

RAS-I-143

February 10, 2009

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
Pa'ina Hawaii, LLC)
Materials License Application)
_____)

Docket No. 30-36974-ML
ASLBP No. 06-843-01-ML

NOTICE OF FILING ORIGINAL SUPPLEMENTAL WRITTEN TESTIMONY
AND DECLARATION OF MARVIN RESNIKOFF, Ph.D., AND ORIGINAL
WRITTEN TESTIMONY AND DECLARATION OF METE A.
SOZEN, S.E. (IL), Ph.D., IN SUPPORT OF INTERVENOR CONCERNED
CITIZENS OF HONOLULU'S SUPPLEMENTAL STATEMENT OF POSITION

Attached hereto are the original, signed Supplemental Written Testimony and Declaration of Marvin Resnikoff, Ph.D., and the original, signed Written Testimony and Declaration of Mete A. Sozen, S.E. (IL), Ph.D., which Concerned Citizens of Honolulu filed on February 2, 2009 in support of its Supplemental Statement of Position.

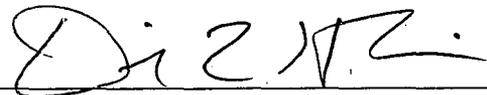
Dated at Honolulu, Hawai'i, February 10, 2009.

Respectfully submitted,

DOCKETED
USNRC

February 11, 2009 (8:30am)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF



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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Q.5: Please turn your attention now to paragraph A.25 of Mr. Blevins' testimony, where he states that the likelihood of accidents involving exposures of workers to lethal doses from the underwater irradiator design would be low because "the underwater irradiator will consist of multiple layers of steel and concrete," and "Pa'ina will have continuous monitoring systems in place to detect radioactivity in and above the pool [and] will have source loading procedures, as well as general radiation safety procedures." Do you agree with this assessment?

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

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

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

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

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

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

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

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

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

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

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

Q.8: In paragraph A.22, Dr. Durham states that, "even if an explosion above the pool were plausible, the force generated by an exploding aircraft would not remove a significant

amount of water from the irradiator pool” since the force of the explosion would come from directly above the pool, “preventing all but a small amount of water from leaving the pool.” Do you agree with his analysis?

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

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

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

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

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

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

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

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

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

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

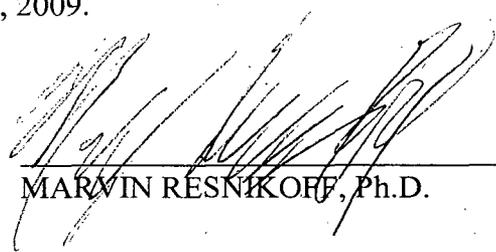
Concerned Citizens has previously submitted a true and correct copy of my July 6, 2007 report as Exhibit “10.” This report, together with my August 24, 2007 declaration, which is Exhibit “36,” accurately reflect my views regarding the potential threats to public health and safety, as well as the natural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

Q.11: Does this conclude your testimony?

A.11: Yes.

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

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



MARVIN RESNIKOFF, Ph.D.

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STOCK NO. 53018 (100/PKG.)

DIV. OF XENTRIX INTERNATIONAL, INC.

Reference:

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Q.4: Please now turn your attention to paragraph A.19 of Dr. Ghosh's testimony, in which he claims that, in the event of an aviation accident involving Pa'ina's proposed irradiator, "it is simply not feasible that airplane or building debris would simultaneously pierce the steel-and-concrete pool liner below the water table and damage the sources to the extent where Co-60 could escape through the breach in the liner." Do you agree with his assessment?

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

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

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

Q.5: Does this conclude your testimony?

A.5: Yes.

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

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



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

CERTIFICATE OF SERVICE

The undersigned hereby certifies that, on February 10, 2009, a true and correct copy of the foregoing document was duly served on the following via e-mail and first-class United States mail, postage prepaid:

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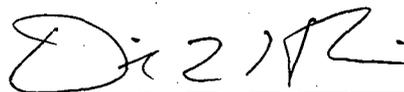
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Dated at Honolulu, Hawai'i, February 10, 2009.



DAVID L. HENKIN
Attorneys for Intervenor
Concerned Citizens of Honolulu



EARTHJUSTICE

Because the earth needs a good lawyer

BOZEMAN, MONTANA DENVER, COLORADO HONOLULU, HAWAII
INTERNATIONAL JUNEAU, ALASKA NEW YORK, NEW YORK OAKLAND, CALIFORNIA
SEATTLE, WASHINGTON TALLAHASSEE, FLORIDA WASHINGTON, D.C.

TRANSMITTAL LETTER

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

VIA FIRST CLASS MAIL

FROM: David L. Henkin

DATE: February 10, 2009

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

ENCLOSURES	DATE	DESCRIPTION
Original and two copies	2/10/09	NOTICE OF FILING ORIGINAL SUPPLEMENTAL WRITTEN TESTIMONY AND DECLARATION OF MARVIN RESNIKOFF, Ph.D., AND ORIGINAL WRITTEN TESTIMONY AND DECLARATION OF METE A. SOZEN, S.E. (IL), Ph.D., IN SUPPORT OF INTERVENOR CONCERNED CITIZENS OF HONOLULU'S SUPPLEMENTAL STATEMENT OF POSITION

- For Your Information.
- For Your Files.
- Per Our Conversation.
- Per Your Request.
- For Review and Comments.
- See Remarks Below.

- For Filing.
- For Recordation.
- For Signature & Return.
- For Necessary Action.
- For Signature & Forwarding.

REMARKS: