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December 17, 1998

MEMO

To: **Coastal Commissioners And Interested Parties**

From: **Peter Douglas, Executive Director**
Mark Delaplaine, Federal Consistency Supervisor

RE: **U.S. Navy, Surface Warfare Engineering Facility (SWEF)**
Naval Construction Battalion Center (NCBC), Port Hueneme, Ventura Co.

On April 30, 1998, the Commission staff objected to two negative determinations for radar systems at the SWEF in Port Hueneme. The Commission staff requested that the Navy submit consistency determinations for the systems. The Navy disagreed with the Commission staff and declined to submit consistency determinations. Based on this disagreement, on August 21, 1998, the Commission requested, and the Navy subsequently agreed, to seek informal mediation of the matter by the Office of Ocean and Coastal Resource Management (OCRM).[1]

On October 29, 1998, the Commission staff met with the Navy and OCRM to discuss how an informal mediation process might best resolve the matter. The outcome of that meeting was memorialized in an OCRM memo to the Commission and the Navy dated November 6, 1998 (Attachment 1). This memo outlines a mutually agreed-upon process for compiling a list of Commission questions and Navy responses, which would then be submitted to an independent and objective technical panel. The goal of the panel's review would be to assist the Commission in determining effects on coastal resources from the radar facilities at the SWEF.

An initial list of questions is contained in the attached memo (Attachment 1, pp. 4-5). The Navy has provided information and comments on the initial list of questions (Attachment 2). The agreed-upon process is for the Commission to review the questions and Navy responses at its January 1999 meeting in Culver City. At the conclusion of the public hearing the Commission will agree on the questions and information to be transmitted to OCRM. Once OCRM receives the packet, OCRM will discuss with the Commission staff and the Navy the appropriate make-up and dynamics of the technical panel to be convened, as discussed on page 6 of Attachment 1. After the technical panel reports back to OCRM, OCRM will provide a final report to the Commission, which will

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[1] Pursuant to federal consistency regulations 15 CFR Part 930, § 930.43 and Subpart G, § 930.110 et seq.

include recommendations for the Commission and the Navy to resolve the matter. Given the current schedule, OCRM expects such a final report could be available in the Spring of 1999. Following this report, the Commission will take a formal action on the two negative determinations that are the subject of the previously-discussed Commission staff objections.

Attachments

Attachment 1. November 6, 1998, OCRM memo to the Commission and the Navy.

Attachment 2. Navy response to questions in OCRM memo.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT
Silver Spring, Maryland 20910

NOV - 6 1998

MEMORANDUM FOR: Peter M. Douglas
California Coastal Commission

Chuck Hogle
U.S. Navy, Port Hueneme

FROM: Jeffrey R. Benoit JRB
Director

SUBJECT: Outcome of October 29, 1998, Meeting to Discuss the Surface Warfare Engineering Facility at Port Hueneme

This memorandum provides you with a report of the important issues, agreements and next steps identified at our October 29, 1998, meeting in San Francisco. Our discussions were fruitful and positive. The Office of Ocean and Coastal Resource Management (OCRM), as mediator, appreciates the commitment, flexibility and resourcefulness of both the Navy and the California Coastal Commission (Commission) to resolve the coastal management issues involving the Navy's Surface Warfare Engineering Facility (SWEF) at Port Hueneme, Ventura County.

This report is divided into the following sections: Purpose of the Informal Negotiations and OCRM's Role as Mediator, Proposed Negotiation Steps, Questions to Present to the Commission and the Public, the Navy's Response to the Questions, Independent Technical Review, Future Planning Actions for the SWEF, and Final OCRM Report to the Commission.

Purpose of the Informal Negotiations and OCRM's Role as Mediator

The SWEF uses various radar emissions to simulate combat scenarios to test a ship's combat systems. The Commission, and residents of Ventura County, are concerned that the radar emissions pose public health risks and may affect coastal uses (public access near the SWEF, coastal shipping, and commercial and recreational fishing). The Navy does not believe that the SWEF poses public health risks or causes coastal effects.

The Commission requested that the Navy provide, pursuant to the Coastal Zone Management Act (CZMA) federal consistency requirement, a consistency determination and other information for the SWEF. The Navy declined and, instead, provided the Commission with negative determinations.

ATTACHMENT 1

The Commission requested that OCRM informally mediate the matter. The Navy agreed. The purpose of the informal negotiations is for OCRM, as mediator, to assist the Commission in determining, relying on advice from an independent and objective technical panel, whether radar emissions from the SWEF will adversely affect the public's use of coastal resources. OCRM will provide its findings to the Commission and the Navy for appropriate action.

The Navy and the Commission have agreed that all interaction, documents, requests, etc. shall be from the Commission or the Navy to OCRM. Public involvement and interaction will occur through the Commission (either through the Commission staff or Commission meetings) and then to OCRM. OCRM will not act on or pass through information or requests provided by either the Navy or the Commission, until OCRM has obtained the agreement of the other party or, if either party requests and OCRM believes the request is appropriate and reasonable.

OCRM's point of contact for this informal negotiation is:

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The Navy's point of contact is:

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ATTACHMENT 1, p. 2

Proposed Negotiation Steps

The Navy and the Commission have agreed that the informal negotiations will follow the following steps:

1. **Negotiation Questions.** The Commission staff and the Navy have agreed on a set of questions regarding the SWEF and coastal effects. The questions will eventually be used to focus OCRM's and the technical panel's deliberations regarding coastal effects. These questions are contained in this memorandum, see below.

2. **Navy Response.** The Navy shall prepare a response to these questions.

3. **OCRM Review and Report.** OCRM, the Navy and the Commission staff shall briefly review the questions and the Navy's response. Following this review, OCRM shall provide the Commission with a report that includes the questions, the Navy's response and proposed next steps. The parties shall endeavor to complete steps 1, 2 and 3 by December 16, 1998.

4. **Commission Review and Public Input.** Commission staff will transmit OCRM's report on the questions and the Navy's response to Commission members and the public on or about December 18, 1998, and will discuss the report at the Commission meeting in Los Angeles on January 12-15, 1999 (subject to availability of the Navy's response).

5. **Commission Decision.** At the January Commission meeting, the public will have the opportunity to comment on the questions, the Navy's response and the negotiation's next steps. Following review of the Navy's response to questions, public comments and Commission deliberations, the Commission will determine which issues have been resolved, which issues require additional review or request that OCRM add or modify questions.

6. **Technical Panel.** OCRM, the Navy and the Commission will agree on the make-up of the technical panel and technical panel review timeframe. OCRM will contact and secure the commitments of technical panel members. OCRM will consult with the technical panel to address those issues requiring additional review.

7. **OCRM Report.** OCRM will provide the Commission and the Navy with its report on coastal effects, based on the review by the technical panel.

Questions to Present to the Commission and the Public

OCRM, the Navy and Commission staff have agreed that the following questions are the questions and issues that need to be addressed to determine whether coastal effects from the SWEF are reasonably foreseeable. These questions, along with the Navy's responses, will be submitted to the Commission for its consideration at the January meeting.

1. Do the radar frequency (RF) emissions from the SWEF pose a risk to people who use coastal resources?

In answering this question, the following questions should also be considered:

1.a. Do the SWEF RF emissions affect public access and recreation at public beaches and La Jenelle Park, coastal shipping, or commercial or recreational fishing?

1.b. What is the maximum level (and duration) of foreseeable exposure that could be received by a shipboard person?

1.c. Does the evidence support the Navy's conclusion that no harmful exposure could occur on a nearby ship (including transiting ships, moored ships, dredging ships, fishing vessels, etc.)?

1.d. How does the lowered height of the radar on Building 5186 affect exposure calculations to ships and public areas?

1.e. Can reflection of SWEF radar emissions off metal ship structures focus and intensify exposure?

2. Is there potential for adverse effects on wildlife from SWEF radar emissions?

3. What is the baseline worst case scenario for SWEF radar emissions in the uncontrolled environment?

In answering this question, the following questions should also be considered:

3.a. What are the maximum RF levels that could be emitted at the same time and what would be the effect of such levels on the uncontrolled environment?

3.b. What are the maximum RF levels that could be directed at a particular point, i.e., a shipboard person, and what would be the

effect of such levels on a point in the uncontrolled environment?

3.c. What are the expected operational maximum RF levels and what effect would such emissions have on the uncontrolled environment?

3.d. Are multiple source RF emissions a factor in any worst case scenario (i.e., a ship moving through several radar beams)?

3.e. What is the distinction between RF emission capabilities "as installed" versus "as operated?"

3.f. What controls are in place to ensure that an RF standard is not exceeded?

3.g. What are the consequences to people in the uncontrolled environment if an RF standard was exceeded by various percentages? Are there thresholds above an RF standard that the Commission could use to determine whether the Commission should be concerned?

4. How will the Navy interact with the Commission in the future?

In answering this question, the following questions should also be considered:

4.a. What technical information should the Navy provide and the Commission seek, and what will be available, in reviewing modifications to the SWEF?

5. With what RF standards does the Navy comply? What do those standards mean? What is the status of evolving international RF emission standards and would the international standards be useful in determining whether SWEF RF emissions pose a risk to coastal users? How will the Navy respond if/when the international standards change?

6. How do SWEF RF emissions compare to other radar emissions?

7. To what extent is the Navy, in response to these questions, relying on information that is not available to the public?

<u>The Navy's Response to the Questions</u>

The Navy will provide a response to the questions described above. The Navy's response will build upon previous information provided by the Navy but will be organized and written in less technical jargon. The primary purpose of the Navy's response is to provide the Commission (and the public) with information that will assist the

Commission in deciding whether the Navy's previously submitted Negative Determinations meet the requirements of the CZMA, and what questions will be provided, through OCRM, to the technical panel.

Independent Technical Review

OCRM, the Navy and the Commission have agreed, in principle, that OCRM may rely on a panel of technical experts to review the Navy's response to the questions when determining whether the SWEF RF emissions cause coastal effects. The selection of the technical panel, the charge to the technical panel, what the panel will consider, how long the panel will have and how the panel will function will be agreed to by both parties. The make up and dynamics of the technical panel will be determined once the parties agree as to which Navy answers require additional review. OCRM will contact the panel members shortly after the January Commission meeting. All interaction with the technical panel will be through OCRM. The technical panel will report to OCRM.

Once OCRM, the Commission and the Navy understand what types of expertise will be needed on the technical panel, OCRM will request appropriate organizations to participate. Potential panel members may or may not include: the National Telecommunications Information Administration, within the U.S. Department of Commerce; the Terminal Doppler Radar program, within the Federal Aviation Administration; the National Air and Radiation Laboratory, within the U.S. Environmental Protection Agency; and possibly, one or two university programs.

Future Planning Actions for the SWEF

The Navy and the Commission have agreed to improve coordination and planning for future projects or changes that may result in modifications to the SWEF. The Navy has committed to describe the process that the Navy uses when making changes to the SWEF. These procedures will clarify the Navy's process, ensure that the Commission, as well as other environmental regulatory organizations, clearly understand when in the process that they will be notified as well as the type of information that will be provided. These procedures will also, to the extent possible, ensure that information released addresses the issues at hand in a clear (easily understood) and complete manner.

Final OCRM Report to the Commission

After the technical panel reports to OCRM, OCRM will discuss the panel's findings with the Navy and the Commission. OCRM will then make its final report to the Commission. OCRM will base its finding of coastal effects on the panel's findings. OCRM will also provide

recommendations for the Commission and the Navy for final resolution of this negotiation. If the questions and Navy response are considered at the January Commission meeting, then a final report should be issued in the Spring of 1999. After this report is issued, the Commission will take a formal consistency action on the Negative Determinations that were previously objected to by the Commission's Executive Director.

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PORT HUENEME DIVISION

NAVAL SURFACE WARFARE CENTER

RESPONSE TO

RF QUESTIONS

ENCLOSURE (1)

ATTACHMENT 2

INTRODUCTION

This document is the response to questions that the California Coastal Commission and the public have raised concerning Radio Frequency (RF) emissions from radars located at the Navy's Surface Warfare Engineering Facility (SWEF). Of particular concern is the potential for adverse effects on coastal resources, and there use and access by the public. The answers to many of the questions raised are based upon technical aspects of radar systems and therefore are somewhat complex. The Navy has made a concerted effort to simplify the answers so that a non-technical person can understand them. Much of the technical detail used to support the answers has been left in various references.

Port Hueneme Division, Naval Surface Warfare Center, Port Hueneme, (PHD NSWC) is the In-Service Engineering Agent (ISEA) for many weapon systems presently installed in the US Navy fleet. SWEF was constructed to allow ships combat systems to be tested, evaluated and changed without requiring installation aboard ships or equipping a laboratory at sea. SWEF is responsible for assuring ship board systems work effectively, safely and reliably.

Integral to the operations at SWEF is radar equipment. There are two types of radar equipment at SWEF. These are search radar systems and fire control radar systems. Search radar systems search for targets and provide target positions to radar operators. Fire control radar point in a specific direction and are used to detect and track air or surface targets. There are 16 radars installed at SWEF. Fourteen 14 radars are installed on building 1384. The other 2 radars, the MK74 MOD 6/8 Continuous Wave Illuminator (CWI) and MK 74 MOD 6/8 track are installed on building 5186. Table 1 lists all of the radars and their operating restrictions.

Some basic background information about radars and RF hazards is helpful in understanding the answers provided.

Radar uses radio waves that are bounced off of an object to determine things such as the objects' range (distance), bearing (direction) and sometimes speed. In general, the higher the frequency the more accurate the resulting information becomes. As a result, over the years the operating frequencies of radars have increased so that most new radars, including the radars at SWEF, operate at frequencies above 8 GHz. (8 billion cycles per second).

As the frequency increases (and the size of the radio wave gets smaller) the radio waves become less able to penetrate. When a frequency of 10 GHz is reached most of the radio waves are reflected and there is little penetration of the radio wave. As an illustration of this point, microwave ovens, which use the same kind of power to heat and cook food, are designed to operate at frequencies just above 1 GHz to ensure proper penetration and even heating of food. If a microwave oven used higher frequencies the radio waves would tend to just bounce off the food and only heat the surface of the food.

RF safety standards as developed by the Institute of Electrical and Electronic Engineers (IEEE) and American National Standards Institute (ANSI) and adopted by the Navy are comprised of two parts. The first group of safety standards are for controlled area or zones where people would know that they might have the potential to be exposed to hazardous levels of RF. An example would be the area around a high power radar transmitter or its' antenna. Standards for these areas are based on a limit that is 10 times the exposure that might result in potential deleterious biological effects. The second group of safety standards relate to uncontrolled areas or zones. The standard for this area is based upon an exposure limit that is 50 times the level that might be required to produce potentially deleterious biological effects. The uncontrolled area is further divided into two more separate areas. The first is an area in which the RF levels are so low that there is no limit to the exposure allowed. The second area referred to, as the RF hazard zone or safe separation distance is an area that has defined permissible exposure limits (PEL) that if not exceeded are considered safe for personnel. At the exposure limit for the hazard area in the uncontrolled zone, the exposure is still 50 times that which might cause potentially deleterious biological effects.

The distance from the radar in which the permissible exposure level (PEL) is reached represents the safe separation distance or the closest one can get to the radar and remain there indefinitely. Any closer and the time allowed in the beam must be limited, such that the exposure time is limited to the time within the Navy specification. When one is beyond the RF hazard zone there is no time limit for exposure. These safe separation distances, as shown in figures (1-16), depict the shipping lane and the safe separation distances for each radar. Note that the radars, which have safe separation distances that extend into the shipping lane, emit RF at high elevations only, and do not affect even tall ships (because the beam is projected over the ships).

RF hazard surveys are conducted to ensure that SWEF radars that are installed or modified operate safely. The RF hazard surveys are performed by Space and Naval Warfare Center, Charleston (formally NISE East), SPAWAR. Results of the surveys conducted in 1989 reference (1), 1994 reference (2), 1996 references (3) and 1998, are documented in reports which include all radars installed and operational at SWEF. All releasable sections of reports of the 1989, 1994, and 1997 have been provided to the general public and to the Commission. The 1998 report is still a work in progress and will be released when completed. The Navy will continue to offer access to any classified information in those reports to the Commission or its representative with the appropriate security clearance

To ensure that the following responses are clearly understood several items should be clarified. First, all answers are based upon the equipment as currently installed and operated. The distinction between "as installed" and "as operated" is as follows. "As installed" refers to the actual way the equipment is installed at SWEF. It means that rather than the equipment being installed with the RF power capabilities and radiation sections of a shipboard system, the SWEF radars are restricted to lesser power levels and specific radiation sectors (see table (1) for the restrictions on a specific radar). "As operated" refers to the set of operational restrictions and the procedures that ensures

that the various safety constraints remain in effect. For example, procedures are in place at the SWEF complex to ensure emission sectors are operating properly each and every time a radar actively radiates out the antenna. The procedures consist of items such as a check of the RF emission sectors into dummy load (an internal device used to simulate radiation out of the antenna), prior to radiating out of the antenna. Second, the radars at SWEF have been physically modified to limit their power output and the directions in which they can radiate as shown in table 1. Third the Radio Frequency (RF) hazard zones (or safe separation distance) calculations are based upon the unclassified frequency range for each equipment as shown in Table (1). It was necessary to use a frequency range because the exact operating frequency is classified for national security purposes. The RF hazard zones discussed within are larger than what would be required if the Navy used the exact operating frequency. Fourth, that any radar or radar operational mode that is not currently listed when compared to historical documents, is not listed because that radar or radar operational mode is no longer available due to equipment removal or deactivation. Fifth, the RF hazard zones of the radars do not extend into the shipping lane (see figures (17 and 18)) or are elevated such that they are well above any vessel in the shipping lane as shown in figure (19).

RESPONSES

QUESTION 1. Do the radar frequency (RF) emissions from the SWEF pose a risk to people who use coastal resources?

QUESTION 1.a. "Do the SWEF RF emissions affect public access and recreation at public beaches and La Jannelle Park, coastal shipping, or commercial or recreational fishing?"

QUESTION 1.b. "What is the maximum level (and duration) of foreseeable exposure that could be received by a shipboard person?"

QUESTION 1.c. "Does the evidence support the navy's conclusion that no harmful exposure could occur on a nearby ship (including transiting ships, moored ships, dredging ships, fishing vessels, etc.)?"

QUESTION 1.d. "How does the lowered height of the radar on building 5186 affect exposure calculations to ships and public areas?"

QUESTION 1.e. "Can reflections of SWEF radar emissions off metal ship structures focus and intensify exposure?"

NAVY RESPONSE TO QUESTION 1. SWEF radio frequency (RF) emissions do not pose a risk to people who use coastal resources. There is no unsafe public exposure to RF emissions from SWEF radars. Radars do not pose a risk to the public because the various radars at SWEF have been modified to restrict their transmitter power levels as well as the direction and elevations in which they can radiate. The SWEF radars that have a hazard zone that extend beyond the SWEF fence, can only radiate out toward sea and or at high elevations (as shown in table 1). The radars do not emit toward the ground or at

coastal water locations. Therefore no significant RF emissions are capable of reaching the public either at nearby beaches, parks or locations where commercial or recreational ships and their crew are present.

A ship can not get close enough to the SWEF to enter the RF hazard zones. The RF hazard zones (or safe separation distances) from the radar is the area in front of the SWEF extending towards the shipping channel that is used to enter Port Hueneme. (Figure 19). These hazard zones are elevated above the water level (40-95ft) as shown in figures (1-16) and point upwards as shown in figures (17 and 18). The radar beams are straight beams and do not arc. A ship is prevented from getting close enough to SWEF to enter the hazard zone because of the draft and length of the ship and the shallow depth of the channel (encl. (1) a copy of a portion of the Deep Draft Vessel log at Port Hueneme), (figure 17).

RF emission surveys conducted in October 1996 (report dated Jan 1997, hereinafter "1997 survey") confirms that there is no risk to the public. The RF hazard surveys of 1989, 1994,1997 and 1998 also verify that the emission sectors and power level restrictions were properly implemented.

The 1997 survey was the most comprehensive because it included all active radars at SWEF at that time and surveyed ground and water areas to verify RF levels. During this survey, measurements were collected near the beaches, jetties and at various locations on the water in front of the SWEF complex (the uncontrolled areas where the general public may be located) with all radars radiating simultaneously and with their modifications in place. (Modifications in place prevent the radars from radiating in an improper direction by effectively turning off the radars.) For the 1997 survey, the radars were pointed just inside their emission sectors (directions in which RF emissions are permitted) and measurements were conducted at locations where the radars could not point. This was to demonstrate that no RF emissions were encountered from reflected energy. The 1997 survey measurements were completed to confirm that cumulative RF emissions from all sources were within Navy specifications for areas where the general public may be located and are insignificant. Navy specifications are based on Institute of Electrical and Electronics Engineers / American National Standards Institute (IEEE/ANSI) levels for exposure. The Navy uses the IEEE/ANSI standards for RF exposure and incorporates them into the Navy instruction on RF exposure.

The 1997 survey (page E4) shows that the emissions, near the ground and at water level are either not detectable with the test equipment or in one case 0.1mw/sq.cm, well below a power density level that would indicate a RF hazard zone. This means that the RF exposure is insignificant and poses no risk to the public. Thus, the 1997 survey confirmed that there are no RF hazards from radars at the SWEF. Accordingly, the SWEF radar frequency emissions do not pose a risk to people who use coastal resources.

QUESTION 1.a. "Do the SWEF RF emissions affect public access and recreation at public beaches and La Jannelle Park, coastal shipping, or commercial or recreational fishing?"

NAVY RESPONSE TO QUESTION 1.a. Public access and recreation at public beaches and La Jannelle Park, coastal shipping or commercial or recreational fishing are not affected by RF emissions from SWEF radars. The radars do not affect the public because the radars have been modified as necessary to restrict their transmitter power levels and to restrict the direction and elevations in which they can radiate. The SWEF radars that have a hazard zone that extend beyond the SWEF fence can only radiate out toward the open sea at high elevations. The radars cannot emit toward the ground or at coastal water locations. Therefore no significant RF emissions are capable of reaching the beaches, La Janelle Park or places where commercial or recreational ships and their crew are present.

RF emission surveys of 1989, 1994, 1997 confirm that SWEF RF emissions do not affect public access and recreation at beaches and La Janelle Park, and coastal shipping or commercial or recreational fishing. The 1997 survey, which involved all radars at the SWEF operating simultaneously, confirms that the beaches and park are free from unsafe RF emissions.

The surveys of 1989, 1994, 1997 also confirm that existing RF hazard zones are outside of the shipping channel and outside any area that a ship could enter (figures 1-16). Because of the high elevations of the radar beams, a ship would need to have operator areas 65 feet or higher above water level to be in the RF hazard zone. This hypothetical ship would also need to be close enough to the SWEF to enter the RF hazard zone. However, this is physically impossible given that ships of that height (65 feet or higher) would have a draft of greater than 21 feet and the water under the RF hazard zone is only 16 feet deep. The hazard zones are elevated above the water level (40-65ft) as shown in figures (1-16) and point upwards when tracking. The only radar that has a RF hazard zone less than 65 feet is the MK 74 MOD 6/8 TRACK. That radar's RF hazard zone stops approximately 300 feet short of the shipping channel over shallow water and therefore is not a concern to commercial shipping. Recreational vessels are not tall enough to enter into the hazard zones regardless of how close they get to the SWEF and therefore cannot be affected. Thus, RF emissions from SWEF could not effect any existing ship (Figure 19).

QUESTION 1.b. "What is the maximum level (and duration) of foreseeable exposure that could be received by a shipboard person?"

NAVY RESPONSE TO QUESTION 1.b. The equipment that causes the maximum exposure is the MK 74 Mod 14 CWI radar when it is stationary and radiating towards the shipping lane. This radar has a RF hazard zone that extends the furthest of any radars at SWEF. Using a ship that can get the closest to the SWEF (however, still not in the RF hazard zone), a cargo ship with a 21 foot draft, passing the radar at the closest point at

high tide moving at 5 knots, the exposure to a person onboard the ship would be would be 1.0 seconds at 6.2 mw/sq.cm (milliWatt per square centimeter). This exposure level is safe regardless of the length of time, according to the Navy standards (based on IEEE/ANSI standards). Even if the ship were to ground and remain stationary, the exposure to shipboard personnel would be 6.2mw/sq.cm, which according to the Navy standard is safe regardless of the time of exposure. When exposed to RF levels below the standard, personnel are safe regardless of the length of exposure time. Thus, there are no exposure limits applied to shipboard personnel.

QUESTION 1.c. "Does the evidence support the Navy's conclusion that no harmful exposure could occur on a nearby ship (including transiting ships, moored ships, dredging ships, fishing vessels, etc.)?"

NAVY RESPONSE TO QUESTION 1.c. The evidence supports the Navy's conclusion that no harmful exposures could occur on nearby ships. As indicated in the 1997 survey on page E4, measurements taken at numerous water locations show that no significant RF is located on the water in front of the SWEF complex. The 1997 survey confirms that no harmful exposure could occur on a nearby ship (including transiting ships, moored ships, dredging ships, fishing vessels, etc.), (reference 3, page E4).

The radars at SWEF emit RF at high elevations above ships. Only insignificant levels of RF were measured at any point on the water surface in the 1997 survey (actual measurements were approximately 6 feet above the water). During the 1997 survey (reference (3) page E4), a boat was used to collect RF emission data at distinct points on the water inside and outside the jetties in front of the building where RF radars point. Measurements at the water locations were collected with all radars aimed to the measurement points and emitting RF simultaneously. This was done in order to measure the cumulative effects of all radars at ground and water locations. The maximum RF level was 0.1 mw/sq. cm. at one measurement point closest to the west jetty. That maximum RF level (0.1mw/sq.cm) is a power density level, which is well below the Navy standard and is considered insignificant. RF levels at all other locations were so small that they were undetectable. The RF hazard limit for directional radars used during the test vary from slightly greater than 3 to slightly less than 7 mw/sq.cm, and is 3000% to 7000% greater than the power density measured. At the power level of 0.1mw/sq, the allowed duration is indefinite—a person can safely remain for any length of time.

The 1997 survey supports the Navy's conclusion that no harmful exposure could occur on a nearby ship or people (including transiting ships, moored ships, dredging ships, fishing vessels, or their crews).

QUESTION 1.d. "How does the lowered height of the radar on building 5186 affect exposure calculations to ships and public areas?"

NAVY RESPONSE TO QUESTION 1.d. The lowered height of building 5186 does not affect exposure calculations for either ships or the public areas. The MK 74 MOD 6/8, the system installed on building 5186, is approximately 40 feet above the

water, which is lower than any other installation at the SWEF complex. The system does not point toward the coastal water or ground, and therefore emits RF above locations where boats or people may be present. The height of the radar installation on building 5186 does not change how exposure calculations are performed. **The basic exposure calculations are done using the following formula:**

$$R = \sqrt{\frac{P_t G}{4\pi P_d L_c L_t}}$$

Where L_c is coupling loss between the RF tube and the antenna and L_t is the RF transmission line loss between the transmitter and the antenna (including loss in RF components).
Where P_d is power density (or PEL expressed in mW/cm^2), P_t is transmitter output power (expressed in mW) and G is antenna gain (no units).
For the frequencies used at SWEF the PEL can be calculated as follows:

$$PEL = \frac{\text{Frequency in MHz}}{1500}$$

Tables 1 and 2 contain data that can be used to calculate the safe separation distances for the radars at SWEF.

These formulas are not affected by building height.

Furthermore, RF hazard surveys confirm that the building height does not impact public exposure. Measurements were collected at six water locations and nine ground locations when the MK 74 MOD 6/8 system was surveyed during December 1996 (reference (3) page E2). Measurements were collected at ground locations along the beach in front of the building, east and west jetties, and along the fence line adjacent to the radar. Measurements were also collected at water locations including areas in front of the radar inside and outside of the mouth of the harbor and locations adjacent to the La Jannelle Park. All of these locations were chosen because they are areas where recreational boaters, swimmers, dredging ships or fisherman could be located. At all fifteen locations, no RF was detected. These measurements in the 1997 survey support the Navy's conclusion that the lowered height does not affect the public.

QUESTION 1.e. "Can reflections of SWEF radar emissions off metal ship structures focus and intensify exposure?"

NAVY RESPONSE TO QUESTION 1.e. Reflections do not focus or intensify exposure to RF from SWEF. When RF reflects off a metal structure the primary effect is scattering (wave "breaks apart"). The effect of scattering is to break up the electromagnetic wave and reflect it in all directions. When the wave is "broken up" the

power associated with the reflection is greatly weakened. If the electromagnetic wave hits a flat structure, the wave energy is both absorbed by the metal structure and reflected at the same angle as the initial electromagnetic wave. The wave is not refocused. Therefore, it is impossible for the reflected electromagnetic wave to have the same intensity or greater intensity than the original emission.

QUESTION 2. "Is there potential for adverse affect on wildlife from SWEF radar emissions?"

NAVY RESPONSE TO QUESTION 2. The wildlife on the ground and in the water near the SWEF are not affected by radar emissions. The 1997 RF survey, (reference (3)) confirms that RF levels on the ground and on the water are insignificant, even with multiple radars active simultaneously. Since the concentrations of RF are localized to areas well above the ground, the only wildlife that may be affected are birds. However, any risk is greatly reduced by the bird's movement in flight. Furthermore, birds will not remain on moving radars or other equipment and therefore will not be exposed to intense radar emissions.

QUESTION 3. "What is the baseline worse case scenario for SWEF radar emissions in the uncontrolled environment?"

QUESTION 3a. "What are the maximum RF levels that could be emitted at the same time and what would be the effect of such levels on the uncontrolled environment?"

QUESTION 3b. "What are the maximum RF levels that could be directed at a particular point, i.e., a shipboard person, and what would be the effect of such levels on a point in the uncontrolled environment?"

QUESTION 3c. "What are the expected operational maximum RF levels and what effect would such emissions have on the uncontrolled environment?"

QUESTION 3d. "Are multiple source RF emissions a factor in any worse case scenario (i.e., a ship moving through several radar beams)?"

QUESTION 3e. "What is the distinction between RF emission capabilities "as installed" versus "as operated?"

QUESTION 3f. "What controls are in place to ensure that an RF standard is not exceeded?"

QUESTION 3g. "What are the consequences to people in the uncontrolled environment if an RF standard was exceeded by various percentages? Are there thresholds above an RF standard that the Commission could use to determine whether the Commission should be concerned?"

QUESTION 3. "What is the baseline worse case scenario for SWEF radar emissions in the uncontrolled environment?"

NAVY RESPONSE TO QUESTION 3 Since the RF hazard zones do not extend into the shipping channel, the Navy developed a worst case scenario to analyze the effect of

SWEF radar emissions in the uncontrolled environment. This scenario included the MK 86 SPG 60, the MK 92 STIR TRACK and the MK 92 STIR CWI radars. Other radars were eliminated from this worst case study because their power is too low to have any effect on the shipping channel or their beams do not overlap within the shipping channel.

The worst case scenario would occur when several radar beams overlap in the shipping channel. To do this the radars would have to be tracking a target and the target would have to be low enough to keep the radars pointed near the horizon. The radars do not present any RF hazards even when their beams are combined. Details of the analysis are contained in the answer to 3.b.

QUESTION 3a. "What are the maximum RF levels that could be emitted at the same time and what would be the effect of such levels on the uncontrolled environment?"

NAVY RESPONSE TO QUESTION 3a. The Navy addressed the maximum RF levels that could be emitted at the same time in the 1997 RF survey. The 1997 RF survey (reference (3)) was conducted with all radars operating simultaneously and reported measured RF levels of zero or 0.1mw/sq.cm at one location. These measured RF levels were either well below the power density level that would indicate a RF hazard zone or were undetectable at all ground and coastal water locations.

While SWEF radars are used individually and not simultaneously, the 1997 RF survey reported that operating SWEF radars simultaneously at the maximum power levels have no significant impact on the uncontrolled environment. Furthermore, the radars do not point toward the coastal water or ground, and therefore emit RF above locations where boats or people may be present (see figure 1-16).

QUESTION 3b. "What are the maximum RF levels that could be directed at a particular point, i.e., a shipboard person, and what would be the effect of such levels on a point in the uncontrolled environment?"

NAVY RESPONSE TO QUESTION 3b. The maximum RF levels achievable at a particular point, i.e. a shipboard person, was considered by analyzing what could occur when multiple radars track a target such that their radar beams overlap over the harbor shipping lane. This maximum level is a power density ratio of 0.41. The Navy's analysis included the beams from MK 92 STIR, MK 92 CWI, and MK 86 AN/SPG-60. Because these radars are installed in the same general location they can track a single target with beams pointing over the shipping channel. The excluded radar beams overlap or intersect at great distances from the SWEF where their power levels are significantly reduced. The following analysis demonstrates that there is no RF hazard from those radar beams overlapping in the shipping channel.

In the following example, a point was chosen at the edge of the shipping lane closest to the radars where several radars can point, and it is a location where a person could be standing on a ship (between 55 and 60 ft above the water). An overlap of 6 feet was required such that a person would be in the beam of the radar (whole body exposure to the emissions).

The basic question when referring to multiple radars and multiple beams is cumulative impacts. Cumulative impact is calculated by first calculating the absolute power level at one specific location (i.e., distance from the radar). Next, a ratio is calculated for each single radar (absolute power level at a single location divided by the permissible exposure level). The final step in determining if the hazard specification is reached is to add all the ratios from each radar. If the answer is greater than one (1), the specification for permissible exposure is exceeded. If one (1) or less, the specification for permissible exposure has not been exceeded. The beams will have a 6-foot overlap starting at 80 feet above the water at 1000 feet from the radars where they are aligned in bearing. The point of overlap is outside the shipping lane away from the SWEF complex. The multiple radar calculation for the three radars whose beams intersect over the shipping lane yields the following power at the selected point and the power to permissible exposure limit ratios:

MK 86 SPG-60 (power density is 0.53 mw/sq.cm, permissible exposure limit is estimated at 5.0 mw/sq.cm, ratio of power to exposure limit is 0.53/5.0 = 0.11)

MK 92 STIR TRACK (power density is 0.24 mw/sq.cm, permissible exposure limit is estimated at 5.0 mw/sq.cm, ratio of power to exposure limit is 0.24/5.0 = 0.05)

MK 92 STIR CWI (power density is 1.51 mw/sq.cm, permissible exposure limit is estimated at 6.0 mw/sq.cm, ratio of power to exposure limit is 1.51/6.0 = 0.25)

Adding these three ratios together yields 0.11+0.05+0.25=0.41, which is well below the specification of a ratio of 1.0. Therefore, there are no hazards from multiple radars.

There is no mission requirement to operate these radars together. Therefore, the likelihood of simultaneous transmissions at the location discussed above is small. In addition, the beams overlap 80 feet above ground level and therefore do not effect ships. There are no effects on shipboard personnel or public areas.

QUESTION 3c. "What are the expected operational maximum RF levels and what effect would such emissions have on the uncontrolled environment?"

NAVY RESPONSE TO QUESTION 3c. The maximum operational RF level that could be reasonably expected is the same as the maximum RF level that could be directed to a point in space. That is a power density ratio of 0.41. The maximum RF level achievable could occur when multiple radars track a target such that their radar beams

overlap over the harbor shipping lane. The Navy's analysis included the beams from MK 92 STIR, MK 92 CWI, and MK 86 AN/SPG-60. Because these radars are installed in the same general location they can track a single target with beams pointing over the shipping channel. The excluded radar beams overlap or intersect at great distances from the SWEF where their power levels are significantly reduced. The following analysis demonstrates that there is not a RF hazard as a result of these radars pointing so that their beams overlap in the shipping lane.

In the following example, the point will be chosen at the edge of the shipping lane, closest to the radars, where several radars can point to a location on a ship where a person may be standing (between 55 and 60 ft above the water). An overlap of 6 feet was required such that a person would be in the beam of the radar (whole body exposure to the emissions).

The basic question when referring to multiple radars and multiple beams is cumulative impacts. Cumulative impact is calculated by first calculating the absolute power level at one specific location (i.e., distance from the radar). Next, a ratio is calculated for each single radar (absolute power level at a single location divided by the permissible exposure level). The final step in determining if the hazard specification is reached is to add all the ratios from each radar. If the answer is greater than one (1), the specification for permissible exposure is exceeded. If one (1) or less, the specification for permissible exposure has not been exceeded. The beams will have a 6-foot overlap starting at 80 feet above the water at 1000 feet from the radars where they are aligned in bearing. The point of overlap is outside the shipping lane away from the SWEF complex. The multiple radar calculation for the three radars whose beams intersect over the shipping lane, yields the following power at the selected point and the power to permissible exposure limit ratios:

MK 86 SPG-60 (power density is 0.53 mw/sq.cm, permissible exposure limit is estimated at 5.0 mw/sq.cm, ratio of power to exposure limit is 0.53/5.0 = 0.11)

MK 92 STIR TRACK (power density is 0.24 mw/sq.cm, permissible exposure limit is estimated at 5.0 mw/sq.cm, ratio of power to exposure limit is 0.24/5.0 = 0.05)

MK 92 STIR CWI (power density is 1.51 mw/sq.cm, permissible exposure limit is estimated at 6.0 mw/sq.cm, ratio of power to exposure limit is 1.51/6.0 = 0.25)

Adding these three ratios together yields 0.11+0.05+0.24=0.41, which is well below the specification of a ratio of 1.0. Therefore, there are no hazards from multiple radars.

There is no mission requirement to operate these radars together. Therefore, the likelihood of simultaneous transmissions in the location discussed above is small. In addition, the beams overlap 80 feet above ground level and therefore do not affect ships. There are no effects on shipboard personnel or public areas.

QUESTION 3d. "Are multiple source RF emissions a factor in any worse case scenario (i.e., a ship moving through several radar beams)?"

NAVY RESPONSE TO QUESTION 3d. In the Navy's constructed worst case scenario discussed above, we consider the RF emissions from multiple radars. However, the 1997 survey, which analyzed all radars operating simultaneously, confirmed that there were no cumulative RF hazards caused by multiple beams. Multiple sources were considered in the 1997 survey including all active radars at SWEF at that time. During this survey, measurements were collected near the beaches, jetties and at various locations on the water in front of the SWEF complex (the uncontrolled areas where the general public may be located) with all radars radiating simultaneously and with their modifications in place. The 1997 survey reports with their water surface measurements support the Navy's conclusion that no harmful exposure could occur on a nearby ship or people (including transiting ships, moored ships, dredging ships, fishing vessels, or their crews).

It should be noted that multiple exposures to RF do not have an accumulative effect. Unless a vessel is in a hazard zone, there should be no effect from the radar beam. If a vessel where in a hazard zone, there would be a time exposure limit applied to personnel aboard.

QUESTION 3e. "What is the distinction between RF emission capabilities "as installed" versus "as operated?"

NAVY RESPONSE TO QUESTION 3e. "As installed" refers to the actual way the equipment is installed. In the case of the radars at SWEF, it means that rather than the equipment being installed with the RF power capabilities and radiation sections of a shipboard system. The radars are restricted to lesser power levels and specific radiation sectors (see table (1) for the restrictions on a specific radar). "As operated" refers to the set of operational restrictions and the procedures that ensures that the various safety constraints remain in effect. For example, procedures are in place at the SWEF complex to ensure emission sectors are operating properly each and every time a radar actively radiates out the antenna. The procedures consist of items such as a check of the RF emission sectors into dummy load (an internal device used to simulate radiation out of the antenna), prior to radiating out of the antenna.

The radars at SWEF are installed with their maximum power levels set to a level that will meet minimum mission requirements and protect personnel. This means that in many cases the RF power output of the radars has been reduced during installation, when compared to standard Navy shipboard installations. In addition, the allowable emission sectors (directions in which RF emission is permitted), have also been reduced to minimum mission requirements, yielding emission sectors that are frequently less than that used in the fleet. Table (1) shows the power levels and emission sectors as installed at SWEF.

QUESTION 3f. "What controls are in place to ensure that an RF standard is not exceeded?"

NAVY RESPONSE TO QUESTION 3f. There are several different controls to ensure that our RF emission limits are not exceeded. These controls are related to installation design, the modifications to the equipment and restricted access to the facility. At the SWEF complex, whenever a system is being considered for installation, the Navy completes an installation design. The installation drawing includes the projected power level as well as the elevation and bearing restrictions. After the Navy installs the equipment, the Navy conducts an electromagnetic radiation hazard survey to verify that the power level restrictions have been properly implemented. The Navy uses the results of a pre-installation assessment to determine where the systems will be installed, and any limitations on the direction in which the systems will emit radio frequencies. Following radar system installation, the Navy conducts a site survey called a Hazards of Electromagnetic Radiation to Personnel (HERP) to test the radio frequency emission strength and further define acceptable and unacceptable directions to emit radio frequencies. Surveys concentrate on radio frequency emissions that are transmitted into the sky through the antenna located on the roof, as well as emissions inside the equipment spaces in the building.

In addition, safety controls are applied across the board to all radars installed at the SWEF complex to preclude radars from pointing at houses, beaches, parks or commercial buildings within the area. The radars at SWEF have safety controls (sensors, switches, and/or procedures) which restrict radio frequency emissions to well defined areas. Safety switches send an electrical signal to the radar and stop the transmitter from operating when the radars' antenna is pointed in direction where it should not radiate. In some cases, the computer program functioning with the equipment senses the antenna position in elevation and/or bearing and automatically shuts down the radar if it is pointed into a non-radiate sector (performing the same function as the safety switches). Emissions from these radar systems are limited to well defined sectors and not toward water or land adjacent to SWEF. Procedures are in place at the SWEF complex to ensure emission sectors are operating properly each and every time a radar actively radiates out the antenna. The procedures consist of items such as a check of the RF emission sectors into dummy load (an internal device used to simulate radiation out of the antenna), prior to radiating out of the antenna.

American National Standards Institute (ANSI) and DoD exposure limits in the uncontrolled environment (public) are maintained in all adjacent public areas. If RF studies and/or RF field measurements indicate potential hazards to personnel within the complex or to the general public, radar characteristics would be changed to ensure that RF safety limits are met. This involves changing the physical placement of an antenna, lowering transmitter output power, and adjusting RF transmission sectors (establishing non-radiate sectors) in both bearing and elevation, and establishing administrative procedures for RF transmissions.

Radar equipment is protected from unauthorized access. The entire complex is located on Navy-owned property with a personnel exclusion fence around the perimeter. Routine public access to the SWEF complex is not permissible. All radars are installed on buildings that are accessible through the building entrance only and are installed between approximately 30 to over 100 feet above the ground.

QUESTION 3g. "What are the consequences to people in the uncontrolled environment if an RF standard was exceeded by various percentages? Are there thresholds above an RF standard that the Commission could use to determine whether the Commission should be concerned?"

NAVY RESPONSE TO QUESTION 3g. The consequences of exposing a body to RF levels greater than the permissible exposure limit is body heating. The primary effect is surface skin heating with very little penetration into the body. The Navy uses the DoD standard to define an overexposure that warrants an investigation. The value for overexposure is five times the permissible exposure limit. This means that if the permissible exposure limit is 6 mw/sq. cm, a RF hazard would be investigated if the exposure is 30 mw/sq.cm or greater. The public cannot get close enough to the radar for an overexposure to occur. It would be reasonable for the Commission to be concerned if the public would be exposed to RF levels that exceed the Navy standard.

QUESTION 4. "How will the Navy interact with the Commission in the future?"

QUESTION 4a. "What technical information should the Navy provide and the Commission seek, and what will be available, in reviewing additions to the SWEF?"

NAVY RESPONSE TO QUESTION 4. The Navy is hopeful that this process will improve our interaction with the Commission. The Navy will comply with the Coastal Zone Management Act by submitting negative determinations or consistency determinations as appropriate prior to the installation or modification of a radar system at the SWEF. The determinations will include a description of the equipment being installed or modified including any safety controls or modifications in place and any potential impact on the coastal zone. After the system is installed and the RF hazard report is completed, the Navy will provide the Commission with a copy of the RF hazard report verifying the actual conditions of operation. RF hazard reports can only be conducted after a new system is installed or a modification is installed. The Navy will assign a point of contact to be available to the Commission to address follow-up questions or provide other information.

QUESTION 4a. "What technical information should the Navy provide and the Commission seek, and what will be available, in reviewing additions to the SWEF?"

NAVY RESPONSE TO QUESTION 4a. To assist the Commission in reviewing additions to SWEF, the Navy will provide a description of the equipment and provide information explaining where the RF hazard zones exist in relation to the uncontrolled areas including the shipping channel. The Navy will also explain any safety controls or other modifications in place. In addition, the Navy will provide copies of all final RF hazard reports.

The Navy will also perform an analysis of any new radar to determine if the new radar may have a beam that could intersect with other radars within the shipping channel. If the radar has a beam that overlaps with other radars, the Navy will calculate the permissible exposure ratio and make adjustments as necessary. This analysis will become part of the installation design. The Navy will provide the results of this analysis to the Commission.

QUESTION 5. "(a) With what RF standards does the Navy comply? (b) What do those standards mean? (c) What is the status of evolving international RF emission standards and would international standards be useful in determining whether SWEF RF emissions pose a risk to coastal users? (d) How will the Navy respond if/when the international standards change?"

NAVY RESPONSE TO QUESTION 5a. The Navy follows the Department of Defense (DOD) standard which is based on the National Institute of Electrical and Electronics Engineers (IEEE) and American National Standards Institute (ANSI) standard for RF exposure. DOD standard 6055.11of February 1995 "Protection of DOD Personnel from Exposure to Radio Frequency Radiation" sets exposure limits for all radars located at SWEF.

5(b) What do those standards mean? Safety exposure guidelines have been established to prevent harmful effects in human beings from exposure to RF fields. All DoD radar systems and operations, including those at SWEF, are required to follow the same guidelines. The guidelines are based upon a consensus derived voluntary standard, developed by the IEEE, which is a Non-Governmental Standards Organization. The standard was approved and adopted by the ANSI. The ANSI standard was developed after more than nine years of open, public review by over 120 internationally recognized experts from over 14 different disciplines, including scientists, public health officials, medical doctors, engineers, and technical experts from industry, academia, and government.

The ANSI guidelines cover the frequencies from 3 kHz to 300 GHz and include guidelines for two distinctly different environments, controlled and uncontrolled. Generally, controlled environments represent areas that may be occupied by personnel who accept potential exposure as a concomitant of employment or duties, by individuals who knowingly enter areas where such levels are to be expected, and by personnel passing through such areas. Existing physical arrangements or areas, such as fences, perimeters, or weather deck(s) of a ship may be used in establishing controlled

environments. Uncontrolled environments generally represent living quarters, workplaces, or public access areas where personnel would not expect to encounter high levels of RF energy. The maximum Permissible Exposure Limits (PELs) for the controlled environment is established based on a 10 times safety factor (0.4 W/Kg) averaged over the whole body. In the uncontrolled environment, the exposure limit is based on a 50 times safety factor (0.08 W/Kg), averaged over the whole body.

The PELs for controlled environments for radars installed at SWEF are based on scientifically derived values to limit the absorption of electromagnetic energy in the broader human resonance frequency range of 100 kHz to 6 GHz and to restrict induced currents in the body. For uncontrolled environments, further reduction occurs to control RF levels in areas such as living quarters and workplaces that are not associated with RF radars. That reduction is based on a consensus designed to maintain lower exposure levels in the uncontrolled environment. The basis and the rationale for the PELs in controlled and uncontrolled environments are addressed in IEEE C95.1- 1991. The following web site provides a detailed discussion concerning the basis, background and application of IEEE C95.1-1991. (http://homepage.seas.upenn.edu/~kfoster/rf_mw.htm)

5(c) What is the status of evolving international RF emission standards and would international standards be useful in determining whether SWEF RF emissions pose a risk to coastal users? The World Health Organization, (WHO) in May of 1996, launched an international project to assess health and environmental effects of exposure to electric and magnetic fields, which became known as the International EMF project. The project will last for five years and will bring together current knowledge and available resources of key international and national agencies and scientific institutions in order to arrive at scientifically-sound recommendations for health risk assessments of exposure to static and time varying electric and magnetic fields in the frequency range of 0-300 GHz. This project is still on-going and recommended standards are not expected until the completion of the project (sometime in 2001). A review of the WHO reports to date indicates that the RF exposure standards for the RF region that the radars at SWEF operate may have little or no change. However studies are still in progress and until the results are available, the Navy cannot assess the applicability to radars at SWEF.

5(d) How will the Navy respond if/when the international standards change?" As changes to the international standards are made; they are reviewed and adopted by the IEEE and ANSI. DOD will change its' standards to comply with the IEEE/ANSI standards and the Navy will comply with those revised DOD standards.

Further information on the WHO efforts on EMF can be obtained from web page http://www.who.int/peh-emf//contents encl. (2) ELECTROMAGNETIC FIELDS AND PUBLIC HEALTH THE international EMF Project (http://www.who.int/inf-fs/en/fact181.html and encl. (3) ELECTROMAGNETIC FIELDS AND PUBLIC HEALTH Health Effects of Radio frequency Fields Based on: Environmental Health Criteria 137 "Electromagnetic Fields (300Hz to 300GHz), World Health Organization, Geneva, 1993, and the report of the Scientific Review under the auspices of the International EMF Project of the World Health Organization,

Munich, Germany, November 1996. http://www.who.int.inf-fs/en/fact183.html and encl. (4) ELECTROMAGNETIC FIELDS AND PUBLIC HEALTH, PUBLIC PERCEPTION OF EMF RISKS http://www.who.int.inf-fs.en.fact184.html are provided for additional information.

QUESTION 6. "How do SWEF RF emissions compare to other radar emissions?"

NAVY RESPONSE TO QUESTION 6. RF emissions from SWEF radars are generally much less than from those deployed for commercial application. SWEF emissions from radars occur occasionally (a few hours a week), while emissions from other commercial radar are continuous.

One example is the NEXRAD doppler weather radar used by the National Weather Bureau to assess storms and predicts weather patterns. These systems are located throughout the United States and operate continuously (see encl. (5)). RF emissions produced by the NEXRAD radar are lower in frequency than all SWEF radars (with one exception-MK 23 TAS). Since the radar operates over a continuous 360-degree extent, there are no radiation hazards with this radar (similar to the search radar at SWEF). The fact that this radar rotates through 360 degrees of coverage mitigates any RF hazards that may be present from fixed beam operation (non-rotating). The output power is 1560 watts, which is more than some radars at SWEF and less than others. The primary difference is that the NEXRAD radars operate continuously, while SWEF radars only operate only a few hours a week.

Another example is the AN/SPS-73 navigation radar installed onboard boats or ships. The radar is used for navigation and can operate at frequencies similar to the majority of those at SWEF. The installation of these radars on boats is such that the surrounding areas are irradiated with RF. However, as with the SWEF search radar, no hazards are present because the antenna rotates see encl. (6). This type of radar also operates continuously while the boat is underway. The output power is 25,000 watts (X-band) or 30,000 watts (S-band), which is more power than any radar at SWEF. This differs from the radar at SWEF in that the radars at SWEF only operate occasionally.

An airport surveillance radar (ARSR-4) is also included for comparison (encl. (7)). This is a type of airport radar that is used by the Federal Aviation Administration (FAA) for tracking aircraft out to 250 miles. It is also a search radar and operates continuously, unlike the radars at SWEF. The fact that this radar rotates through 360 degrees of coverage mitigates any RF hazards that may be present from fixed beam operation (non-rotating). Again, the primary difference between this radar and the SWEF radars (in terms of RF emissions) are that this operates continuously, while the radars at SWEF operate occasionally.

Los Angeles International Airport uses two ASR-9 air surveillance radars for tracking aircraft. These radars are also located adjacent to communities but are not hazardous because they rotate over 360 degrees. The fact that this radar rotates through

360 degrees of coverage mitigates any RF hazards that may be present from fixed beam operation (non-rotating). The frequencies of these radars are lower than those at SWEF, which will yield lower permissible exposure limits than radars at SWEF. Average power is 1500 watts, which is greater than some radars at SWEF and less than others.

Other RF emission sources include microwave relay stations and radio stations. These produce RF emissions on a continuous basis, unlike SWEF radars that emit only a few times each week. In contrast to radio station emissions that are intended to cover the communities, SWEF radar emissions are directed at the open seas and at high elevations. Encl. (8) is a profile of emission data collected in a residential community by Evans Associates. The plot shows various levels of RF (below the permissible exposure limit) throughout the community.

QUESTION 7. "To what extent is the Navy, in response to these questions, relying on information that is not available to the public?"

NAVY RESPONSE TO QUESTION 7. The Navy, for national security reasons, has had to rely on certain information that is not available to the public. This information regards exact operating frequencies at SWEF, certain safe separation distance and power density calculations. The Navy will continue to offer access to this classified information to the Commission or its representative with the appropriate security clearance.

The exact operating frequencies at SWEF must be classified to protect the national defense. The Navy has used frequency ranges that contain the actual frequency numbers when providing information to the public. As a result, the RF hazard zones discussed in this document are larger than would be required if the Navy used the exact frequencies.

Finally, proprietary software owned by Space and Naval Warfare Systems Center (SPAWAR) was initially used to make safe separation distance calculations, and power density calculations. The software used for making the calculations is not available to the public. However, this was only used for convenience and was not needed to actually perform these calculations. Encl. (9) shows methods used to make these same calculations by hand, which will give results differing little from those using the proprietary software.

List of References

Reference (1) Hazards of Electromagnetic Radiation Survey Final Report
Dated Feb 1989

Reference (2) Hazards of Electromagnetic Radiation to Personnel (HERP) Survey Report
dated July 1994

Reference (3) Electromagnetic Radiation Hazard Survey Final Report
Dated Jan 1997

SYSTEM	SAFE SEPARATION DISTANCES	EMISSION SECTORS		FREQUENCY and POWER	
	UNCONTROLLED ENVIRONMENT				
SWEF RADAR NAME Height above Water used in Calculation (ft)	SWEF RADAR (feet)	Approximate bearing (degrees true)	Approximate lower antenna elevation (degrees relative)	FREQUENCY BAND	TRANSMITTER MAXIMUM POWER (AVERAGE)
FCS MK 92 CAS-CWI (95 ft)	<173	142 - 92	0	J-BAND 10-20 GHZ	5000
FCS MK 92 CAS-Track (95 ft)	<87	142 - 92	0	I-BAND 8-10 GHZ	400
FCS MK 92 CAS Search (85 ft)	<1	360	+1.4	I-BAND 8-10 GHZ	1000
FCS MK 92 STIR-CWI (80 ft)	<462	151 - 257	0	J-BAND 10-20 GHZ	5000
FCS MK 92 STIR-Track (80 ft)	<190	151 - 257	0	I-BAND 8-10 GHZ	1000
MK 86 SPG-60 (65 ft)	<303	152 - 261	0	I-BAND 8-10 GHZ	825
MK 86 SPQ-9A (65 ft)	<1	360	0	I-BAND 8-10 GHZ	58
MK 74 MOD 14 (TARTAR SM2/NTU)-CWI (65 ft)	<457	138 263	0	J-BAND 10-20 GHZ	1500
MK 74 MOD 14 (TARTAR SM2/NTU)-Track (65 ft)	<465	138 263	0	G-BAND 5-6 GHZ	1600
MK 23 TAS (117 ft)	<2.5	117 - 269	0	D-BAND 1-2 GHZ	5600
MK 57 NSSMS Radar A (65 ft)	<321	137 - 255	0	J-BAND 10-20 GHZ	1800
MK 57 NSSMS Radar B (95 ft)	<321	117 - 260	0	J-BAND 10-20 GHZ	1800
TARTAR MK 74 MOD 6/8/A/N/SPG-51C-Track (40 ft)	<486	133 - 184	0	G-BAND 4-6 GHZ	550
TARTAR MK 74 MOD 6/8/A/N/SPG-51C-CWI (40 ft)	IS NOT OPERATED OUT ANTENNA	133 - 184	0	J-BAND 10-20 GHZ	0
AN/SPQ-9B (70 ft)	<1	360	0	I-BAND 8-10 GHZ	300
FCS MK 99 (65 ft)	<1320	360	+5	J-BAND 10-20 GHZ	120x0

Table 1

SWEF EMITTER NAME	ANTENNA GAIN	SYSTEM LOSS(GAIN) INCLUDES COUPLING FACTOR LOSS	POWER USED IN CALCULATION	COMMENTS
FCS MK 92 CAS-CWI	35.5	8.73	5000	
FCS MK 92 CAS-Track	35	4	400	
FCS MK 92 CAS Search	35	3	1000	ROTATING SYSTEM DUTY CYCLE = 0.0039
FCS MK 92 STIR-CWI	42	6.52	5060	
FCS MK 92 STIR-Track	41.5	7	1000	
MK 86 SPG-60	41	2.2	825	
MK 86 SPQ-9A	37.5	0	576	ROTATING SYSTEM DUTY CYCLE = 0.0042
MK 74 MOD 14 (TARTAR SM2/NTU)-CWI	42.5	1.82	1500 (REDUCED from report)	
MK 74 MOD 14 (TARTAR SM2/NTU)-Track	39.6	2.27	1600 (REDUCED from report)	
MK 23 TAS	21	0	5600	ROTATING SYSTEM DUTY CYCLE = 0.0092
MK 57 NSSMS Radar A	36.5	0	1800	
MK 57 NSSMS Radar B	36.5	0	1800	
TARTAR MK 74 MOD 6/8/A/N/SPG-51C-Track	39.5	(1.87)	550	
TARTAR MK 74 MOD 6/8/A/N/SPG-51C-CWI	45	0.68	4000	
AN/SPQ-9B	43	0	400	ROTATING SYSTEM DUTY CYCLE = 0.0042
FCS MK 99	43	2.48	12000	

Losses were adjusted based on the empirical measurement (if data was available). If no measurement data was available or used, the loss was set to zero, which yields a worse case value for safe separation distances (i.e., SPQ-9A, SPQ-9B, TAS, MK 57)

Table 2