August 10, 2007

Michael Kohn, President
Pa'ina Hawaii, LLC
P.O. Box 30542
Honolulu, Hawaii 96820

SUBJECT: FINAL ENVIRONMENTAL ASSESSMENT FOR PROPOSED PA'INA HAWAII, LLC IRRADIATOR

Dear Mr. Kohn:

The U.S. Nuclear Regulatory Commission staff has completed its final environmental assessment for the proposed underwater irradiator in accordance with the terms of a March 20, 2006, settlement agreement with Concerned Citizens of Honolulu. Enclosed is the final environmental assessment and associated "Finding of No Significant Impact." This information will be published shortly in the *Federal Register.* Related documents are also available on the NRC's website: http://www.nrc.gov/materials.html by selecting "Pa'ina Irradiator" in the Quick Links box. If you have any questions, please contact Patricia Swain at (301) 415-5405 or by email at pbs2@nrc.gov.

Sincerely,

/RA/

Patricia Swain, Acting Branch Chief
Environmental Review Branch
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 030-36974

Enclosure:
Final Environmental Assessment

cc: Enclosed list

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FINAL ENVIRONMENTAL ASSESSMENT
RELATED TO
THE PROPOSED PA'INA HAWAII, LLC UNDERWATER IRRADIATOR IN HONOLULU, HAWAII

PREPARED BY
THE U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF WASTE MANAGEMENT AND ENVIRONMENTAL PROTECTION
OFFICE OF FEDERAL AND STATE MATERIALS AND
ENVIRONMENTAL MANAGEMENT PROGRAMS

U.S. NUCLEAR REGULATORY COMMISSION
DOCKET NO. 030-36974

FINAL ENVIRONMENTAL ASSESSMENT RELATED TO THE PROPOSED PA'INA HAWAII, LLC UNDERWATER IRRADIATOR IN HONOLULU, HAWAII

Introduction

The U.S. Nuclear Regulatory Commission (NRC) is in receipt of a license application dated June 23, 2005, from Pa'ina Hawaii, LLC, that would authorize the possession and use of sealed radioactive sources in an underwater irradiator for the production and research irradiation of food, cosmetic, and pharmaceutical products (Pa'ina, 2005a). The proposed irradiator would be located immediately adjacent to Honolulu International Airport on Palekona Street near Lagoon Drive. The irradiator would primarily be used for phytosanitary treatment of fresh fruit and vegetables bound for the mainland from the Hawaiian Islands and similar products being imported to the Hawaiian Islands as well as irradiation of cosmetics and pharmaceutical products. The irradiator would also be used by the applicant to conduct research and development projects, and irradiate a wide range of other materials as specifically approved by the NRC on a case-by-case basis.

The NRC has completed its final evaluation of the proposed irradiator against the requirements found in the NRC's regulations at Title 10 of the Code of Federal Regulations (10 CFR), Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Typically, the licensing of irradiators is categorically excluded from detailed environmental review as described in the NRC regulations at 10 CFR 51.22(c)(14)(vii). However, the NRC staff entered into a settlement agreement (NRC, 2006a) with Concerned Citizens of Honolulu, the interveners in the adjudicatory hearing to be held on the license application. The settlement agreement included a provision for the NRC staff to prepare a draft environmental assessment (EA) and hold a public comment meeting in Honolulu, Hawaii prior to making a final decision. The NRC staff published a notice in the Federal Register requesting public review and comment on the draft EA on December 28, 2006 (71 FR 78231), and established February 8, 2007, as the deadline for submitting public comments on the draft EA. Approximately 47 individual comment documents (i.e., letters, facsimiles, and e-mails) were received by the NRC. Also, 221 identical emails were submitted by various individuals. In addition, oral comments were received from 43 individuals at a public meeting conducted by the NRC on February 1, 2007.

Appendix A of this final environmental assessment contains figures and diagrams related to the proposed licensing action. Appendix B includes the NRC's consideration of terrorist activities, and Appendix C contains a summary of public comments and NRC responses.

The Proposed Action

Pa'ina Hawaii, LLC has submitted a license application (Pa'ina, 2005a) for the possession and use of cobalt-60 (Co-60) sealed sources in an underwater irradiator. In this type of irradiator the sealed sources remain at the bottom of the irradiator pool at all times (i.e., approximately 12-18 feet below the pool surface) (See Figures A-1 and A-2 in Appendix A). Human access to the sealed sources and the space subject to irradiation is not physically possible without entering the irradiator pool. The product to be irradiated is placed in a water-tight container (i.e., product bell) and lowered into the irradiator pool water.

The proposed Pa'ina irradiator, was designed by Gray*Star, Inc. for use with two different types of radioactive Co-60 sealed source assemblies. Both source assemblies are doubly encapsulated. The inner capsule contains nickel coated Co-60 metal slugs. The inner capsule is either stainless steel or zircalloy and has two welded end caps. The inner capsule is then placed in the stainless steel outer capsule which also has two welded end plugs. The Co-60 sealed source assemblies (i.e., sealed sources or sources) are of robust construction and meet the NRC regulations (i.e., 10 CFR 36.21) for leak tests, corrosion, temperature shock, pressure, impact, vibration, puncture, and bending.

The irradiator has several main components including a pool, source holders and rack, plenum, surge tank, and a hoist and transfer system. The irradiator pool is made of two steel tanks, one inside the other. (See Figures A-2 and A-3 in Appendix A) The inner tank, which is in contact with the pool water, is constructed of one-quarter inch thick stainless steel. Steel separators, or I-beams, connect the inner-tank to the outer-tank. The outer-tank is constructed of one-quarter inch carbon steel and is externally coated with a polyurethane material (Pa'ina, 2005; NRC, 2006b) designed to protect against underground environmental conditions, (e.g. salt water). The steel separators, or I-beams, provide for strength and the ability to independently conduct hydrostatic pressure testing of the two tanks. Both tanks are leak checked off-site by filling the gap between the tanks with water and inspecting for leaks both inside and outside the pools. The irradiator pool is fabricated off-site and shipped to the proposed site and re-inspected for any damage that may have occurred during shipment.

During on-site construction activities, the pool formed from the two tanks is lowered into the excavation. A concrete foundation is placed underneath the pool and allowed to cure. The pool is then filled with water and the space between the inner and outer pools is checked for water leakage. After the leak test, the six-inch space between the tanks is filled with concrete. Finally, the area surrounding the pool is backfilled, based on site-specific back fill procedures and materials. To account for seismic activity and to separate any floor motion from the pool, a six-inch space between the pool/surge tank and the surrounding floor slab is present.

The pool is approximately 8 feet by 7 feet with the bottom of the pool approximately 18 feet below the ground surface level. Above ground level, the pool will extend 42" [3.5

feet] above the facility floor (See Figures A-2 and A-3 in Appendix A). This lip serves as a barrier to prevent personnel from accidentally falling into the pool. This 42" inch upper lip also helps prevent any water or dirt on the floor from entering the pool. The three layers of the pool's construction provide barriers to any water leaking from the pool to the surrounding environment. As described above, this pool construction method permits verifying the integrity of the pool's steel layers prior to and during installation on-site.

The Co-60 sealed sources are placed in the pool, or removed, in highly-shielded transportation casks. The hoist and cables associated with the overhead trolley system can adequately support the heaviest transportation cask. During source loading the plenum and source rack will be removed to provide space to position the shipping cask at the bottom of the pool. Any sources already present in the pool are placed at the other end of the pool away from the area where the shipping cask is lowered. The shipping cask does not travel over the sources at any time.

During routine operations, the Co-60 sources are locked in place at the bottom of the irradiator pool underneath the plenum (i.e., a watertight box open on the bottom) (See Figure A-4 in Appendix A). The plenum is sealed on the top and sides and contains helium gas under pressure to keep the sources dry during normal operations and to minimize water attenuation of the gamma photons during irradiation. Helium was selected because it is an inert element, will not chemically react with the source encapsulations, has excellent thermal transfer capabilities, and will not significantly dissolve in water. The plenum is constructed of stainless steel, compatible with the stainless steel source encapsulations. There are five vertical enclosures placed side by side (See Figure A-4 in Appendix A). The enclosures are welded to a top manifold that allows helium to freely pass from one enclosure to another. The plenum is completely sealed by welding on the top and sides. The bottom of the plenum is open to allow it to be placed over the source holders. Helium gas enters the plenum through a helium supply tube located on the top of the top manifold. The helium gas is under pressure that is equal to the pressure at the bottom of the plenum. This helium under pressure forces the pool water out of the bottom of the plenum and keeps the interior of the plenum dry. Gas pressure is monitored to assure that the water level does not rise within the plenum so that the sources remain dry.

As described above, the radioactive material is comprised of activated Co-60 slugs doubly encapsulated within the source assembly (i.e., sealed source). The individual Co-60 sealed sources (i.e., source assemblies or sources) are positioned vertically in source holders. Each stainless steel source holder is compatible with both the source encapsulation and the plenum material.

The source holders are stacked on guide rods in the source rack. A source holder may hold multiple sources (i.e., has numerous openings to hold Co-60 sealed sources) (See Figure A-5 in Appendix A). There are three source holders (in the vertical dimension) per enclosure and five enclosures (in the horizontal dimension) for a total of fifteen source holders. These source holders are placed on the source rack which has a

stainless steel base plate. Stainless steel guide rods are vertically welded to the base plate. The source rack is independent (not physically attached) to the plenum. Once the source holders are loaded onto the rack by sliding them down the guide rods, the plenum is lowered over the source rack, source holders, and Co-60 sources. Guides and clearances are built into the system to assure that there is never any contact or force on the sealed sources during all phases of loading and operation.

A stainless steel surge tank is located on one side of the pool near floor level. The primary purpose of the surge tank is to compensate for varying water levels due to pool water displacement from bell (i.e., product container) movement. The surge tank is connected to the pool through a transfer opening at or above the minimum water level. The minimum water level is the lowest amount of water in the pool that will retain shielding integrity during normal operations.

A water purification system that includes filtration, de-ionization, and a water radiation monitor (WRM) is mounted above the surge tank. The WRM is located on the filter system. The purification system's placement over the surge tank prevents any water loss from the water purification system should a leak occur. Although the Co-60 sources are not normally in contact with the pool water during routine operations, the water purification system is designed and maintained with the assumption that the pool water comes in direct contact with the sources (e.g., during source loading, unloading, or reconfiguration). The discharge pipe from the water purification system to the main irradiator pool terminates above the minimum water level. The inlet pipe from the surge tank to the water purification system is located in the surge tank and water access, via the transfer opening, is at or above the minimum water level. The WRM continuously monitors the filter housing to detect any accumulation of radioactive material. An inline conductivity monitor provides feedback for the prevention of electrolytic corrosion of the irradiator pool or source plenum.

A make-up water line is connected to an external water supply. A manual valve is used to add water to make up for water loss due to evaporation loss and a check valve prevents pool water from inadvertently traveling back into the external water supply. There are no water effluent discharges to State waters from the water purification system (Pa'ina, 2005b).

Bells (i.e., product containers) are lowered to either side of the stationary plenum. Limiters (i.e., significant steel structures) prevent the bells from coming in contact with the plenum, and thus protecting the individual Co-60 sources. The plenum is secured at the bottom of the irradiator pool by a stainless steel retaining mechanism that extends from the top of the plenum to the surface of the pool. The retaining mechanism is bolted, padlocked, and tamper sealed at the pool surface. The primary purpose of the retaining mechanism is to assure that the plenum, and the sources, can't be raised to the pool surface under any conditions when the sources are present in the plenum. Plenum inspection and maintenance, should it be necessary, is conducted by breaking the tamper seals, unlocking and unbolting the retaining mechanism, removing the retaining mechanism, and then raising the plenum. After the source holders are

removed, the source rack can also be removed for inspection. In addition to the WRM, an area radiation monitor (ARM) is located over the surface of the pool. The ARM has remote visual alerts and is audible at all Restricted Area personnel entries. The ARM is directly wired to the hoist system. In the event that the ARM, in combination with the WRM, detects the presence of radiation (above the threshold setting), the power to the hoist system is shut off and all hoist movement ceases.

The product to be irradiated is brought into the Restricted Area on carts (i.e., stacked product carriers). Open-bottomed bells are suspended from a hoist system and moved by the overhead rail and trolley. Three hoist/bell assemblies are used. To load the irradiator, the operator lowers a bell enveloping/engaging a cart full of product at a loading station. The bell containing the product is then raised. The operator pushes and holds a button to activate the trolley and move the loaded bell to a “START” position on one side of the pool. A computer detects the bell in the “START” position and when ready, automatically moves the bell over the pool. The bell is then automatically lowered into the pool at one side of the source plenum. After irradiation (of one side of the product), the bell is raised out of the pool water, moved further along the rail over the pool, and lowered to the second side of the plenum for completion of the irradiation cycle. After completion, the bell is automatically raised by the hoist system and moved by trolley to the “FINISH” position on the opposite side of the pool from the “START” position. The “FINISH” position is located above the surge tank to recycle water runoff from the bell. The operator then pushes and holds a button to activate the trolley and move the finished bell to an unloading station where the bell is lowered, detached from the product cart, and sent to the initial loading station.

Product irradiation takes place only near the pool bottom (i.e., under 12-18 feet of water) around the plenum. The product is moved to the bottom of the pool in the bells. All components of the bells in contact with the pool water are made of stainless steel. The bells, even if empty, are heavy enough to prevent them from floating in the pool. They are raised and lowered with conventional hoists and stainless steel cable. The safety factor on all lifting components such as the cable is a factor greater than five times the materials’ yield strength. Should the cables or their attachments fail, the bells might drop into the pool; however, the limiters, which position the bells, keep them clear of the plenum and sources. The retaining mechanism that locks the plenum into position occupies the space in the pool from the plenum to the surface. Therefore, a bell cannot fall and impact the plenum.

The bell is water tight on all sides except for the open bottom. As the bells are lowered into the pool, the increased water pressure tries to force the water level in the bell to rise. However, each bell has a compressed air supply line. The purpose of this compressed air line is to maintain the water level in the bell below the product. The compressed air supply line runs from the hoist mechanism to each bell. A stainless steel pipe on the top of each bell extends above the bell. This pipe is connected to the flexible air supply line. The flexible air line is connected to a retractable reel system located at the hoist mechanism. The purpose of the stainless steel extension, which is curved to prevent radiation streaming, is to prevent radiation damage to the flexible air

line. If the air supply line fails and is open to the water, air would come out of the exposed line and bubble through the water. At no time could pool water be drained through the air supply line. The compressed gas supplied through the flexible air line equalizes the pressure and maintains the water level at the bottom of the bell. As the bell rises out of the pool, the decreased water pressure causes air to escape from the bottom of the bell.

Also, as the bells descend into the pool, the water pressure increases slightly at the bottom of the pool which causes water to be pushed up slightly into the plenum. The plenum is designed with a buffer space below the source holders to allow for water levels to vary and yet keep the source encapsulations dry. All moving parts of the irradiator can be maintained and replaced above the pool and outside the irradiation zone.

The Need for the Proposed Action

The proposed irradiator would be mainly used for the production and research irradiation of food and cosmetic products (Paina, 2005). The irradiator would satisfy several needs related to the control of invasive pest species (Wong, 2006). Specific uses would include (Kohn, 2006):

- 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.

Hawaii currently has four treatment facilities, all located on the big island of Hawaii. These existing facilities consist of three heat treatment facilities and one electron beam irradiator facility. However, some producers are precluded from using these facilities for various reasons including product restrictions and high shipping costs (Wong, 2006). A treatment facility located on Oahu, the central hub for air and sea transportation, is considered to be most useful as it would provide access to the widest range of mainland and foreign destinations with the shortest time delays from field to market (Wong, 2006).

During peak import seasons (e.g., Mother's Day) it is difficult for the Hawaii Department of Agriculture to conduct inspections due to the large volumes of products. Treatment by irradiation in lieu of inspections would allow immediate release of the products and provide benefits to importers (Kohn, 2006).

There is a major effort underway to establish a new biosecurity system for the state of Hawaii (Wong, 2006). Invasive species pose a large threat to Hawaii's native ecology. When invasive species are found there are typically three options for importers, 1) return the product to the sender, 2) destroy the product, or 3) treat with methyl bromide. Shipping the product back to the sender involves additional freight cost and increased product degradation due to time delays, while destruction results in the total loss of the product. Treatment by methyl bromide is an alternative; however it has some

drawbacks such as increased cost, product degradation, and potential damage to the Earth's ozone layer (see discussion under Alternatives). The Hawaii Department of Agriculture believes irradiation has the broadest application for post entry quarantine treatment (Wong, 2006).

The California Department of Agriculture operates a Mediterranean fruit fly sterilization facility on Oahu which provides sterile fruit fly pupae for preventative release programs in California. Currently, California intends to increase the size of this facility and will need additional treatment capacity. The proposed Pa'ina irradiator could potentially be used to meet this need. (Wong, 2006)

Finally, Pa'ina Hawaii has formed the Pacific Agriculture Research Company to conduct research for the benefit of Hawaii agriculture. The proposed irradiator could also serve the University of Hawaii for its research needs (Kohn, 2006).

Environmental Impacts of the Proposed Action

Construction and Normal Operations

The proposed irradiator is expected to have no significant impacts during construction for any resource areas due its small size and the limited type of construction activities. The NRC staff also considered operational impacts. The proposed irradiator would occupy a small percentage of existing industrial space at the airport. Additionally, there are no known land use restrictions that would be created by construction and operation of the proposed Pa'ina irradiator. The NRC has completed consultation requirements under Section 106 of the National Historic Preservation Act. The Hawaii State Historic Preservation Officer responded to NRC staff that the proposed irradiator will have "no effect" on historic properties (Young, 2005). The proposed irradiator would produce very little noticeable noise as the primary moving parts are the overhead hoist and trolley system and the routine product deliveries via truck. Additionally, noise from the proposed irradiator is expected to be negligible when compared to the other noise present at the proposed airport location. There are no air effluents from the proposed irradiator. The proposed irradiator would be enclosed in an industrial-type building of similar size and color to other buildings at the Honolulu International Airport; therefore no visual impacts are expected. The NRC staff finds that the proposed irradiator would have no significant impacts on land use, historical and cultural resources, noise, air quality, or visual quality during operation.

As described in the Proposed Action, there would be no liquid effluents from the proposed irradiator to State waters (Pa'ina, 2005b). Once the pool is filled, only small amounts of water (relative to general industrial users) would be needed to compensate for evaporation. Additionally, the irradiator pool consists of multiple layers of steel and concrete which makes pool leakage unlikely. However, even if the irradiator pool were to leak water, it is unlikely that this water would be radioactively contaminated for several reasons. During normal operations the Co-60 sealed-sources are located in the plenum under a helium atmosphere which is not in direct contact with the pool water.

Additionally, the Co-60 sealed sources are doubly encapsulated in stainless steel and tested to withstand significant forces. Because the pool conditions (i.e., the pH, temperature, and conductivity) would not be conducive to corrosion, the anticipated corrosion rate would be very low (CNWRA, 2007) and thus the cobalt slug would not likely corrode at an appreciable amount, even if exposed to the irradiator pool water. Also, even if a source were to contaminate the pool water, the radiation monitors would be activated and the irradiator would be shut down and the leaking sources would be removed. The three layers of the pool's construction provide barriers to any water leaking from the pool to the surrounding environment. The pool construction method permits verification of the pool integrity prior to and during installation on-site. The NRC staff finds that the proposed irradiator would have no significant impacts on water quality or water use.

Public and occupational health impacts are expected to be small as the expected doses would be well below regulatory standards. For example, the maximum dose at the pool surface would be well below 1 millirem/hour (NRC, 2003; NRC, 2006c). Considering the location of personnel and operational practices of the irradiator, it is unlikely that an employee could receive more than the occupational dose limit which is 5,000 millirem/year. The expected dose rate approximately 20-25 feet from the pool edge is expected to be indistinguishable from background radiation. The expected dose rates outside the building are expected to be indistinguishable from naturally occurring background radiation, therefore it is unlikely that a member of the public could receive more than the public limit which is 100 millirem/year. The NRC staff finds that the proposed irradiator would have no significant impacts on public or occupational health.

Transportation impacts from normal operations would be small. Radioactive Co-60 sealed sources would be shipped approximately once per year. Using RADTRAN 5.3, staff estimated the maximum dose for a full initial shipment would be 3.7×10^{-2} millirem/year. For this calculation, the staff assumed each source contained the maximum allowable activity, 10 sources per cask, one cask per shipment, and six total shipments (NRC, 2006d). Additionally, shipments of various commodities might shift locations (i.e., starting and ending points) however; total shipments are not expected to significantly increase. The NRC staff finds that the proposed irradiator would have no significant impacts from transportation of the sources or additional products.

The proposed irradiator would potentially have small beneficial impacts to socioeconomics. For example, operation of the proposed irradiator would provide Hawaiian sweet potato farmers with an effective and potentially cheaper alternative to fumigation with methyl bromide (APHIS, 2004). Likewise, banana farmers, and importers of fresh flowers and foliage could benefit economically from potentially cheaper treatment alternatives (APHIS, 2006). In approving irradiation treatments for various types of produce, the Animal and Plant Health Inspection Service (APHIS) stated the result of irradiation treatments would be lower costs and increased flexibility for importers, gains which could be realized by U.S. consumers through lower prices (APHIS, 2006). The NRC staff finds that the proposed irradiator would have no significant impacts on socioeconomics.

The proposed irradiator would also have small beneficial impacts to ecology in regard to controlling invasive species. Invasive species are those species non-native to the reference ecosystem and whose introduction causes economic, environmental or human health harm (USDA, 2006). It has been estimated that over 2,500 insect species have been introduced to Hawaii and account for 98% of the pest species in the state (Pimentel et al., 2005). In California, over 600 invasive pests account for 67% of all crop losses (Pimentel et al., 2005). While the proposed irradiator will not diminish the existing population of invasive species, it is seen as one tool in preventing the further introduction and spread of invasive pests. For example, APHIS passed irradiation treatment rules to provide effective quarantine treatment for the mango seed weevil and various forms of the fruit fly (APHIS, 2003). Additionally, the Hawaii Department of Agriculture has stated that an additional irradiator would be a benefit to the "preventative release" program whereby fruit fly pupae are sterilized to prevent the establishment of the fruit fly in California (Wong, 2006). The NRC staff finds that the proposed irradiator would have no significant impacts on ecology.

Aviation Accidents, Natural Phenomena and Abnormal Events

In reviewing impacts from aviation accidents and other natural phenomena, the NRC staff focused its review on the release of radioactive material which could have off-site consequences. The scenario of main concern is the loss of control of the Co-60 sealed sources. Loss of control occurs when source material is physically removed from the pool or when water becomes contaminated and is released from the pool. In order to remove source material from the pool, the source retaining mechanism and lock must be overcome, the plenum must be removed, the source must be removed from the source rack, and the source material must be lifted out of the pool. For the irradiator pool water to become contaminated, the two stainless steel capsules must be breached to expose the radioactive Co-60 slug and allowed to corrode in the water. Even if the building is completely destroyed and the pool damaged by the accident or natural phenomenon, control of the source is not lost unless the source material is removed from the pool or allowed to corrode in the pool water. Similarly, the loss of operating monitoring equipment during an accident or natural phenomenon does not lead to the loss of control of radioactive material. Finally, a reduction in the water level results in increased dose rates in a well collimated beam directly above the pool. For example, a loss of 6 feet of pool water would result in a dose of approximately 300 millirem/hour (NRC, 2007). However, due to the highly collimated beam, and the ability to easily add water, the increased dose rate will not be sufficient to have a significant environmental effect on the area around the proposed facility. In addition, worker doses should not be significantly increased in the area around the pool and the debris around the pool will act as barriers to restrict inadvertent access to the areas of elevated radiation directly above the pool.

As described in more detail in the Safety Topical Report (CNWRA, 2007), the probability of an aircraft crash into the proposed facility is 2.1×10^{-4} (i.e., about once every five thousand years). It should be noted that the probability that an aircraft will crash into

the proposed facility does not reflect the potential for release or dispersal of the radioactive Co-60 from the doubly-encapsulated sources. The source plenum is located under approximately 12-18 feet of water. Additionally, the Co-60 sealed sources in the source plenum are not mechanically coupled to the plenum structure and the plenum structure is not coupled to the rest of the building. In the event of damage to the plenum structure the sources would either remain in the source rack/holder or fall to the floor of the irradiator pool. The Co-60 sources are doubly-encapsulated and have been tested to withstand significant forces. A significantly larger force must be generated by an aircraft crash because much of the force will result in damage to the building and other ground-level structures of the pool. Transferring the force to the bottom of the pool will also result in significant absorption of the force. It is unlikely that a Co-60 sealed source would be breached in the event that an aircraft crashes into the proposed facility. It is also expected that an aviation accident would be accompanied by a jet fuel fire. Jet fuel is lighter than water, thus the jet fuel is expected to burn on top of the irradiator pool with minimal water evaporation. Jet fuel (i.e., purified kerosene) burns at an average temperature of 1,814 °F (NRC, 2004), while the source assemblies have been tested to withstand 1,475 °F for one hour (MDS, 2002). Although the maximum flame temperatures of burning jet fuel is 2,200 °F (Turns, 2000), the melting point of cobalt is 2,723 °F (Bolz and Tuve, 1973). Based on these considerations, the NRC staff finds that potential aviation accidents would have no significant impacts on public health and safety from the proposed irradiator.

As described in more detail in the Safety Topical Report (CNWRA, 2007), a seismically-induced radiological accident is considered negligible due to the nature of the facility and the seismic hazard for the site. The radiological sources at the facility are passive and shielding or containment of the Co-60 sources does not rely on active systems to mitigate potential radiological releases. The historic earthquake ground motions for the site are insufficient to damage the proposed facility to the degree necessary to dislodge Co-60 sources from the pools. Effects of seismic activity would be mitigated by the facility's compliance with the International Building Code and the source design to minimize the amount of force that could be transferred to the source. The NRC staff finds that potential seismic activity would have no significant impacts on public health and safety from the proposed irradiator.

As described in more detail in the Safety Topical Report (CNWRA, 2007), fluid dynamic calculations were conducted to determine impacts from potential tsunami-generated wave run-ups. The results of this analysis showed that the wave velocity required to remove a Co-60 source from the bottom of the pool is larger than the wave velocity of any historical tsunami in Hawaii. These calculations were performed to determine the wave velocity necessary to pull a Co-60 source up to the pool opening. These wave velocities were then evaluated with respect to potential tsunami-generated waves. The calculations are considered bounding because they assume the irradiator plenum and source holder have all failed releasing the Co-60 sources to the floor of the irradiator. The model assumed a wave of water will induce a shear force that will create a vortex inside the pool. This vortex will exert forces (i.e., a vertical velocity) on the released Co-60 sources and cause them to be displaced in the water. Under limiting conditions,

the weight of the Co-60 source must be the same as the drag induced by the rotating fluid in order to be displaced. The calculations showed that a vertical velocity of 0.9 meters per second (m/sec) [2 miles per hour (mph)] is required to induce a drag force sufficient to lift the Co-60 source to the surface of the pool. This vertical velocity would be generated by a shear velocity of between 90 m/sec [203 mph] and 180 m/sec [406 mph]. However, water velocities at the shore for tsunami waves up to 10 meters [32.8 feet] reach 13 m/sec [29 mph]; this velocity is less than 15 percent of that which would be required to bring a source assembly to the surface of the pool. Additionally, this wave will have a fraction of this velocity as it reaches the irradiator pool because of the distance between the coast and the irradiator facility and the barriers to water flow imposed by near shore obstructions, including the building facility, and the presence of other debris. Water velocities for smaller tsunami waves more typical for Oahu would be substantially slower than for the large waves and would likely not even reach the facility. Thus, there is a negligible potential for tsunami waves which could produce wave velocities that would lift and relocate the Co-60 sources from the irradiator pool. The NRC staff finds that potential tsunami activity would have no significant impacts on public health and safety from the proposed irradiator.

A more complete description of hurricanes around Hawaii is provided in the Safety Topical Report (CNWRA, 2007). In summary, the wave velocity associated with a storm surge is significantly less than that associated with a tsunami. Since the 1950s, there have been a number of hurricanes that have passed near Oahu, but none have produced a storm surge that would pose a hazard to the facility. As discussed above, the probability of a large tsunami removing a Co-60 source from the bottom of the proposed irradiator pool is considered negligible. Therefore, the likelihood of a storm surge associated with a hurricane resulting in the release of a Co-60 source is also considered negligible. It is also noted that the upper lip of the irradiator pool, which is constructed of ¼" stainless steel, extends 42" above floor level and helps prevent minor flooding from entering the pool. The NRC staff finds that potential hurricane activity would have no significant impacts on public health and safety from the proposed irradiator.

Other abnormal conditions were also considered. If an air supply line fails and is open to the water, air would come out of the exposed line and bubble through the water. At no time could pool water be 'drained' through the air supply line. The product would become wet but would not present any immediate impact to water quality as the product could still be removed from the pool. This type of scenario is not expected to significantly affect worker health. Also, a curved stainless steel extension is fitted to the top of each bell to prevent radiation streaming and radiation damage to the flexible air line.

Additionally, a gauge is located on the top of the irradiator on the helium supply tube that allows for monitoring of helium pressure in the plenum (which corresponds to water level in the plenum). If a helium leak occurred, either in the plenum or helium line, helium would bubble through the water, but at no time could pool water be 'drained' through the helium supply line. The Co-60 sealed sources would become wet but would

not present any immediate impact to water quality as the sources are double-encapsulated in stainless steel. It is anticipated that the plenum could be raised to the surface and repaired as necessary with no significant impacts to sources or worker health.

Environmental Impacts of the Alternatives to the Proposed Action

The staff considered several different alternatives to the proposed action including denying Pa'ina's license application (i.e., the no-action alternative), and use of alternative quarantine control technologies.

Denial of the application (i.e., the no-action alternative) would result in small changes in current environmental impacts. Fruit and other perishable commodities would have to be treated in a manner consistent with current practice at existing facilities. The primary impact of this no-action alternative is the small economic impacts from limiting the expansion of the sale and distribution of certain fruits and vegetables from Hawaii along with the associated benefits of helping control invasive species. APHIS has recently passed regulations allowing irradiation of sweet potatoes, bell peppers, and bananas (APHIS, 2003; APHIS, 2004; APHIS, 2006). In addition to being a safe treatment method, irradiation would afford farmers from the various Hawaiian islands a potentially more cost-effective means of distributing their products to markets outside of Hawaii. Currently, there is one irradiation facility on the big island of Hawaii. Transportation costs of shipping produce from other islands to the big island of Hawaii and back to Oahu for out-of-state distribution are considered prohibitive (APHIS, 2004; Wong, 2006). While, the environmental impacts of the proposed action and the no-action alternative are similar (i.e., neither alternative has significant environmental impacts), small economic benefits would be foregone by the decreased market outlets available for fruit and vegetable producers on islands other than Hawaii.

Alternative quarantine control technologies include the use of methyl bromide gas and various types of heat treatments. Methyl bromide fumigation is the most common method for controlling quarantine pests. However, methyl bromide is limited to certain commodities at specific temperatures because some commodities are highly sensitive, including certain Hawaiian tropical fruits (EPA, 2006a). Methyl bromide is also known to contribute to the destruction of the Earth's ozone layer and is currently being phased out of production. While quarantine uses are exempted, it is expected that the cost of methyl bromide will increase significantly (APHIS, 2004) as the number of manufactures decrease and others phase back production.

There are currently several different methods of heat treatments available. Hot-water immersion consists of submerging the fruit in a hot-water bath at a specific temperature and time based on the fruit being treated and the pests that may be present. This method is also useful for cut flowers and bulbs. While useful for many fruits, this method is not approved for papayas and guavas and is not recommended for fruits such as grapefruits, plums, and peaches due to unacceptable fruit damage (EPA, 2006b).

While the environmental impacts of the proposed action and the alternatives are similar, small economic benefits would be foregone by the decreased market outlets available for fruit and vegetable producers on islands other than Hawaii (APHIS, 2003; APHIS, 2004; APHIS, 2006). Additional small economic benefits would be foregone from potentially lower-priced and more rapid quarantine treatments (APHIS, 2003; APHIS, 2004; APHIS, 2006).

Agencies and Persons Consulted

The NRC has consulted with the Hawaii State Historical Preservation Officer. The NRC followed this consultation with a request for information to several Native Hawaiian groups and organizations. On December 8, 2005, the Hawaii State Historic Preservation Officer responded to NRC staff that the proposed irradiator project would have "no effect" on historic properties (Young, 2005), thus completing NRC's Section 106 consultation requirements under the National Historic Preservation Act.

The NRC has requested endangered species information from the U.S. Fish and Wildlife Service (FWS). The FWS responded that no listed endangered species or critical habitat occur at the proposed irradiator site (FWS, 2005), thus completing NRC's Section 7 consultation requirements under the Endangered Species Act.

The Hawaii Department of Business, Economic Development & Tourism has indicated to NRC staff that a federal consistency review is not required by the Hawaii Coastal Zone Management Program (Thielen, 2005).

The NRC staff also provided the draft EA to the State of Hawaii, Pa'ina Hawaii, Concerned Citizens of Honolulu, and members of the public for review and comment.

Conclusion

The NRC staff has prepared this EA in support of the proposed action to issue a license to Pa'ina Hawaii for the possession and use of sealed radioactive sources in an underwater irradiator for the production and research irradiation of food, cosmetic, and pharmaceutical products. On the basis of this EA, NRC has concluded that there are no significant environmental impacts and the license application does not warrant the preparation of an Environmental Impact Statement. Accordingly, it has been determined that a Finding of No Significant Impact is appropriate.

Sources Used

This environmental assessment was prepared by Matthew Blevins, Senior Project Manager, in the Office of Federal and State Materials and Environmental Management Programs (FSME), with technical input from Elaine Keegan, Transportation Project Manager, in the Office of Nuclear Material Safety and Safeguards and Anita Gray Turner, Health Physicist, in FSME.

Additionally, the Center for Nuclear Waste Regulatory Analyses provided technical support in aircraft crash hazard analysis and natural phenomena under NRC Contract # NRC–02–04–014.

References:

(APHIS, 2003) "Fruits and Vegetables from Hawaii, Final Rule." Federal Register 68 (February 5, 2003): 5796-5800.

(APHIS, 2004) "Irradiation of Sweetpotatoes from Hawaii, Final Rule." Federal Register 69 (February 18, 2004): 7541-7547.

(APHIS, 2006) "Treatments for Fruits and Vegetables, Final Rule." Federal Register 71 (January 27, 2006): 4451-4464.

(Bolz and Tuve, 1973) R.E. Bolz and G.L. Tuve eds. "CRC Handbook of Tables for Applied Engineering Science." 2nd Edition. Boca Raton, Florida: CRC Press, Inc. p. 119. 1973.

(CNWRA, 2007) "Final Topical Report on Aircraft Crash and Natural Phenomena Hazard at the Pa'ina Hawaii, LLC Irradiator Facility." Center for Nuclear Waste Regulatory Analysis, May 2007.

(EPA, 2006a) "U.S. EPA: Pesticides – Methyl Bromide," U.S. Environmental Protection Agency. <http://www.epa.gov/pesticides/factsheets/chemicals/methylbromide_factsheet.htm>, accessed on September 7, 2006.

(EPA, 2006b) "U.S. EPA: Heat Treatments for Quarantine Commodities," U.S. Environmental Protection Agency. <http://www.epa.gov/Ozone/mbr/casestudies/volume2/heatcom2.html>, accessed on September 7, 2006.

(FWS, 2005) Letter from P. Leonard (U.S. Fish and Wildlife Service) to A. Gaines (NRC), November 8, 2005.

(Kohn, 2006) Email from M. Kohn (Pa'ina Hawaii) to M. Blevins (NRC) "Honolulu irradiator impacts," August 29, 2006.

(MDS, 2002) "Registry of Radioactive Sealed Source s and Devices, Safety Evaluation of Sealed Source No: NR-0220-S-103-S," MDS Nordion. January 23, 2002.

(NRC, 2003) "Inspection 03036239/2003001, CFC Logistics, Inc., Quakertown, Pennsylvania," November 4, 2003.

(NRC, 2004) "Fire Dynamics Tools (FDTs) Quantitative Fire Hazard Analysis Methods

for the U.S. Nuclear Regulatory Commission Fire Protection Inspection Program," NUREG-1805. December 2004.

(NRC, 2006a) "NRC Staff and Concerned Citizens of Honolulu Joint Motion to Dismiss Environmental Contentions," March 20, 2006

(NRC, 2006b) "Note to file: Highlights of August 22, 2006 site visit to CHL Systems, Souderton, Pennsylvania, and email coordinating meeting." Undated.

(NRC, 2006c) Email from A. Turner Gray to M. Blevins: "Mircoshield calculation review." November 27, 2006.

(NRC, 2006d) Email from E. Keegan to M. Blevins "Pa'ina Irradiator SER Input." December 6, 2006.

(NRC, 2007) Microshield Summary Sheet for Loss of 6 Feet of Shielding Water at Pa'ina Irradiator." March 28, 2007.

(Pa'ina, 2005a) "Application for Materials License," June 23, 2005.

(Pa'ina, 2005b) Letter from A. Buchan (Pa'ina) to D. Lau (Hawaii State Department of Health, Clean Water Branch). Undated.

(Pimentel et al., 2005) "Update on the environmental and economic costs associated with alien-invasive species in the United States." Ecological Economics 52(2005):273-288.

(Thielen, 2005) Letter from L. Thielen (Hawaii Department of Business, Economic Development and Tourism) to J. Whitten (NRC). "U.S. Nuclear Regulatory Commission (NRC) License Request for Pa'ina Hawaii, LLC, Irradiator in Honolulu, Hawaii,"

(Turns, 2000) S. Turns. "An Introduction to Combustion: Concepts and Applications." 2nd Edition. New York, New York: McGray Hill Higher Education.

(USDA, 2006) "Invasive Species: About NISIC – What is an Invasive Species?" <http://www.invasivespeciesinfo.gov/whatis.shtml> accessed on November 28, 2006.

(Wong, 2006) Letter from L. Wong (Hawaii Department of Agriculture) to M. Kohn (Pa'ina Hawaii). August 28, 2006.

(Young, 2005) Letter from P. Young (Hawaii State Historic Preservation Officer) to J. Whitten (NRC). "National Historic Preservation Act Section 106 Initiation-Pa'ina Hawaii, LLC Industrial Pool-Type Irradiator to be Built at the Honolulu International Airport Kona District, Moanalua Ahuppua'a, Island of O'ahu, Hawaii'I TMK(1)1-1-076:009 & 10," December 8, 2005.

Appendix A: Figures

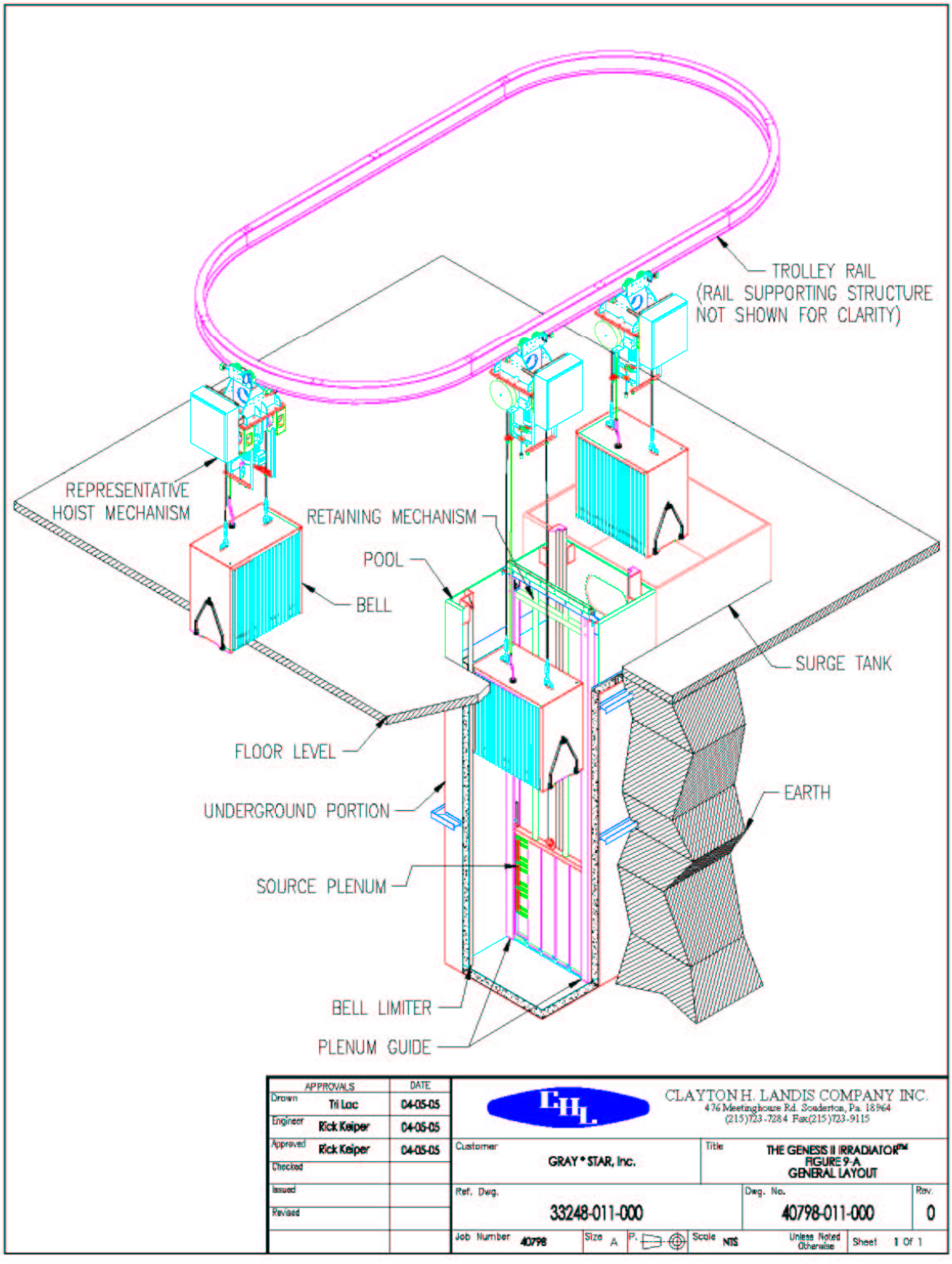

Figure A-1: General Layout of proposed irradiator (Pa'ina, 2005a).

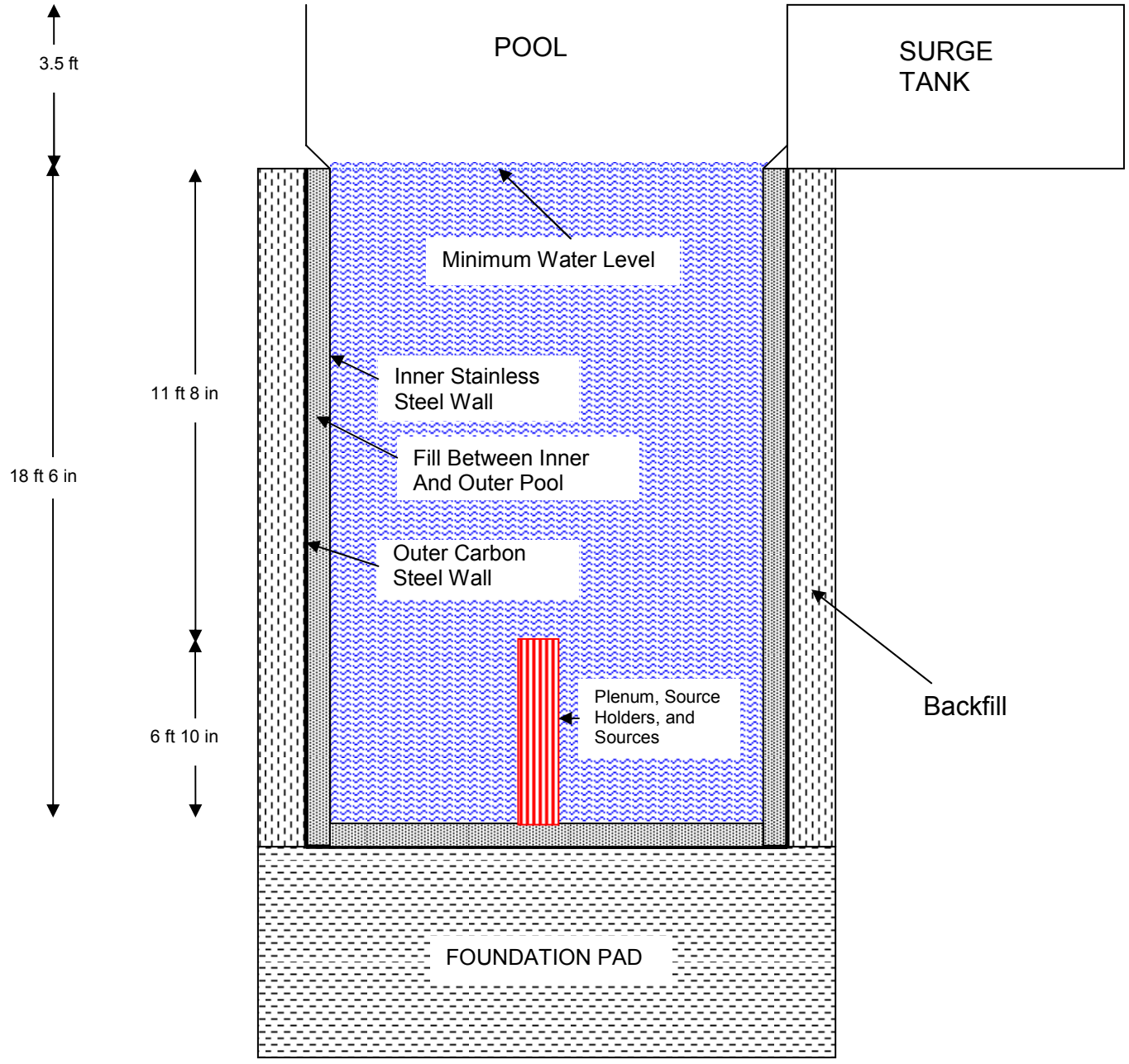

Figure A-2: Simplified schematic of proposed Pa'ina irradiator.

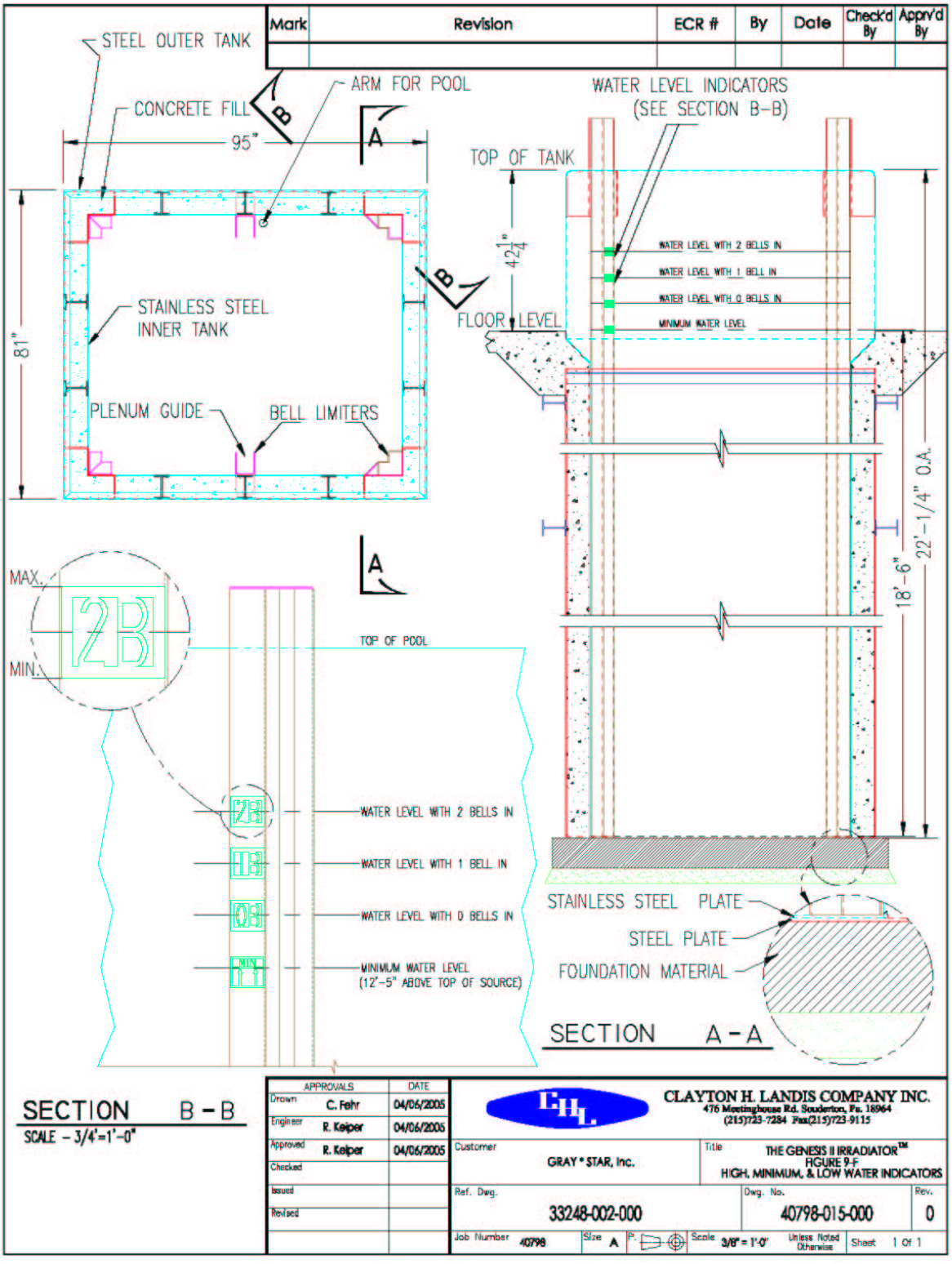

Figure A-3: Details of irradiator design (Pa'ina, 2005a).

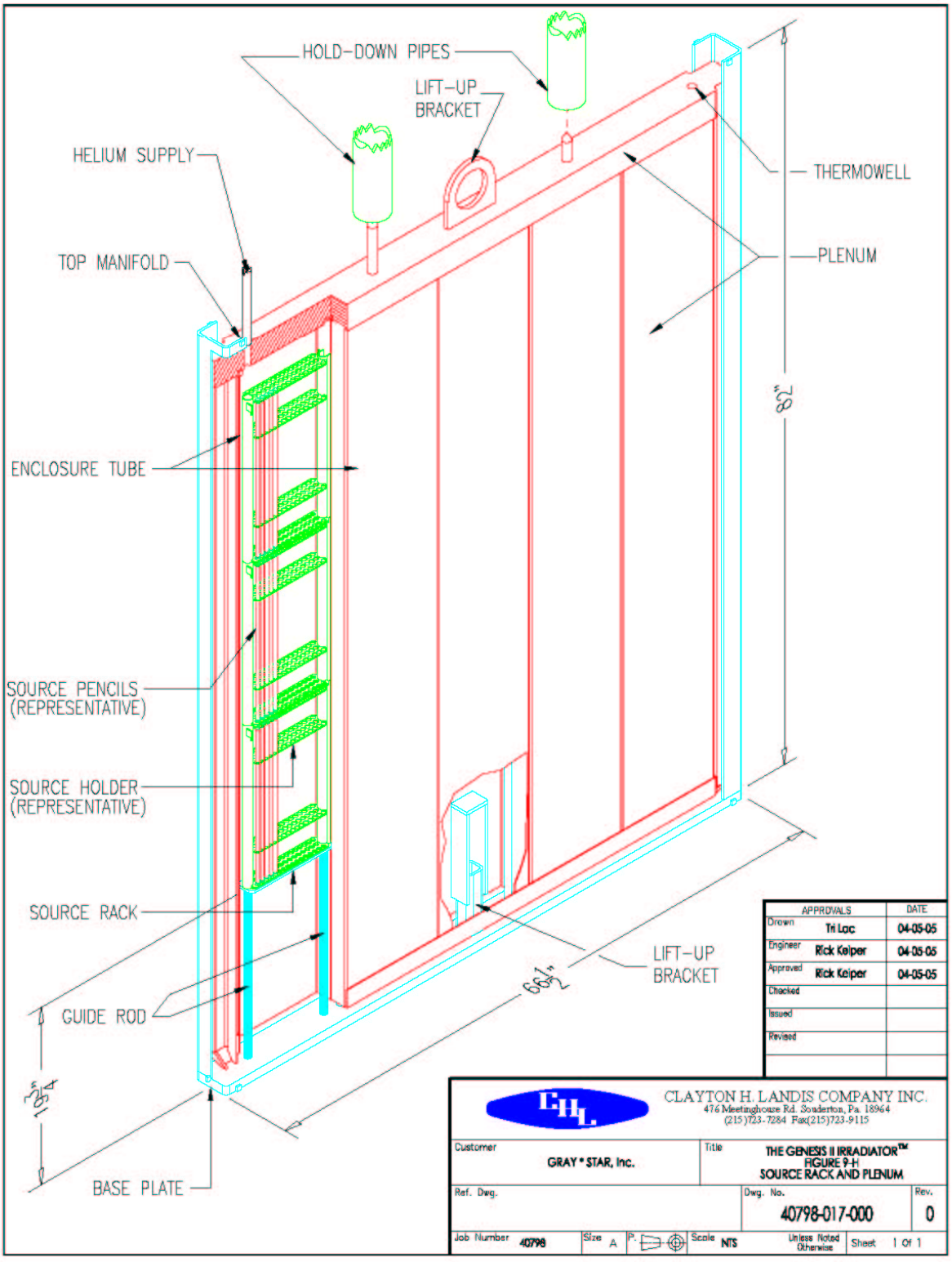

Figure A-4: Irradiator source rack and plenum (Pa'ina, 2005a).

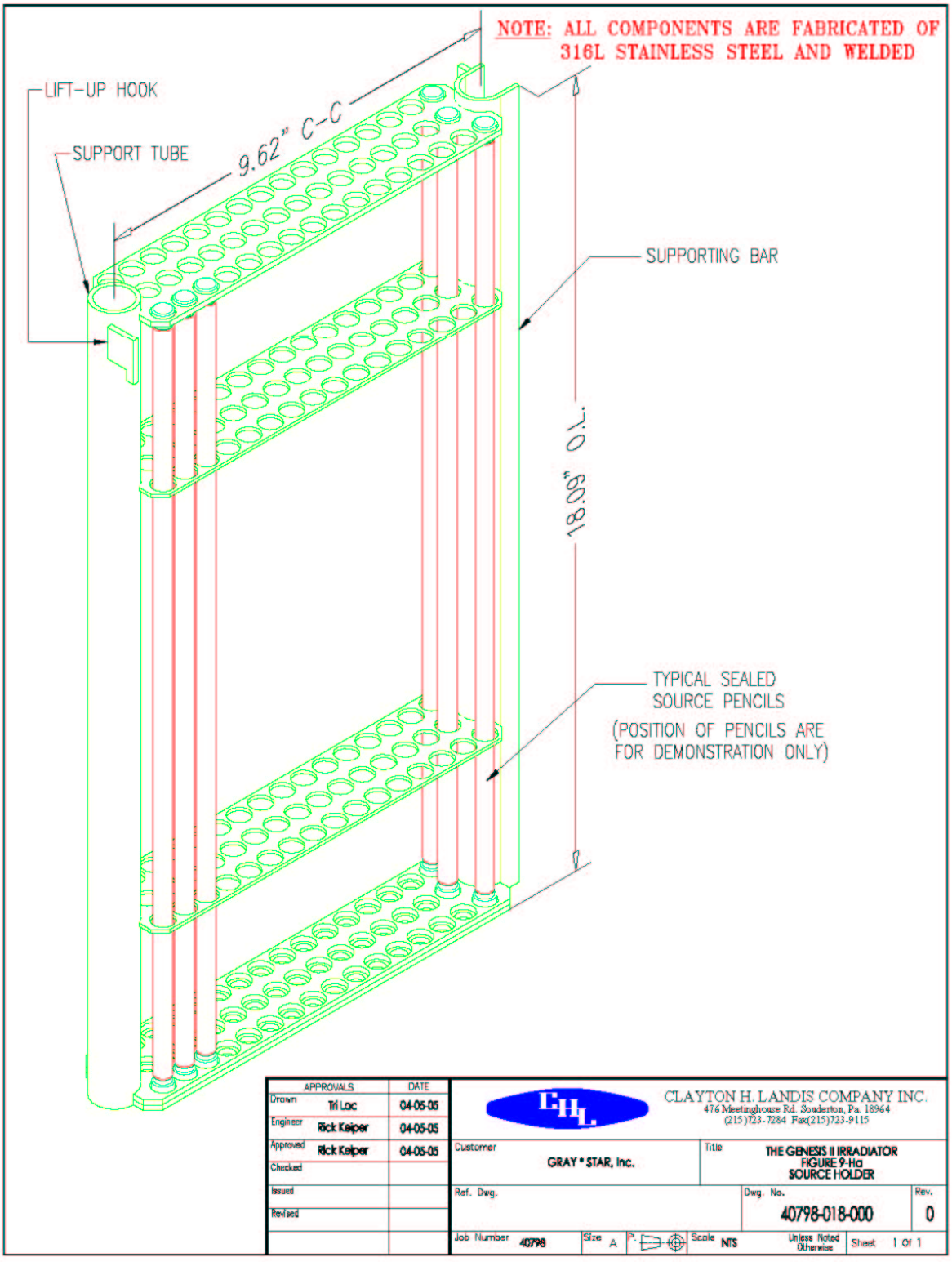

Figure A-5: Irradiator source holder (Pa'ina, 2005a).

Appendix B: Consideration of Terrorist Attacks on the Proposed Pa'ina Irradiator

APPENDIX B
CONSIDERATION OF TERRORIST ATTACKS ON THE PROPOSED PA'INA IRRADIATOR

BACKGROUND

In May of 2002, during the NRC licensing review for the Diablo Canyon Independent Spent Fuel Storage Installation (ISFSI), an intervenor petitioned the NRC to hold a hearing to address a number of contentions. These included a contention that the NRC must consider terrorist acts in assessing the environmental impacts of the ISFSI, in order to comply with the National Environmental Policy Act (NEPA). On December 2, 2002, the NRC's Atomic Safety and Licensing Board (ASLB) denied this contention. The ASLB referred its denial of the terrorism contention to the Commission for review. On January 23, 2003, the Commission affirmed the ASLB's rejection of the terrorism contention. In its decision, the Commission held that NEPA does not require a review of impacts from acts of terrorism, and that an environmental review is not the appropriate forum in which to address the challenges of terrorism.

After the NRC issued the 10 CFR Part 72 license for the Diablo Canyon ISFSI in March 2004, the intervenor and other parties filed suit in the United States Court of Appeals for the Ninth Circuit, seeking that the NRC staff be required to consider terrorist acts in its environmental review associated with this licensing action. In its decision, dated June 2, 2006, *San Luis Obispo Mothers for Peace v. NRC*, 449 F.3d 1016, 1028 (9th Cir. 2006), the Court held that the NRC's "categorical refusal to consider the environmental effects of a terrorist attack" in this licensing proceeding was unreasonable under NEPA. The Ninth Circuit remanded the "NEPA-terrorism" question to the Commission for "further proceedings consistent with this opinion."

Following the remand from the Ninth Circuit, the Commission directed the staff to prepare a revised EA addressing the likelihood of a terrorist attack at the Diablo Canyon ISFSI and the potential consequences of such an attack. The Commission further directed the staff, to the extent practicable, to base its analysis on information already available in agency records, and to make as much of its analysis public as possible. As a result of the Ninth Circuit's decision, the NRC determined that consideration of the environmental impacts of terrorism in the context of this application is warranted. At the outset, it should be noted that in connection with this facility additional security measures will be imposed by order.

OVERVIEW OF SECURITY

The NRC has historically considered the potential impacts of terrorist acts in the development and implementation of its security requirements. Following the September 11 terrorist attacks, the Commission initiated prompt and comprehensive actions to address both immediate and longer-term security measures for NRC-regulated facilities. In the months immediately following the attack, the Commission issued numerous safeguards and threat advisories to its licensees in order to strengthen licensees'

capabilities and readiness to respond to a potential attack on a nuclear facility. As part of the longer-term efforts, the NRC has conducted a comprehensive review of the agency's security program. This review has led to the imposition of additional requirements, through orders and rules, affecting many categories of licensees, including large irradiator licensees.

The Radiation Source Protection and Security Task Force Report to the President and Congress, dated August 15, 2006 (NRC, 2006), evaluated and provided recommendations to the President and Congress relating to the security of radiation sources in the United States from potential terrorist threats, including acts of sabotage, theft, or use of a radiation source in a radiological dispersal device (RDD) or radiological exposure device (RED).

The U.S. framework for security and control of radioactive sources requires multi-jurisdictional coordination. Several U.S. Governmental agencies have authority, sometimes overlapping authority, to regulate radioactive materials. Reducing the risk of the malevolent use of radioactive material involves many crosscutting activities and issues. Protection of risk-significant sources is important in preventing RDD and RED proliferation.

The NRC has been proactive in determining whether the facilities it regulates are adequately protected in light of the September 11 attacks. Specifically, on June 6, 2003 (NRC, 2003), NRC issued Orders to large panoramic and underwater irradiator licensees to make mandatory the voluntary actions taken by those licensees in response to the advisories, and to implement additional security enhancements identified in the NRC's ongoing comprehensive review of its safeguards and security programs and requirements.

In addition, the staff has performed security assessments to evaluate the effects of different threat scenarios and to assess the adequacy of the existing security measures (NRC, 2004).

By their nature, terrorist acts are intended to harm society and possibly the environment. The tragic events of September 11 illustrate too vividly that successful attacks against highly symbolic elements of the US infrastructure (the World Trade Center and the Pentagon), can have serious to grave impacts. The NRC's approach, therefore, focuses on ensuring that the security requirements, design features, and other security measures are adequate and effective in reducing the likelihood and mitigating the effects of terrorist acts using radioactive materials or against nuclear facilities.

TERRORIST ACTIVITIES

In describing the potential for environmental impacts from terrorist activities a description of the relevant terminology is necessary and includes three broad topics: threat, vulnerability, and consequences, as discussed below.

Threat

A threat is considered present when an organization or person has the intent and capability to cause damage to a target. The NRC staff operates on the premise that a general credible threat exists (i.e., the likelihood of attack has a probability of 1). However, this general credible threat should not be confused with the likelihood of a successful terrorist action (i.e., the probability of a successful attack is < 1). Generally in NEPA analysis, the NRC must consider reasonable foreseeable impacts including those from potential accidents. Due to the unique nature of terrorist activities the following discussion focuses on the qualitative probability of a successful attack because at this time it is only possible to assign qualitative probabilities to these events.

The NRC has a Threat Advisory System that it expanded after the September 11 terrorist attacks to include a broader range of licensees, including large irradiator facilities. The NRC has incorporated the threat condition levels used in the DHS's Homeland Security Advisory System, into its own Threat Advisory System. The NRC threat assessment staff reviews, analyzes, coordinates, and disseminates threat and intelligence information, relevant to its licensees, at both strategic and tactical levels. The NRC threat assessment staff also serves as NRC's liaison and coordination staff with other organizations and agencies, including the intelligence and law enforcement communities. Through these improved coordination and communication functions, the NRC is able to efficiently develop and transmit Advisories to the appropriate licensees, who then are able to take prompt action. Thus, the broad actions taken by the Federal government and the specific actions taken by the NRC since September 11, 2001 have helped to reduce the potential for terrorist attacks against NRC-regulated facilities.

NRC currently assesses that there is a general, credible threat to NRC-licensed facilities and materials, although there is no specific information available that indicates a specific threat to panoramic or underwater irradiator facilities.

Vulnerability

Vulnerability in this context refers to a weakness to incur physical damage, or to lose control of the radioactive material in a manner which can lead to unacceptable consequences. Vulnerabilities are specific to the type of attack.

The NRC used a security assessment framework that provided a process and criteria for evaluating results of security assessments for a broad range of activities subject to the NRC's regulatory authority (NRC, 2004) including large irradiator facilities. The security assessment framework is a screening and assessment tool to determine

whether additional security measures beyond those required by the 2003 security orders, are warranted for NRC-regulated facilities, including large irradiator facilities. The security assessments analyze the risk of sabotage and malevolent use of stolen material. Consistent with the NRC's overall approach, security assessments continue to be performed for licensed users possessing risk-significant quantities of radioactive material. Because of the great number and diversity of users, the assessments target representative facilities. The NRC performed security assessments on a range of threat scenarios for the transportation and licensed uses of Category 1 and 2 sources (IAEA 2005). The staff evaluated a spectrum of threat scenarios. Initially, the NRC screened threat scenarios to determine plausibility. Remote and speculative scenarios were screened out based on threat assessments. For those scenarios deemed plausible, NRC assessed the attractiveness of the facility to attack by taking into account factors such as iconic value, complexity of planning required, resources needed, execution risk, and public protective measures. In addition, the NRC made conservative assessments of consequences to assess the potential for early fatalities due to radiological impacts. The NRC then looked at the combined effects of attractiveness and consequence analyses to determine whether additional security measures for large irradiator facilities were necessary.

Consequences

Consequences relate to the magnitude and type of effect from terrorist actions. For the proposed irradiator, a range of consequences can result from radiological sabotage of the irradiator or from theft of the material. The proposed irradiator has numerous protective features that help to prevent or mitigate consequences of potential terrorist attacks. Physical protections are more fully described in the "The Proposed Action" section of the draft EA and generally consist of the robust characteristics of the sources, pool structure, plenum mechanism, and source location. Potential consequences are highly dependent on the type of attack or event scenario.

In conducting the security assessments for irradiator facilities, the NRC chose several designs which were representative of most currently licensed designs. The NRC staff reviewed the analyses done for the irradiator facility security assessments, and compared the assumptions used in these generic assessments to the relevant features of the Pa'ina facility. Based on this comparison, the staff determined that 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. Radiological sabotage of the proposed irradiator is expected to result in generally small radiological consequences. This is due the passive nature and location of the sources and the source design and construction. More specifically, the sources are below ground level (approximately 18 feet), under approximately 5,000 gallons of water, and contained in a very robust pool structure. Additionally, the sources themselves are very robust; made of essentially non-dispersible and insoluble materials (i.e., metal "slugs") which are further encapsulated in two layers of stainless steel. Therefore, it is unlikely to have an offsite release of radioactive material from radiological sabotage of the sources in the irradiator

(SNL, 2004). The most likely outcome of an act of sabotage is that some of the sources would be damaged and some “slugs” of cobalt metal could be released to the pool water. However, this material is essentially non-soluble in water and therefore, there is a low risk of radioactive material escaping the pool (CNWRA, 2007).

Theft or diversion of the radioactive sources presents different scenarios for terrorist threats. The events of September 11 heightened the Nation’s concerns regarding the use of radioactive materials in a malevolent act. Such an attack has been of particular concern because of the widespread use of radioactive materials (often contained in sealed sources) in the United States and abroad by industry, hospitals, and academic institutions. Loss or theft of such materials could lead to their diversion for malicious use in an RDD or RED. An RED is a device whose purpose is to expose people to radiation, rather than to disperse radioactive material into the air, as would an RDD. An RDD is a device or mechanism that is intended to spread radioactive material from the detonation of conventional explosives or other means. An RDD explosion could create fear and panic, contaminate property, and require potentially costly cleanup. RDDs are considered weapons of mass disruption; immediate health effects from exposure to the low radiation levels expected from an RDD would likely be minimal (NRC, 2005). In most cases, any immediate deaths or serious injuries would likely result from the explosion itself, rather than from radiation exposure. It is unlikely that the radioactive material contained in a dirty bomb would result in direct deaths. Use of a dirty bomb could result in radioactive contamination of several city blocks to an entire city. The extent of the contamination depends upon a number of factors including the size of the explosive, the amount and type of radioactive material used, and weather conditions. (DHS, 2003). REDs may result in a few deaths, but would not cause widespread contamination (NRC, 2006).

The potential deterministic health effects from risk-significant sources are the consequences of concern that form the basis of the NRC safeguards and security program for protecting against malevolent events. The security and control requirements focus on protecting against these severe immediate or short-term health consequences. In addition to the security assessments performed by the NRC, DHS is performing comprehensive assessments of the nuclear sector as part of the National Infrastructure Protection Plan (DHS, 2006).

The security compensatory measures, issued by Orders to irradiator licensees, include: enhanced access controls; background screening of personnel; intrusion detection, assessment and alarm response; and coordination with local law enforcement. These enhanced security measures are intended to prevent the theft of radioactive material for malicious purposes and assure prompt response by law enforcement to interdict terrorist or to implement protective actions to mitigate severe consequences of potential terrorist actions (NRC, 2006). Collectively, these measures further reduce the already low probability of a successful terrorist attack on an irradiator facility and reduce the risks of potential radiological consequences if an attack was successful. The same enhanced security measures will be imposed, by Order, for the Pa’ina irradiator if a

license is issued. These measures will be fully implemented before the initial movement of the cobalt-60 sources into the facility.

Because of the uncertainty inherent in assessing the likelihood of a terrorist attack, the NRC recognizes that while the probability, under general credible threat conditions, of such an attack is believed to be low, it cannot be reliably quantified. To ensure that the risk is minimized, the NRC has adopted an approach which focuses on ensuring that the security measures are adequate and effective in countering and mitigating the effects of terrorist attacks against large panoramic and underwater irradiator facilities. To provide high assurance that a terrorist act will not lead to significant radiological consequences, the NRC has analyzed plausible threat scenarios and required enhanced security compensatory measures to protect against the threats. In addition, advanced coordination and planning with local law enforcement and the draft DHS Protective Action Guides for Radiological Dispersal Devices and Improvised Nuclear Devices are intended to mitigate potential radiological consequences. As stated above, all these actions have been taken without regard to the probability of an attack. This protective strategy reduces the risk from a terrorist attack to an acceptable level, thereby reducing the potential for the facility to be considered an attractive target.

CONCLUSION

Based on its ongoing consideration of safeguards and security requirements, its review of information provided by the intelligence community, and the implementation of security compensatory measures at the nation's irradiator facilities, the Commission considers that public health and safety and the environment, and the common defense and security, continue to be adequately protected in the current threat environment.

Based on the various protective and mitigating factors described above, the NRC staff finds that no significant environmental impacts exist from potential terrorist actions which may result from licensing the proposed irradiator. This finding is based, in part, on (1) the continual evaluation of the threat environment by the NRC, in coordination with the Intelligence and law enforcement communities, which provides, in part, the basis for the compensatory measures currently required; (2) the compensatory measures that are in place to reduce the chances of an attack that leads to unacceptable radiological consequences (3) NRC security assessments of the potential consequences of terrorist attacks against irradiator facilities that inform the decisions made regarding the types and level of protective measures; and (4) coordination with law enforcement agencies to mitigate consequences should there be an attempt to steal radioactive material for malevolent purposes.

The NRC staff concludes that the construction, and operation, of the Pa'ina irradiator facility, even when potential terrorist attacks on the facility are considered, will not result in a significant effect on the human environment. NRC safety and security requirements, imposed through regulations and orders, and implemented by the licensee, in combination with the design requirements for panoramic and underwater

irradiators, provide adequate protection against successful terrorist attacks on irradiator facilities.

REFERENCES

(CNWRA, 2007) "Final Topical Report on Aircraft Crash and Natural Phenomena Hazard at the Pa'ina Hawaii, LLC Irradiator Facility." Center for Nuclear Waste Regulatory Analysis, May 2007.

(DHS, 2003) "DHS Radiological Dispersion Devices Fact Sheet," U.S. Department of Homeland Security. http://www.dhs.gov/xnews/releases/press_release_0085.shtm (accessed on May 1, 2007).

(DHS, 2006) "National Infrastructure Protection Plan," U.S. Department of Homeland Security. <http://www.dhs.gov/xprevprot/programs/editorial_0827.shtm>, (accessed on May 1, 2007).

(IAEA 2005) "Categorization of Radioactive Sources, Safety Standards Series No. RS-G-1.9," International Atomic Energy Agency. August 2005.

(NRC, 2003) "Order Imposing Compensatory Measures - All Panoramic and Underwater Irradiators Authorized to Possess Greater Than 10,000 Curies of Byproduct Material in the Form of Sealed Sources," U.S. Nuclear Regulatory Commission, EA 02-249. June 6, 2003.

(NRC, 2004) "Protecting Our Nation – Since 9-11-01," U.S. Nuclear Regulatory Commission, NUREG/BR-0314, September.

(NRC, 2005) "Backgrounder on Dirty Bombs," U.S. Nuclear Regulatory Commission. <http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/dirty-bombs-bg.html> (accessed on May 1, 2007).

(NRC, 2006) "The Radiation Source Protection and Security Task Force Report," August 15, 2006.

(SNL 2004) LaChance, Jeffery, etal., "Draft Vulnerability Assessment of Material Facilities," March 8, 2004, Sandia National Laboratory for U.S. Nuclear Regulatory Commission. (SGI)

Appendix C: Public Comments on the Draft Environmental Assessment

APPENDIX C
PUBLIC COMMENTS ON THE DRAFT ENVIRONMENTAL ASSESSMENT

Background:

The U.S. Nuclear Regulatory Commission (NRC) staff published a notice in the Federal Register requesting public review and comment on the Draft Environmental Assessment (Draft EA) on December 28, 2006 (71 FR 78231) and established February 8, 2007 as the deadline for submitting public comments on the Draft EA. Approximately 47 individual comment documents (i.e., letters, facsimiles, and e-mails) were received by the NRC. Also, 221 identical emails were submitted by various individuals. In addition, oral comments were received from 43 individuals at a public meeting conducted by the NRC on February 1, 2007.

In the public notice, the NRC staff provided information on where to obtain a free copy of the Draft EA. Additionally, copies of the Draft EA were mailed to approximately 27 individuals. An electronic version of the draft EA and supporting information (e.g., Draft Topical Report on Aviation Accidents and Natural Phenomena) was made accessible through the NRC's project-specific web site (http://www.nrc.gov/materials/paina.pdf) and through the NRC's Agencywide Documents Access and Management System (ADAMS) database on the NRC's web site. All public comments and the public meeting transcript are available on this website and through ADAMS.

As discussed in more detail in Appendix B, the staff also issued a supplemental appendix to the Draft EA on June 8, 2007 (72 FR 31866) which presented the staff's consideration of terrorist acts on the proposed facility. The staff established July 9, 2007 as the deadline for submitting public comments on Appendix B and received comments from five individuals.

Comment Review:

The NRC staff reviewed each comment letter and the transcript of the public meeting. Comments relating to similar issues and topics were grouped. This appendix presents the comments, or summaries of comments, along with the NRC staff's corresponding responses. When comments have resulted in a modification to the Draft EA, those changes are noted in the staff's response. In cases for which the comments do not warrant a detailed response, the NRC staff provides an explanation as to why no further response is necessary. In all cases, the NRC staff sought to respond to all comments received during the public comment period.

Major Issues and Topics of Concern:

The majority of the comments received specifically addressed the scope of the environmental reviews, analysis, and issues contained in the Draft EA, including safety, need for an irradiator, accidents, and the NRC's environmental review process.

However, other comments addressed topics and issues that were not part of the review process for the proposed action. Those comments included questions about the NRC's safety evaluation of the proposed facility, security concerns, general statements of support or opposition to irradiators, and statements about food irradiation. Because these issues did not directly relate to the environmental effects of the proposed action and were outside the scope of the NEPA review of the proposed action, the NRC staff did not prepare detailed responses to these comments.

Summarized below are the comments and NRC response. The complete comment letters are available as a matter of public record and are available from NRC's public document room which is available online at http://www.nrc.gov/reading-rm/adams/web-based.html . Select the "Begin ADAMS Search" link. To find all publicly available documents type in "Docket "03036974" and click the "Search" link. This search may be narrowed by selecting the "Advanced Search" link, typing in "03036974" in the Docket Number field and any other appropriate keyword related to the subject of interest in the various fields that are present. The complete meeting transcript is available by typing ADAMS Accession Number "ML070590704" in the "Search" box. Table 1 provides a list of the public comments received during the draft EA comment period and the ADAMS Accession Numbers. Table 2 provides a list of the public comments received during the Appendix B comment period and the ADAMS Accession Numbers.

Table 1: Comments on Draft Environmental Assessment

Comment Number	Name	Affiliation	ADAMS Accession Number
1	Russell N. Stein	GRAY*STAR	ML070110438
2	Marci Muraoka	Member of the Public	ML070160436
3	Robert E. Potter	Member of the Public	ML070290585
4	Robert Arakaki	Hawaii State Senate	ML070290589
5	Lorraine Robinson	Kalihi-Palama Community Council	ML070290595
6	Karl Rhoads	House of Representatives	ML070330024

7	Henry Delincee	Federal Research Centre of Nutrition and Food	ML070430123
8	Chris Trepal	Earth Day Coalition	ML070430125
9	Diane Duffey	Member of the Public	ML070430142
10	Macario Rio	Member of the Public	ML070430143
11	Katie Sirk	Member of the Public	ML070430146
12	Henry Curtis	Life of the Land-Hawaii	ML070430150
13	John Kaneko	Member of the Public	ML070430153
14	Kaitlyn McKee	Member of the Public	ML070470410
15	Cha Smith	KAHEA	ML070470417
16	Karen Arincorayan	Member of the Public	ML070470301
17	Adrian Chang	Member of the Public	ML070470305
18	Robert G. Briggs	Member of the Public	ML070470307
19	Vanessa Garner	Isaacson and Duffy, PC	ML070470308
20	Helen Kopp	Member of the Public	ML070470310
21	Dan Meier	Member of the Public	ML070470312
22	Judy Stover	Member of the Public	ML070470316
23	Lauren Guite	Member of the Public	ML070470319

24	Nadine Newlight	Member of the Public	ML070470320
25	Monica Keady	Member of the Public	ML070470323
26	Peter Camarda	Member of the Public	ML070470324
27	Monica Keady	Member of the Public	ML070470329
28	Aurora E. Hunter	Member of the Public	ML070470331
29	Bobby McClintock	Member of the Public	ML070470335
30	Ella Kay Elledge	Member of the Public	ML070470429
31	Mailie La Zarr	Member of the Public	ML070470366
32	Unsigned	Member of the Public	ML070470394
33	William J. Perritt	Member of the Public	ML070470399
34	Lorraine Medina	Member of the Public	ML070470403
35	Diane Pedersen	Member of the Public	ML070470284
36	Ron Kendzierski	Member of the Public	ML070470419
37	David Paulson	Member of the Public	ML070470427
38	Bobbie Deff	Member of the Public	ML070470438
39	Kaliko Armona	Member of the Public	ML070470453
40	Amy Y. Kimura	Member of the Public	ML070470464
41	Sherrie Ching	Member of the Public	ML070470472

42	David Henkin	Earthjustice	ML070470615
43	Cindy Goldstein	Member of the Public	ML070510201
44	Marie Riley	Member of the Public	ML070660050
45	Legault Xavier	Member of the Public	ML070660051
46	Kaitlyn L. McKee	Member of the Public	ML070660052
Comments 47-267	Various	Members of the Public	*ML070920341
268	Wenonah Hauter	Food & Water Watch	ML070950343
269	Barbara Vaile	Member of the Public	ML070950346
270	William B. Corbett	Member of the Public	ML070950350

*One example of the 220 similar emails received

Table 2: Comments on Appendix B: Consideration of Terrorist Acts

Comment Number	Name	Affiliation	ADAMS Accession Number
1	Sherwood Martinelli	Green Nuclear Butterfly	ML071660042
2	Dianne R. Nielson	Utah Energy Advisor	ML071870150
3	David A. Paulson	Member of Public	ML071910260
4	David L. Henkin	Earthjustice	ML071940241
5	Bernadette Young	Member of Public	ML071980068

6	Clyde W. Nāmuʻo	Office of Hawaiian Affairs	ML072120024

Comments and Responses:

NEPA

Comments: A number of commenters were concerned about the quality of the EA itself and its findings. Some commenters agreed with the FONSI, while others disagreed with it and commented that an EIS should be prepared. One commenter, for instance commented that "the expert reports" he'd enclosed with his comments "reveal substantial disputes with the NRC's consultants over the reasonableness of the agency's preliminary conclusion there would be no significant impacts." Another commenter commented that "the EA violates NEPA's command to take a 'hard look at the effects from proceeding with [the proposed irradiator].'" A third commenter commented that the EA concludes with a FONSI only because it narrowly defines "environmental impact." Some commenters noted that, while determining the environmental impacts of the proposed action, the EA allows economic considerations to outweigh the risks to public health and safety. One commenter in particular stated that "the commissions charge should be to protect U.S. citizens and not to support the nuclear industry." Finally, one commenter requested that the NRC "take the time to prepare a Final Environmental Assessment that includes sufficient facts and analysis to accurately determine whether an Environmental Impact Statement is warranted."

A few commenters commented that the EA does not consider enough alternatives and that those considered were not done so in depth. Some comments stated that there is a lack of information provided in the EA, including comments that no new data were measured or derived as part of the EA. One commenter requested that the NRC "comply with NEPA by providing a full range of alternatives, giving the technological analysis, food restrictions, environmental impacts, and all other relevant information for each alternative." Another commenter commented that "The draft EA fails to consider reasonable alternatives that would avoid impacts inherently associated with Pa'ina's preferred technology (a Co-60 irradiator) and location (a site subject to aviation accidents and natural disasters)." Comments about how the location will affect Hawaii's economy were made by several commenters. Commenters are concerned about building the facility in the urban area. Another commenter said that the close location to Pearl Harbor and Hickam can put well trained teams and equipment on scene in a matter of moments to handle much bigger problems than a Co-60 issue. Finally, another commenter expressed concern for the facility being located near the ocean.

The NRC received a number of comments, stating that the EA does not properly assess the impacts of the proposed action. One commenter comments that "The EA underestimates the magnitude of the potential beneficial impacts." Another commenter comments that the EA fails to consider the impacts if the company goes bankrupt due to the potential lack of a market for irradiated products. One commenter comments that

the EA does not adequately evaluate the impacts nor provide the analyses used to make a determination that the impacts are not significant.

Finally, one commenter asked for the justification for the proposed action. Another commented that "Since the irradiator and the contemplated sale of irradiated food 'are inextricably intertwined,' they 'are "connected actions" within the meaning of the CEQ regulations,' requiring the draft EA to analyze potential health impacts."

NRC Response: *NRC has determined by regulation that certain licensing and regulatory actions are categorically excluded from an environmental review. The NRC has determined that these categorical exclusions do not individually or cumulatively have a significant effect on the human environment. The NRC's Statements of Consideration (49 FR 9352, March 12, 1984) explains that personnel exposures during the use of irradiators are less than 5% of the limits described in Title 10 of the Code of Federal Regulations, Part 20, and Standards for Protection Against Radiation. In addition, there are no effluent releases resulting from the operation of irradiators. Based on this, the NRC regulations specifically exclude irradiator licensing actions from the need to develop an environmental assessment.*

However, the NRC staff entered into a settlement agreement with Concerned Citizens of Honolulu, the interveners in the adjudicatory hearing to be held on the license application. The settlement agreement included a provision for the NRC staff to prepare an environmental assessment and hold a public comment meeting in Honolulu, Hawaii prior to making a final decision.

NRC does not normally consider alternative locations in our environmental assessments. This is generally reserved for Environmental Impact Statements. The rationale being that if there are no significant impacts there is no need to consider other locations, also NRC has no authority to prescribe a different location.

NRC has issued Orders, to large panoramic and underwater irradiator licensees, requiring them to implement additional compensatory measures for enhanced security. A brief look at some (not all) of these facilities located in the U.S. and Canada revealed 8 irradiator facilities located near airports (5 of them near international airports) at distances ranging from 0 to 5 miles. One of these facilities is located 0.3 miles from an active runaway of an international airport.

Food irradiation is a process in which food products are exposed to a controlled amount of radiant energy to kill harmful bacteria such as E. Coli, Campylobacter, and Salmonella (FDA, 2000). The process also can control insects and parasites, reduce spoilage, and inhibit ripening and sprouting. NRC's role in irradiation, food or otherwise, is to assure that facilities are constructed and operated safely. Thus, NRC does not have a position on irradiation of food. However, the U.S. Food and Drug Administration (FDA) has approved irradiation of meat and poultry, certain types of seafood, fresh fruits, vegetables, and spices. The FDA has determined that this process is safe and helps to kills bacteria and insects. Irradiation does not make food radioactive. The

process may cause a small loss of nutrients but no more than with other processing methods such as cooking, canning, or heat pasteurization (FDA, 2000). Also, federal rules require irradiated foods to be labeled as such to distinguish them from non-irradiated foods.

Public Health And Safety

Irradiated Food

Comments: Some commenters expressed concern about the potential to develop cancer from the consumption of irradiated food. Other comments talk about the possibility of developing birth defects, health problems, and the risk of death as a result of the consumption of food treated with an irradiator. One commenter asked who would be responsible for any health problems or deaths that come as a result of the consumption of these products. One commenter asked about the adverse effects that irradiation has on food. Another commenter said that irradiation contributes to a significant loss of nutrients and food flavor. A commenter stated that irradiation may be used as a substitute for handling and sanitation. Another commenter agreed with the construction of the irradiator because many products from Hawaii must be irradiated before being exported to the rest of the United States.

NRC Response: *Food irradiation is a process in which food products are exposed to a controlled amount of radiant energy to kill harmful bacteria such as E. Coli, Campylobacter, and Salmonella. The process also can control insects and parasites, reduce spoilage, and inhibit ripening and sprouting. As stated above, NRC does not have a position on irradiation of food. NRC's role in irradiation, food or otherwise, is to assure that facilities are constructed and operated safely. However, the FDA has approved irradiation of meat and poultry, certain types of seafood, fresh fruits, vegetables, and spices. Many health experts agree that using irradiation can effectively reduce food-borne hazards and ensure that harmful organisms are not in food we buy (FDA, 2000). The FDA has determined that this process is safe and helps to kill bacteria and insects. Irradiation does not make food radioactive. The process may cause a small loss of nutrients but no more than with other processing methods such as cooking, canning, or heat pasteurization. Also, federal rules require irradiated foods to be labeled as such to distinguish them from non-irradiated foods (FDA, 2000).*

Leaking Problems

Comments: Some commenters expressed concern about the potential for radioactive material to leak from the facility. Several comments ask about what is going to happen if radioactive material leaks to the surrounding environment. One commenter expressed concern about the effect of radioactive leaks on the international airport.

NRC Response: *There will be multiple systems and layers of protection at the Pa'ina facility to prevent contamination of the pool water and leakage of the pool liner. In*

addition, the licensee will have continuous monitoring systems in place to detect radioactivity in the pool water and to detect loss of water from the pool. However, if contaminated water did leak from the pool, the licensee would be required to take corrective action (e.g., remediation of groundwater contamination). The proposed Pa'ina irradiator pool consists of multiple layers of steel and concrete which makes pool leakage highly unlikely. However, even if the pool were to leak water, the radioactive source encapsulation would also have to fail in order to cause any groundwater contamination. If a source encapsulation were to leak into the pool water, the radiation monitors would be activated and the irradiator would be shut down and the leaking sources would be removed. The three layers of the pool's construction provide barriers to any water leaking from the pool to the surrounding environment. The pool construction method permits verification of the pool integrity prior to and during installation on-site. However, if contaminated water did leak from the pool, the licensee would be required to take corrective action (e.g., remediation of groundwater contamination).

Additionally, NRC plans to have inspectors with expertise in geotechnical issues, concrete, and construction methods conducting oversight of the pool construction. NRC inspectors will also be present during other key portions of the construction phase, loading of sealed sources, and pre-operational testing. NRC inspectors will conduct unannounced inspections during operations to assure compliance with the terms and conditions of the license and NRC regulations.

Occupational Problems

Comments: Some commenters expressed concern about the risk of serious health problems that could affect workers and people at the facility. One commenter expressed concern of the effect of losing control of radioactive material.

NRC Response: *The transport and handling of radioactive material is strictly regulated by both the NRC and the U.S. Department of Transportation. The design of the Pai'na facility does not involve the constant movement of the radioactive sources, rather the sources are always underwater in a "shielded" position which results in very low radiation levels at the pool surface. The likelihood of accidents involving exposure of workers to lethal doses from this specific irradiator design is expected to be low. Access controls for workers, visitors, and the public are required to ensure that radiation doses to these groups are within the limits prescribed by regulation and are as low as reasonably achievable. These controls consists of specialized training, radiation monitoring, personnel monitoring, audit programs, access barriers, and other engineering controls to reduce radiation doses.*

Exposure to Radiation

Comments*:* Some commenters expressed concern about whether the people that live around the facility are going to be exposed to radiation. One commenter expressed concern about the possibility of globalization and consolidation of the food industry. One

commenter asked what are going to be the end products of the process.

NRC Response: *Facilities are constructed to standard designs with multiple safeguards to protect worker health and safeguard the community. The NRC's regulations limit the exposure of members of the public from the operation of a licensed facility to no more than 100 millirem each year. For comparison purposes, the average annual radiation exposure from natural sources to an individual in the United States is about 300 millirem. Exposures from this facility are expected to be indistinguishable from background radiation and thus a very small fraction of the 100 millirem limit. Licensees are required to demonstrate compliance with this limit by a combination of mathematical calculations and radiation surveys.*

Transportation

Comments: Some commenters expressed concern about how Co-60 is going to be transported to and from the facility and how it is going to be stored.

NRC Response: *Radioactive materials required for irradiators are transported in lead-shielded steel casks. These casks are designed to withstand the most severe accidents, including collisions, punctures, and exposure to fire and water depths. Large quantities of radioactive material are safely shipped all over the world to supply some 170 irradiators processing a variety of goods. Radioactive source suppliers are required to ensure that shipping packages containing sources are sufficiently robust and meet all applicable NRC standards. They must also transport radioactive materials in accordance with U.S. Department of Transportation regulations. The sources are typically returned to the supplier once their radioactivity levels have dropped to the point where they can no longer efficiently irradiate product material. Again, NRC and Department of Transportation requirements on the shipment of such materials must be met when they are returned to suppliers. Transportation impacts from Pa'ina's normal operations would be small. Radioactive Co-60 sealed sources would be shipped approximately once per year. Using RADTRAN 5.3, staff estimated the maximum dose for a full initial shipment would be 0.4 millirem/year to a member of the public. The limit for an individual member of the public is 100 millirem/year. Therefore, the NRC staff determined that the proposed Pa'ina irradiator would have no significant impacts from transportation of the sources or additional products.*

Economy

Socioeconomics

Comments: Some commenters expressed concern about how tourism will be affected when tourists see the facility next to the airport. Other commenters were concerned about Hawaii's dependence on tourism. Other commenters were concerned about how the proposed facility will affect the agricultural economy. One commenter stated that this irradiator will be a benefit to the Hawaiian economy, extending and diversifying the Hawaiian economy beyond tourism. Another commenter stated that people with MCS

can't ingest irradiated foods. This was seen as putting the poor at a distinct disadvantage as they cannot afford to buy better quality/organic food. Some commenters said that the installation of a commercial irradiator will greatly benefit agriculture in Hawaii in the same way it will benefit farmers. Another commenter stated that the construction of the irradiator in Hawaii will create new satisfying jobs allowing Hawaii to compete in the global market. Finally, another commenter stated that historically, food irradiation companies across the United States have faltered financially.

NRC Response: *The proposed irradiator would potentially have small beneficial impacts to socioeconomics because more products would have the potential to be exported to different parts of the United States. While the proposed irradiator will not diminish the existing population of invasive species, it is seen as one tool in preventing the further introduction and spread of invasive pests. Invasive species pose a large threat to Hawaii's native ecology. When invasive species are found there are typically three options for importers: they return the product to the sender; they can destroy the product; or they can treat it with methyl bromide. Shipping the product back to the sender involves additional freight cost and increased product degradation due to time delays, while destruction results in the total loss of the product. Treatment by methyl bromide is an alternative; however it has some drawbacks such as increased cost, product degradation, and potential damage to the Earth's ozone layer.*

The applicant has also formed Pacific Agriculture Research Company to conduct research to benefit Hawaii's agriculture community. In addition, the proposed irradiator could serve the University of Hawaii for its research needs.

In terms of tourism, there is no reason to believe that the irradiator would have any effect. There are currently several others irradiators in Hawaii along with numerous medical, academic, and industrial licensees. The proposed irradiator would be visually indistinguishable for other typical industrial buildings in the area.

Ecology

Comments: A few commenters commented that the proposed action would benefit Hawaii's ecology, while others commented that the effects of the proposed action would be detrimental to the ecology. Those in favor of the proposed action commented that Hawaii lacks an effective and comprehensive way to protect against invasive species. These commenters state that by using the irradiator to disinfest incoming shipments, the unique Hawaiian ecology will be protected.

One commenter opposed the proposed action and commented that the irradiation facility would be an "awful sight to see." She also commented that if the irradiator contaminates the ground or explodes it will be an act of disrespect to the land and Hawaii will never be the same. If the land is harmed, the commenter feels she would have failed to take care of her land.

NRC Response: *The proposed irradiator will satisfy several needs which benefit Hawaii's Ecology in controlling invasive species (Wong, 2006). Invasive species are those species non-native to the reference ecosystem and whose introduction causes economic, environmental or human health harm (USDA, 2006). It has been estimated that over 2,500 insect species have been introduced to Hawaii and account for 98% of the pest species in the state (Pimentel et al., 2005). In California, over 600 invasive pests account for 67% of all crop losses (Pimentel et al., 2005). The objective of the proposed irradiator is to control invasive species on fruits, vegetables and cut foliage on both imports and exports helping prevent the further introduction and spread of these species. Invasive species pose a large threat to Hawaiian Ecology, and for this reason the proposed action will be beneficial to Hawaii. Also, this is a preventive action for the mainland U.S. and other countries because the irradiation of Hawaii products will help prevent the further introduction of invasive species in these areas.*

Off-Normal Operation

General Accidents

Comments: Some general comments regarding the discussion of accidents are that building that facility would be "tempting fate" and that "The agencies have not been forthright in provided studies of the consequences of contamination for natural causes, human error, or terrorist attacks." One commenter suggested that studies be conducted to assess measures to reduce threats through evacuation plans and safeguards. Another commenter commented that the EA lacks sufficient data to back up its claims of public safety under accident scenarios and terms such as "small," "highly unlikely," "improbable," and "significant forces" are not well defined in the EA.

NRC Response: *The licensee will be required to have emergency procedures for a variety of emergencies. The robust physical design of individual sources, the storage arrangement, and the pool must be designed and constructed in an effort to minimize the likelihood and severity of emergencies.*

The NRC requires that irradiator operators have emergency procedures that include coordination with local and state emergency response agencies. Companies that operate irradiation facilities are required to have emergency procedures for a variety of emergencies, including leaking sources and low water or leakage from the storage pool. No license for possession and use of sealed sources is issued unless satisfactory emergency procedures have been developed.

The terminology in the EA has been edited for consistency. The term "small" is a term of art commonly used in NRC environmental review documents. Specifically, the term is used when "the environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource" (NRC, 2003). The terms "highly unlikely" and improbable" have been replaced with "unlikely." The use of "unlikely" is a qualitative description of probability used to indicate a low probability of occurrence based on staff experience and the scenarios reviewed.

Airplane Accidents

Comments: A number of commenters expressed concern about the potential dangers if an aircraft were to impact the proposed facility. One commenter asked what would be the outcome of such an impact and whether it could set of a chain of explosions affecting the weapons at the nearby military bases. Another commenter commented that "A news article stated that the airport control personnel must rely on sight vs. radar to track aircraft." He inquired, "How does this lend to increased risk?" Finally, another commenter noted that the "Potential for airplane crash estimates given in the EA" are too low.

NRC Response: *The irradiator facility does not contain explosive material (i.e, the radioactive Co-60 can not explode, it is a chemically inert metal slug). As described in more detail in the Safety Topical Report (CNWRA, 2007), the probability of an aircraft crash into the proposed Pa'ina facility is conservatively estimated at 2.1 x 10^{-4} (i.e., about once every five thousand years). It should be noted that the probability that an aircraft will crash into the proposed facility does not reflect the potential for release or dispersal of the radioactive Co-60 from the doubly-encapsulated sources. The source plenum is located under 12-18 feet of water. Additionally, the Co-60 sealed sources in the source plenum are not mechanically coupled to the plenum structure and the plenum structure is not coupled to the rest of the building. In the event of damage to the plenum structure the sources would either remain in the source rack/holder or fall to the floor of the irradiator. The Co-60 sources are doubly-encapsulated and have been tested to withstand significant forces. A significantly larger force must be generated by an aircraft crash because much of the force will result in damage to the building and other ground-level structures of the pool. Transferring the force to the bottom of the pool will also result in significant absorption of the force. For these reasons it is unlikely that a Co-60 sealed source would be breached in the event that an aircraft crashes into the proposed facility. The NRC staff finds that potential aviation accidents would have no significant impacts on public health and safety from the proposed Pa'ina irradiator.*

Terrorism

Comments: Many commenters expressed concern about the potential for terrorist attacks on the proposed irradiator facility and commented on the way this potential is addressed in the EA. Some commenters suggested that not going forth with the proposed action because of fear of a terrorist attack would be letting the terrorists win. Others suggest that too much detail in the EA about security would potentially make the facility more susceptible to attack. One commenter suggested that the EA can address terrorism by pointing out "that while the report does not specifically address intentional acts of terrorism the EA does evaluate the outcome of events that might conceivably be driven by terrorists. This commenter also suggested that information be provided in the EA to describe how the NRC and the Department of Homeland Security address the issue of terrorist acts.

Some comments specifically questioned the potential for certain types of terrorist attacks and their outcomes. The types of attacks in question are a "Timothy McVey-type" bomb used on the facility, an airplane crashed intentionally into the facility, and whether Co-60 from the facility could be used to make a “dirty bomb,” to contaminate the water supply, or to make a thermal nuclear device. Some comments stated that the NRC does not address acts of terrorism and does not explain the roles of Federal agencies in the war against terrorism. One comment stated that it is impossible for anyone to dive down the bottom of the pool to steal the Co-60, because it would make them sick and weakened within minutes. Finally, one commenter noted that a terrorist attack could take place on New Year’s Eve amidst the sounds of the exploding fireworks and Hawaiians would not know the attack was happening. One comment questioned the transparency and objectivity of the staff’s terrorism assessment while several other comments cited the NRC for a failure to disclose assumptions, and methodologies while generally citing the NRC’s failure to provide full disclosure and a set of references. Other comments cited the NRC’s failure to quantify risk of terrorist attack and to quantify terrorist impacts on shipments of Co-60.

NRC Response: *As a result of the events of September 11, 2001, NRC embarked on an extensive review of its security program and has taken a number of steps to enhance security at licensed facilities. These have included Threat Advisories which called on licensees to take certain prudent steps to enhance their security posture as well as Orders imposing requirements on certain classes of licensees. The NRC has also developed additional security measures which irradiator facilities will be required to implement. These measures are designed to either discourage terrorist attacks or minimize the potential for damage from such an attack. This facility will be designed with many of those measures in mind. The measures will be developed taking into consideration the threats as we know them and the potential vulnerabilities of these facilities. The NRC will issue an Order to Pa’ina Hawaii, LLC, which will impose, by means of a license condition, those additional security measures on the facility, if the license is issued.*

The radiation safety regulatory requirements, as well as the security and control enhancements implemented by licensees in response to Orders, are designed to prevent unintended radiation exposure and to prevent and mitigate deliberate malicious acts, which have the potential to result in significant injuries from radiological exposure.

A more complete discussion of terrorist actions has been included in Appendix B of this Final EA. Due to the sensitive nature of this information, many of the details can not be provided in publicly available documents.

In Appendix B, the staff provided the NRC’s process for selecting and analyzing the types of attacks or the consequences without revealing protected information. Although the staff could not provide all the details of referenced documents and analyses, the general methodology and analyses relied upon were referenced.

The staff notes that there is no design basis threat for irradiators. Following the

issuance of the 2003 security orders for irradiators, the NRC used a security assessment framework as a screening and assessment tool to determine whether additional security measures, beyond those required by regulation and security orders, were warranted for irradiators. Initially, NRC screened threat scenarios to determine plausibility. For those scenarios deemed plausible, NRC assessed the attractiveness of the facility to attack by taking into account such factors as iconic value, complexity of planning required, resources needed, execution risk, and public protective measures. The staff has discussed these factors to the extent possible considering the nature of the protected information (i.e., much of the information is protected as either Safeguards Information, SUNSI, or classified as Confidential or Secret).

Additionally, the staff has assessed likely modes of attack, weapons and vulnerabilities of irradiators. Appendix B discusses this analysis, however, due to the nature of the protected information, the staff is not at liberty to share those details in a publicly available document. All documents used in the staff's analysis were referenced in Appendix B. As previously discussed in the ongoing hearing process the shipment of radioactive materials is outside the scope of this environmental assessment. These sources have been previously licensed for shipment with adequate consideration of environmental impacts.

Natural Disaster

Comments: There were a few comments regarding the ability of the proposed facility to withstand the effects of a natural disaster such as a hurricane, tsunami, or flood. One comment stated that the EA underestimates potential hurricane damage by not including effects from increased buoyancy, forceful winds, and fires and that a break in the pool lining below the floor level could severely reduce shielding, threatening radiation exposure. The same commenter states that tsunami run-up's are underestimated in the EA to be 3-4 feet, when records show they can go as high as 31 feet. Finally, this commenter notes that, the EA should include a consideration of "the failure of peripheral equipment, power and back up generators, dispersal of leaking pool water, and grounded aircraft or equipment carried and crushing against the irradiator facility, which could affect the integrity of the pool, draining the water below the minimum level needed to shield the Co-60 sources when the flood waters recede."

NRC Response: *The Final EA has been updated to include a more complete discussion of types of impacts that may have off-site consequences. The scenario of main concern is the loss of control of the Co-60 sealed sources. Loss of control occurs when radioactive material is physically removed from the pool or when water becomes contaminated and is released from the pool. In order to remove radioactive material from the pool, the source retaining mechanism and lock must be overcome, the plenum must be removed, the source must be removed from the source rack, and the radioactive material must be lifted out of the pool. For the irradiator pool water to become contaminated, the two stainless steel capsules must be breached to expose the radioactive Co-60 slug and allow it to corrode in the water. Even if the building is completely destroyed and the pool damaged by the accident or natural phenomenon,*

control of the sealed source is not lost unless the source material is removed from the pool or allowed to corrode in the pool water. Similarly, the loss of operating monitoring equipment during an accident or natural phenomenon does not lead to the loss of control of radioactive material. Finally, a reduction in the water level results in increased dose rates in a well collimated beam directly above the pool. For example, a loss of 6 feet of pool water would result in a dose of approximately 300 millirem/hour (NRC, 2007). However, due to the highly collimated beam, and the ability to easily add water, the increased dose rate will not be sufficient to have a significant environmental effect on the area around the proposed facility. In addition, worker doses should not be significantly increased in the area around the pool and the debris around the pool will act as barriers to restrict inadvertent access to the areas of elevated radiation directly above the pool.

As described in more detail in the Safety Topical Report (CNWRA, 2007), fluid dynamic calculations were conducted to determine impacts from potential tsunami-generated wave run-ups. These calculations were performed to determine the wave velocity necessary to pull a Co-60 source up to the pool opening. These wave velocities were then evaluated with respect to potential tsunami-generated waves. The NRC staff found that potential tsunami activity would have no significant impacts on public health and safety from the proposed Pa'ina irradiator.

A complete description of hurricanes around Hawaii is provided in the Safety Topical Report (CNWRA, 2007). In summary, the wave velocity associated with a storm surge is significantly less than that associated with a tsunami. The probability of a large tsunami removing a Co-60 source from the bottom of the proposed irradiator pool is considered negligible. Therefore, the likelihood of a storm surge associated with a hurricane resulting in the release of a Co-60 source is also considered negligible. The NRC staff finds that potential hurricane activity would have no significant impacts on public health and safety from the proposed Pa'ina irradiator.

As described in more detail in the Safety Topical Report (CNWRA, 2007), a seismically-induced radiological accident is considered negligible due to the nature of the proposed facility and the seismic hazard for the site. The radiological sources at the facility are passive and shielding or containment of the Co-60 sources does not rely on active systems to mitigate potential radiological releases. The earthquake ground motions for the site are insufficient to damage the proposed facility to the degree necessary to dislodge Co-60 sources from the pools. The NRC staff finds that potential seismic activity would have no significant impacts on public health and safety from the proposed Pa'ina irradiator.

REFERENCES

(CNWRA, 2007) "Final Topical Report on Aircraft Crash and Natural Phenomena Hazard at the Pa'ina Hawaii, LLC Irradiator Facility." Center for Nuclear Waste Regulatory Analysis, May 2007.

(FDA, 2000) “Food Irradiation: A Safe Measure.” , http://www.fda.gov/opacom/catalog/irradbro.html> accessed April 24, 2007.

(NRC, 2003) “Environmental Review Guidance for Licensing Actions Associated with NMSS Programs.” NUREG-1748. August 2003.

(NRC, 2007) Microshield Summary Sheet for Loss of 6 Feet of Shielding Water at Pa’ina Irradiator.” March 28, 2007.

(Pimentel et al., 2005) “Update on the environmental and economic costs associated with alien-invasive species in the United States.” Ecological Economics 52(2005):273-288.

(Wong, 2006) Letter from L. Wong (Hawaii Department of Agriculture) to M. Kohn (Pa’ina Hawaii). August 28, 2006.