

**REPORT PREPARED FOR THE PURPOSE OF PROCEEDINGS  
IN THE ADMINISTRATIVE APPEALS TRIBUNAL**

<b>File No(s):</b>	N 1149 OF 2010
<b>Applicant:</b>	NO SHIP ACTION GROUP, INC
<b>Respondent:</b>	MINISTER FOR THE ENVIRONMENT HERITAGE AND THE ARTS  STATE OF NEW SOUTH WALES
<b>Report prepared by:</b>	STEVEN M. PAULSEN

- I have attached my CV or included in the report details of my qualifications and/or experience.
- I have attached the letter of instruction or included in the report details of the questions or issues that I was asked to address and a reference to any documents or other materials that I was given to consider.
- I have included in the report details of the facts and any assumptions that inform the report.
- I have included details of the sources for the factual information in the report.
- I have included any other relevant matters such as details of examinations, tests and other investigations that I have relied upon or details of literature and other secondary sources that I have relied upon.

**Declaration**

I acknowledge that I have an overriding duty to provide impartial and independent assistance to the Tribunal. No matters of significance have been withheld from the Tribunal.

  
(Signature)

April 13, 2010

## INTRODUCTION

Please find below my expert opinion on the ex-HMAS Adelaide conditions of PCB containing items.

The following information is attached:

Annexure A – Resume

Annexure B – Letter of Instructions

Annexure C – Sampling ships for PCBs regulated for disposal

### 1. **Likely location of PCBs on the HMAS Adelaide prior to the ‘preparation’ for sinking described in the REF and the URS Report**

This vessel would be very similar in construction to other US vessels upon which I have conducted PCB containing items (PCB items) surveys in the past due to the fact that construction began in 1976 and was completed in 1978 in Seattle, WA, USA. Previously, I have identified PCB's in electrical cables; ventilation gaskets; stuffing tube packing (hub putty); bulkhead insulation; sound deadening; fiberglass pipe insulation; cork insulation (pipe or refrigerated units); rubber pipe insulation; rubber or plastic isolation mounts; caulking; self sticking labels, tapes, pins or hangers; watertight door gaskets; felt pipe hanger inserts; pipe gaskets; paint; grease; lube oil; hydraulic oil; electrical ballasts; electrical transformers; and sump sludge/water. The USEPA<sup>1</sup> also lists a few PCB items which I have not encountered: voltage regulators, switches, reclosers, bushings, electromagnets, carbonless copy paper, and floor finish.

This is quite an expansive list of items which may contain PCB's and all of which should have been removed from the vessel prior to sinking. At minimum; a random, category sorted sampling scheme should be used to collect samples of the non-liquid suspect PCB items. Subsequent removal and proper disposal of the PCB item groups must be completed prior to scrapping or reefing of the vessel.

The documentation which has been provided to me does not indicate that testing or removal of all of the suspect PCB items has been completed.

The Australian Government Department of Defence letter to Mr. John O'Reilly titled **TRANSFER OF INFORMATION ASSOCIATED WITH HANDOVER OF EX-HMAS ADELAIDE** enclosure 5. List of compartments containing Polychlorinated Biphenyl and Beryllium identifies 4 compartments which have power cabinets, high power components and power supply. This is the Department of Defence disclosure of where they admit knowing there are PCB items, I do not believe that this should be inferred as a list of the only PCB items left on the vessel.

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<sup>1</sup> [www.epa.gov/wastes/hazard/tsd/pcbs/pubs/about.htm](http://www.epa.gov/wastes/hazard/tsd/pcbs/pubs/about.htm)

**2. Likely location of PCBs on the HMAS Adelaide after the ‘preparation’ for sinking described in the REF and the URS Report (Polglaze)**

The URS report<sup>2</sup> states “Electrical and electronic systems and fittings have been virtually totally removed from the ship. All cathode ray tubes and thermionic valves have been removed. Electrical cables have largely been removed, with remaining cable in these area limited to small offcuts where cable runs pierce bulkheads and deckheads.”

I have concerns about the “virtually totally removed” sentence. This does not indicate to me that the systems and fittings have been totally removed, else why would there be a limiting adjective used in a permit application? This statement allows me to believe that systems and fittings are not totally removed. The third sentence in the URS permit application actually states that electrical cables have been left on board the vessel.

The URS permit application relies on The Australian Government Department of Defence letter to Mr. John O’Reilly titled **TRANSFER OF INFORMATION ASSOCIATED WITH HANDOVER OF EX-HMAS ADELAIDE** enclosure 5. List of compartments containing Polychlorinated Biphenyl and Beryllium as a statement that these are the only areas on board the vessel that PCB items are located. The URS permit application does not relate any sampling and analysis for PCB’s except an AIRSAFE report.

There has not been any documentation sent to me which discusses whether there has been any sample collection or analysis of suspect PCB items. There has not been any documentation sent to me which discusses removal of suspect PCB items without sampling and analysis. Based on the documents which I have received, I would have to believe that all suspect PCB items on the vessel still remain on the vessel with the exception of a majority of the electrical cables.

**3. PCB testing conducted by AIRSAFE for McMahon Services Australia (detailed in the AIRSAFE report of 3 March 2010).**

The AIRSAFE TEST REPORT pages 2-6 of 12 describe the samples as “Insulation” from various locations as described in the document, but the ENVIROLAB analysis is reported as “PCB in Swab”. Did the laboratory analyze swab samples which they collected from the “Insulation” samples? Or did the original collector collect swab samples? The reports do not contain signatory chain of custody forms, which usually have columns and rows in a table for sample identification, type of sample, size of sample, analysis requested, location of sample, date sample collected, preservative used, temperature upon receipt by the lab, etc. I believe that this AIRSAFE TEST REPORT contains inadequate data to determine whether this sampling and analysis has any relevance to PCB content in insulation on the vessel.

Identification of PCB in insulation should include the collection of a bulk sample of the material to be tested. This sample should include the full depth of the material and any coverings, paint, adhesives, and markings on the material. A swab sample collected from the surface of the insulation would only give a result of surface contamination (which is also possible, especially in electric/electronic/mechanical maintenance areas or workshops). If the intent of the sampling and analysis is to determine if the insulation contains PCB’s, then it must be a bulk sample submitted to laboratory.

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<sup>2</sup> URS (2010) report regarding ex-HMAS Adelaide; Artificial Reef APL

#### 4. Characteristics of a sampling program that would adequately determine the presence or absence of PCBs on the HMAS Adelaide after 'preparation'

All suspect PCB items should be removed, this may seem to be a cost prohibitive method. This determined a need for random, stratified sampling scheme must be used for sampling suspect non-liquid PCB items. A stratified system categorizes the suspect PCB items by type, use, or category and subsequently renders the number of samples to collect from that category, type, or use (**Strata**). The basis for this sampling scheme is the technical policy document produced by the Operations Branch in the Chemical Management Division of USEPA entitled SAMPLING SHIPS FOR PCBs REGULATED FOR DISPOSAL (SSPRD, see Annexure C) . This document was not intended to be used after the PCB regulations proposed on December 6, 1994 were finalized, but there have been no further recommendations for a more advanced sampling scheme.

In practice, I use a modified stratification scheme and I also have modified the numbers of samples collected as outlined out by the SSPRD. The SSPRD's original sampling and stratification method relies on the total displacement weight of the vessel. The formula laid out in the SSPRD is to use the gross ton weight square root of the vessel to calculate the number of samples collected. The Adelaide is 4100 tons with the square root of 4100 equaling 64 total samples collected. The SSPRD (at page 11) defines the Strata as follows:

- Stratum I: electrical cable samples collected at the rate of 0.4 of square root of tons;
- Stratum II: ventilation gaskets samples collected at the rate of 0.4 of square root of tons; and
- Stratum III: other known sources of non-liquid PCBs including the miscellaneous plastics, rubbers, insulation, sound deadening, etc – samples collected at the rate of 0.2 of square of tons.

In the modified stratification scheme that I use, the Strata are as follows:

- Stratum I would be electrical cable samples at .4 of the total 64 equaling 26 samples. My modification at this point is based on past results, specific vessel repair and refit information, and cost. I will either assume that all electrical cable with an outside diameter of 7/8 inch SAE ( 2.22 cm) and greater is PCB containing and collect 26 samples of cable with a diameter smaller than that or collect 52 samples with 26 collected larger than and 26 collected smaller than.
- Stratum II is paint samples collected with 26 samples collected and analyzed, concentrating on mechanical and electrical spaces and electric/electronic/mechanic repair spaces. This Stratum is not included in the original guidance document.
- Stratum III is ventilation gaskets with 26 samples collected (I go back to following the original guidance document).
- Stratum IV includes the nine substrata of miscellaneous rubbers, plastics, felt, foam, cork, insulation, sound deadening, etc. I again leave the original guidance document by collecting 26 samples rather than 13 (.2 of 64).

This brings us to a total of 104 samples (130 if sampling large electrical cable) collected and analyzed for a vessel the size of the Adelaide. This is an example of the methodology I use for sampling ships at this time.

Since the Adelaide has been partially dismantled the sampling and analysis plan would need to be modified to meet the materials which remain on the vessel, however I would begin with the example outlined above.

I do not have any documentation before me which identifies that sufficient sampling and analysis occurred to determine if the Adelaide is PCB free or not. The only sampling and analysis I am aware of is the AIRSAFE TEST REPORT which I discussed in a previous paragraph.

**5. Possibility of PCBs leaching into the environment, if the vessel were sunk in its current condition**

The URS permit application states “Electrical cables have largely been removed, with remaining cable in these area limited to small offcuts where cable runs pierce bulkheads and deckheads.” Unless these cables were sampled and analyzed to not contain PCB’s, then the likelihood of PCB’s leaching into the environment is very probable.

There is also no documentation that the items listed by The Australian Government Department of Defence letter to Mr. John O’Reilly titled **TRANSFER OF INFORMATION ASSOCIATED WITH HANDOVER OF EX-HMAS ADELAIDE** enclosure 5. List of compartments containing Polychlorinated Biphenyl and Beryllium were removed. There is also a strong possibility that these items could leach PCB’s into the environment.

I find that there is insufficient documentation that suspect PCB items were sampled and analyzed or removed in their entirety to provide assurance that PCB’s would not be aboard the vessel and leachable to the environment.

# SAMPLING SHIPS FOR PCBs REGULATED FOR DISPOSAL

## I. Introduction

At the request of the United States Environmental Protection Agency's (EPA's) Federal Facilities Enforcement Office and the EPA Regional PCB Coordinators, this technical policy document was prepared by the Operations Branch in the Chemical Management Division to provide an interim method of determining whether polychlorinated biphenyls (PCBs) have been removed from ships (vessels). The determination is necessary to enable a vessel containing no PCBs regulated for disposal to be exported for purposes of metal recovery. This temporary interim policy is different from the provisions addressing the export of PCBs in the December 6, 1994 proposed amendments to the PCB regulations at 40 CFR 761. Differences between this temporary interim technical policy and the proposed regulations are based on the request from the enforcement program and the EPA Regional offices. Unless otherwise designated in writing from EPA's Office of Enforcement and Compliance Assurance, this policy is no longer in effect at the finalization of the relevant amendments to the PCB regulations proposed on December 6, 1994.

## II. Purpose

This policy addresses management of PCBs and/or PCB items regulated for disposal known or suspected to be on board vessels destined for scrapping for purposes of metal recovery/recycling. This guidance is self-implementing. There are notification and recordkeeping requirements, however, no EPA PCB disposal approval is required to carry out the scrapping procedure. EPA may determine that information sent in the notification is incomplete and retains the right to request complete information as required in the notification.

This policy provides two options for shipbreakers or scrappers to remove PCBs from a vessel.

- (1) All known sources of liquid PCBs, defined in IV. below, and all known uses of non-liquid PCBs, defined in V. below are removed. No sampling or measurements are required for this removal).

(2) Use this policy to sample the vessel and chemically analyzing the samples for the presence of PCBs to determine whether PCBs at concentrations regulated for disposal are present on the vessel. Scrappers can opt either to: (a) sample all items suspected to contain PCBs in all classes of uses of non-liquid PCBs (called Strata in VI.c.(2)(B)(ii)(c) below); or (b) in place of sampling and analysis of items in all classes known uses of PCBs, scrappers may utilize this policy to remove some classes of uses of non-liquid PCBs and sample all other classes.

*As an example of (2)(b), assume that for economic reasons, a scrapper decided to remove and dispose as regulated for disposal all electrical cable, because in his/her experience a sufficient proportion of the cable is regulated and the expense of sampling and analysis would only confirm that all cable would be regulated or the sampling and analysis costs to determine which cable was regulated exceeded the economic benefit from identifying regulated and non-regulated cable. Once the electrical cable was removed and disposed as regulated PCBs, the scrapper would still be required to either remove all other known use strata (air handling system gaskets and other known uses [other than cable and air handling gaskets]) or sample to determine whether there were regulated PCBs in these other known uses of non-liquid PCBs.*

This policy does not address any other potentially regulated material such as asbestos, lead, or any material considered hazardous under the Resource Conservation and Recovery Act.

### III. Notification

At the point of sale of a vessel for scrap metal recovery, the owner or sales office which sells a vessel for scrapping shall notify the EPA Regional PCB Coordinator, where the vessel is berthed at the time the bid is accepted, of: a) the time the vessel will be moved from its storage berth to the scrapping point or storage point for scrapping, and b) the intended future location of storage prior to scrapping and the scrapping location.

At the point of sale, the purchaser of the vessel for scrapping shall notify the EPA Regional PCB Coordinator(s), where the vessel is to be stored prior to scrapping and where the vessel is to be scrapped, of: a) the time the ship will be moved from the berth to the storage for scrapping and scrapping location; b) the location(s) of storage and scrapping; c) the date of arrival at that (those) location(s); d) the proposed time period of the storage and scrapping activities; e) the business address and phone number of a responsible party from the sales office who can provide the status of the sale/scrapping activity; and f) the business address and phone number of a responsible party from the scrapper who can provide information on the status of the storage/scrapping activities.

Thirty calendar days before starting the scrapping activity, a scrapper shall provide the EPA Regional PCB Coordinator(s), where the vessel is to be stored and/or scrapped, with:

- a) A map showing the location of the storage facility and scrapping location;
- b) The scrapping plan which details on the identification of known sources of PCBs on the vessel.
- c) A floor (deck) plan for each deck of the vessel showing the location(s) of PCBs to be removed; and
- d) The schedule for scrapping of the ship, including: 1) the estimated date that all PCBs will be removed from the ship; 2) the estimated date all PCBs greater than or equal to (≥) 50 parts per million (ppm), which are removed from the ship and placed in storage, will be removed from storage and sent for PCB disposal, 3) disposal method and company to be used for each kind of PCB waste ≥50 ppm, and 4) the PCB removal equipment decontamination procedures and schedule.

At any time, EPA inspectors shall have the option of inspecting any vessel during a PCB removal activity which is part of scrapping.

#### IV. Liquid PCBs

## **Known sources of Liquid PCBs**

Known sources of liquid PCBs potentially on board vessels are: electrical equipment - including transformers, capacitors, fluorescent light ballasts, voltage regulators, circuit breakers, liquid-filled cable, reclosers, rectifiers; hydraulic equipment; heat transfer fluids; vacuum pump oil; air compressor lubricants; cutting oil; and grease.

## **Management and Disposal of Liquid PCBs**

Prior to beginning scrapping operations, all PCB items or equipment on board the vessel containing liquid PCBs at concentrations  $\geq 50$  ppm shall be removed from the vessel and be disposed in accordance with the PCB disposal regulations at 40 CFR 761 Subpart D. Accumulations of small capacitors present in fluorescent light ballasts and electronic equipment, which may be disposed of as municipal solid waste under 40 CFR 761, may be addressed under the Comprehensive Environmental Response, Compensation, and Liability Act minimum reportable disposal quantity regulations.

Impervious solid surfaces, (as defined at 40 CFR 761.123) which are contaminated with liquid PCBs, shall be cleaned to less than 100 micrograms per 100 centimeters square ( $< 100 \text{ } \mu\text{g}/100 \text{ cm}^2$ ) PCBs.

Non-impervious solid surfaces, (as defined at 40 CFR 761.123) which are contaminated with liquid PCBs, shall not be evaluated for PCB removal by a surface sampling test, but cleaned to  $< 50$  ppm, as measured by a core or scrape sample, if the solid will be recycled by smelting. If the solid will be recycled but not smelted, the PCB cleanup level is  $< 2$  ppm, as measured by a core or scrape sample.

## V. Non-Liquid PCBs

### **Known Sources of Non-Liquid PCBs**

Known sources of non-liquid PCB materials in vessels are non-conducting materials in electrical cables (such as plastic and rubber), gaskets in air handling systems, other rubber gaskets, other felt gaskets, thermal insulation material (including fiberglass, felt, foam, and cork), sound deadening felt, oil-based paints, grouting/caulking, adhesives, tapes, rubber isolation mounts, foundation mounts, pipe hangers, rubber/plastic parts of all sizes and shapes, and any other materials where plasticizers were used.

For purposes of this policy, paints and other thin coatings on metal will not be required to be removed if the coated metal will be smelted.

### **Management and Disposal of Non-Liquid PCBs**

The concentration of PCBs in electrical cable shall be based on the concentration of PCBs in each non-metal, non-liquid component of the cable individually. The concentration of PCBs in electrical cable shall not be based on the total weight of PCBs in the cable divided by the total weight (a) of all non-metal components, (b) of all metal components, or (c) of all non-metal and metal components. If one non-metal component of the cable is regulated for disposal, the entire cable is regulated for disposal. Separation of PCB materials ( $\leq 50$  ppm PCBs) from non-PCB materials (less than 50 ppm PCBs) for purposes of disposal of PCBs and/or deregulation of metal (for purposes of PCB disposal) shall be in accordance with the approval requirements in 40 CFR 761 Subpart D. PCBs  $\geq 50$  ppm which are removed from the vessel are regulated for disposal and are subject to the requirements for storage and disposal at 40 CFR 761 Subpart D.

## VI. Sampling to Verify that PCBs Have Been Removed from a Vessel

In the event that all of the following known sources of non-liquid PCBs:

non-conducting materials in electrical cable; gaskets in air handling systems, rubber gaskets (other than air handling system gaskets); felt

gaskets (other than air handling system gaskets); thermal insulation material (fiberglass, felt, foam, cork, etc ); sound deadening felt; oil based paints in containers (not paint applied to surfaces of the vessel); grouting/caulking; adhesives; tapes; rubber isolation mounts; foundation mounts; and pipe hangers

have not been removed from a vessel during scrapping, the following plan shall be used to sample a vessel to verify that there are no PCBs at concentrations  $\geq 50$  ppm in these uses left on a vessel when it is exported. EPA has not designated a method for removal of PCB uses from a vessel. Appendix 1, EPA has designated and required the chemical analysis including extraction procedures for verifying that there are no PCBs at concentrations  $\geq 50$  ppm remain on the vessel, either after removal of PCBs or verifying an the assumption that no PCBs need to be removed. These same procedures shall be used for determining PCB concentrations for purposes of identifying disposal status with respect to 40 CFR 761.

a. Certification

At least thirty days prior to the date of exporting the vessel or, if not exporting, domestic smelting, the President or Chief Executive Officer (CEO) of the scrapping company shall notify the EPA Regional PCB Coordinator, in the EPA Region where the vessel to be scrapped is located, of the intended date of export /domestic smelting. Fourteen days prior to the intended date of export the CEO shall file a certificate with the EPA Regional Administrator having jurisdiction where the scrapping occurs, stating that:

- all known PCB liquids have been removed from the vessel;
- any kinds of liquids listed in IV. (above) which have not been removed from the vessel but which could contain PCBs based on their use have been analyzed for PCBs and found to be less than 50 ppm and are not the result of dilution following the sale of the vessel;
- uses listed in "Known Sources of Non-Liquid PCBs" (V. above) have been sampled according to the attached plan and extracted and chemically analyzed according to procedures listed above in Appendix 1

(Determination of the PCB Concentration in Non-Liquid PCB Uses), and none of the samples had PCB concentrations  $\geq 50$  ppm and none of the materials contain  $< 50$  ppm PCBs as the result of dilution following the sale of the vessel; and

- records and documentation of sampling and analysis will be maintained for five calendar years at the scrapping location following completion of the last chemical analysis or the day of the last PCB removal activity which ever is later. In the event that the scrapping company, which is keeping these documents and records, ceases business operations before the end of the five year period, the records and documentation shall be sent to the EPA Regional PCB Coordinator. In the event that a scrapping company changes address or becomes part of another company, the company shall notify the EPA Regional PCB Coordinator of any new location where the records and documentation will be kept.

b. Records of the Sampling and Analysis Results

The sampling and analysis results for all samples taken to verify that PCBs have been removed shall be maintained for EPA inspection. Results should be listed two ways: by individual sample and by sampling scheme stage (how the sample was selected in the sampling plan).

The information required for the each individual sample listing is at a minimum: a unique sample identification number; the kind of material or item sampled; the location where the sample was collected (the deck on the vessel and frame number or the distance from the bow of the vessel to the sample location); the date the sample was collected; the sample collector; the amount of sample collected; the analytical procedure used; the PCB concentration in the sample; and the limit of quantitation for the chemical analysis.

For each step in the sample selection process the unique samples selected shall be listed in categories according to the outline of VI.c.(2)(B)-(D) below. For example, each sample shall be listed for each category, i.e., deck, each kind of material (felt gasket, pipe hanger, oil based paint, etc.), and each area such as high voltage electrical equipment areas.

### c. Sampling Plan

This sampling plan is a variation of a stratified random sample. In this kind of sampling, the entire population of non-liquid PCBs is divided up into mutually exclusive sub-populations called strata (singular for strata is stratum). Each stratum is sampled independently and is represented independently. In this sample, the weight for the different strata in the total sample is not equal, but is weighted toward the increased probability, based on historical chemical analysis of PCB for PCBs on vessels, of finding larger amounts of PCBs in certain uses. Samples are taken in each stratum according to a random sampling procedure.

In the event that the representative sample of a stratum finds one sample  $\geq 50$  ppm, the entire stratum must be resampled following further removal of non-liquid PCBs containing  $\geq 50$  ppm. Removal of only the sampled material is not acceptable. Resampling requires regeneration of a new random sampling of the stratum to determine whether all materials containing  $\geq 50$  PCBs have been removed.

*For example, assume that the sample of 25 electrical cables, selected in accordance with this policy, showed one cable having  $\geq 50$  ppm PCBs in one of its non-liquid components. Based on this sample all electrical cable would be considered regulated for disposal. It would not be in compliance with this policy to dispose of the one cable, replace the cable in the sample with another cable which did not have a non-liquid component  $\geq 50$  ppm and assume that all electrical cable was  $< 50$  ppm and unregulated for disposal. Rather, a new 25 electrical cable sample would have to be reselected in accordance with the policy and reanalyzed. It would be prudent to remove all cable of any type found to contain PCBs  $\geq 50$  ppm before resampling.*

(1) Numbers of samples to be taken

All samples shall be taken and analyzed from the materials remaining on the vessel in uses listed above in V. "Known Sources of Non-Liquid PCBs." There are several different categories of quotas each requiring a minimum number of samples: minimum total from the vessel, minimum total from each deck, minimum total from each kind of use, and minimum total from each of three classes of use (strata). Scrappers may sample more than the minimum number of samples in any or all categories.

(2) Minimum numbers of samples:

(A) Minimum Total Number of Samples (T) - is the larger of fifteen samples or the square root, rounded off to the nearest whole number, of the gross weight of the vessel as sold in long tons (2,200 pounds equals one long ton);

(B) The minimum total number of samples shall be distributed as follows:

(i) When T is 15

(a) Samples shall be taken according to the following priority order until fifteen samples have been collected. If there are no uses in the category, proceed to the next category.

(i) Four air handling system gaskets.

(ii) Three samples of electrical cable containing of non conducting, non-metal material. Each cable may have several different non-metal components which have to be analyzed individually.

(iii) One sample each from the following category:

- rubber gaskets (other than air handling system gaskets)
- felt gaskets (other than air handling system gaskets)
- fiberglass, felt, foam, or cork thermal insulation material
- sound deadening felt
- grouting, caulking, rubber isolation mounts, foundation mounts, and adhesives
- tapes
- pipe hangers, and
- rubber/plastic parts of all sizes and shapes (other than listed above in VI.c.(2)(B)(i)(a))

(b) If there are insufficient uses to select fifteen total samples using the procedures in VI. c. (2)(B)(i)(a), provide in the original notification (required in III. above) to the EPA Regional PCB Coordinator with a to scale deck plan of the ship and a written certification that this procedure if followed would result in fewer than fifteen samples.

(ii) When T is > 15

(a) Minimum Total Number of Samples on Each Deck ("deck quota") - three samples from each level/deck on the vessel, where known sources of non-liquid PCB uses are located prior to any removal activity;

(b) Minimum Total Number of Samples from Each Known Use of Non-Liquid PCBs - a minimum of one sample from each of the known uses of non-liquid PCBs in IV (above) which are present on the vessel .

(c) A further categorization of samples is required as follows. The population of all known sources of non-liquid PCBs in V. (above) will fall into one of these three subpopulations which will be referred to as strata. The strata are: (i) electrical cable insulation, (ii) air handling system gaskets, and (iii) the other known sources of non-liquid PCBs as listed in IV, above (excluding the known sources of non-liquid PCBs which compose the first two strata [i and ii]).

(Stratum 1) At least 0.4(T) electrical cable samples shall be taken. Each non-conducting materials (plastic, rubber, etc.) from each electrical cable shall be chemically analyzed separately. Three fourths of the total electrical cable samples or 0.3(T) samples shall be taken from electrical cable in engine compartments, auxiliary machinery compartments, areas having radio transmission and receiving equipment, x-ray equipment, radar equipment, and any other high voltage electrical equipment.

(Stratum 2) At least 0.4(T) samples shall be taken from gaskets in air handling systems. One half of the air handling system samples or at least 0.2(T) samples shall be from air handling systems gaskets engine compartments, auxiliary machinery compartments, and in areas where there fuel, explosives and munitions were stored and handled.

(Stratum 3) At least 0.2(T) samples shall be taken from this stratum. In the event that 0.2(T)  $\geq$  9, one sample shall be taken from each of the following nine groups

(substrata): rubber gaskets (other than air handling system gaskets); felt gaskets (other than in air handling system gaskets); thermal insulation material (fiber glass, felt, foam, and cork thermal insulation material); sound deadening felt; grouting/caulking, rubber isolation mounts, foundation mounts, and adhesives; tapes; oil-based paint in containers (paint on surface of the vessel is not included); pipe hangers; and rubber and/or plastic parts of all sizes/shapes (other than listed in stratum 1, stratum 2, or the preceding substrata in this stratum). In the event that there is an insufficient number of samples in  $0.2(T) < 9$ , the  $0.2(T)$  samples shall be randomly selected from a numbered list of the nine substrata.

(d) Samples in different strata may be also be counted in the total number of samples for a deck in V.c.(2)(B)(ii)(a), so long as all minimum total numbers of samples are taken for each stratum and each "deck quota". For example if the radar compartment is in one of the island decks and two Stratum 1 samples are taken there, no additional samples are necessary to fill the "deck quota." However, additional samples may be taken from that deck to complete required numbers of samples for strata other than deck strata.

(C) Minimum Sample Number Example

*Assume that the vessel to be sampled is a 30,000 ton aircraft carrier having six decks in the main body of the vessel and five decks in the island.*

*(i) According to VI.c.(2)(A) the minimum total number of samples is the square root of thirty thousand or 173.2 rounded off to 173.*

*(ii) According to VI.c.(2)(B)(ii)(c), 69 samples of cable, 69 samples of air handling systems gaskets and 35 samples of other known non-liquid uses of PCBs are required.*

(iii) *Of the 69 samples for cable in Stratum 1, 52 are required to be from specified areas.*

(iv) *Of the 69 samples for air handling system gaskets in Stratum 2, 34 are required to be from specified areas.*

(v) *Of the 35 samples taken for known non-liquid PCB sources other than electrical cable and air handling system gaskets (Stratum 3), at least one sample shall be from each of the nine substrata in stratum 3.*

### (3) Removal of Known Sources of PCBs Resulting in Non-Existing Strata

In the event that all of the known uses of PCBs (as listed in III. and IV.) or in a particular stratum or category have been removed from the vessel for purposes of PCB disposal, no samples are required to be taken from that stratum or category to demonstrate that all PCBs  $\geq 50$  ppm have been removed. The minimum number of samples from the unsampled stratum (or strata) do not have to be transferred to another stratum. The total number of samples, T, is simply reduced by the total number of sampled from each stratum which was not sampled, because all of a known use, which made up a stratum had been removed from the vessel for PCB disposal.

### (4) Selecting Locations for Sampling

Sample locations are to be selected employing floor (deck) plans, a random number table or generator, and a tape measure. Sample locations on each deck (or level) of a vessel are to be selected separately.

(A) Stage 1 - Selection of a Room (Space or Compartment). On each deck, sample sites for each stratum may be selected by three methods for the first stage, which is the selection of a room.

Method 1 - In the event that there is only one room on a deck or one room in a stratum, the room is automatically selected and the sample locations are taken using the second and third stage sampling procedures below.

List (make a census of) all applicable known sources of non-liquid PCBs (see 5. above) in each room. Then, select the number of sample locations from the listed numbers by a random number generator and collect the sample(s).

Method 2 - Rooms (spaces or compartments), including sections of hallways and stairwells on each deck, are assigned sequential numbers and specific rooms (spaces or compartments) are selected using the random number table or generator.

Method 3 - Two dimensional coordinates are to be randomly selected on each deck based on a scale drawing of the floor (deck) plan. Location of selected coordinates is somewhat facilitated by the bow to stern markings all over a vessel. Starboard to port dimensions may be determined by using the floor (deck) plan and measuring from interior walls (bulkheads) rather from the side of the vessel.

(B) Stage 2 - Once a room (space or compartment) is selected, each wall (bulkhead) and the ceiling (overhead) is assigned a number and a wall (bulkhead)/ceiling [overhead] is selected using a random number table or generator. (Stage 2 following Stage 1, Method ,1 appears in Method 1.)

(C) Stage 3 - Location of a sample site on the selected wall (bulkhead) or ceiling (overhead) will be purposive (or intentional) with three conditions. (Stage 3 following Stage 1, Method ,1 appears in Method 1.)

(i) all quotas must be met for all strata,

- (ii) if more than one size of cable is present, all cable in the area selected shall be assigned a unique number and one cable selected for sampling using random number table or generator, and
- (iii) only one sample each of any specific kind of known use of non-liquid PCBs may be collected from a single room (space or compartment), unless the number of rooms (spaces or compartments) having the specific kind of use is smaller than the total number of samples required.

Whichever known source of non-liquid PCBs requires a sample and is found in the room (space or compartment), shall to be sampled from the selected wall or ceiling (overhead). If no such known source of non-liquid PCBs is present, another wall or ceiling (overhead) shall be randomly selected using the procedures in stage 2 and stage 3. Resampling of a wall or ceiling (overhead) when there is no known source of non-liquid PCBs present shall occur no more than twice (a total of three selections including the original selection) before it is necessary to select another room (space or compartment) through stage 1.

*(D) Guidance to Facilitate Sample Site Selection*

*First, locate the specified cable and specified air handling system gaskets sample sites and collect samples. Likely cable (Stratum 1) will be more prevalent on a limited number of decks. Likewise gaskets (Stratum 2) will be more prevalent on a limited number of decks. Samples from these two strata will likely fill the "deck quota" from (2) above. It may be that the Stratum 1 and Stratum 2 samples will also have to be used to fill other "deck quota" when these materials are even though less prevalent than on the other decks, they are more prevalent than the scarcer Stratum 3 materials. Note well: Because of the limited*

*prevalence and wide distribution of the varying known non-liquid uses of PCBs on board the vessel, it is prudent to attempt to fill "deck quotas" with cable first and then with air handling system gaskets.*

*To fill Stratum 3 - "known uses of non-liquid PCBs," it may be more productive to not pre-determine what use would be sampled at a random location, but to search for any/all of the uses and keep a tally of the use strata as they are filled by the random sampling. Assume that the lower decks on a vessel have a higher proportion of thermal insulating material but a lower proportion of electrical cable. Even if all deck strata had been filled on the lower decks it would be prudent to use the random sampling scheme to find thermal insulating material for Stratum 3 even though the "deck quota" might already have been filled. Either a formal or informal comprehensive or cursory census known uses of non-liquid PCBs on board the vessel, Appendix 2 is an example, will probably speed up sample site selection.*

*It might also prove prudent to have several alternate randomly selected sites available when sampling to account for the possibility of an ineligible site (a site where no known uses of non-liquid PCBs are found at a randomly selected site). The sampling scheme does not provide for or tolerate the purposive (or intentional) selection of a "nearby" or other convenient sample in the event that a randomly selected site is ineligible.*

d. Resampling after Additional Removal of  $\geq 50$  ppm PCBs

In the event that any individual sample shows greater than 50 parts per million PCBs, further removal shall occur and the entire sample category shall be reselected. It is unacceptable to remove a material showing  $\geq 50$  ppm and then assuming that there are no other PCBs present at  $\geq 50$  ppm in the category. In a representative sample, one "hit" of  $\geq 50$  ppm requires either removal of all of the items on the vessel or resampling of the entire population represented by the sample.

## VII. Disposal of Removed PCBs

Once sampled and characterized as to PCB concentration, in accordance with the requirements of 40 CFR 761, PCBs and PCB Items shall be contained and marked for storage and/or manifested for transportation to approved storage/disposal facilities for disposal.

In place of sampling, all non-liquid PCBs removed from a vessel may be assumed to contain greater than 50 ppm PCBs and then must be disposed of in accordance with 40 CFR 761.

## Appendix 1

### Determination of the PCB Concentration in Non-Liquid PCB Uses for Purposes of Disposal

The PCB regulations do not address the determination of PCB concentrations based on an extraction which simulates environmental exposure. The ultimate fate of many of the non-liquid PCBs is thermal destruction in metal smelting. For purposes of thermal destruction all PCBs are considered to be accessible to and involved in the destruction process. Risk from thermal destruction should be approached from a total PCB concentration. Therefore, for PCBs to be disposed of by thermal destruction methods, an exhaustive method shall be used to extract the PCBs which are often tightly bound in a plastic, rubber, or resinous matrix. Extraction of PCBs from non-liquid uses shall require toluene as a solvent in a soxhlet extraction method equivalent to Method 3540 in SW-846 "OSW Test Methods for Evaluating Solid Waste." The extract shall be cleaned with concentrated sulfuric acid. Extracts shall be blown down with nitrogen or evaporated in a rotary evaporator. Since using a Kuderna-Danish apparatus to concentrate toluene has been found to be problematic, this apparatus is not recommended for use. Chemical analysis shall be according to Method 8080, Method 8081, or Method 8280 or equivalent also in SW-846 "OSW Test Methods for Evaluating Solid Waste."

EPA may consider other proposed extraction and/or chemical analysis procedures so long as, at a minimum, the proposals are submitted to EPA no less than 90 days prior to the intended use of the methods and the following information is also included with the proposal.

- (1) A detailed description of the proposed method. Details should be on the order of the details in Method 3540 and Method 8080, Method 8081, and Method 8280.

(2) Analytical results from at least ten representative samples, having PCB concentrations above and below the concentration of concern, using both the proposed method and Method 3540 with Method 8080/8081/8280 are submitted and the performance of the proposed method indicates equivalence (or improvement) in precision, accuracy, sensitivity, and specificity.

If EPA accepts the proposal, the acceptance and any conditions of acceptance will be in forwarded to the proposer in writing within the 90 days of the receipt of a complete proposal. EPA reserves the right to conduct its own formal verification of the proposed method before issuing an approval. If EPA chooses to verify the method, EPA will notify the proposer in writing no more than 30 days after receipt of the proposal. The notification will indicate the time needed for verification which will be a minimum of ninety days.

Appendix 2 - EXAMPLE OF NON-LIQUID PCB CENSUS ON ONE DECK OF A SHIP

HANGER DECK	Room Identification Numbers																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
NON-LIQUID PCB USE																				
Electrical Cable	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Electrical Cable Substratum	x					x														
Gaskets	x	x	x	x					x	x	x	x								
Gaskets Substratum		x	x													x				
Rubber Gaskets					x		x	x	x											
Felt Gaskets					x			x	x				x			x				
Thermal Insulation Material (including fiberglass, felt, foam, and cork),	x	x		x	x									x	x					
Sound Deadening Felt,																				
Grouting/Caulking Adhesives		x	x	x	x				x				x	x			x	x		
Tapes																				
Rubber Isolation Mounts	x			x				x	x			x					x	x		
Foundation Mounts		x					x							x						
Pipe Hangers																				
Rubber/plastic Parts of Differing Sizes/Shapes		x		x				x							x					