

August 26, 2008

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**Q.6.** How were the Topical Reports prepared?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Q.35: Does this conclude your testimony?

A.35: Yes.