

6220  
26 Jun 98

From: Executive Secretary, Navy Epidemiology Board  
To: Commanding Officer, Navy Environmental Health Center  
Via: President, Navy Epidemiology Board

Subj: MINUTES OF THE NAVY EPIDEMIOLOGY BOARD (NEB) MEETING OF  
May 20-22, 1998

Ref: (a) NAVENVIRHLTHCENINST 6220.1E

- Encl: (1) List of Attendees  
(2) Navy Epidemiology Board Directory  
(3) Navy Epidemiology Board Agenda  
(4) Navy Epidemiology Board Meeting Evaluation  
(5) Briefings  
(6) Career Pathway for Preventive Medicine Officers  
(7) Meningococcal Vaccine Boosters  
(8) EPI-RAP 98-001 Medical Intelligence Needs of the Navy & Marine Corps  
(9) EPI-RAP 98-002 New Criteria for the Command Review  
(10) EPI-RAP 98-003 Validation of the Naval Disease Reporting System  
(11) EPI-RAP 98-004 Tri-Service Surveillance and Vaccine Trials for  
Coccidioidomycosis (Cocci)  
(12) EPI-RAP 98-005 Hepatitis A Immunization for Europe  
(13) EPI-RAP 98-006 Hepatitis B Vaccination for the Far East  
(14) EPI-RAP 98-007 Management of Hepatitis C in the Department of the Navy  
(15) EPI-RAP 98-008 Hepatitis B and C Virus Screening Prior to Accession  
(16) EPI-RAP 98-009 Assessing Chemical Content of Potable Water Produced on United  
States Navy Ships - Scientifically Defensible or Fantasy?  
(17) EPI-RAP 98-010 Tuberculosis Control Program

1. The subject meeting was held at the Navy Environmental Health Center, May 20-22, 1998, in accordance with reference (a). Attendees are listed in enclosure (1). The NEB Directory, the meeting agenda, and the meeting evaluation are provided as enclosures (2) through (4), respectively.

## 2. Briefings.

- a. NEHC Preventive Medicine, CDR Rendin: See enclosure (5), attachment (A).
- b. NEPMU2, CAPT(sel) Schibly: The CIHL Lab is completed. Also, the first CBR-E class was given at NEPMU2 in February. Another may be given at NEPMU2 in September.

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c. NEPMU-5, CAPT Olson: The Unit is preparing for the Operational Preventive Medicine Course to be offered in June. NEPMU5 is involved in a study of respiratory disease chemoprophylaxis during SEAL training comparing azithromycin and penicillin. Staff has recently made submissions to Vaccine, Annals of Internal Medicine, and Military Medicine.

d. NEPMU-7, CDR Orndorff: See enclosure (5), attachment (B).

e. HQMC, LCDR Fallon: Issues of concern to the Marines Corps at this time include the use of SAMS for tracking Anthrax immunizations; DNBI surveillance in garrison; vaccine policy, and deployment surveillance.

f. Specialty Leader, CAPT Thomas: See enclosure (5), attachment (C).

g. Health Promotion, Ms. Diana Settles & Mr. Mark Long: See enclosure (5), attachment (D).

h. JPMPG and AFEB, LTC DeFraitess: See enclosure (5), attachment, (E).

i. Air Force Epidemiology Services, MAJ Trent: See enclosure (5), attachment, (F).

j. NMRI, CDR McCarthy: See enclosure (5), attachment (G).

k. Update on Leishmaniasis, CDR Orndorff: See enclosure (5), attachment (H).

l. BUMED (Med-24), CDR McBride: See enclosure (5), attachment (I)

m. Occupational Medicine, CAPT Betts: See enclosure (5), attachment (J).

n. Clinical Epidemiology, CAPT Kuehne: See enclosure (5), attachment (K).

o. Put Prevention Into Practice, Ms. Nancy Von Tersch: See enclosure (5), attachment (L).

p. DoD Influenza Program, LCDR Malakooti: See enclosure (5), attachment (M).

q. Entomology Issues, LCDR Cope: See enclosure (5), attachment (N).

r. Lesson Training Guides, CDR Hooker: The epidemiologists from the NEPMUs were reminded to continue to work with Pam Barsness to develop and complete lesson training guides.

s. Workshop Evaluation, CDR Olesen: See enclosure (5), attachment (O)

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3. **Old Business** (Previous EPI-RAPs still pending)

a. **EPI-RAP 97-001: Revised Reportable Diseases**

Action Taken: The draft of the new reportable disease instruction called Medical Event Reports is at BUMED for signature.

Status: Closed

b. **EPI-RAP 97-002: Preventive Medicine Career Pathways**

Action Taken: CDR Potter completed the revised Career Pathway for Preventive Medicine Officers, and it was adopted by the NEB (See enclosure (6)).

Status: Closed

c. **EPI-RAP 97-004: Chemoprophylaxis After Occupational Exposure to HIV**

Action Taken: Message was released by BUMED.

Status: Closed

d. **EPI-RAP 97-005: ASTMH-Certificate in Tropical Medicine and Traveler's Health for Navy PMOs**

Action Taken: Included as an elective in the Career Pathway of Preventive Medicine Officers.

Status: Closed

e. **EPI-RAP 97-008: PPD False Positive Reactions Associated With the Use of Aplisol**

Action Taken: Produced a draft BUMED Tuberculosis Control Program instruction to require the recording of the manufacturer and lot number. CDC study showed no difference in sensitivity and specificity of Aplisol (Parke-Davis) and Tubersol (Connaught).

Action Required: Dr. Hyman and CDR Hooker from NEHC are comparing the two products in a small study at Atsugi, and will present data from the study at the next NEB. This EPI-RAP will be subsumed under EPI-RAP 98-010.

Status: Closed

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f. **EPI-RAP 97-009: Influenza Vaccine Availability**

Action Taken: Early shipments of the Influenza Vaccine are possible.

Action Required: CDR McBride will include this information in the next Influenza Message.

Status: Closed

g. **EPI-RAP 97-010: Deployment Surveillance**

Action Taken: CDR McBride presented an update on deployment surveillance.

Status: Closed

h. **EPI-RAP 97-012: Meningococcal Vaccine Booster**

NEB Recommendation: Insufficient data at present to recommend a policy. No policy change or additional studies recommended at this time (See enclosure (7)).

Status: Closed

i. **EPI-RAP 97-013: Typhoid Vaccine for Military Use**

Action Taken: A message about typhoid vaccine availability is scheduled to be released through the Medical and Dental Materiel Bulletin.

Status: Closed

j. **EPI-RAP 97-014: Hepatitis B Vaccine for Active Duty**

Status: Subsumed by EPI-RAP 98-006

k. **EPI-RAP 97-015: Recommendations for the Protection of Visitors to Infectious Agent Patients in Isolation Rooms**

NEB Recommendation: Support the recommendation that patients be encouraged to wear a surgical mask, and visitors be offered one to wear.

Action Taken: CDR McBride will investigate making this into policy.

Status: Open

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4. **New Business** (EPI-RAPs)

- a. **EPI-RAP 98-001: Medical Intelligence Needs of the Navy & Marine Corps**, enclosure (7)

NEB Recommendation: Existing medical intelligence resources are adequate. There is no need to produce an additional product.

Status: Closed

- b. **EPI-RAP 98-002: New Criteria for the Command Review**, enclosure (8)

NEB Recommendation: Form an ad hoc committee to draft a new list of command review criteria for the NEPMU Epidemiology Departments.

Action Required: CAPT(sel) Schibly is the chairperson of the committee. Committee members include CAPT Olson, CDR Yund, and CDR Orndorff. The committee will present its work at the next NEB.

Status: Open

- c. **EPI-RAP 98-003: Validation of NDRS Surveillance System**, enclosure (9)

NEB Recommendation: The NEB agreed that validation of data is required. Policy on the validation of data will be developed by NEHC for implementation by the NEPMUs.

Action Required: Dr. Bob Morrow will draft policy for the validation of reportable medical event data, and will present this at the next NEB.

Status: Open

- d. **EPI-RAP 98-004: Tri-service Surveillance and Vaccine Trials for Coccidioidomycosis (Cocci)**, enclosure (10)

NEB Recommendation: Collect more military and state data on Cocci and present at the next NEB for a decision on referring the issue to the Armed Forces Epidemiology Board and the Joint Preventive Medicine Policy Group.

Action Required: CAPT Olson will collect data.

Status: Open

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e. **EPI-RAP 98-005: Hepatitis A immunization for Europe**, enclosure (11)

NEB Recommendation: Offer Hepatitis A immunization to dependents transferring to intermediate and high risk areas.

Action Required: CDR Potter will investigate having the overseas screening requirements changed, and will report his progress at the next NEB meeting. The NEHC Preventive Medicine Directorate will incorporate this into the next BUMED NOTICE on Immunization Requirements and Recommendations, and recommend it be included in the next Quad-Service instruction on Immunizations and Chemoprophylaxis.

Status: Open

f. **EPI-RAP 98-006: Hepatitis B Vaccination for the Far East**, enclosure (12)

NEB Recommendation: Require Hepatitis B vaccine for all active duty personnel stationed in or transferring to the Far East.

Action Required: LCDR Fallon will draft a message to send to BUMED for approval and dissemination requiring the use of Hepatitis B vaccine for active duty personnel in the Far East. CDR Potter will investigate having the overseas screening requirements changed, and will report his progress at the next NEB meeting. The NEHC Preventive Medicine Directorate will incorporate this into the next BUMED NOTICE on Immunization Requirements and Recommendations, and recommend it be included in the next Quad-Service instruction on Immunizations and Chemoprophylaxis.

Status: Open

g. **EPI-RAP 98-007: Management of Hepatitis C in the Department of the Navy**, enclosure (13)

NEB Recommendation: Perform cost-benefit analysis of various testing options to help determine the best policy recommendations. Await results of recommendation for informed consent from blood donors who are within 6 months of accession (see EPI-RAP 98-008).

Action Required: CDR McBride will perform cost-benefit analysis of testing options to guide future policy decisions.

Status: Open

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h. **EPI-RAP 98-008: Hepatitis B and C Virus Screening Prior to Accession**, enclosure (14)

NEB Recommendation: Informed consent be obtained from blood donors who are within 6 months of accession so they will be aware that they will be discharged if their blood test shows certain blood-borne diseases. Below is a proposed consent for blood donation solicitation of active duty military members. In addition to the standard information provided to prospective donors, the following information will be given to active duty members:

“1. After donation your blood will be screened for evidence of infectious diseases, including HIV, Hepatitis B, and Hepatitis C. Results of this screening, if positive, will be sent to your command.

2. HIV, Hepatitis C infection, and chronic carriage of Hepatitis B are currently disqualifying for military duty if identified within the first six months of service. You may be administratively separated from service if such infections are found as a result of your blood donation.”

Active duty members will indicate by signature that they have read and understand the above statements.

Action Required: CDR McBride will submit this draft to BUMED for action.

Status: Open

i. **EPI-RAP 98-009: Assessing Chemical Content of Potable Water Produced on United States Navy Ships—Scientifically Defensible or Fantasy?** , enclosure (15)

NEB Recommendation: Conduct study to evaluate chemical quality of shipboard water.

Action Required: Preventive Medicine Directorate will determine type of study.

Status: Closed

j. **EPI-RAP 98-010: Tuberculosis Control Program**, enclosure (16)

NEB Recommendation: Complete study at Atsugi comparing Tubersol and Aplisol, and request data from CDC on erythema from Tubersol and Aplisol when analysis is done.

Action Required: CDR Hooker and Dr. Hyman will complete study, and request data.

Status: Open

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5. **Next Meeting.** The next meeting is scheduled for October 27-29, 1998.

S. G. HOOKER  
CDR, MC, USN

Minutes reviewed and approved by President, Navy Epidemiology Board.

Date

H. G. POTTER  
CDR, MC, USN

Minutes reviewed by Commanding Officer, NAVENVIRHLTHCEN.

Comments:

Approved/Disapproved

Date

R. L. BUCK

**NAVY EPIDEMIOLOGY BOARD  
NAVY ENVIRONMENTAL HEALTH CENTER  
NORFOLK, VA**

ATTENDANCE ROSTER FOR  
NAVY EPIDEMIOLOGY BOARD MEETING OF MAY 20-22, 1998

**MEMBERS PRESENT**

CDR G. Potter, MC, USN (**President**/Naval Hospital Bremerton)  
CAPT Olson, MC, USN (NEPMU-5)  
CAPT L. Betts, MC, USN (NEHC)  
CAPT(Sel) B. Schibly, MC, USN (NEPMU-2)  
CDR S. Hooker, MC, USN (**Executive Secretary**/NEHC)  
CDR M. McCarthy, MC, USN (NMRI)  
CDR Orndorff, MC, USN (NEPMU7)  
CDR McBride, MC, USN (BUMED Med-24)  
LCDR A. Fallon, MC, USN (**Vice President**/NNMC)  
LCDR M. Ryan, MC, USN (Great Lakes)  
CDR R. Rendin, MSC, USN (NEHC)

**GUESTS**

CAPT J. L. Malone, MC, USN (NMC Portsmouth)  
CAPT Thomas, MC, USN (NEPMU2)  
CAPT Hayashi, MC, USN (CNSL)  
LTC DeFraitcs, MC, USA (DASG-HS-PM)  
Maj Trent, BSC, USAF (AL-AOES)  
LCDR Malakooti, MC, USN (NEPMU2)  
Dr. Morrow (NEHC)  
HMC Shuck (NEHC)

**MEMBERS ABSENT**

CDR J. Yund, MC, USN (NEPMU-6)

**NAVY EPIDEMIOLOGY BOARD**  
**May 20-22, 1998**  
**AGENDA**

Wednesday, May 20, 1998

0800 - 0810 Welcome & Opening Remarks - CDR Potter  
0810 - 0830 Commanding Officer Remarks - CAPT Buck

**Program Updates**

0830 - 0850 NEHC PM - CDR Rendin  
0850 - 0910 NEPMU Briefs  
0910 - 0930 HQ USMC - LCDR Fallon  
0930 - 1000 Specialty Leader - CAPT Thomas  
1000 - 1030 **Break**  
1030 - 1045 Health Promotion - CAPT Brawley  
1045 - 1115 JPMPG & USA - LTC DeFraitis  
1115 - 1130 USAF - MAJ Trent  
1130 - 1300 **Lunch (HIV Presentation - Optional)**  
1300 - 1400 GEIS - CDR McCarthy  
1400 - 1415 **Break**  
1415 - 1445 Update on Leishmaniasis in Sicily - CDR Orndorff  
1445 - 1630 Review of Old Business (EPI-RAPS)

Thursday, May 21, 1998

**New Business (EPI-RAPS)**

0800 - 0830 Medical Intelligence (EPI-RAP 98-001) - HMC Shuck  
0830 - 0900 Command Review (EPI-RAP 98-002) - CDR Hooker  
0900 - 0930 Validation of Data (EPI-RAP 98-003) - Dr. Morrow  
0930 - 1000 **Break**  
1000 - 1030 Coccidioidomycosis Vaccine (EPI-RAP 98-004) - CAPT Olson  
1030 - 1100 Hepatitis A Vaccine Requirements in Europe (EPI-RAP 98-005) -  
CDR Orndorff  
1100 - 1130 Hepatitis B Vaccine Requirements in the Far East (EPI-RAP 98-006)-  
LCDR Fallon  
1130 - 1300 **Lunch**  
1300 - 1330 Hepatitis C Policies (EPI-RAP 98-007) - CDR McBride  
1330 - 1400 MCRD Parris Island & Hepatitis (EPI-RAP 98-008) - LCDR Malakooti  
1400 - 1430 Shipboard Water Quality (EPI-RAP 98-009) - LT Cardwell  
1430 - 1500 **Break**  
1500 - 1530 Tuberculosis Control Program (EPI-RAP 98-010) - CDR Hooker  
1530 - 1630 Deployment Surveillance (Brief) - CDR McBride

Enclosure (3)

Friday, May 22, 1998

**Program Briefs**

0800 - 0830 Occupational Medicine - CAPT Betts  
0830 - 0900 Clinical Epidemiology - CAPT Kuehne  
0900 - 0930 Put Prevention Into Practice - Nancy Von Tersch  
0930 - 0945 DoD Influenza Program - LCDR Malakooti  
0945 - 1000 **Break**  
1000 - 1015 Entomology Issues - LCDR Cope  
1015 - 1030 Lesson Training Guides - CDR Hooker  
1030 - 1100 Workshop Evaluation - CDR Olesen

**Administrative Business**

1100 - 1130 Unfinished Business  
1130 - 1145 Selection of Date for Next Meeting and Closing Remarks  
1145 **Adjourn**

**NEB Meeting Evaluation**  
**May 20-22, 1998**  
(10 Evaluations Completed)

**1. What did we do well?**

**Course/Agenda:**

- ◆ Good range of topics (3)
- ◆ Info exchange very good (3)
- ◆ Good, quality EPI-RAPS (2)
- ◆ Kept schedule well (2)
- ◆ “Excellent agenda” (1)
- ◆ Good course length
- ◆ “Working lunch good idea”
- ◆ “Course well organized”
- ◆ Advanced E-mail meeting schedule very useful
- ◆ Good interdisciplinary discussion

**Personnel:**

- ◆ Good inter-service representation (1)
- ◆ “Professional” presentations
- ◆ “Great assistance from HM1 Sanders”
- ◆ “Welcome” atmosphere

**Training Aids:**

- ◆ Good handouts & audiovisual support

**Billeting:**

- ◆ Good location & price

**2. What should we improve?**

**Course/agenda:**

- ◆ Working lunch on both days
- ◆ Shorten course to two days
- ◆ Discipline time limits and scope of discussion
- ◆ Present course outside of NEHC
- ◆ “Screen EPI –RAPS for focus on questions to be resolved
- ◆ Reduce the “FYI only” briefings

**Personnel:**

- ◆ Keep the attendees “in the room”
- ◆ Invite Coast Guard personnel

**Support:**

- ◆ Improve Norfolk maps & send to attendees
- ◆ Put handouts on web
- ◆ Set up NEB Forum on web page for NEB discussions
- ◆ Put coffee mess in room; offer coffee and cake on the breaks only
- ◆ Make “an event” out of lunch and require all to attend

**Billeting:**

- ◆ Billeting without phones & hot water

**3. How would you rate the effectiveness of this meeting using the following scale:  
5(excellent) – 0(poor)?**

Results:      Mean: 4.3      Mode: 4      Range: 4-5

**NAVY EPIDEMIOLOGY BOARD  
REQUEST FOR ACTION PAPER (EPI-RAP)**

**21 May 98  
EPI-RAP 98-001**

**TITLE**

Medical Intelligence Needs of the Navy & Marine Corps

**ISSUE/PROBLEM STATEMENT**

Some have indicated a concern for the present state of medical intelligence products and services, particularly as it relates to the Navy and Marine Corps.

**PRIORITY**

To be determined

**BACKGROUND**

The Armed Forces Medical Intelligence Center (AFMIC) is DoD's main source of medical intelligence. They produce the MEDIC, and provide consultative services. Beginning in January 1999, the MEDIC will be updated annually.

Some of the concerns with medical intelligence products is that they are too generic and do not always apply to the Fleet. The Armed Forces Preventive Medicine Working Group meets at least annually to provide recommendations for the MEDIC. This Working Group has representatives from the Navy preventive medicine community.

The Navy Preventive Medicine Information System (NAPMIS) which required the Disease Risk Assessment Profiles (DISRAPs) and the Vector Risk Assessment Profiles (VECTRAPS) has been rewritten; and the draft of the new instruction requires that only VECTRAPS be produced.

Also, the MEF PMOs and the NEPMU Epi Departments provide tailored verbal or written medical intelligence information on request.

**ACTION NEEDED**

1. Do the present medical intelligence products and services adequately meet the needs of the Navy and Marine Corps?
2. Do the personnel at NEPMU or other preventive medicine personnel need to augment the existing products and services with another written product?
3. How can we better influence the products and services that exist to improve their quality?
4. Should we develop a feedback system to ensure that the information presented in the AFMIC MEDIC adequately meets the needs of the Navy and Marine Corps?

**ISSUE ORIGINATOR**

CDR Stephen Hooker  
Chief Judy Shuck

Enclosure (8)

**PERTINENT REFERENCES**

Will be included in a handout

**PERTINENT PERSONNEL**

NEPMUs

NEHC Plans & Operations

NEHC Preventive Medicine

**NAVY EPIDEMIOLOGY BOARD  
REQUEST FOR ACTION PAPER (EPI-RAP)**

**21 May 98  
EPI-RAP 98-002**

**TITLE**

New Criteria for the Command Review

**ISSUE/PROBLEM STATEMENT**

Every 3 years field offices undergo an inspection called a Command Review in lieu of a visit by the Medical Inspector General. Most of the criteria used for those Reviews is obsolete.

**PRIORITY**

To be determined

**BACKGROUND**

Traditionally, the Epidemiology Departments of the NEPMUs have been inspected for compliance with disease reporting, medical intelligence, and operational support. The need for vigorous operational support continues, but is difficult to verify and quantitate. The disease reporting and medical intelligence criteria have dramatically changed. The list of criteria for reviewing NEPMU Epidemiology Departments is in need of a major revision. This also addresses the heart of the issue: What are our major responsibilities at present and in the future? What are our measures of success/failure? What criteria should be used to determine effectiveness?

**ACTION NEEDED**

1. Review the list of criteria for reviewing Epidemiology Departments
2. Review the NEPMU mission statements
3. Outline our major responsibilities
4. Develop a new list of criteria

**ISSUE ORIGINATOR**

CDR Stephen Hooker

**PERTINENT REFERENCES**

Will be included in a handout

**PERTINENT PERSONNEL**

NEPMUs  
NEHC Plans & Operations  
NEHC Preventive Medicine

Enclosure (9)

**NAVY EPIDEMIOLOGY BOARD  
REQUEST FOR ACTION PAPER (EPI-RAP)**

**21 May 98  
EPI-RAP 98-003**

**TITLE**

Validation of NDRS Surveillance System

**ISSUE**

The Epidemiology community is now collecting and analyzing surveillance data via the electronic NDRS system. Each MTF is required to report cases of selected diseases according to the Tri-Service Reportable disease list. For this information to be used effectively to diagnose population-based problems and inform readiness and health policies, there must be a mechanism for determining the reliability and validity of the data generated through the surveillance system.

**PRIORITY**

Urgent.

**BACKGROUND**

In 1997 the NEHC received over 900 reports of disease in active duty personnel in the USN and USMC. This was an increase over the number of reports in 1996. Without knowledge of the accuracy and completeness of the reporting we are hampered in our interpretation of this data. The cases represent real disease occurrence, but we need a mechanism to determine their accuracy and usefulness. Because reporting is mandated via instruction, the validation of data may be interpreted as a form of inspection and individuals feel the risk of being "put on report." Furthermore, traditionally the tracking of cases of reportable disease has been exclusively the responsibility of the Preventive Medicine Departments and clinical and laboratory services have not been involved in data checks in the past. There is not at present a requirement for validating data other than what would be reasonably expected as part of professional functioning.

**ACTION NEEDED**

A clear policy and rationale of an implementation plan should be recommended by the Navy Epidemiology Board to address this essential issue. The Board might recommend specific data checks to be carried out at the time of data entry at the MTF level, and active survey of randomly selected records or sites of supervisory activities to be carried out by the NEPMU Epidemiology Departments and NEHC Preventive Medicine Directorate. The Navy Epidemiology Board should suggest ways in which this new data validation activity can be implemented in a collaborative, non-threatening, universally applicable manner.

**ISSUE ORIGINATOR**

Robert C. Morrow, MD, MPH  
Epidemiologist, Preventive Medicine  
NEHC

Enclosure (10)

**PERTINENT REFERENCES**

BUMEDINST 6220.12 19 Apr 1996

BUMED MSG on NDRS: BUMED WASH DC 061600Z OCT 97

**PERTINENT PERSONNEL**

None outside of Navy Epidemiology Community. General issue may be of concern also to CDC, State Health Department, Disease Registries, Vital Statistics, and Community based academics

**NAVY EPIDEMIOLOGY BOARD  
REQUEST FOR ACTION PAPER (EPI RAP)**

**21 May 98  
EPI-RAP 98-004**

**TITLE**

Tri-service Surveillance and Vaccine Trials for Coccidioidomycosis (Cocci)

**ISSUE/PROBLEM STATEMENT**

Seminal military work half a century ago defined the epidemiology of Cocci. Today, we are ideally positioned to implement a structure for primary and secondary prevention and militarily relevant vaccine trials.

**BACKGROUND**

C. immitis (Cocci) is one of a small number of primary pathogenic fungi capable of causing invasive disease in normal hosts. Cocci is limited to the desert Southwest, but, despite this geographical limitation, it is responsible for a great deal of morbidity and mortality. Infections in Kern County, California alone accounted for approximately \$45m in direct costs of hospitalizations and outpatient care in the interval 1991-93. C. immitis is endemic not only in the San Joaquin Valley, but also in the deserts near Los Angeles and San Diego, as well as the heavily populated Phoenix-Tucson region. An estimated 25,000 to 100,000 new cases are reported each year on the basis of skin test reactivity. With U.S. strategic interests such as they are, heavy military use of the desert training areas of the American Southwest might be expected far into the future.

We know that immunization against Cocci is feasible because secondary infections with C. immitis are extraordinarily rare. Ideally, a vaccine would prevent, or drastically reduce, the incidence of symptomatic infection, but one would most like to protect those at high risk for disseminated disease. The mechanism of genetically determined increased risk of disseminated disease in Blacks and Filipinos is not known. Inbred strains of mice which are genetically susceptible to lethal infection can be successfully immunized with a recombinant protein vaccine. For this reason, it is probable that individuals who are genetically susceptible to disseminated infection also can be successfully immunized. Civilian academic researchers have proposed phase 1 vaccine trials by the year 2003.

A tri-service apparatus for surveillance of military units deployed to high-risk areas would be helpful. DoDI 6490.3, *Implementation and Application of Joint Medical Surveillance for Deployments*, may apply. Newly reporting servicemembers at selected bases in southern California and Arizona might have a baseline Cocci serology and coccidioidin skin test performed along with a survey of demographic information. At periodic intervals the skin test and serology would be repeated, study participants would be interviewed about exposures during the previous period and the medical record reviewed. With such a structure in place, profiles for vaccine candidates might be established at the same time as educational outreach.

Enclosure (11)

## **ACTION NEEDED**

1. Request issue be presented to AFEB.
2. Establish a working group sanctioned by the Joint Preventive Medicine Policy Group to develop a Joint Instruction and establish liaison with clinicians and vaccine investigators.

## **ISSUE ORIGINATOR**

CAPT Patrick E. Olson, MC, USN, NEPMU-5, (619)556-7075, DSN 526-7075; email peolson@nepmu5.med.navy.mil

## **PERTINENT REFERENCES**

Dewsnap DH, et al. Is it ever safe to stop azole therapy for *Coccidioides immitis* meningitis? *Ann Int Med* 1996;124:305-310.

Galgiani JN. Coccidioidomycosis. *West J Med* 1993;159:153-171.

Galgiani JN, et al. An arthroconidial-spherule antigen of *Coccidioides immitis*: differential expression during in vitro fungal development and evidence for humoral response in humans after infection or vaccination. *Infect Immun* 1992;60:2627-2635.

Kirkland TN, et al. Immunogenicity of a 48-kilodalton recombinant T-cell reactive protein of *Coccidioides immitis*. *Infect Immun* 1998;66:424-431.

Smith CE, et al. Varieties of coccidioidal infection in relation to the epidemiology and control of the diseases. *Am J Public Health* 1946;36:1394-1402.

Stevens DA. Current Concepts: Coccidioidomycosis. *N Engl J Med* 1995; 332:1077-1082.

Zhu Y, et al. Molecular cloning and characterization of *Coccidioides immitis* antigen 2cDNA. *Infect Immun* 1996;64:2695-2699.

**NAVY EPIDEMIOLOGY BOARD  
REQUEST FOR ACTION PAPER (EPI-RAP)**

**21 May 98  
EPI-RAP 98-005**

**TITLE**

Hepatitis A immunization for Europe

**ISSUE/PROBLEM STATEMENT**

Our beneficiaries (Active Duty and family members) are at Intermediate Risk for Hepatitis A infection upon arrival in Spain, Naples, and Sigonella. CDC & ACIP recommend vaccine for intermediate & high risk areas. Italy and Spain are intermediate risk, but additionally, the areas our personnel deploy to are High Risk areas. Vaccination is often not begun until the member or family arrive in theater and thus an effective prevention strategy may be lost.

**PRIORITY**

This topic is timely and needs attention at this board meeting.

**BACKGROUND**

Our beneficiaries (Active duty and family members) are at intermediate risk upon arrival in Spain and Naples, and less so in Sigonella. Italy and Spain are intermediate risk but the areas our personnel deploy to are High Risk areas. Travel by active duty and family members frequently includes High Risk areas. CDC & ACIP recommend vaccine for Intermediate & High risk area. However, DODHA recommended, in Aug. 1996, vaccination for family members & DOD employees only in or going to High Risk areas. Protection is needed in the Southern European theater upon arrival and for those who will deploy shortly after arrival. Often the immunization can not provide immediate protection on short-fused deployment requirements. Protection should be provided prior to risk (PCS). Therefore, it would be prudent to add Hepatitis A vaccination to the overseas screening process. The second dose would then be given at the appropriate interval after arrival at the permanent duty station.

**ACTION NEEDED**

Recommend that vaccination be a requirement for PCS to Europe. The first dose of the vaccine should be given to active duty and offered to family members at the time of the overseas screening.

**ISSUE ORIGINATOR**

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Enclosure (12)

**NAVY EPIDEMIOLOGY BOARD  
REQUEST FOR ACTION PAPER (EPI-RAP)**

**21 May 98  
EPI-RAP 98-006**

**TITLE**

Hepatitis B Vaccination for the Far East

**ISSUE**

Hepatitis B is endemic at high levels in many countries in the Western Pacific area. CDC has recommended vaccinating all children and adolescents. Several commanding officers here are buying the hepatitis B vaccine for their commands and offering it to personnel. Vaccination policy at this point is to vaccinate those who have demonstrated elevated risk, by which time they would have already been exposed.

**PRIORITY**

High priority

**BACKGROUND**

See issue above

**ACTION**

Recommend policy for Hepatitis B vaccination in view of the recognition by some line commanders that the vaccine is beneficial to their personnel. Should this be a routine vaccine series recommended by BUMED and given at MCRD's and Boot camps.

**ISSUE ORIGINATOR**

CDR Ted J Robinson at DSN 622-7232 or [robinsont@iiimef.usmc.mil](mailto:robinsont@iiimef.usmc.mil)

Enclosure (13)

**NAVY EPIDEMIOLOGY BOARD  
REQUEST FOR ACTION PAPER (EPI-RAP)**

**21 May 98  
EPI-RAP 98-007**

**TITLE**

Management of Hepatitis C in the Department of the Navy

**ISSUE/PROBLEM STATEMENT**

A growing number of recruits and other Service members are being identified as being infected with Hepatitis C virus (HCV). Because of the high percentage of infected individuals developing chronic liver disease (usually decades later), a coordinated policy is needed regarding testing, reporting, treatment and service retention.

**PRIORITY**

Intermediate.

**BACKGROUND**

Although the incidence of hepatitis C in the United States has declined by more than 80% since the 1980s, there are 30,000 new cases and 10,000 deaths each year. The number of deaths is expected to triple over the next two decades unless effective prevention and treatment plans are developed. It is estimated that over 4 million Americans are infected with HAV, and it is expected that 85% of these will develop chronic liver disease. Approximately 0.37% of blood donors within the DoD are positive for HCV.

The current DoD and Navy accession policies do not specifically address hepatitis C. The accession points within the Navy and Marine Corps do not have uniform policies providing guidance on what actions to take when a recruit or officer is HCV positive. Further, policy on retaining Service members found to be positive for HCV is not clear. A Tri-Service Working Group is developing policy recommendations on this issue.

**ACTION NEEDED**

1. Propose policy recommendations which would best reflect current understanding of HCV infection, including diagnostic testing and treatment of disease.
2. Coordinate recommendations with other Services and Tri-Service Working Group.

**ISSUE ORIGINATOR**

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Enclosure (14)

**NAVY EPIDEMIOLOGY BOARD  
REQUEST FOR ACTION PAPER (EPI-RAP)**

**21 May 98  
EPI-RAP 98-008**

**TITLE**

Hepatitis B and C virus Screening Prior to Accession

**ISSUE/PROBLEM STATEMENT**

There is no DOD policy for Hep B/C screening prior to enlistment, and each service has a different approach. At MCRD Parris Island, recruits are encouraged to donate blood during regularly scheduled blood donation evolutions, but those who are found to be Hep B or C positive are then discharged from the service.

**PRIORITY**

To be determined

**BACKGROUND**

DOD does not mandate Hep B or C screening prior to enlistment. This has become an issue because recruits at Parris Island have been discharged from the Marine Corps just before or after graduation from bootcamp, when positive Hep B or C results from blood donation screening tests are returned. The command does not want to stop supporting the community blood donor program, but if recruits are properly counseled as to the possible consequences of donating blood, (after the company is marched to the Branch Medical Clinic for the "voluntary" blood donation on day 29) experience has shown they will stop volunteering.

MCRD San Diego does not actively encourage blood donation in this way (though a van is available on site), and RTC Great Lakes does not have blood donation during recruit training. USAF at Lackland has its own blood donation center, where all recruits are taken on about day 3 for briefing prior to voluntary blood donation, with yield of 80-130 units per day. Apparently the USA does not especially encourage blood donation during recruit training, though individual camps may vary.

During the last 12 months about ~157/5666 recruits at MCRD Parris Island had "positive results" during blood donor screening, but the specific data regarding rates of Hep B vs Hep C vs HIV are not yet available.

**ACTION NEEDED**

1. Should all USN/USMC recruits be screened for Hepatitis B and C viruses prior to accession?
2. If not, should there be specific, clear guidelines regarding blood donation during recruit training?
3. Should there be a recommendation to the AFEB that all DoD recruits undergo the same type of screening, if any?

Enclosure (15)

4. Should it be recommended that MCRD Parris Island conduct their blood drive much earlier in bootcamp? Other possible solutions to the problem?
5. Should Hepatitis B vaccine be added to the list of routine vaccinations for all recruits?

**ISSUE ORIGINATOR**

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**PERTINENT REFERENCES**

DOD Directive 6130.3  
MAN MED Ch 15 Sec III

**PERTINENT PERSONNEL**

DOD Preventive Medicine community

**NAVY EPIDEMIOLOGY BOARD  
REQUEST FOR ACTION PAPER (EPI-RAP)**

**21 May 98  
EPI-RAP 98-009**

**TITLE**

Assessing Chemical Content of Potable Water Produced on United States Navy Ships—Scientifically Defensible or Fantasy?

**ISSUE/PROBLEM STATEMENT**

Does potable water produced on U.S. Navy ships contain chemicals that have been associated with adverse health effects in experimental animals and humans exposed through working conditions?

**PRIORITY**

Undefined.

**BACKGROUND:**

The article in *Epidemiology*, published March 1998, Volume 9, Number 2, Trihalomethanes in Drinking Water and Spontaneous Abortion, sparked an interest in the chemical content of shipboard potable water. The Navy Environmental Health Center received numerous inquiries, mostly from the medical community, regarding the likelihood of adverse health effects due to the consumption of potable water produced onboard Navy ships.

Potable water systems onboard U.S. Navy new construction ships may receive a chemical analysis depending on the construction yard, but this is not a requirement. Lack of routine potable water chemical analysis is a concern because shipboard water quality is affected by many environmental factors including geography and system maintenance.

This issue presents difficult questions as to how to assess and manage the possible human health risks within the context of exposure, mission and available technology. The multistage linearized model for quantitative risk assessment is not appropriate for all situations. Further complicating the issue is the sheer diversity of situations (exposures) and unique elements in every case. With the high number of variables and the assumptions that would be required, is it feasible to conduct a study in response to the problem statement?

Regulations based on overestimates and emotion can have serious, unnecessary consequences by keeping economically desirable products from being used and by causing expensive cleanup actions having no measurable benefit to health.

**ACTION NEEDED**

1. Consider the methods and variables involved in producing potable drinking water on U.S. Navy ships.
2. Determine the reality of a valid, well-done study of the chemical content of drinking water onboard U.S. Navy ships.

Enclosure (16)

**ISSUE ORIGINATOR**

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**PERTINENT REFERENCES**

Naval Ship's Technical Manual, Chapter 533, Potable Water Systems  
Safe Drinking Water Act  
EPA Risk Assessment Guidelines: Exposure Assessment

**PERTINENT PERSONNEL**

NHRC  
NEHC  
NAVSEA

**NAVY EPIDEMIOLOGY BOARD  
REQUEST FOR ACTION PAPER (EPI-RAP)**

**21 May 98  
EPI-RAP 98-010**

**TITLE**

Tuberculosis Control Program

**ISSUE/PROBLEM STATEMENT**

There has been a question of false positive PPDs in frequently tested low-risk populations from Aplisol, misreadings, and/or an inappropriate cutoff for recent convertors who are low risk.

**PRIORITY**

Urgent.

**BACKGROUND**

There has been concern and anecdotal evidence in the past that the Parke-Davis PPD product, Aplisol, caused "outbreaks" of false positives PPDs in persons who were low risk for tuberculosis infection. A recent study by CDC showed no difference in the sensitivity and specificity of Aplisol and Tubersol, the other most commonly used PPD. The frequent screening of primarily low risk populations in the military, and the CDC criteria and policy for treating recent convertors, may lead to a majority of convertors being false positive. This may be compounded by misreadings from inadequately trained personnel.

**ACTION NEEDED**

1. Review proposed changes to the Tuberculosis Control Program instruction
2. Make recommendations for improving the reading of PPDs
3. Review proposed PPD Study: (a) Risk category of convertors; (b) Inter-rater reliability; (c) Erythema versus induration; (d) Compliance of those on 3 year testing cycles.
4. Discuss possibility of DoD Tuberculosis Control Program Instruction

**ISSUE ORIGINATOR**

CDR Stephen Hooker

**PERTINENT REFERENCES**

Tuberculosis Control Program Instruction  
CDC Guidance on Tuberculosis Screening

**PERTINENT PERSONNEL**

DoD Preventive Medicine Community

Enclosure (17)



**Risk Analysis of Shipboard Drinking Water  
Chemical Contaminants**

18 August 2000

by

Lieutenant Michael D. Cassady  
Medical Service Corps  
United States Navy

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## **Abstract**

A survey of eleven United States Navy ships was conducted to identify the risk of chemical contamination in their drinking water supply systems. Survey results indicate there is a moderate risk of chemical contamination of the drinking water production, storage, and distribution systems with volatile organic compounds, total petroleum hydrocarbons, disinfection by-products (total trihalomethanes), and lead.

## **Administrative Information**

This project was authorized by the Naval School of Health Sciences, Code OS, Washington, D.C., the Navy Environmental Health Center, Norfolk, Virginia and The Ohio State University, School of Public Health, as a summer practicum for graduate credits towards the completion of MPH Degree requirements, for the author.

## **Summary**

### **Purpose**

To identify the risk of chemical contamination in drinking water supply systems on United States Navy ships and submarines.

### **Findings**

Surveys and interviews with key personnel onboard eleven United States Navy ships were conducted. Findings include:

- Moderate risk of chemical contamination of the drinking water production, storage, and distribution systems onboard ships.

- Most likely source of chemical contamination of shipboard drinking water is volatile organic compounds, total petroleum hydrocarbons, disinfection by-products (total trihalomethanes), and lead.

### **Recommendations**

Installation of additional shipboard monitoring equipment and procedures when ships and submarines are required to operate in littoral or contaminated waters.

Periodic testing of shipboard/submarine water tanks, production systems, and distribution systems for volatile organic compounds, total petroleum hydrocarbons, disinfection by-products, and lead.

Testing should be accomplished immediately upon returning from major deployments/operations (approximately once every two years).

## **Purpose**

The objective of this study was to identify the risk of chemical contamination in drinking water supply systems on United States Navy ships and submarines. Oversight and administrative/technical support were provided by the Environmental Health Department of the Navy Environmental Health Center.

## **Background**

United States Navy ships and submarines produce water while at sea (and at times, in littoral waters) through distilling and reverse osmosis processes. When in port, Navy vessels receive water from local municipalities, contracted agents, and/or watering points ashore.

Shipboard personnel monitor water produced onboard and water received from most foreign sources for bacteriological quality and halogen residuals (chlorine, chloramine, and bromine). Water received from local municipalities, contracted agents, and/or watering points within or under the cognizance of the United States and her territories, United Kingdom, Australia, and Canada may or may not be routinely monitored for bacteriological quality and halogen residual (drinking water standards meet minimum requirements and testing is assumed to be accomplished by local authorities overseeing these sources of water).

An important aspect of the drinking water produced onboard ships and submarines is, its source. Ships and submarines routinely do not produce water unless they are at least twelve miles from the shoreline. Being so far from shore, the sea water that is utilized is not directly subjected to the contaminants identified in the Environmental Protection Agency (EPA) Primary and Secondary Standards under the Safe Drinking Water Act (SDWA), and therefore, are not currently monitored by shipboard personnel. However, the operational environment for ships and submarines is changing and more missions are requiring operations in littoral waters for extended lengths of time.

Littoral waters are more likely to be at risk for primary and secondary contaminants.

Watering points for military units under the cognizance of the United States, her territories, and her allies are governed by EPA regulations and international agreements that adopt minimum requirements for potability of drinking water that meet or exceed EPA requirements. An exception to this may be when water is issued for drinking purposes under strict emergency conditions, (i.e., when there is no safe supply of water available and water has to be obtained, either direct or indirectly, from sources which are unknown or imperfectly known). Monitoring of EPA Primary and Secondary Standards of water received from these points is also not currently being accomplished by Navy personnel.

The drinking water distribution system on ships/submarines is relatively isolated (by physical separation of piping and minimization of cross-connections/backflow connections) from other distribution systems such as fuel, chill water, and the firemain (which contains seawater). However, many chemicals and hazardous materials are being utilized for processes throughout the ships/submarines that could possibly contaminate the drinking water system, if not handled properly. Another concern is, if the source water for water production (sea water) is contaminated (e.g., with fuel or oil), there may be an associated risk of chemical contamination of the final drinking water product.

#### **Types of Water Production Plants**

Flash-Type Distilling Plant: The flash-type distilling plant is widely used throughout the Navy. Flash-type plants are fundamentally different from other type of distilling plants. The most important difference is that the feed is flashed into vapor (steam) by pressure reduction, rather than boiling

inside an evaporator shell. Vapor is also produced by pressure reduction in each successive stage that the feed/brine enters. Two- through six-stage flash-type distilling plants are used in Navy surface ships. To achieve greater distillate output capacities in the most efficient manner, multiple-stage units are used. These plants use the same principles as two-stage plants, with additional stages added between the feed inlet and the brine outlet.

In flash-type plants, seawater is heated in a series of heat exchangers and subsequently discharged into the first-stage flash chamber. Since the pressure in the first-stage flash chamber is lower than the saturation pressure corresponding to the temperature of the feed, a portion of the feed flashes or vaporizes as it passes through the first-stage flash chamber. The vapor rises through a moisture separator or mesh-type demister and is condensed on the first-stage condenser tubes by the cooler seawater flowing through them. The condensed vapor (or distillate) then falls into the first-stage distillate trough. The remaining unflashed feed (brine) enters the second stage through restrictions in the bottom of the flash chamber. Since the brine is now at the saturation temperature of the first-stage vacuum and the second-stage flash chamber is at a lower pressure, a portion of the brine again flashes. Distillate is formed and collected in the second-stage distillate trough in the same manner as in the first stage. The distillate pump removes the distillate (formed in both stages) from the second-stage distillate trough. The remaining brine in the bottom of the second-stage flash chamber is pumped overboard.

The ratio of distillate produced to feed through a flash-type distilling plant is approximately one gallon of distillate per 10 to 20 gallons of feed. This ratio is independent of the number of stages but varies directly with the seawater temperature. Flash-type distilling plants on Navy surface ships range in capacity from 6,000 to 100,000 gallons per day.<sup>1</sup>

Reverse Osmosis: In the late 1970's, a process of directly desalting seawater without the use of heat or a phase change became a practical commercial process. This process, known as reverse osmosis, revolutionized the desalting industry. High-quality water could now be produced at substantially lower energy costs and with substantially less complexity than with conventional distillation systems. The reverse osmosis process can be thought of as similar to the conventional filtration process - pressurized seawater is passed over a semipermeable membrane that passes pure water but excludes salt species. There are, however, three important differences between reverse osmosis and conventional filtration processes:

a. Osmotic Pressure. In the reverse osmosis process, a natural osmotic pressure exists between the saline and the pure water sides of the membrane. For seawater reverse osmosis, an osmotic pressure of 350 to 400 pounds per square inch (psi) exists across the membrane, requiring fairly high pressures (700 to 1000 psi) of operation. Conventional filtration processes typically operate from 10 to 25 psi.

b. Crossflow Operation. In the conventional filtration process, all the process fluid (seawater) normally passes through the filtration media. In the reverse osmosis process, the process fluid passes over the membrane, but only a small portion (20 to 30 percent) passes directly through it. This allows the salt to remain in the concentrating feed solution, which is discharged overboard. The membrane is therefore free of rejected substances. In contrast, the conventional filtration process retains the rejected material, requiring repeated filter replacement.

c. Particle Size. In the conventional filtration process, the filter media acts as a seive, retaining particles as a result of size and

spatial incongruities. In the reverse osmosis process, ions (charged molecular particles) are separated because of their limited diffusion through the membrane. Particulates as such cannot pass through the membrane mechanically unless the membrane is defective.

The term reverse osmosis was developed because the process is often thought of as the reverse of the natural process of osmosis. If two solutions having different concentrations of solute are separated by a semipermeable membrane (permeable to the solvent but not to the solute), solvent from the weaker solution tends to pass through the membrane, decreasing the concentration of the stronger concentrated solution. The equilibrium pressure head developed by an increase in column height is called the osmotic pressure. This process is known as normal osmosis.

If the weaker solution is pure water (solvent) and the concentrated solution is seawater, the resulting osmotic pressure will be about 350 psi. The process can be reversed by applying pressure to the seawater in excess of the osmotic pressure. Water will then pass through the membrane from the concentrated side to the weaker side. The membrane rejects the sea salt and dissolves it back into the remaining seawater.

The greater the difference between the applied pressure and the osmotic pressure, the faster the water will permeate the membrane and the purer the permeated potable water will be. In practice, a pressure of 700 to 1000 psi is required to obtain an acceptable flow of water through the membrane.<sup>2</sup>

The solution-diffusion theory, which as its basis is supported by actual operational data, helps to explain membrane operation. This theory proposes that the water and salt are dissolved directly into the membrane from the saline water side. Their mechanisms of passage through the membrane, however, are distinctly different. The salt diffuses through the membrane from the

seawater side to the freshwater side at a given rate consistent with the principles of diffusion. That is, the migration of salt through the membrane is proportional to the difference of the salinity between the saltwater and freshwater on adjacent sides of the membrane. It is theorized that this diffusional process is a function of the electrical interaction of the salt ions and the active ionic groups in the polymeric structure of the membrane. Pure water, on the other hand, passes through the membrane under hydraulic pressure (its rate of permeation being directly proportional to the hydraulic pressure drop across the membrane). A good reverse osmosis membrane provides maximum waterflow with very low salt diffusion. Salt separates as the waterflow rate through the membrane greatly exceeds the salt diffusion rate. This solution-diffusion concept can be demonstrated on any reverse osmosis plant simply by increasing the pressure. The permeation rate will increase, and the permeate salinity will appear to decline. What actually happens is that the salt diffusion rate remains constant, and the greater water permeation rate results in a greater salt dilution.<sup>2</sup>

The ratio of distillate produced to feed through a reverse osmosis plant is approximately one gallon of distillate per 3 to 5 gallons of feed (or 20 percent to 30 percent). Reverse Osmosis on U. S. Navy surface ships range in capacity from 2,000 to 12,000 gallons per day.

## **Methods**

### **Shipboard Surveys**

Ships surveyed during July/August 2000 for this study, included (with date of commissioning): USS John F. Kennedy (CV-67) September, 1968; USS Mount Whitney (LCC/JCC-20) January, 1971; USS Ponce (LPD-15) July, 1971; USS La Moure County (LST-1194) December, 1971; USS Peterson (DD 969) July, 1977; USS Nassau

(LHA-4) July, 1979; USS Carr (FFG-52) July, 1985; USS Theodore Roosevelt (CVN-71) October, 1986; USS Arleigh Burke (DDG-51) July, 1991; USS Vella Gulf (CG-72) September, 1993; and USS Bataan (LHD-5) September, 1997. No submarines were surveyed during this period.

The surveys conducted onboard these ships consisted of interviews with medical; engineering; lithography/photography; and maintenance personnel who were responsible for monitoring of drinking water quality, production of drinking water, processing/developing of film/x-rays, and industrial processes, respectively. A walk-through survey of selected shipboard spaces (engineering, maintenance, medical, and photography) was also conducted on all listed ships.

Water samples were not collected for chemical testing at this time. However, a brief overview of water sampling procedures, methodology, and results obtained was conducted to ensure that current testing requirements by shipboard personnel (bacteriological and halogen residual) were understood, being completed, and that the water being produced onboard met current requirements.

#### **Review of Existing U. S. Navy Studies**

A review of existing U. S. Navy studies identified by Navy Environmental Health Center personnel and/or the investigator covering current water production and treatment/disinfectant technologies utilized, was done. Identified literature was limited to three studies that are restricted in distribution: *Rejection of Selected Chemical Contaminants by Reverse Osmosis Desalination Modules*; *Developmental Test and Evaluation of a Potable Water Electrolytic Disinfectant Generator*; and *Flash Type Distilling Plant Crude Oil Contamination Test*.

## **Review of Shipboard Water Production Processes**

Two methods of shipboard water production processes were identified and utilized on the ships surveyed: Flash-Type Distilling Plants and Reverse Osmosis (RO) Plants. A basic understanding of these processes was necessary to identify vulnerabilities in the system where contaminants could enter the water. One such weakness was noted in the *Flash Type Distilling Plant Crude Oil Contamination Test* study where the inability of the flash-type distilling plants to separate fuel and crude oil contamination from the final distillate product was documented.

## **Discussion of Results**

The eleven surface ships surveyed ranged in size from a frigate (USS Carr (FFG-52)) to aircraft carriers (USS John F. Kennedy (CV-67) and USS Theodore Roosevelt (CVN-71)); and in manning from 300 to over 5,000 personnel when the ships are deployed. As expected, the drinking water production and storage capacity varied according to the size and manning of the ship.

All ships surveyed (except the USS Arleigh Burke (DDG-51), which had two reverse osmosis plants) had at least two flash-type evaporator plants for the production of drinking water. The evaporators varied in size (one, two, three, and six stages) and production capacity (6,000 to 1000,000 gallons of water per day per evaporator). The flash-type distilling plants provide both drinking water and make-up feedwater for shipboard steam plants.

**Disinfection Systems.** There are two primary shipboard water disinfection systems: bromine cartridges and calcium hypochlorite. The USS Theodore Roosevelt utilized an electrolytic disinfectant generator (EDG), a relatively new technology, to disinfect water. The EDG uses brine electrolysis to produce sodium hypochlorite (NaOCL) as the disinfectant. The EDG has been identified

as a system that may be installed on all new surface ships to replace bromine and calcium hypochlorite as water disinfecting agents.

The methods of disinfecting the drinking water supply onboard ships (bromination, batch chlorination, and use of the electrolytic disinfectant generator) was found to be satisfactory. The required halogen residuals for the disinfection process were obtained/maintained (0.2 ppm after 30 minutes contact time for potable water obtained from approved sources or water produced onboard and 2.0 ppm after 30 minutes contact time for water received from an unapproved source, a source of doubtful quality, or an area where amebiasis or infectious hepatitis is endemic). Even though the focus of this study was chemical contamination, the risk of bacterial contamination was looked into. Due to the above mentioned methods of production and disinfection, the risk of bacterial contamination is minimal.

**Potable Water Tanks.** Access to potable water tanks is limited to select personnel (engineering and medical). Water tanks are usually "skin tanks" (sharing a bulkhead with the hull of the ship) and are located on the bottom and sides of the ship. Physical access to water tanks are limited to small openings (hatches) that may be located in the ship's bilge and sounding tubes (used to monitor tank levels in conjunction with mechanical/computerized tank level indicators). Some drinking water storage tanks (especially on older ships) may also share a common bulkhead with fuel/oil storage tanks and ballast tanks (which may contain sea water). The risk of chemical contamination of drinking water storage tanks due to rusting, wear/tear, and leakage between the water and adjacent fuel/oil storage tanks either through common bulkheads and/or the hatches that are covered by bilge water (the bilge collects "dirty" water, oil, hydraulic fluids, and other liquid wastes) is possible.

Another concern is the inner coating of the potable water storage tanks

(either during construction or during yard periods to repair/rehabilitate the tanks). Within the past year, two U. S. Navy ships have been identified where lead-based paint was used as the inner surface coating of potable water tanks. Even though the use of lead-based paints for this purpose is not authorized, the use has obviously occurred and the possibility of similar uses on other ships and submarines should not be ignored. Due to this fact, the risk of lead contamination of the water supply is possible.

**Sounding Tubes.** The most frequent physical access to water tanks occurs through the sounding tubes. Sounding tubes provide immediate/direct access to finished drinking water and are used to monitor water tank levels and to introduce chlorine when batch chlorinating a specific water tank is necessary. "Sounding tapes" are fed through the sounding tubes to "sound" (measure) the water levels. The sounding tapes are also designated for potable water tank use only (tapes are also utilized to "sound" fuel/oil tanks) and are required to be disinfected with a chlorine solution before being introduced to the sounding tubes/water tanks. Due to the small surface area of the sounding tapes, procedures to disinfect the tapes before use, and large quantity of water involved, the risk of chemical contamination through the use of the sounding tapes is minimal.

The sounding tubes are also required to be capped and secured (locked) when not in use and are located throughout the ship (i.e., engineering, berthing, and other common spaces). Unsecured sounding tubes were noted on a number of occasions in different spaces. Contamination of drinking water may occur through unsecured tubes with machinery-type of fluids (i.e., hydraulic, oil, fuels, etc...) in engineering spaces, cleaning solvents and dust/dirt in berthing spaces, or through accidents/intentional actions in any space. Due to the direct access of sounding tubes to the finished drinking water supply, the

risk of chemical contamination of the drinking water due to unsecured sounding tubes is possible.

**Industrial Processes.** Industrial processes that utilized chemicals and/or hazardous materials appeared to be completed in a manner that prevented and/or contained any spills. For example, parts washers (basically a dishwasher for machinery parts) utilized biodegradable detergents and were self-contained. No cross-connections with the drinking water system in the areas surveyed were noted. The numbers of chemicals and hazardous materials authorized/utilized onboard ships have also decreased dramatically the past decade and the guidelines that govern and track their use have become more stringent. The chemical contamination risk of drinking water regarding industrial processes that utilize chemicals and/or hazardous materials is minimal since these processes are separate and do not come into physical contact with the drinking water system.

**Photography.** Another area of concentration was photography processes. The large majority of film processors identified during the surveys were self-contained, stand-alone units (i.e., no direct, "hard-plumbed" water source to the processor). This type of set-up eliminates any chance of cross-connections and/or back siphonage of photography chemicals into the drinking water system. Medical processors for x-rays did have a direct water connection, however, these processors have cross-connection/back-flow prevention devices installed and/or incorporated into the design of the processor. Manual processing of film was identified on one ship. Film processing chemicals were utilized in "processing pans" and disposed of as hazardous waste once the film was developed. The chemical contamination risk of drinking water in regards to photography processes is minimal since the process is separate from the drinking water system.

**Disinfection By-Products.** Surface and ground water contain organic materials (measured as total organic carbon) that may react with disinfectants to form disinfection by-products (DBPs). As mentioned above, the source water that is routinely utilized by U. S. Navy ships and submarines are not influenced by waters that contain organic materials. However, there are situations that the source water for water production may be influenced by water containing organic material (i.e., operations in littoral waters and source/finished water contaminated with fuel, oil, or other petroleum based products).

The two methods of shipboard water production (distillation and reverse osmosis) will not remove all organic chemicals. In fact, it has been demonstrated that volatile hydrocarbons will carry-over through the distilling plants into the distillate when the sea (source water) is contaminated with low levels of fresh crude oil.<sup>3</sup> It has also been demonstrated that fuels and oils were, at best, moderately rejected by reverse osmosis.<sup>4</sup> Accumulation of disinfection by-products and therefore, total trihalomethanes (TTHMs), may be expected if these organic chemical contaminants are present. The chemical contamination risk of drinking water with disinfection by-products and total trihalomethanes is possible since the current shipboard water production methods do not remove all organic chemicals that may contaminate the source water.

**Volatile Organic Compounds/Total Petroleum Hydrocarbons.** Two studies conducted by the Naval Sea Systems Command have been identified that demonstrates that the current shipboard water production methods do not remove all organic chemicals that may contaminate the source water (sea water). In regards to the flash-type distillers, full scale distilling plant testing with crude oil contamination has demonstrated light hydrocarbons and toxic aromatic hydrocarbons will be distilled and carry over into the distillate. Light

distillate fuels such as JP-5 (jet fuel) and naval distillate (diesel fuel) will also be distilled and carry over into the final water product. Other than petroleum odors coming from the air ejector vent and oil droplets splashing on the stage port hole windows, there was no other indication of contamination occurring. Low levels of light oil and aromatic hydrocarbon carry over into the distillate, will be difficult to detect visually or by odor.<sup>3</sup>

Weathering of the crude oil on the sea surface will have an effect on the carry over of light fractions into the distillate. However, the most toxic hydrocarbons such as benzene and toluene will dissolve into the water column beneath the water slick and remain for up to two days until they are completely evaporated. Based on the results of the testing, it can be expected that one percent of the benzene and three percent of the toluene will be distilled in shipboard distilling plants and carry over into the distillate.<sup>3</sup>

Testing of reverse osmosis systems have indicated a moderate to good rejection of cyclic hydrocarbons, cleaning agents, and fuels/oils. There were several inorganic materials (cyanide, arsenic, cadmium, chromium, and magnesium) which were either poorly rejected by the reverse osmosis membrane and/or the solubility in sea water is high. The possibility exists that the materials could be present in sufficiently high concentrations to result in unacceptable levels in the final product water.<sup>4</sup>

Another consideration is while ships are transiting oil slicks, the amount of oil in the sea water that will be drawn into the distilling/reverse osmosis sea chests, and therefore, the amount of contamination that will result, is difficult to determine. Variables include depth and location of the sea chests; ship speed and formations; weathering of the oil; and thickness of the oil slick emulsion. The chemical contamination risk of drinking water with volatile organic compounds/total petroleum hydrocarbons, disinfection by-

products, and total trihalomethanes is possible. The current shipboard water production methods do not remove these type of contaminates and the possibility of the source water and/or the final water product (i.e., through indirect/direct contamination of sounding tubes, leaking water tanks, etc...) being contaminated is possible.

## **Conclusions**

Even though, drinking water produced onboard ship is of high quality there is moderate risk of chemical contamination of the drinking water production, storage, and distribution systems.

The most likely risk identified and the source of chemical contamination of shipboard drinking water is volatile organic compounds, total petroleum hydrocarbons, disinfection by-products (total trihalomethanes), and lead through the use of lead-based paints as sealants/coatings on the interior of potable water tanks.

## **Recommendations**

- Installation of additional shipboard monitoring equipment (i.e., oil content meter to monitor inlet sea water) and procedures to reduce the possibility of oil or aromatic contamination of drinking water for ships and submarines expected to operate in littoral or contaminated waters.

- Periodic testing of shipboard/submarine water tanks and distribution systems for volatile organic compounds, total petroleum hydrocarbons, disinfection by-products (total trihalomethanes), and lead.

- Testing should be accomplished immediately upon returning from major deployments and/or operations (approximately once every two years), prior to hook-up, and use of any water source foreign to the shipboard water production

plants. Estimated cost of testing is \$750 to \$1,000 per ship based on figures provided by local EPA certified labs.

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<sup>1</sup> *Naval Ships Technical Manual Library NSTM015, Chapter 531-Volume 1-Desalination Low-Pressure Distilling Plants* (February, 1999), Naval Sea Systems Command

<sup>2</sup> *Naval Ships Technical Manual Library NSTM015, Chapter 531-Volume 3-Desalination Reverse Osmosis Desalination Plants* (February, 1999), Naval Sea Systems Command

<sup>3</sup> Steck, Richard W. (1992), "Flash Type Distilling Plant Crude Oil Contamination Test."

<sup>4</sup> Pizzino, J. F. and Titus, M. W. (1983), "Rejection of Selected Chemical Contaminates by Reverse Osmosis Desalination Modules."

## Acknowledgement

The author would like to acknowledge the expert assistance of LT Rohini Suraj, MSC, USN, Head, Environmental Health Department, and Mr. Charles A. Robinson, Environmental Health Technical Development Branch of the Navy Environmental Health Center, for the opportunity to conduct this analysis. LT Suraj offered invaluable support preparing the results of the survey for this report. The author would also like to express his appreciation for the cooperation and support of CAPT Konrad E. Hayashi, MC, USN and CAPT David Hiland, MC, USN, Force Surgeons, Naval Surface Forces and Naval Air Forces, U. S. Atlantic Fleet, respectively, and their staffs, in facilitating access to the U. S. Navy ships surveyed. Without all of their help, this study would not have been accomplished.