MINUTES FROM THE EPA SCIENCE ADVISORY BOARD
Polychlorinated Biphenyl - Artificial Reef Risk Assessment (PCB-ARRA)
Consultative Panel
Face-to-Face Meeting
August 1-2, 2005

PURPOSE: The Polychlorinated Biphenyl - Artificial Reef Risk Assessment (PCB-ARRA)
Consultative Panel of the EPA Science Advisory Board (SAB) met on August 1-2, 2005 to provide non-consensus, oral advice on the human health and ecological risk assessments prepared and submitted by the U. S. Navy. The focus of the SAB consultation included the leaching studies, the PRAM, and characterization of potential risks. *Attachment A* is the Federal Register notice announcing the teleconference (70 FR 8, January 12, 2005). A meeting agenda is included as *Attachment B.*

LOCATION: SAB Conference Center, Woodies Building, 3rd floor, 1025 F St., NW, Washington, DC

DATE AND TIME: August 1-2, 2005, 8:30 - 5:00 pm Eastern Time.

PARTICIPANTS: The following individuals participated in this meeting: PCB-ARRA Consultative Panel Members - Dr. Joan Rose (CHAIR), Dr. Gregory Biddinger, Dr. James Bus, Dr. David Dzombak, Dr. Taylor Eighmy, Dr. Dale Hattis, Dr. Randy Maddalena, Dr. Michael Newman, Dr. Gary S. Sayler, Dr. Laura Steinberg, Dr. Thomas Theis, Dr. Timothy Thompson, and Dr. Lauren Zeise. The Consultative Panel roster is included as *Attachment C* and a set of biographical sketches is included in *Attachment D*. SAB Staff - Dr. Vanessa Vu, SAB Staff Office Director, Dr. Tony Maciorowski, Associate Director for Science and Dr. Sue Shallal, Designated Federal Officer (DFO); Other Participants – A sign-in sheet indicates that approximately 50 others were also present, including EPA Staff, Navy Scientists and members of the public *(Attachment E)*.

MEETING SUMMARY: The meeting followed the agenda (*Attachment B*). Each of the 5 documents examined by the PCB-ARRA Panel was described by the Navy Scientists and a discussion by panel members followed (1-Investigation of Polychlorinated Biphenyl Release-Rates from Selected Shipboard Solid Material Under Laboratory-Simulated Shallow Ocean (Artificial Reef) Environments, June 2005 (Draft Final); 2- Time Dynamic Model (TDM) Documentation, May 2005 (Draft Final); 3- Prospective Risk Assessment Model (PRAM) Documentation Version 1.4, May 2005 (Draft Final); 4- Ex-ORISKANY Artificial Reef Project Human Health Risk Assessment, June 2005 (Draft Final); 5- Ex-ORISKANY Artificial Reef Project Ecological Risk Assessment, June 2005, (Draft Final)). The discussion of the charge questions were lead by panel members as indicated in *Attachment F*. A summary of the panel's comments and a compilation of individual panel comments are appended to these minutes *(Appendix A and B, respectively).* A summary of the meeting follows.

Convene the Meeting and Introductory Remarks – Dr. Suhair Shallal, Designated Federal Officer (DFO), opened the meeting at 8:30 pm and gave an overview of SAB procedures for panel formation and then outlined the purpose of this meeting, namely to provide oral advice for the Navy's preliminary human health and ecological risk assessments associated with the presence of non-liquid PCB on a vessel to be deployed as an artificial reef. Dr. Shallal then introduced Dr. Joan Rose, Chair of the PCB-ARRA Consultative Panel to proceed with the agenda.

Dr. Rose gave Dr. Maciorowski of the SAB Staff Office an opportunity to make his welcoming remarks. Dr. Maciorowski thanked Dr. Rose for her willingness to serve as Chair of PCB-ARRA Consultative Panel and thanked the other Panel Members for taking time from their busy schedules to participate in this consultation. Dr. Rose then reviewed the agenda and asked panel members to introduce themselves. She then introduced the first speaker, Ms. Wendy Cleland-Hamnett.

The purpose of the PCB permit

Ms. Cleland-Hamnett presented the Agency's process for reviewing the Navy's request to deploy a vessel as an artificial reef off the coast of Florida (*Attachment G*). She also explained that this is a precedent-setting endeavor. The panel was asked to give their advice and recommendations regarding the scientific soundness of the Navy's ecological and human health risk assessments and the related models.

She explained that under the mandate of the Toxic Substances Control Act (TSCA), the Agency must determine the risk associated with the release of PCBs before issuing a permit for sinking the Navy vessel. There will be 700 lbs of PCB left on the vessel when it is deployed. This assessment is precedent-setting and will be important to future decisions regarding 12 other ships that have been identified for possible deployment as artificial reefs.

Presentations by Navy scientists

Bill Wild (SPAWARSYSCEN – SD)

He introduced the scientists that have contributed to the development of the PRAM and TDM models, as well as, the human health and ecological risk assessments. He provided a summary of the Navy's effort and outlined the major milestones (*Attachment H).*
He stated that the ex-Vermillion was sunk 18 yrs before this current study was undertaken. He also indicated that several MARAD ships may be reefed. In the case of the Oriskany, all liquid PCBs have been removed; the major source of PCBs still remaining is the insulation for the electrical cables. The removal of all electrical cables is cost prohibitive.

He stated that this effort was the result of a collaboration between state, federal and local officials, including the U.S. Navy (NAVSEA, SSC-SD, NEHC, Contractors), EPA - OPPT, EPA – Region 4, EPA – ORD, State of South Carolina, State of Florida (FWCC, DEP, DOH), and Escambia County (Florida).

Beth Freize reiterated that it is costly to remove PCBs in older ships.

Maria Doa of OPPTS confirmed that MARAD was interested in reefing some of their ships.

In reply to a question regarding the removal method for liquid PCBs, Tom Pape of CACI responded that liquid PCBs, such as hydraulic fluid and other lubricants, had been removed by repeat flushing procedures until the samples produced no detectable levels of PCBs.

Robert George, Ph.D., PCB-LRS Principal Investigator SPAWAR (Attachment I)

Dr. George presented the methodology and results of the leach rate study (LRS). He was asked whether the issue of variability of PCB (i.e., in cable) was addressed. He indicated that the historic distribution of materials can be found in the Leaching Study document.

He also stated that most cables on board the ship are in tact and as indicated in the report the Mass-Balance was within 20%. He explained that a 1 Liter volume of ASTM (American Society for Testing and Materials) sea water was used and the cable sample was enclosed in a "cage" device so as to not lose any of the cable pieces during the course of the experiment. He further explained that a single sample of cable was followed over time. Panel members expressed concern that one sample of cable was analyzed and that this does contribute to the uncertainty surrounding the variability of PCB concentrations and rate of release from the cable insulation. It was also noted that biodegradation was not addressed in this study.

Ken Richter, Ph.D., biological oceanographer SSC – San Diego

He presented the conceptual site model for time dynamic model (TDM) which models the advective dispersal of initial PCBs in all directions in a stratified water column (*Attachment J).* The TDM relies on first order kinetics reaching matrix equilibrium in 24 hours, partially reversible adsorption in sediment, concentrations averaged in annuli. He also presented the following representative model output for total PCBs: 10-15 in water, 10-12 in sediment outside ship; about 103 higher inside the ship. In two years 873 g PCB released, < 1 g stays in model domain

PRAM values are used as the inputs for TDM (i.e., TSS total suspended solids, DOC dissolved organic carbon). The DeToro 1982 manuscript (p. 5) was used to obtain desorption coefficients.

Cheryl Warren, Ph.D., P.E., Senior Modeler, URS Corporation

She presented the PRAM design (*Attachment K).* The PRAM is based on an ellipse

equation. The quadric equation is used to solve for the distance *i* for any ZOI selected (Fig 13). Moving from ZOI 1 to ZOI 2, the concentration does not double. ZOI is based on foraging and habitat requirements (i.e., ZOI of 2 (14.7 m) for reef-associated species (near-field foraging) and ZOI of 5 (48.9 m) for less reef-associated species). The pycnocline is 5 feet above the top of the ship and open areas are considered exterior

The Ex-VERMILLION may not be suitable for comparison site due to several unknowns including, PCB load estimates, types of materials, and PCB concentrations.
PRAM (1.4) has undergone some recommended changes, such as, a Pycnocline, to concentrate PCBs in lower water column, more trophic levels for representative fish, based on dietary and habitation preferences and upper-bound fish exposure estimated by using ZOI of 2, to account for high reef-fidelity fish.

Robert K. Johnston, Ph.D., SPAWARSYSCEN - SD

Dr. Johnston presented the PRAM evaluation methodology (*Attachment L)*. He stated that the model evaluation criteria showed that the outputs from PRAM are plausible and reasonably good estimates (conservative) of exposure (i.e., BAFs followed expected behavior, Biomagnification Factors agreed with literature values, Food Web Magnification Factors agreed with literature values)

He also mentioned that the PRAM only evaluates potential toxicological effects from PCB exposure. The benchmarks and evaluation criteria are based on the ecorisk assessment performed for the ex-VERMILLION.

He concluded that it was unlikely that PCBs released from sinking the ex-ORISKANY to create an underwater reef will harm the environment.

PCB-ARRA panel members expressed some concern regarding the inputs to PRAM. They are based on the leaching experiments which may not be representative of actually leaching concentrations. Panel members suggested that a monitoring study be initiated after sinking the Ex-Oriskany.

Higher concentration experiments should be conducted or assume that PCB levels are at lubricant concentrations.

There are different ways to deal with the heterogeneity of samples. Dr. Newman offered a reference (Richard Gilbert et al) – he reiterated that one sample is not satisfactory. He continued stating that more samples may be done in a specific way-

-Leaching data can be gathered from monolithic leaching, wash off domain and a depletion domain.

Dr. Dzombak wondered about the representativeness of the sample used in the leaching study. He also stated that contamination from the liquid PCBs due to spills is probably a

cause of variability. The clean up during the remediation process removed contaminated parts and retested them.

He asked if there was any vendor information. Navy scientists replied there was no information on the percentage of content on the inventory. There was also the issue of retrofitting that may have occurred over time and the addition of upgrades.

In addition the linear length of cable is not available, only the weight of the cable is known. There is 1242 lbs to 700 lbs of PCB left on board. The removal of cable is very expensive.

Dr. Dzombak also stated that rate variability is an issue– the zero detects are not real and the use of a single sample is not adequate. He added that there are 209 leaching behaviors occurring at the same time and more experiments are needed so as not to rely on a single point. The use of a "cage" introduces other issues i.e., corrosion. PRAM should be tested by doing more monitoring after sinking. The mobilization of PCB by degradation by biofilms and other fouling organisms is a concern. Biodegradation fate information would be helpful for public confidence.

In the discussion of the TDM, Dr. Steinberg stated that the documentation is not well developed.
How the water flow occurs is unclear p 6-7 and the equations are needed.
Irreversibility issue should be further discussed and she offered other references to be included, i.e., Schwinn et al and Ball et al.

The speed of current and the geometry of the vessel should be included to more accurately predict PCB release.

A sensitivity analysis should be done. The development of acute and subacute estimate is the reason for this model- it may be underestimating the actual release by using crude assumptions.

Since there is particle settling, DOC, suspended solids, etc., this is a transient model- why use equilibrium?

Dr. Dzombak and others agreed that hydrodynamics are not well modeled in the TDM and PRAM.

Feeding habits of the fish in the area need to be better elucidated, as well as, where fish feed downstream or upstream from the movement of PCBs.

If other ships are sunk within 6000 mi, can this model handle these issues?

More of the uncertainty needs to be included in the PRAM and some validation procedures should be established. Data from ex-vermillion can be used and the methodology described by

Beckett of Athens, GA may be applied. This is a weight-of-the-evidence validation.

Table 10 vs Table 11 numbers need to be corrected.
Section 3 should come to the front and a reordering of some of the information would be helpful

The food web does not discuss bacteria and this needs to be included. There are references cited and are not found in the back of the document. There should be more transparency as to why certain numbers are used. Using probabilistic modeling early in the process would be helpful.

The meeting adjourned at approximately 5:20 PM.

Tuesday August 2, 2005

The meeting resumed at 9:00 AM

Jim Garrison, Ph.D., Senior Risk Assessor, URS Corporation

Dr. Garrison presented the human health risk assessment approach (*Attachment M)*. He began with the Site Conceptual Exposure Model (SCEM) and discussed the fish ingestion scenario that was used. He stated that they had applied standard EPA methodology using point estimates.

Adult and children exposure was considered including recreational anglers for a 30-yr exposure time period (30 yr exposure = residence value). The PRAM was used to model chronic exposure and the TDM for subchronic exposure

A survey of 5 reefs provided the data on the type of fish and amount of fish available. The Tox values were taken from IRIS and HEAST. There are no acute tox values for PCBs and multiple sources were not considered.

Total PCBs = Σ PCB homologs , PCB 126 not found in the leach studies.

All cancer risk was between 10^{-6} and 10^{-4}

Dr. Zeise asked if a breast fed infant scenario was also considered. She explained that the Monkey study for alachlor looks at breast feeding and has data.

Dr. Bus stated that the first 2 yr release will not contribute to exposure. He further suggested that there are other sites available to evaluate some of the fish burden (Japanese fleet, Andrea Doria).

Dr. Hattis added that the release rate from cable insulation is driving the risk numbers.

Dr. Maddalena concluded that how the ship is prepared before sinking will determine the extent of leaching.

Zeise reiterated her concern that a breast milk exposure is an important pathway. He also noted that the fish consumption values used in HHRA are similar to the general population values.

Dr. Bus noted that the diver scenario qualitative assessment is reasonable. When there is an absence of dermal absorption values, then use dose / surface area and use quantitative assessment to frame the uncertainty.

Panel members added that congeners can be assessed at other artificial reef sites; however it is hard to discern ship associated PCBs from those of other sources. Degradation of surface by bacteria on the interior should also be assessed.

Modeling of the amount of loading to the environment should also be considered- i.e., calculate the amount binding to sediments, released to air, etc

Dr. Zeise added that the caveats in the IRIS documents should be included and an MOE approach may be useful.

When Tim Thompson asked if a probabilistic risk assessment approach should be extended to the HHRA, Dr. Hattis, Maddalena and Zeise agreed that the exposure component of the HHRA can be done using a PRA approach.

Dr. Robert K. Johnston, SPAWARSYSCEN - SD

The Ecological risk assessment was presented next by Dr. Johnston (*Attachment P)*. He stated that only toxicologic effects were considered. He presented the conceptual model food chain.

The effects from bioaccumulation were examined using TSV (tissue screening value) and NOED-LOED (no effect dose- low effect dose).

PRAM was not intended to evaluate Ecological Risk

There were some concerns regarding the ERA expressed by panel members. They noted that tissue concentration is not an endpoint- it is a measure of exposure. They suggested that the concentration should be related to a toxic effect. Dr. Newman and others noted that the use of HQ <1 in increments is not necessary and was uninformative.

Panel members also indicated that the food chain was incomplete and bacteria need to be included. There should also be an attempt to include a discussion of the benefits of

artificial reefs, i.e., risk – benefit analysis.

Panel members suggested that juvenile fish should be included in the risk assessment. Species that feed on surface of the ship and the crustaceans must be included as well.

Dr. Newman suggested that the Ecological Risk Assessment for the Housatonic River which includes turtle data could be used to inform the Navy's risk assessment. Swatkin et al is a good reference. Information regarding estrogenic effects of PCBs for turtles and immunocompetence of marine mammals should also be included.

A discussion of AhR-mediated effects of PCBs is needed and more details regarding PCB biomagnification.

Panel members reiterated that HQ (hazard quotient) splitting is not informative and the PRAM should be updated to perform PRA. In conclusion, panel members agreed that when more ships are sunk- a probabilistic risk assessment should be used. A monitoring program to gather more data associated with each sinking should be undertaken.

Dr. Rose presented a summary of the comments from panel members. Dr. Rose invited panel members to make edits and revisions to her summary by sending their suggestions to Dr. Shallal. Those revisions would be incorporated and a revised summary would be provided to all panel members. The final revised summary can be found in appendix A.

Meeting Adjournment – Dr. Shallal stated that she would send an e-mail to all panel members reminding them of the items requested and their due dates, as agreed. The meeting was adjourned at approximately 1:00 pm.

Respectfully Submitted:

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Dr. Suhair Shallal
Designated Federal Officer,
EPA SAB PCB-ARRA Consultative Panel

I certify that these minutes are accurate to the best of my knowledge:

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Dr. Joan Rose
Chair,
EPA SAB PCB-ARRA Consultative Panel

APPENDICES

Appendix A	Summary of Panel Comments
Appendix B	Individual Panel Comments

ATTACHMENTS

Attachment A	Federal Register notice (70 FR 8, January 12, 2005)
Attachment B	Meeting Agenda
Attachment C	Panel Roster
Attachment D	Panel Biographical sketches
Attachment E	Sign-in sheets – available upon request
Attachment F	Charge Assignments
Attachment G	Powerpoint presentation by Wendy Cleland-Hamnett
Attachment H	Powerpoint presentation (overview) by Bill Wild
Attachment I	Powerpoint presentation (LRS) by Robert George
Attachment J	Powerpoint presentation (TDM) by Ken Richter
Attachment K	Powerpoint presentation (PRAM) by Cheryl Warren
Attachment L	Powerpoint presentation (PRAM) by Robert K. Johnston
Attachment M	Powerpoint presentation (HHRA) by Jim Garrison
Attachment N	Powerpoint presentation (ERA) by Robert K. Johnston