ph.D. IN SUPPORT OF CONCERNED CITIZENS OF HONOLULU'S CONTENTIONS RE: FINAL SAFETY EVALUATION REPORT

Under penalty of perjury, I, Dr. George Pararas-Carayannis, hereby declare that:

1. In my September 12, 2007 declaration, I focused on the statements the Nuclear Regulatory Commission Staff made in its August 17, 2007 Safety Evaluation Report ("SER") (ADAMS Accession No. ML072260186) regarding the risks that earthquakes pose to the irradiator Pa'ina Hawaii, LLC proposes to build and operate on Palekona Street in Honolulu. As discussed in that declaration, the Staff has no basis to conclude that the actions Pa'ina proposes to take would be adequate to avoid liquefaction or that a horizontal separation of six inches between the sides of the irradiator pool and the building slab would provide adequate isolation during a seismic event. Based on my decades of experience in the field, I have concluded there is a substantial risk of liquefaction from an earthquake at Pa'ina's selected site and there is no basis for the SER's assumption about what constitutes "a seismic event typical of the area," undermining its conclusion the irradiator design would provide "adequate isolation" in the event of an earthquake.

EXHIBIT 33

2. I have now reviewed Pa'ina's answer to Concerned Citizens' contentions, which was filed on October 1, 2007. In its answer, Pa'ina does not contest that liquefaction might occur. Instead, it claims no damage would result even in the event of complete liquefaction of all the soil around the pool. The SER did not make a similar claim, relying instead on "[a]ctions that the applicant will take to avoid soil liquefaction," and, accordingly, I did not previously have occasion to address it. For the following reasons, I conclude Pa'ina has not adequately demonstrated that liquefaction would not pose a safety risk.

3. Liquefaction, but mainly strong ground motions, enhanced in the unconsolidated sediments of Pa'ina's chosen site could cause cracks in the pool structure, allowing escape of pool shielding water and/or radioactive material. Notably, even in the absence of liquefaction, enhancement of ground motions could occur in alluvial deposits like those underlying the Palekona Street site. Thus, damage to the structure could occur with full liquefaction, partial liquefaction or no liquefaction at all. Liquefaction may result in the settling, sinking, tilting and/or cracking of the entire structure or in its separation from the superstructure above it. Damage could occur from strong ground motions caused by the seismic surface wave, which travels much like a sea wave. The rupture geometry of the seismic source region can affect the directivity and frequency of the surface seismic waves. Furthermore, the surface waves could separate into trains of certain periods.

4. Waves of certain periods could enhance the ground accelerations – both vertical and horizontal – in the alluvial sediments of the Palekona Street site, causing significant damage. For example, I conducted the survey of Mexico City following the

catastrophic 1985 earthquake and found that most of the damage was due to maximum ground accelerations caused by a single monochromatic surface seismic wave traveling within a 30-foot layer of sediments. Similar conditions exist at the site Pa'ina has proposed for its irradiator.

5. To determine the potential for liquefaction and strong ground motions to cause structural failure of the proposed irradiator, one would need to make a number of assumptions regarding the vertical and horizontal seismic accelerations and then estimate how dynamic forces would affect the structural integrity of the pool structure. It is a problem of earthquake engineering that requires the introduction of input variables into a numerical or a scaled physical model, and then interpretation of the output results for adequacy of design.

6. While Pa'ina claims it performed such an analysis, the March 9, 2006 letter it cites fails to provide – and Pa'ina has not otherwise disclosed – the underlying data or calculations. Accordingly, it is not possible to conduct a comprehensive peer review of the assumptions Pa'ina made in support of its conclusion the pool structure would not be damaged in the event of total liquefaction. In the absence of supporting data and calculations, any reliance by the Staff on Pa'ina's analysis in concluding the proposed irradiator would be safe (and there is no suggestion in the SER that the Staff did rely on this analysis) would be based on blind faith, rather than reasoned inquiry.

7. While Pa'ina has not disclosed all of its assumptions, we do know that a key one – that effective peak ground acceleration would not exceed 0.15g – is flawed, rendering the rest of Pa'ina's analysis unreliable. As discussed in my September 12, 2007 declaration, there is no basis for Pa'ina's (and the Staff's) assumption that the

specified effective peak ground acceleration of 0.15g of Uniform Building Code seismic zone 2A designation is applicable to the reclaimed land at Pa'ina's preferred site, which has substrata of unconsolidated alluvial sediments. Unlike magnitude, which represents a single quantity of an earthquake's energy release, intensity does not have a single value for a given earthquake. Rather, it can vary significantly from place to place depending on substrata soil conditions. The potential horizontal seismic ground motions on which Pa'ina relied represent statistical estimates for the entire southern coast of O'ahu which may not be valid for the alluvial material at the proposed facility site. In addition, it does not appear Pa'ina took into consideration the potential focusing effects of seismic energy on O'ahu.

8. Due to the flaws in the underlying analysis, there is no basis for Pa'ina's assumption about the peak ground acceleration to which the proposed irradiator might be subjected. Accordingly, the value of 102 lbs/cf may not actually be the maximum pressure that would be exerted against the pool structure, as Pa'ina assumes. Since the maximum assumed peak acceleration of 0.15g could be enhanced in alluvial sediments, the 144 lbs/cf design pressure of the pool's wall could well be exceeded, threatening a rupture of the pool lining. A study far more extensive than the cursory analysis Pa'ina has performed would be necessary before the Staff could make an informed decision whether the pool structure would rupture in the event of liquefaction. The easiest way to warrantee safety is to chose an alternate site for the irradiator far from the shoreline and on solid ground.

9. Pa'ina's claim that the six-inch separation between the sides of the irradiator pool and the building slab would "insure[] isolation ... even in [the] worst-

scenario that was assumed for the purpose of this analysis" is similarly flawed since it is also based on the unsupported assumption that the peak ground acceleration to which the proposed irradiator might be subject would be 0.15g. As discussed in my September 12, 2007 declaration, the Lana'i earthquake of 1871, the Maui earthquake of 1938, and the 1948 earthquake offshore of Honolulu all produced greater than Modified Mercalli Force V Intensities. In the event of another earthquake of similar intensity, the unconsolidated alluvial sediments at Pa'ina's preferred site could experience peak ground accelerations far in excess of 0.15g. Pa'ina has failed to establish that its irradiator design would survive such an event.

10. Pa'ina fails to appreciate the significance of the discussion in my September 12, 2007 declaration of the Lana'i earthquake of 1871. Regardless of the intervening upgrades to the building code, the mere fact the 1871 earthquake caused extensive damage to buildings on a location with relatively stable substrata conditions is indicative of the potential harm to structures at locations with far less stable conditions, such as the reclaimed land Pa'ina proposes for its irradiator, should an earthquake of similar magnitude and intensity occur again.

11. One cannot assume, as Pa'ina apparently does, that, if an earthquake similar to the one in 1871 occurred again, there would be no damage to Punahou School buildings or other buildings on O'ahu simply because the building code was upgraded to a zone 2A designation. To assume a code upgrade alone provides adequate protection from future earthquakes is erroneous. In California, the building codes were upgraded after the Long Beach earthquake of 1933 destroyed schools in the area. The codes were upgraded again after the destructive 1971 San Fernando Valley earthquake. Everyone

had a false sense of safety and believed the 1971 codes were adequate, until the 1994 Northridge earthquake struck, with devastating effect.

12. The lesson is that mere compliance with whatever building code happens to be in effect is no guarantee of safety. Particularly when a project with the potential for significant harm to public safety and the environment in the event of a structural failure is involved, as here, detailed analysis of the soil conditions at the specific proposed site is vital to assess whether public safety would be threatened in the event of an earthquake. Neither Pa'ina nor the Staff performed such an analysis, precluding the Staff from making an informed decision about whether Pa'ina's proposed irradiator would be "adequate to protect health and minimize danger to life or property," as 10 C.F.R. § 30.33(a)(2) requires.

I declare under penalty of perjury that the factual information provided above is true and correct to the best of my knowledge and belief, and that the professional opinions expressed above are based on my best professional judgment.

Executed at Athens, Greece on this 5th day of October, 2007.

Dr. George Pararas-Carayannis

GEOTECHNICAL REPORT

PĀ'INA HAWAI'I IRRADIATION FACILITY
192 Palekona Street
Honolulu, Hawai'i

Weidig Geoanalysts Project No. 05-0072.001

WEIDIG
Geoanalysts

EXHIBIT 34

GEOTECHNICAL REPORT
PĀ'INA HAWAI'I IRRADIATION FACILITY
192 PALEKONA STREET
HONOLULU, HAWAI'I

Project No: 05-0072.001

Date: September 14, 2005

Prepared for:

Pā'ina Hawai'i, Inc.
Attn: Michael Kohn
P. O. Box 31264
Honolulu, Hawai'i 96820

Prepared by:

Weidig Geoanalysts
1200 College Walk, Suite 121
Honolulu, Hawai'i 96817

Authored by:

Paul C. Weidig
Licensed Professional Engineer No. 8,047-C

PAUL COLIN WEIDIG
LICENSED PROFESSIONAL ENGINEER
No. 8047-C
HAWAII, U.S.A.

WEIDIG
Geoanalysts

WEIDIG
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www.geoanalysts.com

September 14, 2005

Project No. 05-0072.001

To: Pā'ina Hawai'i, Inc.
P. O. Box 31264
Honolulu, Hawai'i 96820

Attn: Michael Kohn

Subject: Geotechnical Investigation
Pā'ina Hawai'i Irradiation Facility
192 Palekona Street
Honolulu, Hawai'i

Attached is our report of the geotechnical study we conducted for your new facility near Honolulu International Airport. The principal conclusions and recommendations are as follow:

- Your property is underlain by an eight-foot-thick zone of fill consisting of silty sand and gravel that was placed to create the airport and surrounding industrial tracts. The upper three feet of the fill is generally compact to dense, but the remainder is soft or very loose. The fill overlies typically very loose to semicompact gravelly sand lagoonal sediments to a depth of about 24.5 feet, below which are storm surge deposits composed of a dense, silty, gravelly sand to the maximum depth explored, about 36.5 feet. Ground water was intercepted at an average depth of about eight feet, near the contact between the fill and the marine soils.

- The proposed building should be supported on conventional spread foundations based at a comparatively shallow depth in recompacted, preexisting fill. The proposed irradiation chamber can be supported upon a reinforced concrete mat founded on lagoonal deposits. The chamber excavation should be shored with sheet piles to facilitate construction. The new concrete slab-on-grade floor, loading dock and pavement system should be supported on recompacted surficial soils, new fill. Specific recommendations are presented in the report.

- We should be retained to inspect the foundation excavations as well as to test and observe any earthwork.

If you have any questions regarding this report, or if we can be of assistance to you in any other way, please do not hesitate to call. Mahalo for this opportunity to be of service.

Respectfully submitted,

Paul C. Weidig

Paul C. Weidig, P.E.
President

PCW/lr/05-0072.001

BORING LOCATION: See Site Plan	DRILLER: Valley Well Drilling	**BORING NO. B-1**
BORING ELEVATION:	LOGGED BY: Berwin Chow	
DATE DRILLED: August 12, 2005	TYPE DRILL RIG: Mobile B59/ 64" hollow augers	

OTHER LAB TESTS	DRY UNIT WEIGHT (pcf)	MOISTURE CONTENT (%)	UNCONFINED STRENGTH (ksf)	PLASTICITY INDEX (%)	BLOW COUNT (Blows per foot)	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	GRAPHIC SYMBOL	UNIFIED SOIL CLASSIFICATION	GEOTECHNICAL DESCRIPTION
	95	17.2			28	SB-1			SM	**SILTY SAND**, light brown, dry, semicompact, fine to medium sand, with scattered fine to medium coralline gravel - Fill -
DS	74	42.9			11	SB-2	5			very wet, loose
	103	23.2			22	SB-3			SP	**GRAVELLY SAND**, pale yellowish-gray, saturated, semi-compact, fine to medium gravel, fine to coarse sand, coralline, poorly graded
SA	88	32.2			14	SB-4	10			loose
	87	35.4			12	SB-5	15			light gray
	88	29.9			24	SB-6	20			semicompact
										Bottom of Boring No. B-1 @ 21.5 ft. Stabilized ground water level measured @ 8.4 ft.
							25			

SAMPLE TYPE

BK - Bulk
CB - Core Barrel
DN - Denison Sampler
SB - Split Barrel
SP - Standard Penetration
ST - Shelby Tube

OTHER LABORATORY TESTS

AL - Atterberg Limits
CN - Consolidation
DS - Direct Shear Strength
PR - Proctor Compaction
SA - Sieve Analysis
TX - Triaxial Compression

LOG OF BORING

WEIDIG Geoanalysts

PĀ`INA HAWAI`I IRRADIATION FACILITY
192 Palekona Street
Honolulu, Hawai`i

DATE: September, 2005

PROJECT NO. 05-0072.001

PLATE NO. A3

BORING LOCATION: See Site Plan	DRILLER: Valley Well Drilling	**BORING NO. B-2**
BORING ELEVATION:	LOGGED BY: Berwin Chow	
DATE DRILLED: August 12, 2005	TYPE DRILL RIG: Mobile B59/ 64" hollow augers	

OTHER LAB TESTS	DRY UNIT WEIGHT (pcf)	MOISTURE CONTENT (%)	UNCONFINED STRENGTH (ksf)	PLASTICITY INDEX (%)	BLOW COUNT (Blows per foot)	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	GRAPHIC SYMBOL	UNIFIED SOIL CLASSIFICATION	GEOTECHNICAL DESCRIPTION
	68	21.9			47	SB-1			SM	**SILTY SAND**, light brown, dry, compact, fine to medium sand, with scattered fine to medium coralline gravel - Fill -
	73	43.9			9	SB-2	5			very wet, very loose
	73	27.3			33	SB-3			SP	▼ **GRAVELLY SAND**, *pale yellowish-gray, saturated, compact,* fine to medium gravel, fine to coarse sand, coralline, poorly graded
	90	29.5			46	SB-4	10			
SA	86	38.4			11	SB-5	15			light gray, very loose, slightly silty
	65	42.1			4	SB-6	20			
							25			*Bottom of Boring No. B-2 @ 21.5 ft.* Stabilized ground water level measured @ 8.6 ft.

SAMPLE TYPE

BK - Bulk
CB - Core Barrel
DN - Denison Sampler
SB - Split Barrel
SP - Standard Penetration
ST - Shelby Tube

OTHER LABORATORY TESTS

AL - Atterberg Limits
CN - Consolidation
DS - Direct Shear Strength
PR - Proctor Compaction
SA - Sieve Analysis
TX - Triaxial Compression

LOG OF BORING

WEIDIG Geoanalysts

PĀ`INA HAWAI`I IRRADIATION FACILITY
192 Palekona Street
Honolulu, Hawai`i

DATE: September, 2005 | PROJECT NO. 05-0072.001

PLATE NO. A4

BORING LOCATION: See Site Plan	DRILLER: Valley Well Drilling	**BORING NO. B-3**
BORING ELEVATION:	LOGGED BY: Berwin Chow	
DATE DRILLED: August 12, 2005	TYPE DRILL RIG: Mobile B59/ 64" hollow augers	

OTHER LAB TESTS	DRY UNIT WEIGHT (pcf)	MOISTURE CONTENT (%)	UNCONFINED STRENGTH (ksf)	PLASTICITY INDEX (%)	BLOW COUNT (Blows per foot)	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	GRAPHIC SYMBOL	UNIFIED SOIL CLASSIFICATION	GEOTECHNICAL DESCRIPTION
	68	21.9			51	SB-1			SM	**SILTY SAND**, light brown, dry, compact, fine to medium sand, with scattered fine to medium coralline gravel - Fill -
	73	43.9			12	SB-2	5			very wet, loose
	73	27.3			38	SB-3			SP	▼ **GRAVELLY SAND**, pale yellowish-gray, saturated, compact, fine to medium gravel, fine to coarse sand, coralline, poorly graded
	90	29.5			57	SB-4	10			
	86	38.4			41	SB-5	15			light gray
	65	42.1			18	SB-6	20			loose
							25			Bottom of Boring No. B-3 @ 21.5 ft. Stabilized ground water level measured @ 8.0 ft.

SAMPLE TYPE

BK - Bulk
CB - Core Barrel
DN - Denison Sampler
SB - Split Barrel
SP - Standard Penetration
ST - Shelby Tube

OTHER LABORATORY TESTS

AL - Atterberg Limits
CN - Consolidation
DS - Direct Shear Strength
PR - Proctor Compaction
SA - Sieve Analysis
TX - Triaxial Compression

LOG OF BORING

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PĀ`INA HAWAI`I IRRADIATION FACILITY
192 Palekona Street
Honolulu, Hawai`i

DATE: September, 2005 | PROJECT NO. 05-0072.001

PLATE NO. A5

BORING LOCATION: See Site Plan	DRILLER: Valley Well Drilling	**BORING NO. B-4**
BORING ELEVATION:	LOGGED BY: Berwin Chow	
DATE DRILLED: August 12, 2005	TYPE DRILL RIG: Mobile B59/ 64" hollow augers	

OTHER LAB TESTS	DRY UNIT WEIGHT (pcf)	MOISTURE CONTENT (%)	UNCONFINED STRENGTH (ksf)	PLASTICITY INDEX (%)	BLOW COUNT (Blows per foot)	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	UNIFIED SOIL CLASSIFICATION	GEOTECHNICAL DESCRIPTION
	68	21.9			98	SB-1		SM	**SILTY SAND**, light brown, moist, dense, fine to medium sand, with scattered fine to medium coralline gravel - Fill -
DS	73	43.9			8	SB-2	5	CH	**CLAY**, very pale gray to white, very wet, soft
	73	27.3			62	SB-3		SP	**GRAVELLY SAND**, pale yellowish-gray, saturated, compact, fine to medium gravel, fine to coarse sand, coralline, poorly graded
	90	29.5			21	SB-4	10		semicompact
	86	38.4			22	SB-5	15		light gray to light gray-brown
	65	42.1			26	SB-6	20		
							25		Bottom of Boring No. B-4 @ 21.5 ft. Stabilized ground water level measured @ 7.8 ft.

SAMPLE TYPE

BK - Bulk
CB - Core Barrel
DN - Denison Sampler
SB - Split Barrel
SP - Standard Penetration
ST - Shelby Tube

OTHER LABORATORY TESTS

AL - Atterberg Limits
CN - Consolidation
DS - Direct Shear Strength
PR - Proctor Compaction
SA - Sieve Analysis
TX - Triaxial Compression

LOG OF BORING

WEIDIG Geoanalysts

PĀ`INA HAWAI`I IRRADIATION FACILITY
192 Palekona Street
Honolulu, Hawai`i

DATE: September, 2005

PROJECT NO. 05-0072.001

BORING LOCATION: See Site Plan	DRILLER: Valley Well Drilling	**BORING NO. B-5**
BORING ELEVATION:	LOGGED BY: Berwin Chow	
DATE DRILLED: August 12, 2005	TYPE DRILL RIG: Mobile B59 / 6" hollow augers	

OTHER LAB TESTS	DRY UNIT WEIGHT (pcf)	MOISTURE CONTENT (%)	UNCONFINED STRENGTH (ksf)	PLASTICITY INDEX (%)	BLOW COUNT (Blows per foot)	SAMPLE TYPE AND NUMBER	DEPTH IN FEET	UNIFIED SOIL CLASSIFICATION	GEOTECHNICAL DESCRIPTION
	88	28.8			117	SB-1		SM	**GRAVELLY SAND**, light brown, moist, dense, fine to medium sand, with scattered fine to medium coralline gravel - Fill -
SA	71	22.3			21	SB-2	5		semicompact
	94	252			25	SB-3			wet
	110	12.2			44	SB-4	10	SP	**GRAVELLY SAND**, pale yellowish-gray, saturated, compact, fine to medium gravel, fine to coarse sand, coralline, poorly graded
DS	82	37.8			9	SB-5	15		light gray to light gray-brown, very loose
	82	24.9			23	SB-6	20		light brown, semicompact
	91	26.9			120	SB-7	25	GM	**SILTY, GRAVELLY SAND**, tan to buff, saturated, very dense, fine to medium gravel, fine to coarse sand, coralline, poorly graded, incipiently cemented
	93	27.7			92	SB-8	30		
	85	34.7			104	SB-9	35		
							40		Bottom of Boring No. B-5 @ 36.5 ft. Stabilized ground water level measured @ 8.6 ft.

SAMPLE TYPE

BK - Bulk
CB - Core Barrel
DN - Denison Sampler
SB - Split Barrel
SP - Standard Penetration
ST - Shelby Tube

OTHER LABORATORY TESTS

AL - Atterberg Limits
CN - Consolidation
DS - Direct Shear Strength
SA - Sieve Analysis
SS - Shrink/Swell
UC - Unconfined Compression

LOG OF BORING

WEIDIG Geoanalysts

PĀ`INA HAWAI`I IRRADIATION FACILITY
192 Palekona Street
Honolulu, Hawai`i

DATE: September, 2005

PROJECT NO. 05-0072.001

MAJOR DIVISIONS			SYMBOLS ICON	SYMBOLS CODE	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS More than 50% of material is larger than the No. 200 Sieve	GRAVEL AND GRAVELLY SOILS Less than 50% of coarse fraction passes the No. 4 Sieve	CLEAN GRAVELS Less than 12% of fine fraction passes the No. 200 Sieve		GW	Well-graded gravels, gravel-sand mixtures, little or no fines
				GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
		SILTY OR CLAYEY GRAVELS At least 12% of fine fraction passes the No. 200 Sieve		GM	Silty gravels, gravel-sand-silt mixtures
				GC	Clayey gravels, gravel-sand-clay mixtures
	SAND AND SANDY SOILS Less than 50% of coarse fraction passes the No. 4 Sieve	CLEAN SANDS Less than 12% of fine fraction passes the No. 200 Sieve		SW	Well-graded sands, gravelly sands, little or no fines
				SP	Poorly-graded sands, gravelly sands, little or no fines
		SILTY OR CLAYEY SANDS At least 12% of fine fraction passes the No. 200 Sieve		SM	Silty sands, sand-silt mixtures
				SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS More than 50% of material is smaller than the No. 200 Sieve	SILTS AND CLAYS Liquid Limit is less than 50	Plasticity index is above "A" Line		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		Plasticity index is below "A" Line		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or slightly plastic clayey silts
				OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS Liquid Limit is greater than 50	Plasticity index is above "A" Line		CH	Inorganic clays of high plasticity
		Plasticity index is below "A" Line		MH	Inorganic silts, micaceous or diatomaceous fine sands or silty soils
				OH	Organic clays of medium to high plasticity, organic silts
				Pt	Peat, humus, marsh soils with high organic content

UNIFIED SOIL CLASSIFICATION SYSTEM

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Geoanalysts

PĀ`INA HAWAI`I IRRADIATION FACILITY
192 Palekona Street
Honolulu, Hawai`i

DATE: September, 2005

PROJECT NO. 05-0072.001

PLATE NO. A8

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of Pa'ina Hawaii, LLC Material License Application	)))))	Docket No. 30-36974-ML ASLBP No. 06-843-01-ML

SUPPLEMENTAL WRITTEN TESTIMONY AND
DECLARATION OF MARVIN RESNIKOFF, Ph.D.

I, Dr. Marvin Resnikoff, declare under penalty of perjury that the contents of the following Supplemental Written Testimony and Declaration of Marvin Resnikoff, Ph.D. are true and correct to the best of my knowledge:

Q.1: Please state your name, occupation, employer, and business address.

A.1: As stated in my prior testimony, my name is Marvin Resnikoff. I am a physicist with a Ph.D. in high-energy theoretical physics from the University of Michigan and also the Senior Associate of Radioactive Waste Management Associates ("RWMA"), a private technical consulting firm based in New York City. Our offices are located at 526 West 26th Street, Room 517, New York, NY 10001.

A copy of my resume is attached hereto as Exhibit "35."

Q.2: Are you familiar with the NRC Staff's Initial Statement of Position on Amended Environmental Contentions 3 and 4, which was filed in the Pa'ina Hawaii, LLC licensing proceeding on August 26, 2008?

A.2: I have reviewed the Staff's testimonies of Matthew D. Blevins, James Durham, Amitava Ghosh, John Stamatakos, and Kaoshik Das, which discuss, among other things, reports I prepared evaluating the deficiencies of the Center for Nuclear Waste Regulatory Analysis ("CNWRA's") draft and final topical reports for Pa'ina's proposed irradiator, as well as the Staff's environmental assessment ("EA") for that proposed facility.

Concerned Citizens has previously submitted true and correct copies of my February 7, 2007 report and my February 9, 2007 declaration as Exhibits "2" and "3," respectively. True and correct copies of my August 24, 2007, May 2, 2008, and May 22, 2008

declarations are attached hereto as Exhibits "36" through "38," respectively. These analyses accurately reflect my views regarding the potential threats to public health and safety, as well as the natural environment, associated with construction and operation of the proposed irradiator at Pa'ina's preferred location.

Q.3: At this time, please turn your attention to paragraph A.23 of Mr. Blevins' testimony, in which he states that, "based on the MicroShield calculations and the well-collimated beam, it is not foreseeable that the dose rate equivalent [to irradiator workers] would exceed 5000 mrem/yr," the Part 20 dose limits. Do you agree with Mr. Blevins' assessment?

A.3: No. Initially, let me correct an error in the calculations discussed in my prior testimony regarding the dose rate in the event of an aviation accident or natural disaster that caused the shielding water to drain to the level of the surrounding water table. While my calculations took into account shielding by the plenum, I inadvertently did not take into account a change in the buildup factor. Having evaluated the buildup factor, I now agree with Mr. Blevins that, with an eight-foot drop in shielding water, the dose rate, at 42 inches above floor level, would be approximately 8.5 rem/hour.

With a dose rate of 8.5 rem/hour, any personnel on the scene would be subjected to more than the annual occupational dose limit of 5,000 millirem/year in only thirty-five minutes. There is no basis for Mr. Blevins' assumption irradiator workers would not be exposed to these high levels of radiation since a catastrophic accident would likely destroy the irradiator lip, widening the "well-collimated beam" so that workers in proximity to the irradiator pool would be exposed.

The Staff's MicroShield calculations assume the 42-inch high irradiator lip would remain intact, a highly unlikely scenario given the sworn statement of Gray*Star Vice-President Russell N. Stein that the lip is designed to be "sacrificial" in a disaster scenario. The Staff's analysis also ignores that, even if the lip remained intact, workers responding to an accident would likely bend over the lip to inspect the damage.

In addition, it's important to bear in mind that the Part 20 dose limit for irradiator workers does not apply to emergency responders, who are treated under the regulations the same as other members of the public. Emergency responders on the scene would receive radiation doses in excess of the 100 millirem/year limit in less than 43 seconds, if the irradiator lip remained intact, and even more quickly if the irradiator lip were destroyed, allowing exposures at the facility floor level.

Q.4: In paragraph A.24 of his testimony, Mr. Blevins claims that debris associated with an accident "would prevent inadvertent access by acting as a physical barrier." Do you agree?

A.4: No. Mr. Blevins' claim is pure speculation. There is no reason to believe debris from an aviation accident or natural disaster would completely fill the irradiator structure,

preventing access to areas of elevated radiation near the irradiator pool. Mr. Blevins' reliance on the report prepared by Professors Sozen and Hoffman is misplaced since, as the report explains, the simulation they performed was designed solely to demonstrate the vulnerability of the irradiator structure; it was not designed to predict the precise distribution of debris following an aviation accident.

Moreover, even if debris initially did block access to the irradiator pool following an accident, it is only reasonable to expect that irradiator workers and emergency responders would eventually remove that debris so they could access the pool and inspect it for damage. When they did, they could be exposed to excessive radiation. As discussed above, the dose adjacent to the pool irradiator would be greater than 8.5 rem/hour if an accident drained the shielding water to the level of the surrounding groundwater. Emergency responders – who, for regulatory purposes, are considered members of the public – would be exposed to the 100 millirem/year maximum dose in less than 43 seconds.

Q.5: Please turn your attention now to paragraph A.25 of Mr. Blevins' testimony, where he states that the likelihood of accidents involving exposures of workers to lethal doses from the underwater irradiator design would be low because "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 [and] will have source loading procedures, as well as general radiation safety procedures." Do you agree with this assessment?

A.5: No. Mr. Blevins fails to consider the potential impacts associated with an aviation accident or natural disaster, which could render these safeguards completely ineffective. As explained previously, airplane or building debris could easily pierce or rupture the layers of steel and concrete that comprise the irradiator pool liner. Such debris would also likely destroy the continuous monitoring systems. Thus, even if these safeguards were adequate to keep the risk of lethal doses low during normal operations, Mr. Blevins' assumption these safeguards would remain effective following a catastrophic accident is unjustified.

Q.6: In paragraph A.27 of his testimony, Mr. Blevins claims that, in calculating the dose rate from an eight-foot water loss, you did not take into account shielding from the source encapsulation and the plenum. Is that accurate?

A.6: No. My calculations are set forth in Exhibit "26," which was attached to my prior testimony. As shown in that exhibit, to calculate the dose rate, I started with the Staff's calculations for a six-foot water loss and then scaled the increased dose rate due to the decrease in attenuation by water. Since the Staff's calculations for a six-foot water loss already took into account the shielding from the source encapsulation and the plenum, my calculations likewise accounted for it.

As discussed above, my calculations for an eight-foot water loss do not differ from the Staff's for a dose rate 42 inches above the facility floor. If the irradiator lip were

destroyed, as is entirely possible in an aircraft accident or natural disaster, the dose at the floor level would be greater.

Q.7: Now please turn your attention to the testimony provided by the CNWRA staff. In paragraphs A.15 through A.17 of his testimony, Dr. Ghosh discusses differences between the approaches you and he took to calculating the likelihood of an aviation accident involving Pa'ina's proposed irradiator. Do you agree with Dr. Ghosh's analysis?

A.7: I disagree with many of the assumptions Dr. Ghosh made in preparing his analysis of the likelihood that Pa'ina's irradiator would be involved in an aviation accident. Moreover, as stated in my prior testimony, there are numerous ways in which Dr. Ghosh mischaracterizes the analysis I conducted.

That said, there is little point in discussing our disagreements in detail because, at the end of the day, Dr. Ghosh arrived at the same order of magnitude of risk as I did. Whether one accepts my conclusion that the annual risk of an aviation accident involving an irradiator at Pa'ina's proposed location is 1 in 1757 (nearly 1 in 175 over the course of a ten-year license) or Dr. Ghosh's assessment that the risk is 1 in 5,000 (1 in 500 over the license term), the odds of an accident at the proposed location are unusually high, necessitating a careful review of accident consequences, as well as an evaluation of alternate locations where such risks could be avoided.

Notably, the fatal airplane crash in the mid-1990's that Dr. Ghosh discusses in paragraph A.15 (Honolulu airport director Benjamin Schlapak reports that this accident occurred in 1997, while Dr. Ghosh's summary of National Transportation Safety Board data apparently reports the same incident as occurring in 1994) involved an airplane that was destroyed after descending into a warehouse located only ¼-mile north of the airport. This accident confirms that the risk of aviation accidents involving facilities located in close proximity to the runways at Honolulu International Airport is not at all speculative. While such incidents may not occur every day, they do happen.

It is only prudent to consider alternate locations where the risk of a catastrophic aviation accident could be all but eliminated. As discussed in my February 7, 2007 report, by moving the irradiator a mere ten miles from the airport, one could reduce the probability of an accident by a factor of 1,000, avoiding unnecessary risk.

Alternatively, if a location adjacent to active runways is critical, Pa'ina and the NRC Staff should consider whether the project goals could be accomplished through the use of a non-nuclear technology, such as an x-ray or electron-beam irradiator. Use of a non-nuclear irradiator would eliminate all potential for excessive radiation exposures, whether from an aviation accident, natural disaster, terrorist attack, or otherwise.

Q.8: In paragraph A.22, Dr. Durham states 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" since the force of the explosion would come from directly above the pool, "preventing all but a small amount of water from leaving the pool." Do you agree with his analysis?

A.8: As with other aspects of the CNWRA's consequence analysis, Dr. Durham has failed to provide any calculations to back up his assertions. To determine how much water could be removed from the irradiator pool in the event of an explosion involves a complicated analysis that Dr. Durham apparently has not performed. It is not reasonable simply to assume only a small amount of water would leave the pool.

Compared to air, water is relatively non-compressible. Thus, if a blast were to occur directly above the pool, one would expect water to escape the compression along the walls of the pool. The amount of water escaping the compression would increase depending on the explosive force of the compression. If the instantaneous compression were high, then a great amount of water would be released. Here's a somewhat imperfect analogy. Think of a diver doing a cannonball dive, legs held tight; the splash is considerable.

The commercial airplanes that use Honolulu International Airport carry large amounts of aviation fuel. For example, a Boeing 767-200ER contains 23,980 gallons of jet fuel (http://www.boeing.com/commercial/767family/pf/pf_200prod.html). In the event that such an airplane were to strike Pa'ina's irradiator shortly after take-off, a massive explosion could occur. The CNWRA staff should have, but failed to, calculate the potential for such an explosion to remove substantial amounts of shielding water from the irradiator pool.

Q.9: Please turn your attention now to paragraph A.23, in which Dr. Durham states that, "'pulverizing' the Co-60 sources is all but impossible" and, thus, the pool water would not become contaminated, "[e]ven if a projectile fell directly into the pool." Do you agree with Dr. Durham's assessment?

A.9: No. No one at CNWRA has performed any analysis of whether the forces involved in an aviation accident could shatter the sources themselves, contaminating the pool water. Accordingly, Dr. Durham has no basis for making any assessment of the likelihood of such an event occurring.

As discussed in my prior testimony, unlike Dr. Durham, I performed calculations, set forth in Exhibit "23," that show the impact associated with an aviation accident would far exceed the standards the Co-60 sources are designed to withstand. Even if a commercial jet engine were dropped onto the sources from only the top of the irradiator pool (a very conservative assumption since, in an airplane crash, the engine would fall from a much greater height), the energy imparted would be over 7,500 times the energy imparted by a 20-kg weight falling from a height of one meter, the more stringent of the standards applicable to the sources Pa'ina proposes to use.

Since an aviation accident could apply to the Co-60 sources forces many orders of magnitude beyond those for which the sources were designed, the CNWRA staff should have – but failed to – perform the necessary calculations to determine the likelihood that ruptured sources would contaminate the pool water, which could then escape the facility though ruptures in the pool lining, spreading radioactive contamination to the groundwater and nearby Ke'ehi Lagoon.

Q.10: On page 11 of its September 15, 2008 Rebuttal Statement of Position and Testimony, the Staff asserts that the location where a radioactive dispersal device using sources taken from Pa'ina's proposed irradiator would be detonated is entirely speculative. Do you agree with that assessment?

Q.10: No. The Staff ignores that that the irradiator site itself – located at the transportation hub for the entire state of Hawai'i, in a highly urbanized area, and near symbolic and military targets like Pearl Harbor and Hickam Air Force Base – would be a prime location for dispersing the radioactive material proposed to be stored at the site. As I discussed in a July 6, 2007 report that Concerned Citizens submitted with its comments on the draft version of Appendix B, the irradiator pool and sources are vulnerable to terrorist attack using an M3A1 shaped charge, a TOW2 or MILAN anti-tank missile, or airplane.

In any of these scenarios, following puncture of the pool lining, a party of saboteurs could ignite a combustible material or detonate explosives inside the pool, which could, in turn, blast apart or aerosolize the Co-60 pellets at the bottom of the pool, resulting in dispersal of radioactive particulates into the surrounding environment. A radiological release would contaminate the surrounding area, including the Honolulu International Airport and Ke'ehi Lagoon.

Concerned Citizens has previously submitted a true and correct copy of my July 6, 2007 report as Exhibit "10." This report, together with my August 24, 2007 declaration, which is Exhibit "36," accurately reflect my views regarding the potential threats to public health and safety, as well as the natural environment, associated with terrorist attack involving Pa'ina's proposed irradiator. To reduce these threats, the Staff should have considered locations for Pa'ina's proposed irradiator that were out of urban Honolulu, away from strategic military bases, and far from Hawai'i's transportation and financial hubs, where the facility would be a less attractive target.

Q.11: Does this conclude your testimony?

A.11: Yes.

I declare under penalty of perjury that I have read the foregoing Supplemental Written Testimony and Declaration of Marvin Resnikoff, Ph.D. and know the contents thereof to be true of my own knowledge.

Dated at New York, New York, February 2, 2009.

MARVIN RESNIKOFF, Ph.D.

Resume of Marvin Resnikoff, Ph.D.

Dr. Marvin Resnikoff is Senior Associate at Radioactive Waste Management Associates and is an international consultant on radioactive waste management issues. He is Principal Manager at Associates and is Project Director for dose reconstruction and risk assessment studies of radioactive waste facilities and transportation of radioactive materials. Dr. Resnikoff has concentrated exclusively on radioactive waste issues since 1974. He has conducted studies on the remediation and closure of the leaking Maxey Flats, Kentucky radioactive landfill for Maxey Flats Concerned Citizens, Inc. and of the leaking uranium basin on the NMI/Starmet site in Concord, Massachusetts under grants from the Environmental Protection Agency. He also conducted studies of the Wayne and Maywood, New Jersey thorium Superfund sites and proposed low-level radioactive waste facilities at Martinsville (Illinois), Boyd County (Nebraska), Wake County (North Carolina), Ward Valley (California) and Hudspeth County (Texas). He investigated phosphogypsum plants in Florida, Texas and Alberta, Canada, and served as an expert witness in a personal injury case involving a Texas phosphogypsum worker. He has also served as an expert witness for CRPE, a public interest groups, regarding the proposed expansion of the Buttonwillow, California NORM landfill. He has conducted several studies of transportation accident risks and probabilities for the State of Nevada and several counties in Nevada (Lander, Churchill, Clark) and California (Inyo) and dose reconstruction studies of oil pipe cleaners in Mississippi and Louisiana, residents of Canon City, Colorado near a former uranium mill, residents of West Chicago, Illinois near a former thorium processing plant, and residents and former workers at a thorium processing facility in Maywood, New Jersey. In West Chicago he calculated exposures and risks due to thorium contamination and served as an expert witness for plaintiffs A Muzzey, S Bryan, D Schroeder and assisted counsel for plaintiffs KL West and KA West. He is presently serving as an expert witness for plaintiffs in Karnes County, Texas, Milan, NM and Uravan, CO, who were exposed to radioactivity from uranium mining and milling activities and for former workers and residents at the ITCO oil pipe cleaning yard in Louisiana. He also evaluated radiation exposures and risks in worker compensation cases involving G Boeni and M Talitsch, former workers at Maywood Chemical Works thorium processing plant. He served as an expert witness for a public interest group in the licensing of a food irradiator in Milford Township, Pennsylvania. In June 2000, he was appointed to a Blue Ribbon Panel on Alternatives to Incineration by DOE Secretary Bill Richardson.

In March 2004, Dr. Resnikoff was project director and co-author of a study of groundwater contamination at DOE facilities, *Danger Lurks Below.* He also authored or co-authored books on transporting radioactive fuel (*The Next Nuclear Gamble*) for the Council on Economic Priorities, and on DOE facilities (*Deadly Defense*) and low-level waste facilities (*Living Without Landfills*) for the Radioactive Waste Campaign.

In February 1976, assisted by four engineering students at State University of New York at Buffalo, Dr. Resnikoff authored a paper that, according to *Science*, changed the direction of power reactor decommissioning in the United States. His paper showed that power reactors could not be entombed for long enough periods to allow the radioactivity to decay to safe enough levels for unrestricted release. The presence of long-lived radionuclides meant that large volumes of decommissioning waste would still have to go to low-level or high-level waste disposal facilities. He assisted public interest groups on the decommissioning of the Yankee-Rowe, Diablo Canyon,

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Big Rock Point and Haddam Neck reactors. He served as an expert witness for the Town of Wiscasset, Maine, on a case involving property assessment of a dry storage facility.

Under a contract with the State of Utah, Dr. Resnikoff is a technical consultant to DEQ on the proposed dry cask storage facility for high-level waste at Skull Valley, Utah and proposed storage/transportation casks. He is assisting the State on licensing proceedings before the Nuclear Regulatory Commission. In addition, at hearings before state commissions and in federal court, he has investigated proposed dry storage facilities at the Point Beach (WI), Prairie Island (MN), Palisades (MI) and Maine Yankee reactors. He has also prepared studies on transportation risks and consequences for the State of Nevada and Clark and White Pine Counties.

In Canada, he conducted studies on behalf of the Coalition of Environmental Groups and Northwatch for hearings before the Ontario Environmental Assessment Board on issues involving radioactive waste in the nuclear fuel cycle and Elliot Lake tailings and the Interchurch Uranium Coalition in Environmental Impact Statement hearings before a Federal panel regarding the environmental impact of uranium mining in Northern Saskatchewan. He also worked on behalf of the Morningside Heights Consortium regarding radium-contaminated soil in Malvern and on behalf of Northwatch regarding decommissioning the Elliot Lake tailings area before a FEARO panel. He conducted a study for Concerned Citizens of Manitoba regarding transportation of irradiated fuel to a Canadian high-level waste repository.

He was formerly Research Director of the Radioactive Waste Campaign, a public interest organization conducting research and public education on the radioactive waste issue. His duties with the Campaign included directing the research program on low-level commercial and military waste and irradiated nuclear fuel transportation, writing articles, fact sheets and reports, formulating policy and networking with numerous environmental and public interest organizations and the media. He is author of the Campaign's book on "low-level" waste, *Living Without Landfills*, and co-author of the Campaign's book, *Deadly Defense, A Citizen Guide to Military Landfills*.

Between 1981 and 1983, Dr. Resnikoff was a Project Director at the Council on Economic Priorities, a New York-based non-profit research organization, where he authored the 390-page study, *The Next Nuclear Gamble, Transportation and Storage of Nuclear Waste*. The CEP study details the hazard of transporting irradiated nuclear fuel and outlines safer options.

Dr. Resnikoff is an international expert in nuclear waste management, and has testified often before State Legislatures and the U.S. Congress. He has extensively investigated the safety of the West Valley, New York and Barnwell, South Carolina nuclear fuel reprocessing facilities. His paper on reprocessing economics (Environment, July/August, 1975) was the first to show the marginal economics of recycling plutonium. He completed a more detailed study on the same subject for the Environmental Protection Agency, "Cost/Benefits of U/Pu Recycle," in 1983. His paper on decommissioning nuclear reactors (Environment, December, 1976) was the first to show that reactors would remain radioactive for hundreds of thousands of years. In January 2004, a book

on groundwater contamination at DOE facilities he investigated will be released by ANA, a consortium of public interest groups residing near DOE facilities.

Dr. Resnikoff has prepared reports on incineration of radioactive materials, transportation of irradiated fuel and plutonium, reprocessing, and management of low-level radioactive waste. He has served as an expert witness in state and federal court cases and agency proceedings. He has served as a consultant to the State of Kansas on low-level waste management, to the Town of Wayne, New Jersey, in reviewing the cleanup of a local thorium waste dump, to WARD on disposal of radium wastes in Vernon, New Jersey, to the Southwest Research and Information Center and New Mexico Attorney General on shipments of plutonium-contaminated waste to the WIPP facility in New Mexico and the State of Utah on nuclear fuel transport. He has served as a consultant to the New York Attorney General on air shipments of plutonium through New York's Kennedy Airport, and transport of irradiated fuel through New York City, and to the Illinois Attorney General on the expansion of the spent fuel pools at the Morris Operation and the Zion reactor, to the Idaho Attorney General on the transportation of irradiated submarine fuel to the INEL facility in Idaho and to the Alaska Attorney General on shipments of plutonium through Alaska. He was an invited speaker at the 1976 Canadian meeting of the American Nuclear Society to discuss the risk of transporting plutonium by air. As part of an international team of experts for the State of Lower Saxony, the Gorleben International Review, he reviewed the plans of the nuclear industry to locate a reprocessing and waste disposal operation at Gorleben, West Germany. He presented evidence at the Sizewell B Inquiry on behalf of the Town and Country Planning Association (England) on transporting nuclear fuel through London. In July and August 1989, he was an invited guest of Japanese public interest groups, Fishermen's Cooperatives and the Japanese Congress Against A- and H- Bombs (Gensuikin).

Between 1974 and 1981, he was a lecturer at Rachel Carson College, an undergraduate environmental studies division of the State University of New York at Buffalo, where he taught energy and environmental courses. The years 1975-1977 he also worked for the New York Public Interest Group (NYPIRG).

In 1973, Dr. Resnikoff was a Fulbright lecturer in particle physics at the Universidad de Chile in Santiago, Chile. From 1967 to 1973, he was an Assistant Professor of Physics at the State University of New York at Buffalo. He has written numerous papers in particle physics, under grants from the National Science Foundation. He is a 1965 graduate of the University of Michigan with a Doctor of Philosophy in Theoretical Physics, specializing in group theory and particle physics.

Dr. Marvin Resnikoff

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EXPERIENCE:

April 1989 - present **Senior Associate**, Radioactive Waste Management Associates, management of consulting firm focused on radioactive waste issues, evaluation of nuclear transportation and military and commercial radioactive waste disposal facilities.

1978 - 1981; 1983 - April 1989 **Research Director**, Radioactive Waste Campaign, directed research program for Campaign, including research for all fact sheets and the two books, *Living Without Landfills*, and *Deadly Defense*. The fact sheets dealt with low-level radioactive waste landfills, incineration of radioactive waste, transportation of high-level waste and decommissioning of nuclear reactors. Responsible for fund-raising, budget preparation and project management.

1981 - 1983 **Project Director**, Council on Economic Priorities, directed project which produced the report *The Next Nuclear Gamble*, on transportation and storage of high-level waste.

1974 - 1981 **Instructor**, Rachel Carson College, State University of New York at Buffalo, taught classes on energy and the environment, and conducted research into the economics of recycling of plutonium from irradiated fuel under a grant from the Environmental Protection Agency.

1975 - 1976 **Project Coordinator**, SUNY at Buffalo, New York Public Interest Research Group, assisted students on research projects, including project on waste from decommissioning nuclear reactor.

1973 **Fulbright Fellowship** at the Universidad de Chile, conducting research in elementary particle physics.

1967 - 1972 **Assistant Professor of Physics**, SUNY at Buffalo, conducted research in elementary particle physics and taught range of graduate and undergraduate physics courses.

1965 - 1967 **Research Associate**, Department of Physics, University of Maryland, conducted research into elementary particle physics.

EDUCATION

University of Michigan Ann Arbor, Michigan	PhD in Physics, June 1965 M.S. in Physics, Jan 1962 B.A. in Physics/Math, June 1959

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
	)	ASLBP No. 06-843-01-ML
Materials License Application	)	
	)	

DECLARATION OF MARVIN RESNIKOFF, Ph.D.
IN SUPPORT OF CONCERNED CITIZENS'
CONTENTIONS RE: FINAL ENVIRONMENTAL ASSESSMENT

Under penalty of perjury, I, Dr. Marvin Resnikoff, hereby declare that:

1. I am a physicist with a Ph.D. in high-energy theoretical physics from the University of Michigan and also the Senior Associate of Radioactive Waste Management Associates, a private technical consulting firm based in New York City. I previously filed declarations in support of Concerned Citizens of Honolulu's Request for Hearing and Concerned Citizens' Contentions Re: Draft Environmental Assessment And Draft Topical Report. My credentials to discuss risk assessment and other technical issues related to Pa'ina Hawaii, LLC's proposed irradiator were previously stated in my prior declarations and will not be repeated here.

2. I have reviewed the Final Environmental Assessment Related to the Proposed Pa'ina Hawaii, LLC Underwater Irradiator in Honolulu, Hawaii ("Final EA") (ADAMS Accession No. ML071150121), the Final Topical Report on the Effects of Potential Natural Phenomena and Aviation Accidents at the Pa'ina Hawaii, LLC Irradiator Facility ("Final Topical Report") (ADAMS Accession No. ML071280833), and other documents from the hearing file.

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3. In my February 9, 2007 declaration in support of Concerned Citizens' Contentions Re: Draft Environmental Assessment And Draft Topical Report, I discussed the many flaws in the draft Topical Report's analyses of the likelihood and consequences of an aircraft crashing into Pa'ina's proposed irradiator and of the threat of radiation exposure in the event of an aviation accident or natural disaster. I explained that, because the draft EA relies on the draft Topical Report's flawed analysis, its discussion of potential environmental impacts associated with Pa'ina's proposed irradiator is likewise lacking, failing to take into consideration potentially significant impacts to public health and safety and to the environment from aviation accidents and natural disasters. In addition, I noted the draft EA's omission of any analysis of potential impacts associated with terrorist attacks on the irradiator or on Co-60 sources being transported to or from the irradiator and the lack of any consideration of transportation accidents involving such sources. Finally, I explained that, since the reason for the high probability of an aircraft impact is the proximity of the proposed facility to active runways at Honolulu International Airport, the Nuclear Regulatory Commission (NRC) should have evaluated alternate locations for the irradiator, far from the airport, which would substantially reduce risks to the public associated with aviation accidents.

4. The Final EA and Final Topical Report contain few material changes from the draft versions of these documents, and, accordingly, for the most part, the same fatal flaws identified in my earlier declaration remain. In this declaration, I focus on the few instances where the discussion in the Final EA (or in the Final Topical Report, which the Final EA references) differs significantly from the information and analysis presented in the draft. As discussed in detail below, the Final EA fails to take a hard look at

potentially significant impacts to the human environment associated with Pa'ina's proposed irradiator and to consider reasonable alternatives that would accomplish the project's goals with less environmental harm.

5. **Probability of Aircraft Impact into Proposed Pa'ina Irradiator.** The Final EA incorporates by reference the Final Topical Report's analysis of the likelihood of an aircraft striking Pa'ina's proposed irradiator. The Final Topical Report, however, perpetuates the flaws in the draft Topical Report, resulting in an underestimate of the probability of a crash by a factor of 2 to 3, as discussed in my February 9, 2007 declaration and attached report.

6. While the Final Topical Report attempts to show how its 1 in 5,000 aircraft crash probability was overestimated, it continues to ignore significant factors that cut the other way. For example, the Final Topical Report continues to rely on obsolete data and fails to account for unusually elevated crash rates at Honolulu International Airport and the higher proportion of crashes at landings than takeoffs. Moreover, the Final Topical Report continues to use an unreasonably low number of aircraft operations at the Honolulu airport (apparently relying on a five-year average that includes the sharply reduced operations in the years following September 11, 2001) and fails to factor in the projected 20% increase in operations during the ten-year term of Pa'ina's license. As explained in my February 9, 2007 declaration, properly addressing these important factors results in a substantially higher crash probability estimate. Because the Final Topical Report's analysis is not based on an accurate assessment of the likelihood an airplane will hit the facility, the Final EA's reliance on that flawed analysis precludes the NRC from taking the requisite hard look at potentially significant impacts.

7. **Consequences of Aircraft Impact into Pa'ina Irradiator.** Like the draft, the Final EA fails to substantiate with any calculations its assumption the performance criteria set forth in 10 C.F.R. § 36.21 would ensure Co-60 sources at the Pa'ina irradiator survive an aviation accident without being breached. Instead of quantifying the impact of flying aircraft or building debris on the Co-60 sources and evaluating the likelihood radioactive material would be dispersed, the Final EA merely asserts baldly that it is "unlikely that a Co-60 sealed source would be breached in the event that an aircraft crashes in to the proposed facility." The assumption that a release is unlikely lacks any scientific support.

8. Moreover, even if a release of radioactive material were, in fact, "unlikely," that does not mean it is impossible. The Final EA fails to analyze the potentially significant consequences to public health and safety and the environment in the event a release does occur.

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

10. The Final Topical Report, on whose analysis the Final EA relies, states that Co-60 sources provided by Nordion would, in addition to complying with 10 C.F.R. § 36.21, also have passed ANSI test E65646. However, the Final Topical Report lacks any calculations to back up its assertion that sources that pass ANSI test E65646 would

be adequate to prevent dispersal of radioactive material in the event of an aviation accident. Thus, the requisite safety showing has not been made.

11. The Final EA slightly improves on the draft in that it concedes an aviation crash would likely cause a jet fuel fire at Pa'ina's proposed irradiator. The few lines devoted to the topic are, however, rife with unsubstantiated assumptions that preclude reliance on its analysis to evaluate the potential for significant impacts. The Final EA initially assumes burning jet fuel will not come into contact with the sources, ignoring the potential for an aviation accident to breach the irradiator pool, allowing shielding water to escape. Then, without any calculations about rates of evaporation or the length of time a fuel fire would be expected to burn, the Final EA baldly asserts there would be "minimal water evaporation." This is pure speculation.

12. The Final EA's ultimate conclusion that burning jet fuel would not cause potentially significant environmental impacts is likewise unsupported by either calculations or empirical data. Implicitly acknowledging the Final Topical Report erred in asserting jet fuel burns at only up to 599 °F (315 °C), the Final EA notes instead that jet fuel burns at an average temperature of 1,814 °F (990 °C). This is far in excess of the 1,112 °F (600 °C) temperature that sources must withstand under 10 C.F.R. § 36.21(b) and the 1,475 °F (802 °C) temperature under ANSI test E65646. The Final EA fails to substantiate its claim that the inferno associated with an aviation crash could not breach the Co-60 sources, creating the potential for radiation releases. The maximum (adiabatic) flame temperature for jet fuel is greater than 3100 °F, while the melting point of cobalt is 2,723 °F. This indicates that, in addition to the source cladding, the cobalt itself has the possibility of melting.

13. The Final EA also improperly downplays the consequences of a loss of shielding water due to an airplane crash, which threatens exposures above regulatory limits. Using the proprietary program Microshield, the final EA states (on page 9) that a loss of six feet of pool water would result in a dose of 300 millirems/hr. The EA, however, provides no justification for calculations that assume a loss of only six feet of shielding water. According to the Final Topical Report (at page 1-2), the depth of the water table is 2.4 meters (8 feet) below the facility floor. Since a rupture of the pool lining in the event of an accident or natural disaster could cause shielding water to drain to the groundwater level, the EA should have performed its dose calculation assuming an 8-foot drop in water level. My calculations, attached as Exhibit 10, show that the dose at floor level would be greater than 14 rem/hr.

14. In cases in which more shielding water were removed from the irradiator pool, either from the force of an explosion or through evaporation in a fuel fire, radiation doses would be far higher. If all water were removed from the irradiator pool, my calculations show that the likely dose would be over 107,000 rems/hr Emergency personnel could receive an LD50 dose in less than one minute.

15. Whether the water level fell to groundwater level or the irradiator pool were completely dry, emergency responders and irradiator personnel could be seriously injured from radiation exposure.

16. **Transportation Accident.** Using Radtran 5.3, the EA calculates transportation impacts from normal operations and determines these would be small (p. 8). The incident-free impacts considered by the EA involve only normal on the ground impacts. The Staff do not consider normal impacts from transportation on the ground to

the foreign airport, in Canada or Russia, and do not consider the impacts of an accident during flight. Transportation casks are designed for a 30-foot drop onto an unyielding surface and planes obviously fly higher than 30 feet. The environmental impact of an aircraft accident while transporting a cask containing Co-60 pencils should be considered. Transportation impacts are considered for reactor licensing proceedings in which licensees use Table S-4 to assess transporting spent fuel from the reactor site; a similar analysis and Table must be developed for the proposed irradiator.

17. Finally, the Final EA has no basis for dismissing the potential for significant impacts in the event an airplane crash destroys all monitoring equipment and/or incapacitates irradiator personnel. Even if, as the Final EA asserts, the loss of operating monitoring equipment during an accident did not lead to the loss of control of radioactive material, the inability to implement necessary emergency procedures threatens to put first responders and the general public in harm's way. The Final EA fails to evaluate such potential consequences.

18. **Terrorist Attacks on Irradiator.** Unlike the draft, the Final EA includes in Appendix B a discussion of terrorist attacks on Pa'ina's proposed irradiator. The discussion is, however, woefully inadequate to assess the specific threats terrorist attacks pose to the Pa'ina irradiator, the facility's vulnerability to such attacks, and the foreseeable consequences in the event of an attack.

19. Included in Exhibit "2" and incorporated herein by reference is a report I prepared on July 6, 2007 to analyze the vulnerability and potential consequences of a terrorist attack on Pa'ina's proposed irradiator. The report demonstrates the Final EA could have thoroughly analyzed the threats, vulnerability, and potential consequences of

an attack. Such an analysis is necessary allow the NRC to make an informed decision about the risk and potential significance of a terrorist attack on Pa'ina's irradiator.

20. Like the Final EA, my report assumes that a general credible threat of a terrorist attack exists. Under International Atomic Energy Agency (IAEA) guidance, the Pa'ina irradiator, which would be licensed to possess up to one-million curies of Co-60, would be classified as a Category 1 radioactive source. According to the IAEA, Category 1 sources are "considered to be the most 'dangerous' because they can pose a very high risk to human health if not managed safely and securely."

21. To determine the vulnerability of Pa'ina's proposed irradiator, I considered three plausible scenarios involving a determined sabotage group. Scenario one assumed the saboteurs dropped an M3A1 shaped charge to the bottom of the irradiator pool. Scenario two assumed the saboteurs would have the use of a TOW2 or MILAN anti-tank missile. Scenario three assumed the saboteurs would crash a Boeing 757 into the building at greater than 100 mph. This is a conservative assumption because, under normal conditions, B757's take-off and land at about 180 mph. The plausibility is even greater given Pa'ina's proposal to locate its irradiator next to the runways of the Honolulu International Airport.

22. As detailed in the report, the irradiator pool and sources are vulnerable to terrorist attack. In scenario one, an M3A1 shaped charge could easily punch a hole into the side of the pool, likely expelling all the water from the pool and/or allowing all the water to drain from the pool. For scenario two, the force from the TOW2 or MILAN anti-tank missile could punch a hole through the side of the pool. Scenario three demonstrated that the shaft of a Rolls Royce jet engine could puncture the pool wall.

23. In any of these three scenarios, following puncture of the pool lining, a party of saboteurs could ignite a combustible material or detonate explosives inside the pool, which could, in turn, blast apart or aerosolize the Co-60 pellets at the bottom of the pool, resulting in dispersal of radioactive particulates into the surrounding environment.

24. A radiological release would contaminate the surrounding area, including the Honolulu International Airport and Ke'ehi Lagoon. A 2002 report of the Federation of American Scientists – which was attached to my February 9, 2007 declaration – showed detonation of just one Co-60 pencil (about 17,000 curies) at the lower tip of Manhattan would contaminate approximately 1,000 square kilometers, exposing tens of thousands of residents to high-levels of radiation. If the radiation could not be immediately removed, large portions of New York City would be uninhabitable for decades while the Co-60 decayed and/or buildings would need to be demolished. According to the report, the risk of death from cancer would jump to one-in-ten for people who live in an area of about three hundred city blocks.

25. Even if it were possible to remove the radiation in the event Co-60 was detonated at the proposed Pa'ina irradiator, such a cleanup could shut down the runways of the Honolulu International Airport for weeks. A closure of vital runways could seriously hurt Hawai'i's economy, which depends on air shipments for food, goods, and mail service, and could also disrupt Hawai'i's main economic engine, tourism. Moreover, any of these scenarios could immediately kill on-duty irradiator employees, emergency responders, and any other person in the general vicinity, which is easily accessible by the public. Also, whether successful in dispersing Co-60 or not, a terrorist act at the proposed irradiator would likely cause widespread panic and fear, which could

adversely affect the morale and well-being of the people of Hawai'i and cause a decline in tourism. The Final EA fails to assess the significance of any of these possible impacts.

26. Other plausible modes of attack that the Final EA should have considered, but did not, include the potential for terrorists to divert the Cobalt-60 sources during transport to or from the facility or the theft of the sources from the irradiator facility itself. The radioactive materials could then be coupled with an explosive charge or placed in heavily populated locations, exposing the public to unacceptable levels of radioactivity.

I declare under penalty of perjury that the factual information provided above is true and correct to the best of my knowledge and belief, and that the professional opinions expressed above are based on my best professional judgment.

Executed at New York, New York on this 24th day of August, 2007.

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of Pa'ina Hawaii, LLC Material License Application	)))))	Docket No. 30-36974-ML ASLBP No. 06-843-01-ML

DECLARATION OF MARVIN RESNIKOFF, Ph.D., IN SUPPORT OF CONCERNED CITIZENS' AMENDED SAFETY CONTENTION 7

Under penalty of perjury, I, Dr. Marvin Resnikoff, hereby declare that:

1. I am a physicist with a Ph.D. in high-energy theoretical physics from the University of Michigan and also the Senior Associate of Radioactive Waste Management Associates, a private technical consulting firm based in New York City. I previously filed declarations in support of Concerned Citizens of Honolulu's Request for Hearing and Concerned Citizens' contentions regarding the draft and final versions of the environmental assessment and of the Topical Report on the Effects of Potential Natural Phenomena and Aviation Accidents at the Pa'ina Hawaii, LLC Irradiator Facility ("Topical Report"). My credentials to discuss risk assessment and other technical issues related to Pa'ina Hawaii, LLC's proposed irradiator were previously stated in my prior declarations and will not be repeated here.

2. As described in greater detail below, in my opinion, Pa'ina's decision to locate its proposed irradiator immediately adjacent to active runways at Honolulu International Airport ("HNL") creates an unusually elevated risk the facility – together with the one million curies of Cobalt-60 ("Co-60") for which Pa'ina seeks a license –

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would be struck by an airplane. Depending on the methodology used, the annual likelihood of an aviation accident involving the irradiator would be 1-in-2,786 or 1-in-1,757 (nearly one-in-175 over the license's ten year period). Moreover, should an accident occur, there are several reasonable scenarios of potential consequences resulting in radiation exposures in excess of applicable safety standards and off-site releases of contaminated pool water.

3. Pa'ina's license application does not address the threats to safety posed by an aviation accident involving its proposed irradiator. Instead, Pa'ina relies on the Topical Report to demonstrate safety. That document, however, significantly underestimates the probability of an aircraft striking Pa'ina's proposed irradiator and fails to provide any meaningful analysis of the potential consequences of an aviation accident. Because of the Topical Report's many flaws, Pa'ina cannot rely on it to establish its proposed irradiator design would be adequate "to protect health and minimize danger to life or property," as required by 10 C.F.R. § 30.33(a)(2).

4. **Probability of Aircraft Impact into Proposed Pa'ina Irradiator.** Using the Department of Energy ("DOE") standard, DOE-STD-3014-96, "Accident Analysis for Aircraft Crash into Hazardous Facilities," I calculated the expected accident frequency (i.e., the number of accidents per year) of an aircraft impacting the proposed Pa'ina irradiator. The DOE standard is similar to the Nuclear Regulatory Commission ("NRC") methodology (NUREG-0800) I employed in the NRC proceedings regarding the proposed Private Fuel Storage spent fuel storage facility at Skull Valley, Utah. Since NUREG-0800 is designed primarily for potential facilities located at some distance from an airport, not for facilities like the Pa'ina irradiator which would be immediately

adjacent to active airport runways, I question the Center for Nuclear Waste Regulatory Analyses's ("CNRWA's") decision to rely solely on NUREG-0800 for the Topical Report's analysis.

5. My report, a true and correct copy of which is attached hereto as Exhibit "1" and is incorporated herein by reference, details the methodology and calculations I employed to determine the probability of an aircraft impact into the proposed irradiator. In summary, I concluded that the yearly probability using DOE's national crash statistics would be 3.59E-04 (1 in 2,786). If HNL-specific crash rates are used, the yearly probability increases to 5.69E-04 (1 in 1,757).

6. Both crash rates are significantly higher than the yearly probability set forth in CNWRA's Topical Report, 2.0E-04 (1 in 5,000). There are many reasons for the Topical Report's substantial understatement of the risk of an airplane striking the proposed Pa'ina irradiator. First, CNWRA relies on airplane crash data that are more than thirty years old and not applicable to all aircraft. In contrast, the DOE data I used are applicable to all aircraft, including air taxis (which currently constitute over 20% of aircraft operations at HNL), and are updated to 1996. In addition, the Topical Report fails to account for the fact that air crash rates for HNL are higher than the national average, as I did in my alternate calculations using HNL-specific crash rates.

7. Second, the methodology CNWRA used for the Topical Report looks solely at the distance a proposed facility is from the end of the runway, failing to take into account that landings have a higher crash rate than takeoffs.

8. Third, the methodology CNWRA used for the Topical Report employs an equal probability of an air crash to all locations in the vicinity of an airport, and this is not

correct. To take one example, for military aircraft, planes fly parallel to the runway, then make a U-turn and land. The side where military planes first fly is called the "pattern" side. Accordingly, my analysis assumed that the pattern side is over the ocean. This type of fine detail is missing from the Topical Report's analysis.

9. Fifth, the number of aircraft operations at HNL used in the Topical Report's calculations understates the actual number of current operations, and also fails to account for anticipated future growth during the time period for which Pa'ina seeks a materials license. Although unstated in the report's analysis, it appears CNWRA used the average number of aircraft operations at HNL over the five years preceding the report's preparation in 2007, which would reflect the substantial decrease in the number of operations at HNL following September 11, 2001. Since the number of operations at HNL did not begin to increase until the last few years and, as the Federal Aviation Administration has determined, is expected to increase by another 20% during the 10-year period of Pa'ina's license application, the number of operations CNWRA uses in its calculations is unrealistically low. A more realistic, but still conservative, assumption is to use current operational levels. My analysis took this approach, using the most recent numbers then available, which are from airport operations in 2005.

10. **Consequences of Aircraft Impact into Pa'ina Irradiator.** Whether the Board accepts the Topical Report's crash rate or those presented in my report, there would be a significant risk of an airplane crash involving Pa'ina's proposed irradiator over the ten-year term of the requested license. The Topical Report fails, however, to take into account realistic accident scenarios and does not provide data or calculations to

demonstrate the design of Pa'ina's proposed irradiator would be adequate "to protect health and minimize danger to life or property," as required by *10 C.F.R. § 30.33(a)(2).*

11. An aviation accident could damage the pool structure under the floor level, with the impact of airplane or building debris tearing the welds or puncturing the pool liner, resulting in loss of irradiator pool shielding water. Attached hereto as Exhibit "2" are calculations I performed to analyze the velocity at which a jet engine commonly used in commercial aviation (GE model CF6-80C2) would pierce the pool liner (which consists of only six inches of concrete sandwiched between ¼-inch steel), allowing shielding water to escape. My analysis demonstrates that the engine would have to travel at only 38.5 miles per hour to breach the liner.

12. Commercial airplanes commonly land and take-off at 160 miles per hour. Thus, it is clearly plausible that an aviation accident would result in the engine striking the pool liner at speeds far in excess of 38.5 miles per hour.

13. Since the irradiator facility's floor level is also the minimum water level necessary to retain shielding integrity for the Co-60 sources, a breach of the pool structure due to an airplane crash would reduce the irradiator's passive shielding. The Topical Report states (at page 1-2) the depth of the water table is 2.4 meters (8 feet) below the facility floor, and, thus, its assertion that sea water infiltrating through a breach would adequately shield the Co-60 sources is unsupported. In fact, any break in the pool lining below the floor level could dangerously reduce the shielding of the sources.

14. My calculations, attached as Exhibit "3," show that, if the shielding water were to drain to the level of the surrounding water table, the dose at floor level would be greater than 14 rem/hr. In only twenty-two minutes, any irradiator personnel or

emergency responders on the scene would be subjected to more than the annual occupational dose limit of 5,000 millirem/year.

15. In cases in which more shielding water were removed from the irradiator pool, either from the force of an explosion or through evaporation in a fuel fire, radiation doses would be far higher. If all water were removed from the irradiator pool, my calculations show that the likely dose would be over 107,000 rems/hr. Emergency personnel could receive an LD50 dose in less than one minute.

16. Whether the water level fell to groundwater level or the irradiator pool were completely dry, emergency responders and irradiator personnel could be seriously injured from radiation exposure.

17. The risks to emergency responders would be even greater in the event that the force of an airplane crashing into the facility and/or the ensuing fire and explosion of aviation fuel severely injured or killed the irradiator's safety personnel and led to loss of radiation detectors. In this entirely plausible scenario, it would be impossible to implement necessary emergency procedures. In the absence of necessary guidance and radiation survey instruments, firefighters, police and other emergency responders could unwittingly receive extremely high radiation doses.

18. The Topical Report also ignores the potential for contamination of the pool water in the event that an airplane crash breaches the sources. While the report asserts that Co-60 sources that can satisfy the criteria set forth in 10 C.F.R. § 36.21 and ANSI test 65646 would be robust enough to survive an aviation accident, CNWRA never performed any calculations to back up that claim. For example, the report does not quantify the impact of flying airplane debris or building girders following a collision to

allow a comparison with the impact associated with a 2.5 cm-diameter, 20-kg steel weight dropped from a height of 1 meter, the more stringent of the two impact standards. It is not intuitive that an exploding airplane would exert no more force on the irradiator's sources than a weight falling from the height of a tabletop.

19. Attached hereto as Exhibit "4" are calculations I performed that show that, in fact, the impact associated with an aviation accident would far exceed the standards the Co-60 sources must meet. For the purposes of these calculations, I assumed that a commercial jet engine (GE model CF6-80C2) was dropped onto the sources from 18.5 feet, the height of the water in the pool, and had no additional velocity. This is a very conservative assumption since, in an airplane crash, the engine would fall from a much greater height. Taking into account the buoyancy of the pool water (which, prior to the impact, would not yet have drained out), the energy imparted by a commercial jet engine falling from the top of the irradiator pool would be over 7,500 times the energy imparted by a 20-kg weight falling from a height of one meter, the standard applicable to the sources Pa'ina proposes to use. The impact would be far greater if the jet engine fell from a height greater than the top of the irradiator pool, as would undoubtedly be the case in any aviation accident involving the facility.

20. The foregoing analysis makes clear that, in the event of an aviation accident, the forces that would applied to the Co-60 sources would be many orders of magnitude beyond those for which the sources were designed. It is not only plausible, but probable, that the impact would not only rupture the source encapsulation, but shatter the plenum and the sources themselves, contaminating the pool water. The contaminated

water could then escape the facility though ruptures in the pool lining, spreading radioactive contamination to the groundwater and nearby Ke'ehi Lagoon.

I declare under penalty of perjury that the factual information provided above is true and correct to the best of my knowledge and belief, and that the professional opinions expressed above are based on my best professional judgment.

Executed at New York, New York on this 2nd day of May, 2008.

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of Pa'ina Hawaii, LLC Material License Application	)))))	Docket No. 30-36974-ML ASLBP No. 06-843-01-ML

SUPPLEMENTAL DECLARATION OF MARVIN RESNIKOFF, Ph.D., IN SUPPORT OF CONCERNED CITIZENS' AMENDED SAFETY CONTENTION 7

Under penalty of perjury, I, Dr. Marvin Resnikoff, hereby declare that:

1. I am a physicist with a Ph.D. in high-energy theoretical physics from the University of Michigan and also the Senior Associate of Radioactive Waste Management Associates, a private technical consulting firm based in New York City. I previously filed declarations in support of Concerned Citizens of Honolulu's Request for Hearing and Concerned Citizens' contentions regarding the draft and final versions of the environmental assessment and of the Topical Report on the Effects of Potential Natural Phenomena and Aviation Accidents at the Pa'ina Hawaii, LLC Irradiator Facility. My credentials to discuss risk assessment and other technical issues related to Pa'ina Hawaii, LLC's proposed irradiator were previously stated in my prior declarations and will generally not be repeated here.

2. I have reviewed both Pa'ina Hawaii, LLC's and the Nuclear Regulatory Commission ("NRC") Staff's answers to Concerned Citizens' Amended Safety Contention 7. Nothing in these submittals – which notably lack any supporting affidavits from experts – provides any reason to alter my opinions about either (1) the unusually

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elevated risk of an aviation accident created by Pa'ina's decision to locate its proposed irradiator immediately adjacent to active runways at Honolulu International Airport or (2) the reasonable scenarios in which an airplane striking Pa'ina's proposed irradiator would result in radiation exposures in excess of applicable safety standards and off-site releases of contaminated pool water.

3. On page 12 of its answer, Pa'ina inaccurately states I do not claim any expertise in statistical probability. As set forth in my resume, which was attached to the declaration I submitted in support of Concerned Citizens' initial hearing request, I was a joint math/physics major through my master's degree. In the 47 years since I earned my master's degree, I have frequently prepared expert analyses involving the application of principles of statistical probabilities. Among other projects, I served as an expert witness for the State of Utah before an NRC hearing panel, analyzing the probability of air crashes into the proposed Private Fuel Storage facility, and have been a consultant to the State of Nevada on the probability and consequences of transportation accidents involving shipments of radioactive waste to the proposed Yucca Mountain repository.

4. It does not, however, require a profound understanding of statistics to realize that, if the annual probability of an airplane striking Pa'ina's proposed irradiator is 1 in 1,757, the probability of one aviation accident occurring over the ten-year term of the material license Pa'ina seeks would be nearly 1-in-175. While Pa'ina's lawyer considers this "counter-intuitive," most people understand the analogous situation involving a lottery ticket with a one-in-a-million success probability. If one were to buy ten such tickets, the odds of having a winning ticket would increase by ten times, to one-in-100,000.

5. On page 13 of its answer, Pa'ina questions how a "GE jet engine with a diameter of 168 inches [could] fall to the bottom of the irradiator pool, which measures only 69 inches across." The Staff similarly claims (on page 15 of its answer) I have not adequately explained how the engine would strike the liner given that "the irradiator pool will be almost entirely below ground level and the pool surface will be only approximately 81" by 95" wide."

6. As an initial matter, Pa'ina cites no source in support of its claim the GE model CF6-80C2 engine on which I based my calculations measures 168 inches in diameter. According to the GE website (http://www.geae.com/engines/commercial/cf6/cf6-80c2.html), it is the length, not the diameter, of the engine that is 168 inches. The maximum diameter is only 106 inches.

7. In any event, both Pa'ina and the Staff improperly ignore the fact that the maximum diameter of the GE model CF6-80C2 engine includes the rotor blades, which would easily break off in an accident. The maximum diameter of the jet engine shaft, which is the robust portion of the engine that my calculations show could easily pierce the irradiator pool lining, is only 18 inches. In any number of crash scenarios, the 18-inch wide shaft could easily enter the pool, whether it measures 69 inches across (as Pa'ina claims) or 81 inches (as the Staff asserts).

8. On pages 13 through 14 of its answer, Pa'ina challenges my alleged failure "to provide any engineering calculations regarding the forces which must be focused directly on the site of the underground pool, in order to overcome the tons of earth surrounding the 18-foot deep pool, in order to overcome the 1.5 feet of concrete

forming the outer shell of the pool, then to overcome the concrete and steel structures forming the pool, and also to overcome the tons of water within the pool."

9. Pa'ina fails to explain the relevance of the "tons of earth" surrounding the irradiator pool. Once the pool is breached, the surrounding earth can do nothing to keep vital shielding water – which, in the event the Cobalt sources are pulverized by the impact, would be contaminated with radiation – from draining into the surrounding groundwater and reaching nearby Ke'ehi Lagoon.

10. I have carefully reviewed the documents in the hearing file related to the construction of the irradiator pool. None I have seen refers to "1.5 feet of concrete forming the outer shell of the pool," and Pa'ina fails to cite to the document that allegedly includes this construction detail. The closest document I could find was Pa'ina's March 9, 2006 letter responding to various deficiencies noted by the NRC Staff (ML060730528), which discusses construction details for the pool.

11. The March 9, 2006 letter states that, prior to excavating for the irradiator pool, steel sheet piles would be driven into the soil. The area within the piles would be excavated, and then the pool shell would be suspended from beams, with the concrete to which Pa'ina refers poured between the pool shell and the sheet piles. Subtracting the area of the pool from the area of the excavated hole results in approximately 1.5 feet of concrete on two sides of the pool, and approximately one foot of concrete backfill on the other two sides.

12. Whether the concrete backfill on the outside of the pool liner is one-foot thick or 1.5-feet thick has no bearing on whether the irradiator pool would be breached in the event of an aviation accident, allowing vital – and potentially contaminated –

shielding water to escape. As the calculations attached to my initial declaration as Exhibit "2" show, almost all the engine's kinetic energy is required to penetrate the irradiator pool's steel liners; relatively little kinetic energy is needed to penetrate the six inches of concrete sandwiched between those steel liners. Notably, in performing my calculations, I assumed the concrete in the pool liner had a compressive strength of 576,000 psi, orders of magnitude greater than the strength of the "flowable grout" Pa'ina proposes to use both within and outside the pool's steel shells, which has a compressive strength of only 1,000 psi. Pa'ina's concrete grout would easily crumble on impact.

13. The engine shaft would expend very little energy in penetrating the grout surrounding the irradiator pool. As for "the tons of water within the pool," the engine shaft would expend a negligible amount of energy as it sliced through the few meters of water before rupturing the pool liner.

14. On page 15 of its answer, the Staff claims I failed to provide any data or analysis showing an aviation accident could exert enough force to breach the sealed sources. This claim is baseless, since I attached precisely such calculations as Exhibit "4" to my initial declaration. Those calculations show that, even if a jet engine were dropped onto the sources from only the height of the water in the irradiator pool (a very conservative assumption), it would exert over 7,500 times the energy Pa'ina's sources have been tested to withstand.

15. The Staff also inaccurately claims (on page 16 of its answer) that I failed to "address portions of the Licensee's application discussing the design of the irradiator pool—which includes both inner and outer steel tanks with an intermediate concrete liner—and the geology of the irradiator site." Exhibit "2" to my initial declaration

contains calculations showing that a jet engine traveling only 38.5 miles per hour could breach the irradiator pool's steel and concrete liner. As for the site geology, my analysis fully considered the depth of the water table, which is too deep to ensure adequate shielding of the sources in the event the irradiator pool liner is breached, but provides a vector for contaminated pool water to spread through a breach in the liner to reach the groundwater and nearby Ke'ehi Lagoon.

I declare under penalty of perjury that the factual information provided above is true and correct to the best of my knowledge and belief, and that the professional opinions expressed above are based on my best professional judgment.

Executed at New York, New York on this 22nd day of May, 2008.

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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
	)	ASLBP No. 06-843-01-ML
Material License Application	)	
	)	

WRITTEN TESTIMONY AND
DECLARATION OF METE A. SOZEN, S.E. (IL), Ph.D.

I, Mete A. Sozen, declare under penalty of perjury that the contents of the following Written Testimony and Declaration of Mete A. Sozen, S.E. (IL), Ph.D. are true and correct to the best of my knowledge:

Q.1: Please state your name, occupation, employer, and business address.

A.1: My name is Mete A. Sozen. I am the Purdue University Kettelhut Distinguished Professor of Structural Engineering, and have a Ph.D. in Civil Engineering from the University of Illinois, Urbana, as well as a professional Structural Engineer license from the State of Illinois. I have considerable training and experience in the field of structural engineering, and have assisted in the development of structural criteria for earthquake and fire resistant building design and helped develop the first set of regulations for earthquake-resistant design. My research currently focuses on vulnerability assessment of building and transportation structures and effects of explosions and high-velocity impact on building structures. A copy of my resume is attached to this testimony as Exhibit "39."

I am employed by Purdue University, but offer this testimony in my private capacity. My business address is 550 Stadium Mall Drive, West Lafayette, Indiana 47907.

Q.2: Are you familiar with the Nuclear Regulatory Commission ("NRC") Staff's Initial Statement of Position on Amended Environmental Contentions 3 and 4, which was filed in the Pa'ina Hawaii, LLC licensing proceeding on August 26, 2008?

A.2: I have reviewed the testimony of Matthew Blevins, as well as the testimonies of James Durham, Amitava Ghosh, John Stamatakos, and Kaushik Das from the Center for Nuclear Waste Regulatory Analyses ("CNWRA"). Of these, only Mr. Blevins directly discusses the opinions I have offered in this proceeding, in the form of a report I prepared in February 2007 with Purdue University Professor of Computer Science

Christoph Hoffmann. In addition, I have prepared several declarations raising concerns about the safety of Pa'ina's proposed irradiator and the potential for radiation releases in the event the facility is struck by an airplane. None of the testimonies the NRC Staff submitted directly responded to these declarations.

Concerned Citizens previously submitted true and correct copies of my February 2007 report and February 8, 2007 and March 15, 2007 declarations as Exhibits "2" through "4," respectively. These analyses accurately reflect my views regarding the potential threats to public health and safety, as well as the natural environment, associated with construction and operation of the proposed irradiator at Pa'ina's preferred location.

Q.3: At this time, please turn your attention to paragraph A.24 of Mr. Blevins' testimony, where he relies on your February 2007 report to support his claim that, in the event of an airplane crash involving Pa'ina's proposed irradiator, "not just debris, but the entire aircraft, would block access to the area above the irradiator pool," ensuring that no irradiator personnel or emergency responders could access areas of elevated radiation. Do you agree with Mr. Blevins' analysis?

A.3: No. Mr. Blevins' reliance on the report I prepared with Professor Hoffmann is unjustified. As stated on the first page of our report, the numerical analysis we performed considered only one of many possible combinations of aircraft types and speeds that could strike a steel structure similar to Pa'ina's proposed irradiator built adjacent to the active runways at Honolulu International Airport. The analysis illustrates the destructive potential of such an accident, which damage the irradiator pool structure, resulting in loss of shielding water and the introduction of radioactive Cobalt-60 into the human environment. It does not purport to predict the state of aircraft and building debris after impact in the specific scenario analyzed, much less the nearly infinite possible accident permutations that might involve the proposed irradiator.

Figure 5 does not, as Mr. Blevins claims, suggest "the entire airplane ... would block access to the area above the irradiator pool." Rather, Figure 5 represents only a snapshot in the aircraft's progress as it impacts and enters the irradiator building. Professor Hoffmann and I did not mean to suggest that, in any aviation accident, the airplane's final resting place would invariably be above the irradiator pool, blocking all access.

The state of the aircraft after impact is very difficult to predict. It depends on many factors about the impact and about the structural details of the aircraft and of the building. To infer from our report that the aircraft would seal off the building is unjustified.

In addition, it is unreasonable to assume that irradiator personnel and emergency responders will always behave with the proper safety standards in mind. Thus, even the emergency procedures indicate workers should stay away from areas of high

radiation following an aviation accident, experience tells us that the potential for excessive exposures still exists.

Q.4: Please now turn your attention to paragraph A.19 of Dr. Ghosh's testimony, in which he claims that, in the event of an aviation accident involving Pa'ina's proposed irradiator, "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." Do agree with his assessment?

A.4: No. As discussed in the report I prepared with Professor Hoffmann, should an airplane crash into Pa'ina's proposed irradiator, the effects could be devastating. Both the airplane and the building housing the irradiator could be destroyed, with flying debris potentially breaching the source assembly and irradiator pool.

Having received our report as part of Concerned Citizens' comments on the draft environmental assessment, it was incumbent upon the NRC Staff and CNWRA to evaluate rigorously the potential effects on public safety and the environment of such an accident. One cannot categorically rule out the potential for the irradiator pool and sources to be breached and for radioactive Cobalt-60 to be introduced into the human environment without first performing detailed calculations of the forces involved. Yet this is precisely what Dr. Ghosh and the rest of the CNWRA staff have done in their topical report and testimony. It is scientifically indefensible.

In contrast, Concerned Citizens' expert, Dr. Marvin Resnikoff, performed detailed calculations demonstrating that the force of debris from a crashing airplane could be several orders of magnitude greater than those the Cobalt-60 sources Pa'ina proposes to use were designed to withstand. Even if the risk of a catastrophic aviation accident is small, it is not zero. Isn't it the prudent choice to evaluate the feasibility of relocating the facility far from active runways, out of harm's way?

Q.5: Does this conclude your testimony?

A.5: Yes.

I declare under penalty of perjury that I have read the foregoing Written Testimony and Declaration of Mete A. Sozen, Ph.D. and know the contents thereof to be true of my own knowledge.

Dated at West Lafayette, Indiana, January 28, 2009.

Mete A. Sozen

METE A. SOZEN, S.E. (IL), Ph.D.

METE A. SOZEN
550 Stadium Mall Drive
West Lafayette, IN 47907-2051

A graduate (BSc in Civil Engineering) of Robert College (now Bogazici University) in Istanbul Turkey, Dr. Sozen obtained his MS at the University of Illinois and, after working as a structural designer with Kaiser Engineers (Oakland, CA) and Hardesty and Hanover (New York, NY), returned to obtain his PhD degree in Civil Engineering at the University of Illinois, Urbana. Appointed to serve as an assistant professor in civil engineering at the University of Illinois in 1957, he was promoted to associate professor in 1959 and was given the rank of professor in 1963. Since 1993, he has been teaching at Purdue University as the Kettelhut Distinguished Professor of Structural Engineering.

He is a licensed structural engineer (Illinois).

Dr. Sozen's current research focuses on vulnerability assessment of building and transportation structures and effects of explosions and high-velocity impact on building structures.

Dr. Sozen served on the Building Code Committee of the American Concrete Institute and was the chair of the committee (1980) that prepared the first set of specifications for earthquake resistance. He was a member of the four-person committee that produced the Veterans Administration Code for Earthquake Resistant Design of Hospitals in 1972. He has served in many technical committees of the American Concrete Institute, the American Society of Civil Engineers, the European Concrete Committee, the Prestressed Concrete Institute, and the Earthquake Engineering Research Institute. He has served as the Chair of The U.S. National Committee on Natural Disasters. For research related to earthquake issues, he has served as the Joint U.S.-People's Republic of China Committee and the U.S.-Japan Committee, and on the Illinois Governors Earthquake Preparedness Task Force. He has chaired the Joint U.S.-Japan Coordination Committee on Urban Earthquake Disaster Mitigation Research and the National Academy of Sciences Committee on Blast Effects.

Dr. Sozen has been elected to membership in the U.S. National Academy of Engineering (1977) and the Royal Swedish Academy of Engineering Sciences(1990). He has been granted honorary doctorates by Bogazici University (Turkey), Pannonius University (Hungary), The Georgian Technical University (Tbilisi) and honorary memberships by the Assoc. of Turkish Eng. (NY), the American Society of Civil Engineers, and the American Concrete Institute. In 2006 he was included in the list of "Top Seismic Engineers of the 20th Century," by a select commission of the Applied Technology Council (San Francisco) and the Engineering New Record.

Professional Experience

M. A. Sozen has served on a four-person committee of the Veterans Administration to develop the VA structural criteria for earthquake and fire resistant design (1971). He has served as Chair (1977-1983) of the American Concrete Institute subcommittee on seismic design to develop the first set of regulations for earthquake-resistant design. He was a member of the committee that produced ATC3 Model Code for Earthquake-Resistant Design (1978). He has been a consultant to code-writing bodies in Algeria, Colombia, Nicaragua, Romania, El Salvador, Turkey, and

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Venezuela. Through his research and professional committee activities, he has contributed to the development of current design procedures used in the ACI Building Code and the European Concrete Committee model code for flexural and shear strength of prestressed concrete, reinforced concrete floor slabs, and bond. He has documented and analyzed damage caused by the earthquakes of Skopje (1963), Alaska (1964), Caracas (1967), San Fernando (1971), Managua (1972), Guatemala (1974), Mexico City (1985), Sendai (1978), Chile (1985), San Salvador (1986), Loma Prieta (1989), Turkey-Erzincan, (1992), Northridge (1994), Turkey-Marmara (1999), Turkey-Duzce (1999), and Turkey-Bingol (2002) earthquakes.

As a member of the six-person committee of the American Society of Civil Engineers, he has worked on the analysis of the damage to the Pentagon building on 11 September 2001 and the World Trade Centers. He is also involved in an experimental research project related to impact of projectiles on structures.

He has worked as an intermittent consultant on special projects concerned with structural safety and damage to the following organizations:

Advisory Committee on Reactor Safeguards, Nuclear Regulatory Commission (Washington, DC)
Applied Technology Council (Menlo Park, CA)
ARPE (San Juan, P.R.)
Avesipe (Caracas)
Bechtel (Ann Arbor, MI)
Brookhaven National Laboratory (NY)
Bureau of Reclamation, Denver, CO
C. F. Murphy and Associates (Chicago, IL)
CRSI (Chicago, IL)
Consumers Power (Jackson, MI)
Dominican Power Corp. (Santo Domingo)
DuPont Co.
EBASCO (New York, NY)
Edelca (Caracas)
Electric Power Research Institute (Palo Alto, CA)
ERICO (Cleveland, OH)
Gavlin and Reckers (Chicago, IL)
General Cement (Tampa, FL)
Gomez y Associates (Bogota, Colombia)
Harza (Chicago, IL)
I. Cantor (New York, NY)
Iatasa (Buenos Aires)
J. A. Parkin (Toronto, Canada)
Los Alamos National Laboratory (Los Alamos, CA)
Midtconsult Aps (Copenhagen, Denmark)
MOP (Managua)
Nuclear Regulatory Commission (Washington, DC)
Pacific Gas and Electric Co. (San Francisco, CA)

Phillips Petroleum (Paris)
Portland Cement Association (Skokie, IL)
Raymond Concrete Pile Co. (New York, NY)
Skidmore, Owings and Merrill (Chicago, IL)
SANDIA National Laboratories (Albuquerque, NM)
Southern California Edison
State of Utah
Stanford Research Institute (Palo Alto, CA)
TAMS (New York, NY)
United Nations Development Corporation (Paris)
U.S. Army Engineers Waterways Experiment Station (Vicksburg, MS)
U.S. Department of State, Foreign Buildings Office (Washington, DC)
C. E. Walker Associates (Kalamazoo, MI)
Westinghouse, Savannah River Site (Aiken, SC)
Wiss, Janney, and Elstner (Emeryville, CA)

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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
	)	ASLBP No. 06-843-01-ML
Material License Application	)	
	)	

SUPPLEMENTAL WRITTEN TESTIMONY AND DECLARATION OF ERIC D. WEINERT

I, Eric D. Weinert, declare under penalty of perjury that the contents of the following Supplemental Written Testimony and Declaration of Eric D. Weinert are true and correct to the best of my knowledge:

Q.1: Please state your name, occupation, employer, and business address.

A.1: As stated in my prior testimony, my name is Eric D. Weinert. Since August 2000, I have served as the vice president of CW Hawaii Pride, LLC, and, in that capacity, have been in charge of day-to-day operations of Hawaii Pride's x-ray, electron-beam irradiator, which treats all types of locally grown produce to meet the U.S. Department of Agriculture's Animal and Plant Health Inspection Service ("USDA/APHIS") regulations for export from Hawai'i. Hawaii Pride is located on the island of Hawai'i at 16-664 Milo Street, Kea'au, HI 96749.

Q.2: Are you familiar with the Written Direct Testimony of Michael Kohn (dated September 15, 2008), which Pa'ina Hawaii, LLC filed with its Rebuttal Memorandum in Opposition to Intervenor Concerned Citizens of Honolulu's August 26, 2008 Initial Written Statement of Position?

A.2: Yes, I have reviewed Mr. Kohn's testimony.

Q.3: At this time, please turn your attention to paragraph A.3 of Mr. Kohn's testimony, where he describes an x-ray, electron-beam irradiator as "a relatively new and uncertain technology." Do you agree with that characterization?

A.3: No. Even back in 1999, which is the time period Mr. Kohn is talking about, one could not fairly characterize x-ray, electron-beam irradiators as new and uncertain technology. The technology to convert electricity into x-ray beams to irradiate

products has been around for decades and has always been very reliable. Thus, when Titan Corporation made its presentation in 1999, there was nothing novel or uncertain about the technology used in its irradiator.

If Mr. Kohn intended to say that, prior to the start of Hawaii Pride's operations in 2000, no company had previously applied the tried and tested x-ray irradiation technology to treat fruit to meet the U.S. Department of Agriculture's standards for export from Hawai'i, I would agree with that.

However, now that Hawaii Pride has more than eight years of experience successfully irradiating millions of pounds of all types of tropical produce for export from Hawai'i, no one could seriously question the efficacy of using x-ray technology for this purpose. By the time the Nuclear Regulatory Commission staff prepared its environmental assessment for Pa'ina's proposed irradiator in 2007, the use of x-ray technology to treat Hawaiian produce for export had become routine.

Q.4: I now turn your attention to the bottom of page 3 of Mr. Kohn's testimony, where he claims to have made financial calculations that showed that "a price tag of $10 million for the e-beam irradiator with x-ray features added seemed far too high a price." Do you agree with his conclusions?

A.4: Since Mr. Kohn did not provide the financial calculations he claims to have prepared, I'm not in a position to evaluate their specifics. I can say with certainty, however, that, if Mr. Kohn assumed he would have to pay $10 million for an x-ray irradiator, he greatly exaggerated the costs of using x-ray technology, rendering the rest of his analysis suspect. As Mr. Kohn noted in paragraph A.8 of his testimony, Titan Corporation offered to sell him an x-ray irradiator for only $4.75 million, which is less than half the cost he assumed in his calculations. Based on my experience purchasing x-ray technology, $4.75 million is an appropriate price.

With respect to Mr. Kohn's conclusion that the price tag for an x-ray irradiator is "far too high," all I can say is that Hawaii Pride has been using x-ray technology to irradiate Hawaiian produce and has been operating profitably while operating at only about fifteen percent of our facility's capacity.

Q.5: In paragraph A.4 of his testimony, Mr. Kohn claims that "major additional costs" associated with energy loss during conversion of e-beam to x-rays and the alleged need for skilled workers to operate the equipment makes use of an x-ray irradiator uneconomical. Do you agree with his assessment?

A.5: No. Mr. Kohn is correct that there is a 93% energy loss when converting e-beam to x-ray and that Hawai'i has relatively high electricity costs when compared with prices elsewhere in the United States. However, years of experience at Hawaii Pride disprove his assumption that electricity costs make use of an x-ray irradiator uneconomical.

At over 40 cents per kW/hour, electricity costs on Hawai'i Island are considerably higher than the approximately 30 cents per kW/hour Pa'ina would pay on O'ahu. Even with these relatively high electricity costs, Hawaii Pride pays for electricity only about one cent per pound of treated produce.

As for Mr. Kohn's assumption that, to maintain and operate an x-ray irradiator, you have to hire high-priced, highly skilled workers, he is simply wrong. Hawaii Pride employs two people to maintain and operate its equipment, neither of whom came to us with specialized training.

One of our employees is responsible for production scheduling, dosimetry, USDA/APHIS reporting, radiation safety and maintaining the electronic portion of our linear accelerator. That employee has only a bachelor's degree in general engineering. He attended a three-day workshop to learn how to maintain our equipment.

Our second employee, who is responsible for all production, supervises all production employees and maintains the mechanical portion of the linear accelerator, has only a GED; he did not even graduate from college.

In addition, Hawaii Pride has a maintenance service contract with Crawford Services, a California-based company that specializes in preventative maintenance, emergency maintenance and phone support for electron-beam irradiators.

All told, Hawaii Pride's electricity and variable labor costs total less than three cents per pound of treated produce. The fact that Hawaii Pride has consistently been making a profit treating local produce for export disproves Mr. Kohn's unsupported claim that costs for electricity (which would be substantially lower on O'ahu) and labor make use of an x-ray irradiator uneconomical.

Q.6: I now turn your attention to paragraph A.5, where Mr. Kohn claims Hawaii Pride was having financial difficulties in 2002. Is that accurate?

A.6: It is true that Hawaii Pride was struggling financially in 2002, but for reasons completely unrelated to the economic viability of operating an x-ray irradiator in Hawai'i. Our problems in 2002 were a direct result of how Surebeam had structured the purchase agreement. They had nothing to do with inadequate throughput or excessive production costs, as Mr. Kohn suggests.

Q.7: Also in paragraph A.5, Mr. Kohn claims Hawaii Pride requires annual throughput treatment of 16 million pounds of papayas, 5.2 million pounds of sweet potatoes/bananas, and half a million pounds of other fruit just to break even. Is that correct?

A.7: Absolutely not. Our annual throughput averages only 8.4 million pounds – less than half what Mr. Kohn asserts is the bare minimum to cover costs – and we turn a profit.

Q.8: Please now turn your attention to paragraph A.7, where Mr. Kohn claims Hawaii Pride's has experienced "[f]requent equipment failures" that "led to the shut-down of the irradiator," including closures during two separate Christmas seasons, each of which lasted two weeks. Is that accurate?

A.8: No, Mr. Kohn is mistaken. Hawaii Pride's operations have been interrupted during the Christmas season only once, in 2005. Earlier that year, Hawaii Pride had been acquired by a new owner, and Titan and SureBeam no longer had any interest in maintaining the facility. During that Christmas season, we had two instances where cables providing sensory data from the linear accelerator in the treatment chamber back to the programmable logic coordinator failed due to having become brittle from five years of high radiation exposure. This type of failure from long-term radiation exposure is to be expected and both could and should have been prevented with proper maintenance.

Once Hawaii Pride assumed the responsibility for maintaining its own equipment (which had not been the case previously), I immediately began a program of preventative maintenance, which includes stocking a spare of all parts that might be expected to fail in time through use.

Since 2005, our preventative maintenance program has been extremely successful. I am proud to say that, in the past three years, we have not had unscheduled downtime that has lasted more than a few hours. Our track record has proven that, with proper maintenance, x-ray irradiators are extremely reliable.

Q.9: In paragraph A.9 of his testimony, Mr. Kohn states that he is "not aware of any U.S. company now producing the E-beam irradiator of a smaller size appropriate for Hawaii." Is that accurate?

A.9: No. While I have not done extensive research on which companies are selling smaller x-ray irradiators, I know for a fact that L-3 Corporation, an American company that purchased Titan in 2006, has several 5 MeV systems identical to ours available for purchase. Such a unit would likely cost in the neighborhood of $4.75 million, the price Mr. Kohn noted in paragraph A.8 of his testimony.

Q.10: In paragraph A.9 of his testimony, Mr. Kohn also claims "there is now no technical support for the Surebeam E-beam with X-ray added, and no reliable replacement parts for the equipment." Is that accurate?

A.10: Absolutely not. As I mentioned previously, Hawaii Pride has a maintenance service contract with Crawford Services, which specializes in providing techinical support for a wide range of electron-beam irradiators, including our x-ray irradiator.

As for replacement parts, we have never had any problem securing spare parts for our irradiator.

Q.11: Please turn your attention to paragraph A.10 of Mr. Kohn's testimony, where he says that x-ray technology is unreliable and would threaten "to cause substantial losses to [Pa'ina's] client base." Do you agree?

A.11: No. As I discussed previously, Hawaii Pride has proven that, with an appropriate maintenance program, x-ray irradiators are extremely reliable, profitable and appropriate for treating Hawaiian produce. Since we instituted our preventative maintenance program at the end of 2005, our irradiator has never been down for unscheduled repairs for more than a few hours. We have high levels of client satisfaction due to our reliable performance.

Mr. Kohn inaccurately suggests that SureBeam's bankruptcy somehow demonstrates that x-ray irradiators are unreliable or too expensive. As I testified previously, SureBeam's bankruptcy was due to mismanagement of company funds, not any problems with its irradiator technology.

Q.12: Does this conclude your testimony?

A.12: Yes.

I declare under penalty of perjury that I have read the foregoing Supplemental Written Testimony and Declaration of Eric D. Weinert and know the contents thereof to be true of my own knowledge.

Dated at Kea'au, Hawai'i, January 27, 2009.

Eric D. Weinert

ERIC D. WEINERT

CERTIFICATE OF SERVICE

The undersigned hereby certifies that, on February 2, 2009, a true and correct copy of the foregoing document was duly served on the following via e-mail and first-class United States mail, postage prepaid:

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Dated at Honolulu, Hawai'i, February 2, 2009.

DAVID L. HENKIN
Attorneys for Intervenor
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EARTHJUSTICE
Because the earth needs a good lawyer

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INTERNATIONAL JUNEAU, ALASKA NEW YORK, NEW YORK OAKLAND, CALIFORNIA
SEATTLE, WASHINGTON TALLAHASSEE, FLORIDA WASHINGTON, D.C.

TRANSMITTAL LETTER

TO: Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
Attention: Rulemakings and Adjudications Staff

VIA FIRST CLASS MAIL

FROM: David L. Henkin

DATE: February 2, 2009

RE: Pa'ina Hawaii, LLC (Materials License Application),
Docket No. 30-36974-ML, ASLBP No. 06-843-01-ML

ENCLOSURES	DATE	DESCRIPTION
Original and two copies	2/2/09	INTERVENOR CONCERNED CITIZENS OF HONOLULU'S SUPPLEMENTAL STATEMENT OF POSITION

[ ] For Your Information.
[X] For Your Files.
[ ] Per Our Conversation.
[ ] Per Your Request.
[ ] For Review and Comments.
[ ] See Remarks Below.

[X] For Filing.
[ ] For Recordation.
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[ ] For Signature & Forwarding.

REMARKS:

Please note that the signature pages for the declarations of Marvin Resnikoff Ph.D. and Mete A. Sozen Ph.D are scanned copies. We did not receive the original in time for this filing, but will file it as soon as we receive it.

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