REPORT ON MATERIALS CONTAINED

IN THE HULL OF THE FORMER CLEMENCEAU

VOLUME 1

FINAL REPORT

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2.1	Delivery of full version to SSF	22/12/06
2.2	SSF's comments taken into account and re-reading group	18/01/07

CONTENTS

0. GENERAL INFORMATION

0.1 PREAMBLE

This document constitutes the survey report on potentially hazardous materials contained in hull Q790.

This report is presented in accordance with the classification proposed by annex 3 of IMO resolution A962:

- 1A ASBESTOS (see chapter 5)
- 1B PAINT – ADDITIVES (see chapter 6)
- 1C PLASTIC MATERIALS (see chapter 8)
- 1D MATERIALS CONTAINING PCBs, PCTs, PBBs in concentrations equal to or greater than 50 mg/kg (see chapter 7)
- 1E SEALED GASES present in the ship's machinery and equipment (see chapter 8)
- 1F CHEMICAL PRODUCTS present in the ship's machinery and equipment (see chapter 8)
- 1G OTHER SUBSTANCES present in the ship's machinery and equipment (see chapter 8)
- 2 OPERATIONAL WASTE present (see chapter 8)
- 3 STOCKS AND PROVISIONS present (see chapter 8)

0.2 DOCUMENTARY REFERENCES

This report is based on the following documents:

- Contract 06 59 005 470 29 49 of 21 July 2006 and its annexes
- Tender 06.1424 rev 1 of 28 June 2006
- IMO resolution A.962(23)
- Management plan of 5 September 2006
- Intervention plan of 4 October 2006
- Documentary management plan of 10 August 2006

0.3 FIELD OF APPLICATION

Hull Q790, former aircraft carrier "CLEMENCEAU"

0.4 CIRCULATION OF THE DOCUMENT

In accordance with the terms of the contract.

0.5 PARTIES INVOLVED IN THE CONTRACT

Consulting Department: SERVICE DE SOUTIEN DE LA FLOTTE (FLEET SUPPORT SERVICE)

Holder: BUREAU VERITAS

0.6 DEFINITIONS

Volume:

Partitioned elementary space of hull Q790. Each volume is identified by a plan position.
The 1756 volumes counted are divided into 1275 Rooms, 386 Holds and compartments and 95 Bulges.

Room:

Accessible space. Access is gained through a door or panel.

Holds and compartments:

Space requiring specific operations for access, for example opening of a manhole cover for an oil tank or a frame space.

Bulge:

Watertight space external to the initial hull, not accessible without cutting a plate.

Compartment:

The hull is split into 20 compartments separated by watertight bulkheads and identified by letters (A to T).

Deck:

There are 14 levels in the hull and superstructure (block):

- the decks below the waterline are the double bottoms, the 4m deck, the 5.8m deck, the orlop deck,
- the other decks below the flight deck are the main deck, first deck, hangar deck, first gallery and second gallery,
- the block consists of 6 decks (PF1 to PF6).

Identification:

Mission aimed at establishing all information relating to the presence of pollutants (including asbestos) in the products and materials present on board the Q790.
Identification may include in particular visual inspections, testing, sampling and analyses.

Final “pollutants” report:

Based on the extensive identification planned, a “green passport” report will be drawn up in the format attached to the BV bid. This report will include all the information relating to the presence of asbestos and other pollutants present on board the Q790, and particularly the results of identifications and controls. It will include the location of materials by room with the exception of “diffuse” materials, for example electric cables. It will be complemented by general safety instructions regarding materials containing pollutants.

Surveyor:

Individual who carries out a mission of identification of the pollutants in the Q790.

Visual inspection:

Visual examination of the rooms and equipment with a view to looking for then making an inventory of:

- materials or products likely to contain asbestos,
- other pollutants.

Testing:

Action enabling the internal composition of a structure or volume to be checked by an operation complementary to the visual inspection (dismantling, removal, drilling). Testing is different to sampling. Testing is destructive if it requires repair, restoration or addition of material or if it causes the material or product tested to lose its function.

Sample:

Representative part of a product or material intended for laboratory analysis. Sampling allows one or several samples to be created according to the constitution of the element concerned.

Material containing asbestos:

Material or product containing or which may contain asbestos fibres through composition, contact or pollution.

Accessible product or material:

Accessible products or materials are those which can be reached without destructive works (see article R1334-26 of the public health code) either through direct visual inspection, or after the removal of removable elements such as false ceilings, inspection panels, lights, ventilation grilles, etc.

Insulation:

Materials or product capable of separating two zones by limiting the spread of thermal or sound activity. For the Q790, thermal insulations, fire insulations (fire-protection bulkheads), and sound insulations (elimination of aerial sound vibrations) are considered.

Chrysotile:

The most used variety of asbestos fibres (serpentine group).

Amosite:
Very fine asbestos fibres variety (amphibole group).

0.7 ACRONYMS AND ABBREVIATIONS

SSF: Service du Soutien de la Flotte (Fleet Support Service)

BV: Bureau Veritas

IMO: International Maritime Organisation

ITA: Inspection du Travail des Armées (Armed Forces Labour Inspectorate)

0.8 PRINCIPLE OF IDENTIFICATION OF VOLUMES

The identification used is that in use within the Navy.

A room, hold or compartment is identified unitarily by a plan position in the form Xaaabc where:

- X is the compartment letter;
- aaa: one to three figure number designating the deck (from “3” for the 4m platform to “011” for PF6);
- b: number designating the position in the deck according to the longitudinal axis;

- c: number designating the position crossways (“0” in the centre, even for port, odd for starboard).

E.g.: N0110: Compartment N, Deck 01 (1st deck), room 10 (central)

A bulge is identified unitarily by a plan position in the form nnX where:

- nn is a number to run;
- X designates the compartment.

1. CONTEXT

The purpose of the survey is to prepare the dismantling of hull Q 790 (former Clemenceau) by establishing an inventory of the potentially hazardous equipment and materials contained or present on board, based on both documentary work and field surveys.

The survey output data consists essentially of an inventory and mapping of those potentially hazardous materials in accordance with the format of annex 3 of IMO resolution A962.

This inventory must allow the SSF:

- to specify the extent of the decontamination works to be undertaken;
- to identify the precautions to be recommended for dismantling;
- to have a monitoring tool for the decontamination works.

2. PRESENTATION OF THE METHOD

The initial methodology envisaged a statistical approach in view of the high number of volumes and a supposed similarity of volumes of the same kind. The inspections were divided into:

- simple inspection (verification of the known pollutants);
- inspection with sampling of potentially polluted products;
- in-depth inspection with sampling and measurement of supports containing asbestos.

This statistical approach was used, for example, to look for heavy metals in the paintwork of empty compartments and holds for which paint samples were taken in at least 3 volumes of each type.

Bulges being spaces which are not accessible without the cutting of plates, they were not inspected.

For the other volumes, the first inspections showed high heterogeneity of materials containing asbestos and the random nature of the composition of those materials containing asbestos based on their polluted nature (such as lagging or floor slabs). This heterogeneity also concerns decontamination works. It was therefore decided to carry out an in-depth inspection of all those accessible volumes with sample taking and measurement of materials potentially containing asbestos.

The survey was carried out in accordance with the following phases:

- Documentary study of the documents made available by the SSF:
  - dossier DCN A605170024 DBS/BEBS
    Preparatory document with a view to establishing a "green passport" for the hull of the former Clemenceau
  - documentation of the sea trial period design and of the main modifications
- Establishment of a list of volumes and their identifiers
- Preparation of the inspection records, per room
- On-site appraisal of the rooms with sampling
- Input of the results of the field surveys
- Laboratory analysis of the samples taken
- A review of the laboratory results and records by the architects unit and the surveyors division with the definition of additional or more targeted investigations
- An additional survey of the rooms
- Preparation of the reports and their attachments.

2.1 DOCUMENTARY STUDY, DEFINITION OF THE INSPECTION METHOD

The Documentary Analysis Group composed of naval architects started with the documentary study of the DCN dossier with a view to identifying which were the major doubts which were to be raised as a priority (cf. documentary review report TEC 06 1835 of 24/10/06).

The study by the Documentary Analysis Group of the plans made available by the SSF enabled identification of the rooms of the Q790 and assessment of the arrangements of the principal systems. For example, the catapult circuits, pipe systems, cable tunnel layouts.

The study by the Documentary Analysis Group of the plans made available by the Naval Base (construction carried out [1963 atlas]) facilitated investigation by function or theme such as for example, searching for sprayed asbestos insulations or those for certain fluids systems.

Particular effort was made with regard to rooms involving a risk of presence of products containing asbestos.

Additional observation:

The great abundance of documentary resources made necessary a selection of plans necessary for the survey, and a critical analysis of their representivity of the current configuration.

A loss of information was observed on the plans because of the change to black and white and the reproduction process.

Some functions (ventilation) are not completely represented. Some kinds of plans, such as coordination plans, do not cover all the rooms. This lack of exhaustiveness in the topofunctional representation of systems does not therefore allow exhaustive quantities per system and per room to be established and therefore means that measurements will have to be carried out on board.

Rec 1.: The documentary analysis therefore enabled definition of the inspection methodology as:

- deterministic for the measurements of the following networks and systems: pipe lagging, lagging of ventilation shafts, hull and bulkhead insulation, flooring; in order to quantify the amount of material potentially polluted by asbestos per room.
- statistical to determine the ratio of polluted products of the same type and to reduce the error band of some estimations made on a documentary or feedback basis (e.g.: electric cables, paintwork surfaces).

This approach corresponds to the quantification requirement necessary for industries for the sizing of dismantling tasks.

2.2 PREPARATION OF INSPECTION RECORDS AND SCHEDULING OF SURVEYS

An inspection record was created and pre-completed for each room with the information identified in the documentation (DCN document or plans), in order to guide the inspection and verify hypotheses of presence/absence of pollutants. This pre-completion was carried out statistically (selection of rooms).

The record may specify a sampling requirement, regardless of the opinion of the surveyor, in order to specify hypotheses and refine overall judgments.

The records were enriched as the inspections progressed to take into account the most recent information and feedback.

2.3 SURVEY OF ROOMS, TYPES OF MEASUREMENTS AND SAMPLING

During inspections on board, records are furnished with information relating to the potentially polluted materials identified visually (measurements: dimensions of lagging (length, diameter, thickness, area), surface of insulations, descriptions of materials). In the case of sampling (whether decided upon by the surveyor or specified in the record), the characteristics of the sampling point are noted in the record.

Bearing in mind the heterogeneity of pollutant supports over the whole of the ship, sampling is initiated systematically at the start of each compartment, for example by type of lagging or flooring.

To have the least possible impact on the support and on the environment, samples are small and the sampling area is treated with a protective surfactant product or by the fixing of an adhesive (a procedure validated by the Naval Base).

Sampling is carried out to seek out asbestos, heavy metals or PCBs in all supports known to be potentially polluted (insulations, lagging, flooring, paintwork, electric cables, gaskets). One sample can be divided with a view to carrying out several different analyses. Except in special cases, equipment is not investigated; it is inventoried in cohesion with the inspection records.

Computer input of inspection records is carried out after the inspections; a debriefing is organised daily between the surveyors and the architects of the documentary analysis group, so as to comment on the results obtained or the particular expectations for rooms which are still to be inspected.

2.4 LABORATORY ANALYSIS

The samples are sorted by the surveyors before being sent to a laboratory for investigation and characterisation of pollutants.

The laboratories carry out the analyses and the reports are circulated to the surveyors and the architects.

The operating process and the types of analyses to be carried out are described in the decree of 6 March 1993:

- Polarised light optical microscopy (PLOM) in accordance with the MDHS 77 method or any other equivalent method; the magnification is less than 2000 times.

- Transmission electron microscopy equipped with an energy dispersive X-ray analyser (TEMA) in accordance with standard NFX 43-050 or any other equivalent standard; magnification is around 50,000 times.

The information returned is:

- Asbestos analysis (PLOM, TEMA):
  - description of the sample received,
  - number of preparations
  - establishment of the absence or presence of asbestos fibres,
  - name of the mineralogical variety of the asbestos fibres observed
- Investigation and dosage of heavy metals (elements identified in the green passport):
  - Arsenic,
  - Cadmium,
  - Chromium,
  - Copper,
  - Nickel,
  - Lead,
  - Tin,
  - Strontium,
  - Zinc
- Investigation and dosage of polychlorinated biphenyls (PCBs) – the exact value is not systematically sought for PCB contents exceeding 500 mg/kg (i.e. 10 times the regulation limit figure).

For an asbestos analysis, there will be as many results as there may be different elements; for example, a sample of flooring may contain two layers of floor slabs separated by a layer of glue, which makes three different elements i.e. three pieces of information with asbestos in just one of the elements, for example; in that case, the sample will be counted as containing asbestos.

The reports are attached to this document (cf. annex C).

2.5 PROCESSING OF LABORATORY ANALYSIS RESULTS

Use of the analysis reports enables, after a delay of one to two weeks (remote analyses time), the raising of questions from the surveyors, adjustment of the continuation of the survey and refinement of investigations presenting a global interest over the vessel (pollutants by type of room, by type of support, by type of material).

In less than 15 cases out of 1000 results, the information available is inaccurate in the input chain or the results obtained are the opposite of all the other available data. This data has either been corrected by additional analyses or has not been taken into account.

2.6 DRAFTING OF THE REPORT

The various results are dealt with under the following themes:

- For the principal sources of pollution, data is presented per room in table form (annex A) (the sources described are pipe lagging, ventilation lagging, hull and bulkhead insulation, flooring).

- For the other sources of polluted materials, a specific description is supplied in this report (the materials described are the felts on structure reinforcements, munitions lift gaskets, ventilation sleeves, flange gaskets, etc.).

- For some supports (chilled water lagging, floor slabs and coverings, electric cables, etc.), observations are provided.

3. PRESENTATION OF THE ON-SITE SURVEY

3.1 THE ON-SITE SURVEY

The on-site survey was carried out with the following groups:

- BV surveyors (3),
- Designers (3),
- Naval architects (2),
- Management Team (2).

With as the principal missions:

- The surveyors surveyed the rooms, carried out sampling.
- The designers (from naval construction) provided an additional view to that of the surveyor, took measurements and input the daily survey data.
- The naval architects carried out the critical analysis of the surveys and of the laboratory results with regard to the documentation, carried out monitoring of the daily reports and the formatting of the final data.
- An on-site support team assisted with the daily preparation, monitoring of analyses and monitoring of weekly reports.

A survey team consists of a surveyor and a designer.

The on-site survey was carried out in three parts:

- in August 2006, preliminary site visits; these inspections enabled preparation of the report "Environmental risks appraisal" and will not be detailed in this report;
- in September and October 2006, the complete inspection of the inspectable volumes of the Q790;
- in November 2006, inspections associated with certain items or certain additional requests.

For the latter two parts, the on-site survey was carried out by the same teams.

3.2 STANDARD DAY

The day starts with an update on the programme, examination of the inspection records, and of the particular cases expected.

There are two embarkations per day, the remaining time being used for the input of data, preparation of samples for laboratories, exchanges between the surveyors and architects.

At the same time, the programmes for the coming days are drawn up with the inspection records and the requests for access to rooms (accessibility to rooms control); the following up of the laboratory analyses completes the reports to the SSF and to the Naval Base.

3.3 TEAM SAFETY

The survey was carried out on a site presenting risks including that of exposure to asbestos.

Personnel embarking were protected permanently by a breathing mask, full overalls covering the head, gloves, goggles, boots and helmet. It must be noted that the arrangements demanded by the Naval Base for access on board are more restrictive than those demanded by the internal procedures of Bureau Veritas or by regulations, bearing in mind the levels of air pollution measured.

Dressing and undressing rules followed the procedures of the Naval Base.

The on board inspection by the survey team (one surveyor, one quantity surveyor) took place in the company of a dedicated security team from the Q790 unit of the Naval Base (generally two sailors).

Throughout the session (limited to 2 hours 30 minutes, an ITA rule), monitoring of the teams on board the vessel is carried out by radio link with the "Security" room on the quay.

A hazardous gas check is carried out by the LASEM (Naval Base) for each new room visited or for any inspection in a room under the main deck. This check is valid for 24 hours and must be carried out again after that time. In addition, each survey team carries a gas analyser warning of the presence of hazardous gases or lack of oxygen.

Measurements of fibres in the atmosphere were carried out in passageways and the undressing chamber. The figures remained below the regulation thresholds.

A fibre measurement was carried out on the work site at the request of the ITA. The apparatus was carried by the surveyor during the course of an embarkation. The figures remained below the professional regulation thresholds.

4. OBSERVATIONS FROM THE SURVEYS

4.1 FIRST FINDINGS ON THE GROUND AND ANALYSES

The inspection confirms that partial removal of the lagging has been carried out.

Bare lengths of pipe (painted or cleaned) and lengths with the lagging still in place can be found in the same room.

This finding confirms the need to carry out exhaustive measurement of pipe lagging and of ventilation shafts to be able to establish the quantities of what is in place.

The initial visual findings showed the impossibility of establishing systematic conclusions about the pollution or non-pollution of certain systems, such as:

- The chilled water system: this system presents heterogeneity in the visual aspect and the asbestos nature of the cloths covering the lagging (polystyrene, polyurethane or cork). This heterogeneity is observed in the same room or adjacent rooms;
- electric cables: the absence of visible marking of cables does not allow grouping by type to be carried out;
- the ventilation system: this system presents heterogeneity in the visual aspect and the asbestos nature of the cloths covering ventilation shafts;
- floor covering slabs: the coverings sometimes include several layers of slabs of different colour or appearance; laboratory analysis, moreover, shows that a slab of the same colour sometimes contains asbestos, sometimes does not contain asbestos;
- electroluminescent tubes: tubes have been partially dismantled.

Rec 2.:	The initial results of analyses showed that a system could contain asbestos in one room and not contain asbestos in an adjacent room without the external appearance changing.

4.2 TRANSPOSITION OF THE RESULTS OF ANALYSES TO OTHER ROOMS

Lagging (with the exception of the chilled water system)

Systems run from room to room. Few are identified or possess visible identification. The on board inspection showed that systems could be identified, with a risk of error, by deduction based on the external appearance of the lagging and its dimensions and/or from the analysis of existing documentary data.

Rec 3.:	The result of analysis of a sample on a given support in a room is extended by analogy to identical supports in the adjacent rooms.

The limit of this analogy takes into account the local heterogeneities established for the same system (see examples developed below), or the obsolescence of documentary data (absence of monitoring of modifications).

Rec 4.:	In the event of uncertainty, this report recommends using the most safety orientated option.

Insulation

The documentary analysis shows that the types of insulations obey a function (firebreak bulkhead, security chamber, munitions lift, funnel ducts, closed boxes of boilers, etc.).

Rec 5.:	The on board inspection shows that the insulations were homogeneous in the various rooms inspected.

5. RESULTS OF THE SURVEYS: ASBESTOS AND PRODUCTS CONTAINING ASBESTOS

5.1 ESTIMATION OF THE QUANTITY OF THE PRINCIPAL PRODUCTS CONTAINING ASBESTOS PRESENT ON BOARD

Total quantity of the principal products containing asbestos present on board

The products containing asbestos on board break down as follows:

Lagging:

- 17.4 km of piping with lagging containing asbestos (Chrysotile + Amosite) of an average nominal diameter of 65mm
- 2,740 m² of ventilation shafts containing asbestos (Chrysotile) for an average section of around 0.06 m² (300 x 200 mm), i.e. around 2.8 km of shafts.

Insulation:

- 2,380 m² of sprayed asbestos (Amosite)
- 3,920 m² of mattress containing asbestos (asbestos cloth + mattress) (Chrysotile + Amosite)

Flooring/Paint:

- 7,140 m² of flooring containing asbestos (floor slab) (Chrysotile)
- 44,000 m² of paint containing asbestos

Summary per compartment of the products containing asbestos on board

Compartment	A	B	C	D	E	F	G	H	I	J	K
Lagging (m)	51	267	294	888	906	603	612	1357	1140	1194	568
Ventilation (m)	74	107	66	196	171	101	168	182	64	173	96
Flooring (m²)	157	275	709	733	287	233	352	431	151	364	37
Insulation (m²)	2	5	0	99	84	458	149	208	318	2888	250

Compartment	L	M	N	O	P	Q	R	S	T	Block
Lagging (m)	655	1664	1015	1046	1137	693	939	706	828	838
Ventilation (m)	49	60	82	83	192	46	164	111	212	341
Flooring (m²)	197	315	450	290	253	177	575	566	469	120
Insulation (m²)	340	239	111	192	307	89	113	3	50	438

These summaries are deduced from the various items of the tables presented in annex A.

5.2 ASBESTOS ENCOUNTERED

5.2.1. Principal sources of asbestos

These sources of asbestos represent the bulk (in quantity) of the asbestos present on board the vessel. The principal sources of products containing asbestos, the quantities of which are detailed above, are the following:

- Lagging of pipes and ventilation
- Insulation of walls, bulkheads and under deck
- Flooring

These are listed by room in the tables provided in annex A.

5.2.2. Secondary sources of asbestos

The secondary sources of materials containing asbestos are characterised by small quantities spread over the whole of the vessel.

The secondary sources of asbestos are detailed below:

Munitions lift door gaskets: Several munitions lift gaskets were analysed. The results indicate the presence of asbestos.

Rec 6.:	It is recommended that all munitions lift door gaskets be considered to contain asbestos.

Door gaskets: Several door gaskets were analysed. For some, the results indicate the presence of asbestos.

Rec 7.:	It is recommended that all door gaskets be considered to contain asbestos.

Bunker deadlight gaskets: Several bunker deadlight gaskets were analysed. The results indicate the presence of asbestos.

Rec 8.:	It is recommended that all bunker deadlight gaskets be considered to contain asbestos.

Pyrotechnic locker door gaskets: Several pyrotechnic locker door gaskets were analysed. The results indicate the presence of asbestos.

Rec 9.:	It is recommended that all pyrotechnic locker door gaskets be considered to contain asbestos.

Hangar door gaskets: A hangar door gasket sample was taken and gave a positive asbestos result.

Rec 10.: It is recommended that all hangar door gaskets be considered to contain asbestos.

Pipe flange gaskets: Flange gaskets were analysed and the results are asbestos positive.

Rec 11.: It is recommended that all pipe flange gaskets be considered to contain asbestos.

Asbestos felt for protecting stiffener plates: From documentary source, a felt containing asbestos is applied onto the plate of structure reinforcements (construction principle). This asbestos felt was noted at several points of the hull behind the insulation (insulation consisting mostly of material not containing asbestos, with a ceiling of aluminium plate plus mineral wool). We conclude that this felt is present without it being possible to accurately and exhaustively determine its location.

Rec 12.: It is recommended that all mineral wool insulation be considered as potentially polluted by this underlying asbestos felt.

Electric cables stuffing box grey putty: In the stuffing boxes of the cable runs of some electric cables, grey putty was found. Analyses of this putty indicate the presence of asbestos. Even if the product is only visible to the naked eye in some cases, it must be considered that all stuffing boxes are liable to include materials containing asbestos.

Rec 13.: It is recommended that all stuffing boxes be considered liable to include materials containing asbestos.

Electrical packing seal in electrical cabinet: some packing seals were analysed: the results are positive for some samples. Electrical packing seals are to be considered to contain asbestos.

Rec 14.: It is recommended that all electrical packing seals be considered to contain asbestos.

Materials inside electrical equipment: the analyses of samples from the arc-chutes of circuit breakers are positive. Electrical equipment is to be treated taking into account that that some components contain asbestos.

Rec 15.: It is recommended that all electrical equipment be considered to contain asbestos through some of its components.

Brake pad: the analysis of an electric engine brake pad is positive (Ferrodo© brake lining well-known). Rotating shaft brakes are numerous on the vessel (engine, elevator, etc.). These elements are to be considered to contain asbestos.

Rec 16.: It is recommended that all rotating shaft brakes be considered to contain asbestos.

Electrical equipment insulations: baizes and insulations of ovens, hot plates, tumble driers were analysed and some are positive (others negative). It should be noted that little of this kind of equipment is still on board the Q790.

Rec 17.: It is recommended that all baizes and insulations of electrical equipment be considered to contain asbestos.

The other materials potentially containing asbestos are the following:

- paint,
- cement,
- resin,
- putty,
- glue,
- electric cable casing,
- gaskets,
- equipment components.

The principal products polluted by contact with asbestos are:

- pipes,
- ventilation shafts and electric cables surrounded by a cloth,
- bulkheads and floors protected by insulation or paint containing asbestos,
- stiffener plates,

5.2.3. Quantitative approach retained

The approach retained consists of the location and sizing of materials containing asbestos.

Associated components difficult to dissociate from one another are included (approach retained in the results of this survey).

It concerns for example all the lagging, complete insulation systems, floor slabs, stuffing boxes containing asbestos.

The tables by room enable calculation of the overall quantities of material containing asbestos:

- If, for an item, one or more components is considered to be inert for a given pollution, the corresponding quantity is not included in the total.
- Elements of low weight/volume (secondary sources of asbestos) are not taken into account in the total, even if they are present in large numbers or spread around the ship without being identified.

5.3 READING THE RESULTS

5.3.1. Principal sources: Annex A

The results of the survey (on board inspections and documentary analysis) are presented in the tables by room supplied in annex A.

Those tables describe, for each compartment, with a summary for plant rooms (Energy, Propulsion, Cold rooms, Aviation, Hangar), the following information:

- Location: name and plan position of the room
- Function: pipe lagging, insulation, ventilation lagging, flooring
- Dimensions: length, thickness, diameter, area
- Description
- Presence of asbestos: yes/no with proof through analysis of a sample taken or by analogy with a result already obtained elsewhere

Pipe lagging: Only lagging which is assumed to contain asbestos is noted down in the table (with proof through the result of the lab analysis). This means that piping assumed not to contain asbestos has not been noted down.

Ventilation shafts lagging: the inventory is different from the piping; all the ventilation shafts have been inventoried and their lagging has been noted: the reference "paint" is indicated when the shaft is bare, and a description of the lagging is indicated when there is any; the result of the lab analysis is also attached.

Insulation: only insulation which is assumed to contain asbestos has been noted down (with some exceptions) with proof through the result of the lab analysis.

Flooring: All flooring (with the exception of paintwork) has been noted down. This involves paving, linoleum covering, tiling, with proof through the result of the lab analysis. When there is no mention of a sample, the paving is to be considered to contain asbestos.

The tables also contain by way of information the samples carried out on the secondary sources of asbestos.

5.3.2. Plans by deck: Annex B

A set of plans per deck illustrates cartographically the data from the tables for flooring, insulation and paintwork. A colour code characterises the presence of asbestos using the following three colours:

- Red – presence ascertained
- Orange – doubt: room inaccessible but documentary presence
- Green – proven or documentary absence of material containing asbestos
- White – no data (no information available, for example bulges)

5.3.3. Results of laboratory analyses and photographic Dossier: Annexes C and D

To complete the record, the lab analysis reports are attached in annex C, as is a set of photographs taken during the inspections (annex D).

5.4 DETAILED ANALYSIS OF RESULTS

5.4.1. Tables by room – Annex A

The information entered is the information measured, without a weighting or globalisation factor.

For rooms which could not be inspected (no access, hazardous, etc.), the information entered is documentary when it was able to be found.

The presence of asbestos has been indicated by the surveyor taking into account the results of the analyses requested and/or the experience acquired.

Reasoning by analogy (noted "id" in the tables) has been used by the surveyors to characterise similar elements in the same group of rooms (see §4.2)

5.4.2. Observations on pipe lagging

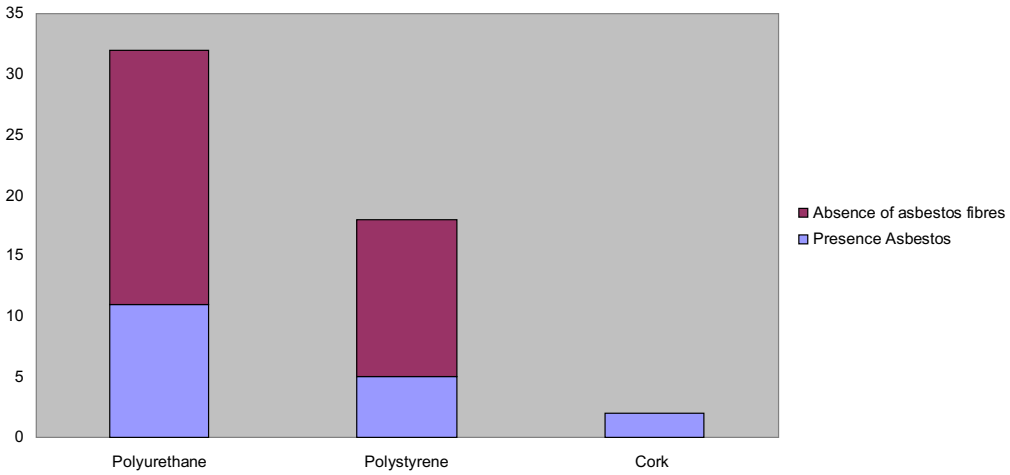
Chilled water system

This system is insulated by a sleeve made of plastic foam (polystyrene or polyurethane) or cork, surrounded by a cloth (whether or not containing asbestos).

Pipes may be lagged for their whole length or partially.

An analysis of the data gathered for this system was carried out. Samples were taken throughout the vessel.

The graph below details, by sample number, and for the different supports, the result of the analyses for presence or absence of asbestos.



For the 52 samples, the three insulating materials are found (polyurethane (32 items), polystyrene (18) and cork (2)) and with the presence of asbestos fibres ascertained for the samples with polyurethane (11 cases), polystyrene (13) and cork (0), i.e. a total of 18 cases (35%).

Neither the documentary analysis of the system or of the plan positions of the rooms crossed, nor the results of the laboratory analyses enable linking of the nature of the insulating material to the asbestos or non-asbestos state of the cloth.

Visual inspection of this system showed several different external appearances, due no doubt to the repair / modification cycles; moreover, a coat of paint often covers the cloth.

Consequently, for this system no mention of a sample was indicated in the tables by room (see annex A).

Rec 18.: It is recommended that all chilled water systems be considered to contain asbestos.

Other lagged pipe systems

During the inspections and despite the study of some coordination plans or atlases made available, it was not possible to identify with certainty, and unambiguously, the outline of the systems.

A large part of the lagging was coated with a heavy layer of surfactants, masking any colour codes. Similarly, the (few) labels were covered with paint.

During the survey, it was possible to partly follow an insulated system and highlight for some, through lab analyses, the co-existence on this same system of sections lagged with materials containing asbestos and sections lagged with materials not containing asbestos.

Accessories to lagged systems

Several jointing pipes were analysed. The results indicate the presence of asbestos.

Rec 19.: It is recommended that all jointing pipes be considered to contain asbestos.

Sleeves, thermal insulation materials and brackets are to be incorporated into the pipe lagging item.

5.4.3. Observations on insulation

The analysis prior to the survey enabled the identification of areas of insulation using asbestos in different forms and techniques using asbestos felts in various forms.

Areas asbestos identified by the documentary analysis were surveyed on board (with the exception of two closed rooms in Mike compartment). Some discrepancies were also observed between documentary data dating from the trial period as a new ship and the on board survey (for example: in India compartment, the frame spaces adjacent to the fuel bunkers were subject to a retrofit in the '70s).

The breakdown of the results of the laboratory analyses is documented in the form of plans for the whole of the hull (see annex B).

Insulation by sprayed asbestos or asbestos board

The inspections and documentary analyses conducted in parallel enabled the exhaustive localisation of sprayed asbestos. This concerns the hangar security chamber (thickness around 40mm), fire-protection bulkheads (thickness around 40mm) and the munitions-lift protection (thickness around 10mm). The catapults pits could not be inspected: the documentation mentions insulation constituted by asbestos inside pits (bulkheads and cover).

The munitions lifts are usually protected on their four sides, most often by asbestos board. For cases in which the munitions lift is stuck against a wall, two configurations were found:

- The asbestos protection is inserted between the munitions lift and the wall and therefore remains in the room.
- The asbestos protection is fitted on the wall of the adjacent room.

Rec 20.: Areas containing sprayed asbestos or asbestos board are to be treated as specific sites.

Insulation with asbestos felt

The original plans indicate the possible implementation of asbestos felt as mechanical or thermal insulation of the reinforcements.

This was observed on site, in particular for the under-floor reinforcement plates (cf. sample C6), in rock wool or glass wool insulations (cf. sample A212).

On the other hand, the presence of asbestos was ruled out for the ventilation shaft support felts (cf. samples C127, C139, C147, C148, C149, C150).

Rec 21.: There is a high risk of presence of asbestos felt in numerous rooms, either stuck under the reinforcement plates or mixed with the original mineral wool. Identification of those felts is not possible prior to dismantling of the insulations, therefore those felts are not identified.

Floor insulation with asbestos cement

Insulation using a cement floor slab expected in the oxygen plant (T0124) was found, but the results of the asbestos analysis are negative, contrary to expectations.

The presence of cement containing asbestos in floor insulation (documentary) was not confirmed during the survey.

Rec 22.: Prudence and the usual precautions during dismantling of cement floor slabs remain appropriate.

5.4.4. Observations on flooring

Systematic investigation of flooring was carried out on board with the principle of one or more samples per floor type for each zone (equivalent to one deck per compartment).

Floor slabs

Analysis of the data gathered for the floor slabs was carried out.

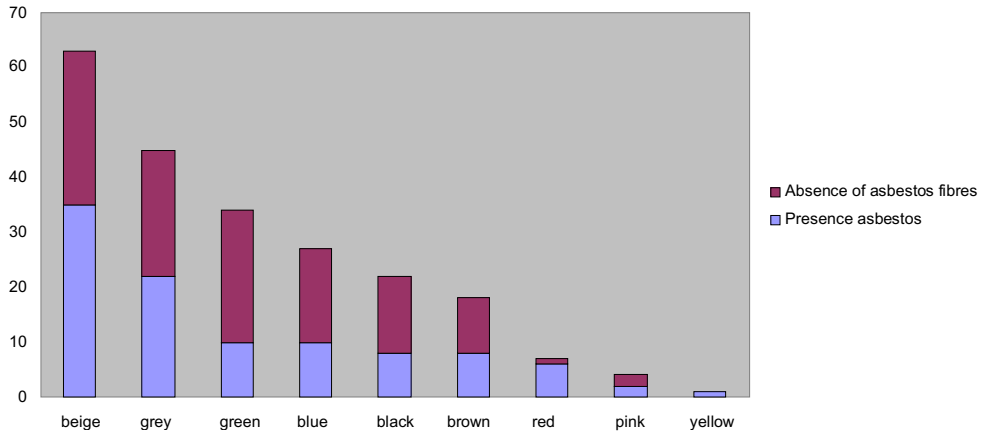
158 slab samples were analysed for asbestos, with 221 distinct elementary results (see § 2.4).

- 63 analyses are negative;
- 95 analyses are positive.

The sampling points are spread throughout all rooms covered with slabs on board, including the block.

The results of the analyses are documented in the form of plans for the whole of the hull (see annex B).

The graph below details, by sample number, and for the different colours identified by the laboratory, the presence or the absence of asbestos in the floor slabs. The samples were taken throughout the ship.



It appears that nearly 50 % of the analyses results indicate samples containing asbestos but with no link to a plan position.

Moreover, the on board conditions (frontal electric light, protective equipment, difficulty locating) limit the reliability of the colour surveys during an on board inspection.

It is not therefore possible to associate a physical criterion (appearance, colour, location) with the asbestos nature of the slab.

It should also be noted that from all the samples including glue, about ten glue elements contain asbestos.

Rec 23.: It is recommended that all floor slabs and glue be considered to contain asbestos.

Linoleum

Analysis of the data gathered for linoleum flooring was carried out.

9 samples were analysed for asbestos and only one proved to be positive. As it concerns just a single black sample, we think that it may perhaps be down to an incorrectly identified tile when the sample was sent to the laboratory.

At the same time, we note that the lead or PCB content thresholds are greatly exceeded for linoleum.

Rec 24.: Although not a material containing asbestos, linoleum is to be treated in a specific process.

Tiling

Some analyses on tiling + glue were carried out (samples A160, A162, B1, B122, C72) and proved to be negative.

Other covering accessories

A nosing was analysed; the result is negative. We can assume that the nosings have been changed since the trial period as a new ship.

5.4.5. Observations on the ventilation lagging

Typology of cases encountered

5 situations were observed on board by the surveyors (see photos in annex D):

- Painted shafts without lagging
- Shafts covered with thin cloth, whether or not it contains asbestos
- Shafts covered with thick cloth, whether or not it contains asbestos

Moreover, the cloths can cover a layer of polyurethane insulation or a fibre glass mattress.

Example of undeterminable cases

The following cases were encountered:

1. The system number is not discriminatory for determining in principle the presence or not of a cloth containing asbestos. We can cite as an example:

   - For system AF1.36, on Deck 01 in room PQ0114 the absence of asbestos cloth was noted and on Deck 0 in room P042, an asbestos cloth (sample A311).
   - For system AF1.43, on Deck 01 room O0112 was noted with asbestos cloth (sample A310) and on Deck 0 room O012 without asbestos cloth.

2. The function of a system (cold air, exhaust air, conditioned air) is not discriminatory for determining the presence or absence of an asbestos cloth.
   The Atlases indicate the different functions of the systems on board. Inspections showed that it is not possible to generalise a local result to the whole of a function or a system. We can cite as example:

- For system AF1.36 (cold air, destination Hold), asbestos cloth was noted in room P042 (sample A311), while for system AF1.35 (cold air, destination Hold), the absence of asbestos cloth in room P012 was noted.
- For system AF1.43 (cold air, after heater), asbestos cloth was noted (sample A310), while for system AF1.44 (cold air, without heater), the absence of asbestos cloth was noted.

3. Of two shafts coming from the same shaft, one may contain asbestos and the other not.
   For example, for the Chilled Air in room OP0411, there is a fork with one branch containing asbestos tissue, and one branch not containing any.

The tables by room give a detailed breakdown of the asbestos laggings.

Accessories to the ventilation systems

Several ventilation frame damper felts were analysed. The results indicate the presence of asbestos.

Rec 25.: It is recommended that ventilation frame damper felts be considered to contain asbestos regardless of the status of the ventilation system in place.

Only one flame-arrester gasket was able to be analysed because of access problems. The results indicate the presence of asbestos.

Rec 26.: It is recommended that flame-arrester gaskets be considered to contain asbestos regardless of the status of the ventilation system in place.

5.4.6. Observations on paintwork containing asbestos

55 paint samples were analysed to search for asbestos.

- 37 analyses are negative, the sampling points being spread throughout the ship, flight deck and block,
- 18 analyses are positive, however 90 % of the sampling points correspond to rooms where decontamination work has taken place or to rooms announced in the DCN documentation. Two particular cases remain:
  - G112 passageway leading to the front diesel,
  - G0114 plant room.

The breakdown of the results of the analyses is documented in the form of plans for the first four decks (see annex B).

The detailed tables attached in the annex specify the distribution of paint containing asbestos mentioning whether it concerns documentary data or an analysis result. The rooms concerned are principally the sea water tanks, some oil tanks, the front and rear structures and the bottoms of the machine and boiler rooms.

Rec 27.: It is recommended that the paintwork in the sea water tanks, oil tanks, front and rear structures and bottoms of the machine and boiler rooms be considered to contain asbestos.

5.4.7. Observations on water on board

Six water samples were taken on board, two in holds, one in a machine, one in a boiler, one in boiler closed vessel, one in a flooded passageway.

- Water present in the bottoms of machine rooms contains asbestos; this is certainly the consequence of the asbestos removal work already carried out in those rooms. On the other hand, water sampled from a closed vessel wetting boiler does not contain any.

Rec 28.: It is recommended that all water present in the machine / propulsion / auxiliary rooms be considered to contain asbestos.

- Water gathered in two holds (oil, TR5) and one passageway does not contain asbestos.

Rec 29.: It is proposed that water from the fuel-oil and TR5 holds (fresh water) and runoff water (rainwater) be considered not to contain asbestos.

It was not possible to take samples from the fresh water tanks (inaccessible) or the recovery tanks (empty or inaccessible because of gaps in ladder rungs).

5.4.8. Observations on electrical elements

Electric cables

57 cable samples were analysed for asbestos.

- 38 analyses are negative.
- 19 analyses are positive.

The cables sampled are of all kinds (power cables, lighting cables, etc.), from all systems (production, ship supply, electronic equipment supply, fire detection, etc.) and of any origin (original cables, fitted replacement cables, etc.). Whenever possible, a photographic survey of the sample was carried out (see annex D).

The sampling points are spread throughout the ship.

Data analysis (visual findings, documentation, surveyors' experience) showed that asbestos could be present in different forms:

- In braid form on the conductor under the protections and casing

- In the casing mass
- In braid or tissue form surrounding the casing

Specific analysis shows that it is not possible to identify visual physical characteristics enabling characterisation of the presence or absence of asbestos. Markings showing the type of cable are not visible.

In parallel, PCB analyses were also carried out during the course of the survey, and it appears that the regulation threshold is often exceeded (see chapter C).

Rec 30.: Electric cables present a dual pollution potential: asbestos and PCB.

5.5 ACCURACY OF DATA

This paragraph describes the different possible sources of error and the checks carried out.

The figures given are in principle overestimates, the principle retained being to include materials for which there is no certainty (analysis result or surveyor's statement) that the material does not contain asbestos.

5.5.1. Limit of analyses

An analysis is requested by the surveyor to remove a doubt or specify a piece of information for a support in a given room.

Strictly, the result observed would only be applicable to the sampling point.

Generalisation of the result must be carried out with many precautions:

- Several samples from the same system can give different results; in the life of the ship, portions of systems or system lagging may have been transformed.
- In a single room, a system may present several configurations over a short distance (one ventilation has three evolutions in 5 metres; several ventilations are split up with different types of lagging); the construction rules of the time left the fitter free to carry it out.
- In a single room and for identical systems, the external appearance of shafts may be different; a cloth-covered ventilation shaft may coexist with a merely painted one.

5.5.2. Difficulty of access

Apart from rooms which cannot be inspected (inaccessible or prohibited), it was not possible, in some cases, to examine the whole of a room because:

- some suspended ceilings could not be dismantled, even partially,
- some pipes could not be found (in voids),
- some pipes could not be measured (prolonged stay in the room being hazardous: gaps in ladder rungs, damaged floor, etc.).

This survey can not give a ruling on rooms which could not be inspected, or on elements which were not accessible. Works allowing exhaustive accessibility will have to be carried out. However, these cases are marginal (less than 10 rooms prohibited and 4 gaps in ladder rungs for example).

5.5.3. Evaluation of the total quantities of products potentially containing asbestos

The quantities measured are those of materials considered to contain asbestos by the surveyors and/or identified as such by analyses, namely:

- pipe lagging measurements,
- ventilation shaft lagging areas.

The area of floors containing asbestos is calculated taking into account all floors covered with slabs and deducting the areas of homogeneous rooms where an analysis has shown that the sample did not contain asbestos.

Areas of paint containing asbestos are evaluated from documentary data and/or assuming a homogeneity per function. Therefore, the following are counted as containing asbestos:

- paint indicated as such by DCN,
- paintwork of rooms or capacities with the same function, whenever an analysis carried out in one of the rooms of the family has proved positive. Such is the case, for example, with machine bottoms.

Some materials and products have not been identified or quantified; this concerns secondary sources of asbestos, detailed above (for example: stuffing boxes for electric cables, flange gaskets, felts, equipment elements, etc.).

Electric cables also containing PCBs will only be mentioned in the materials to be dealt with by the PCB procedures.

6. RESULTS OF THE SURVEYS: HULL PAINTWORK ADDITIVES

6.1 PRESENTATION OF THE SURVEY

Part 1 of Annex 3 of IMO resolution A962 specifies, in paragraph 1B, the metallic elements to be sought as additives of the paintwork of the hull structure, namely:

- Lead (Pb),
- Tin (Sn),
- Cadmium (Cd),
- Organostannics (tributyltin),
- Arsenic (As),
- Zinc (Zn)
- Chromium (Cr),
- Strontium (Sr).

This report also takes into account the results of the analyses of copper (Cu) and nickel (Ni) ions. Organostannics were identified in hull paintwork (cf. Environmental risks appraisal of 04/09/06)).

6.1.1. Sampling with a view to paintwork analysis

The survey took place in two parts:

- Documentary analysis (1956 paint plan) and bibliographical research on pollutants.
- Sampling during the course of the survey.

The selection of rooms for sampling was carried out based on documentary data (verification of the presence of lead, principally) or according to the type of room and the initial analysis results.

Sampling was carried out during inspections carried out on board, in accordance with the indications of the inspection records or, in some cases, at the choice of the surveyor.

Samples were always taken by mechanical cleaning of the wall or of several walls for some rooms.

Sample analysis is by ICP optical emission spectrometry and the results are available per sample for the metals: As, Cd, Cr, Cu, Ni, Pb, Sn, Sr, Zn. (cf. annex C).

6.1.2. Detection of lead on site

A specific campaign enabled the seeking out and detecting of lead in paintwork with direct identification of the presence or absence of lead.

Detection is carried out using portable equipment enabling the lead content to be established in relation to the regulation threshold authorised in France in ships (value displayed equal to 1).

The campaign was prepared from data available in the 1956 paintwork plan (bulkheads, floor, ceiling), varying the paintwork preparations based on minimum lead and preparations supposed to be free from that product.

Bearing in mind the equipment available, measurements were taken with one measurement point per wall, that is to say the floor, and other measurement points on one to four bulkheads and the ceiling. The measurements entered are attached in the results of the lead analyses.

Some measurements could not be carried out, because the relevant parts (proximity of corrosive sea water) were covered by hull insulation or coatings.

The measurements obtained varied from 0.02 (no or very little lead) to 25 (very high Lead concentration).

Detection using specific properties of lead components differing from those of the spectroscopic analysis, an attempt at correspondence was made between the two measurement scales.

Level of detection by portable equipment	Concentration in mg/kg (analysis results)
1	1,800
23	100,000

This indicative correspondence will be included in the following development.

6.2 RESULTS

6.2.1. Results of analyses

The results of analyses are presented in table form sorted by plan position, with no specific indication of the wall.

Results of detections (value displayed when searching for lead) are presented in table form sorted by plan position, with indication of the wall examined.

6.2.2. Plans by deck

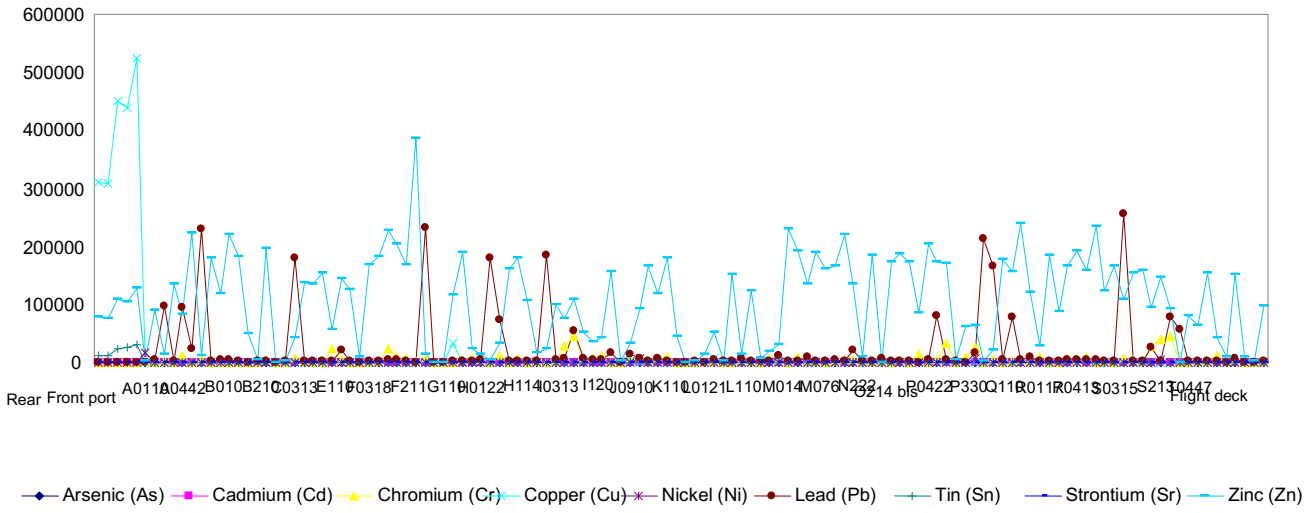
Plans indicate the sampling points (full area) and the results of analyses.

Lead-seeking measurement points are also indicated (shaded area).

6.2.3. Graphs of results per metal

Concentrations are represented (ordinately) and are indicated in ppm (mg/kg); locations of sampling carried out inside and outside are entered in abscissa.

All heavy metals included



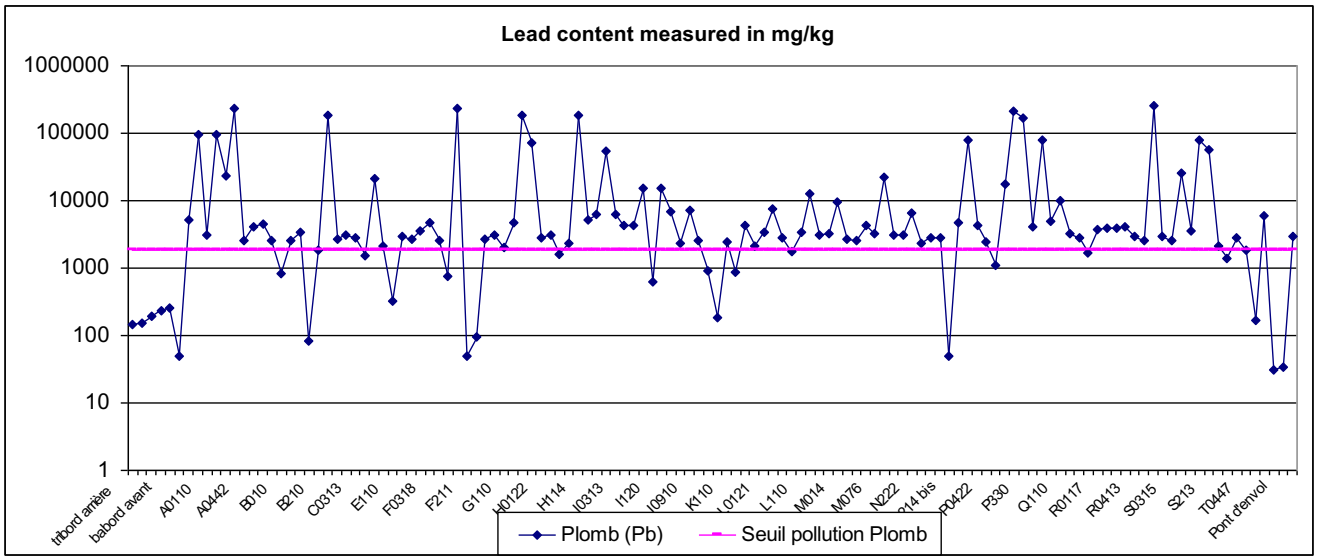
The graph representing the different elements highlights the importance of some concentration peaks, particularly for lead and chromium.
The graph also shows a “background noise” for the other concentrations.
In order to make the data legible, the following paragraphs present the results by elements and with the concentration on a logarithmic scale.

Lead

Both types of measurement are entered:

- Laboratory analysis: dosage of the lead element by spectroscopy giving a concentration in mg/kg (ppm),
- Mobile control: measurement of the lead excitation response giving a measurement level of 0 (non-detection) to 25 (maximum observed)

The graph (on a logarithmic scale) below represents the analyses results by room. The value of 1800 mg/kg is indicated by way of comparison (regulation pollution threshold for ships, see §6.1.2).



Plomb = Lead, Seuil pollution Plomb = Lead pollution threshold
Tribord arrière = Rear starboard, Babord avant = Front port, Pont d'envoi = Flight deck

83% of the paint samples carried out are above this threshold, which implies that the paintwork on board is polluted by lead according to the ship regulation criteria.

With regard to the detection campaign, the conclusions are as follows:

- In spite of the distribution differences of the rooms between the 1956 painting plan (design plan) and Q790, 23 % of the rooms initially to be painted with lead paint still present lead pollution.
- Among the walls surveyed, 5 proved to be polluted by lead whereas the paint plan did not envisage that (walls chosen "at random").
- Some interior and exterior walls of the block are polluted by lead; the block is not described in the painting plan.
- Some "aberrant" measurements undoubtedly correspond to paint repairs carried out during the life of the vessel. Those repairs are not visually detectable.
- The samples taken from the hull and on the flight deck do not contain any lead.

During the inspections, the presence of lead was observed, as well as in the paintwork:

- In sheet lead form (two sheets were found during the course of a general inspection of the block);
- In the form of electric batteries;
- In the tin/lead soldering of electronic devices;
- In linoleum coverings or cables (lead used as a stabiliser).

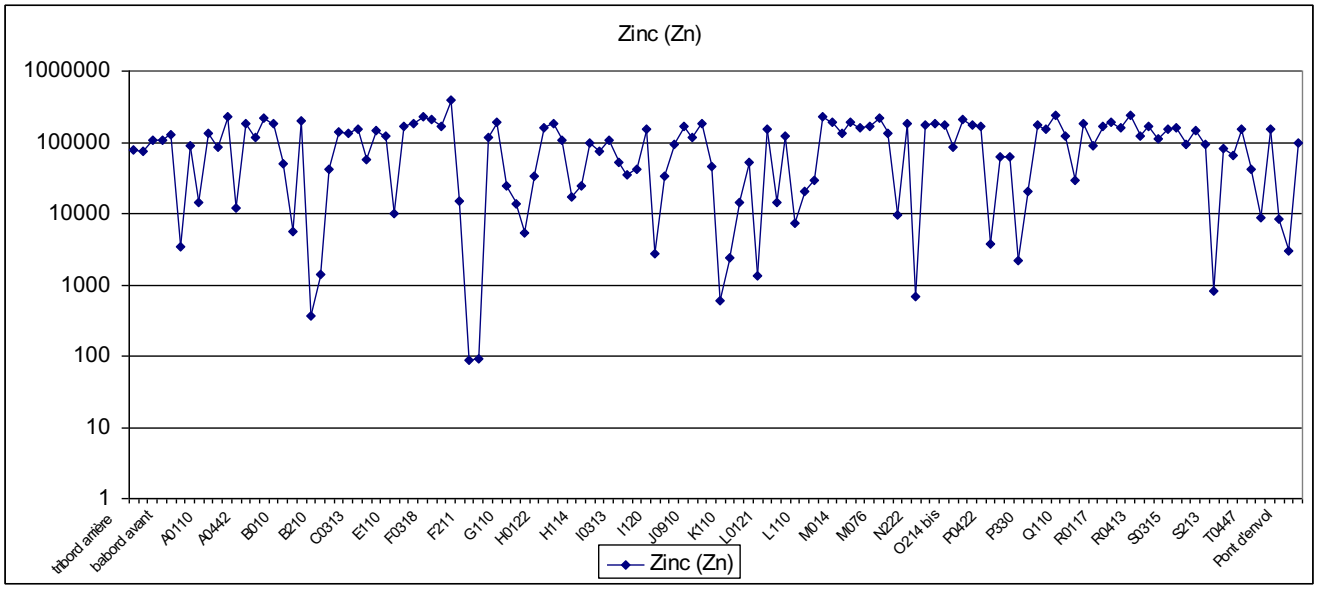
Rec 31.:	It is recommended that internal paintwork be considered overall to be polluted by lead, as well as paintwork external to the block.

Rec 32.: It is proposed that the paintwork of the hull and flight deck be considered as not being polluted by lead.

Zinc

Documentary analysis of the paint plan, and of the procedures at the time, indicates that zinc chromate was used as anticorrosive paint. The product is therefore distributed throughout the hull as a complement to the red lead.

The graph (on logarithmic scale) represents the results of analyses by room.



tribord arrière = rear starboard, babord avant = forward port, pont d'envol = flight deck

An average concentration appears, evolving between 10,000 and 150,000 mg/kg.

According to the 1956 paint plan, zinc would be present in the form of zinc chromate, known for its risks of skin irritation or even cancer or impact on the environment and aquatic organisms.

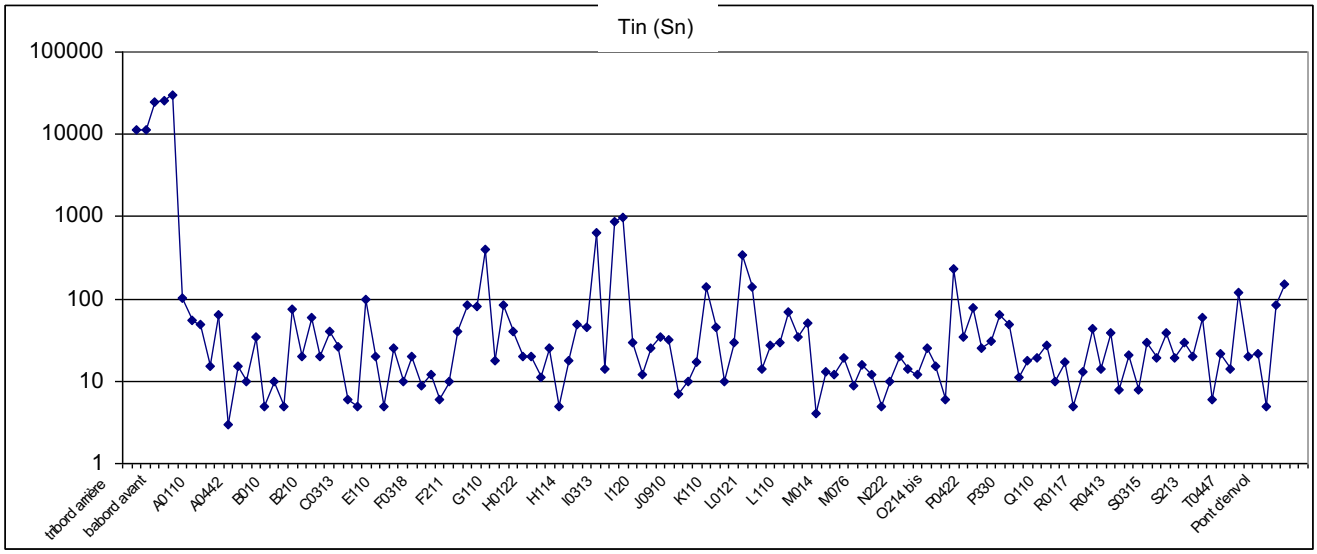
Bearing in mind the concentrations observed in the analyses, it will be necessary to protect personnel working on the dismantling against paint dust and to guarantee against "natural" or involuntary discharges into the environment.

Rec 33.: It is recommended that all paintwork be considered to contain zinc.

Tin

The environmental impact study assessed the impact of organotins released by the hull paintwork. This highlighted that the anti-fouling paints used, although old, were still active at a low-level.

For other surfaces, the graph (on a logarithmic scale) represents the results of analyses by room.



tribord arrière = rear starboard, babord avant = forward port, pont d'envol = flight deck

With the exception of the hull, the maximum value observed is less than 1000 ppm with an average value of 60 ppm.

Precautions will have to be taken for the treatment of waste during work on the hull.

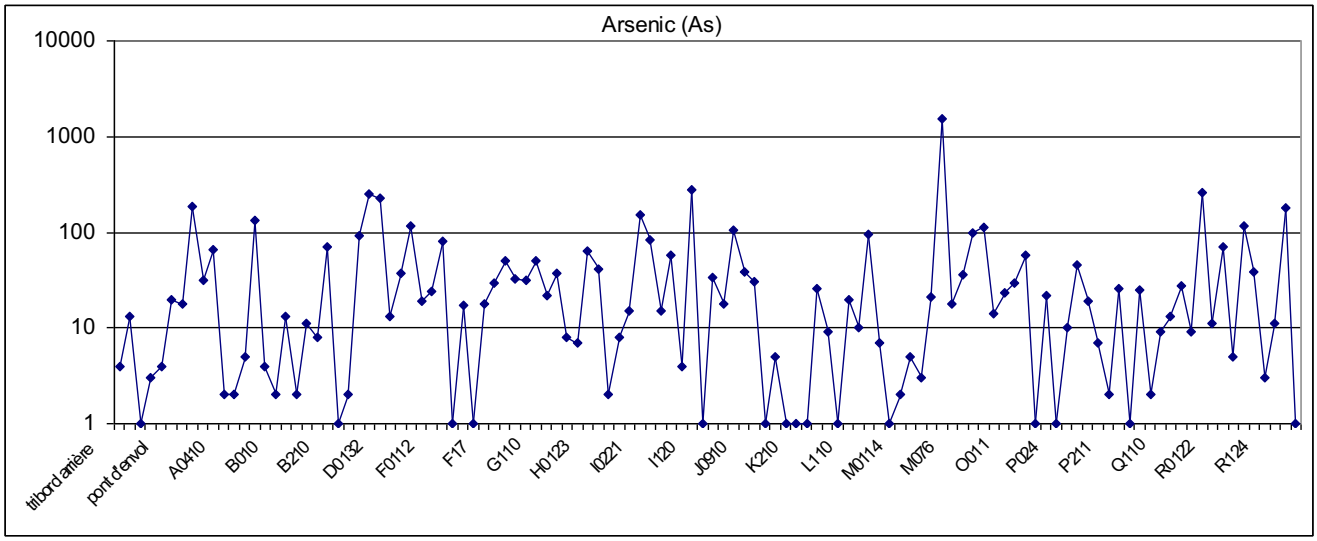
Rec 34.: It is recommended that monitoring of the impact of the hull on the quality of water be maintained.

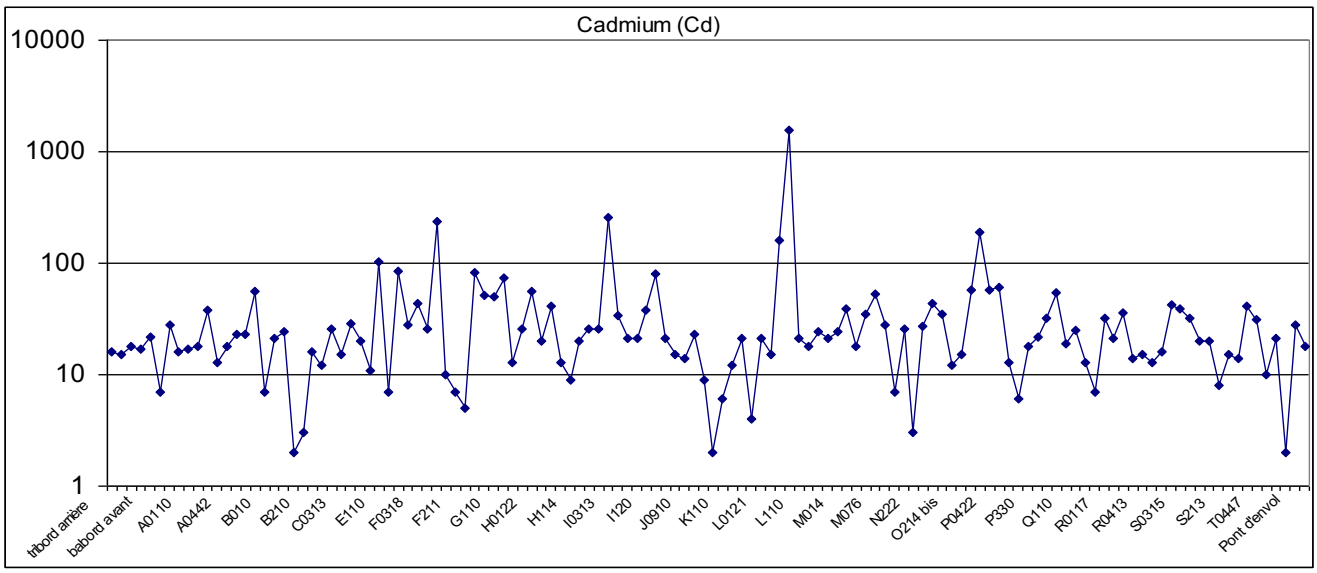
Other elements: Arsenic, Cadmium, Chromium, Nickel, Strontium

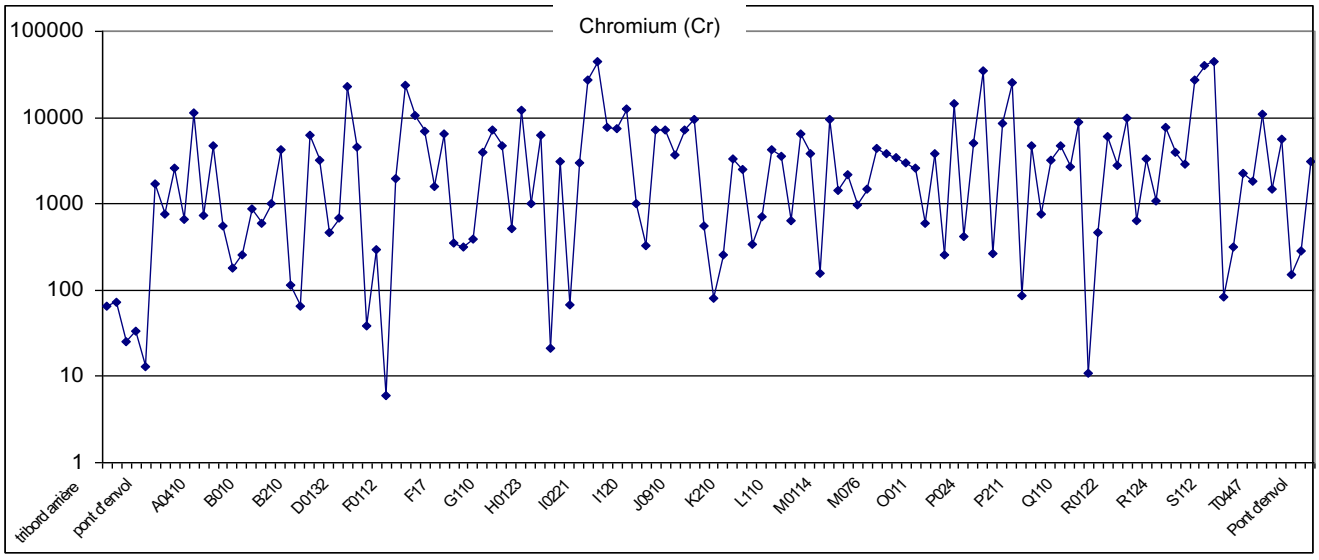
The table below indicates the maximum and minimum concentrations (in mg/kg) observed during the course of analysis of samples

	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Strontium (Sr)
Maximum	1550	1540	44,900	16,300	473
minimum	1	2	6	2	2

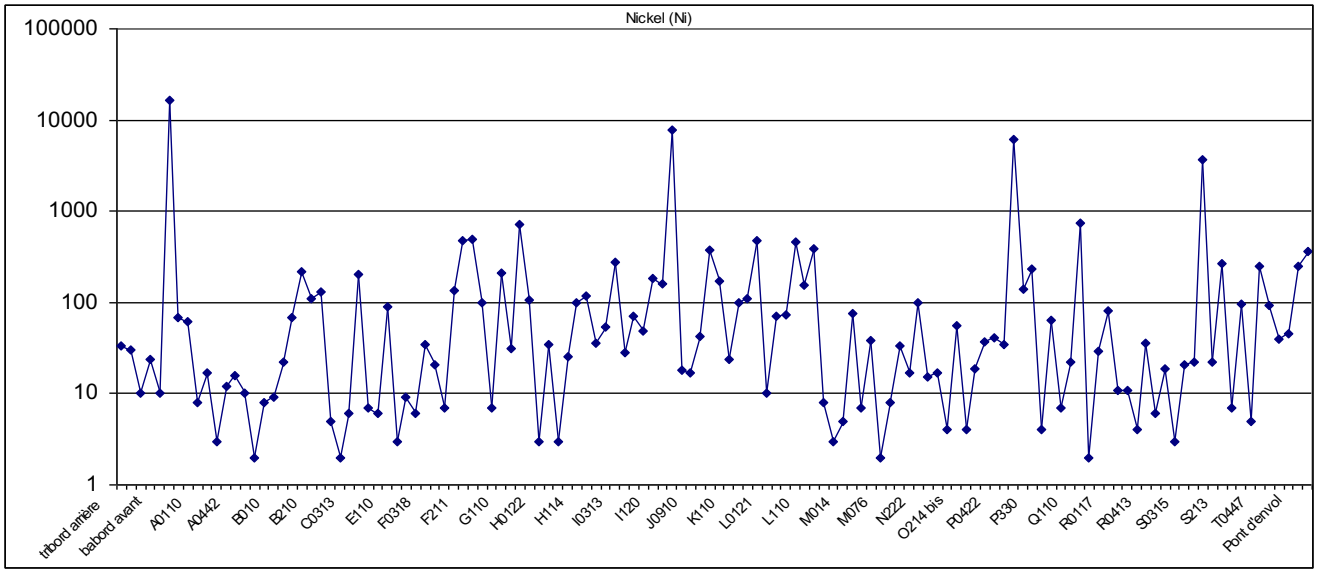
The graphs (on a logarithmic scale) represent the results of analyses by room for the different elements considered.

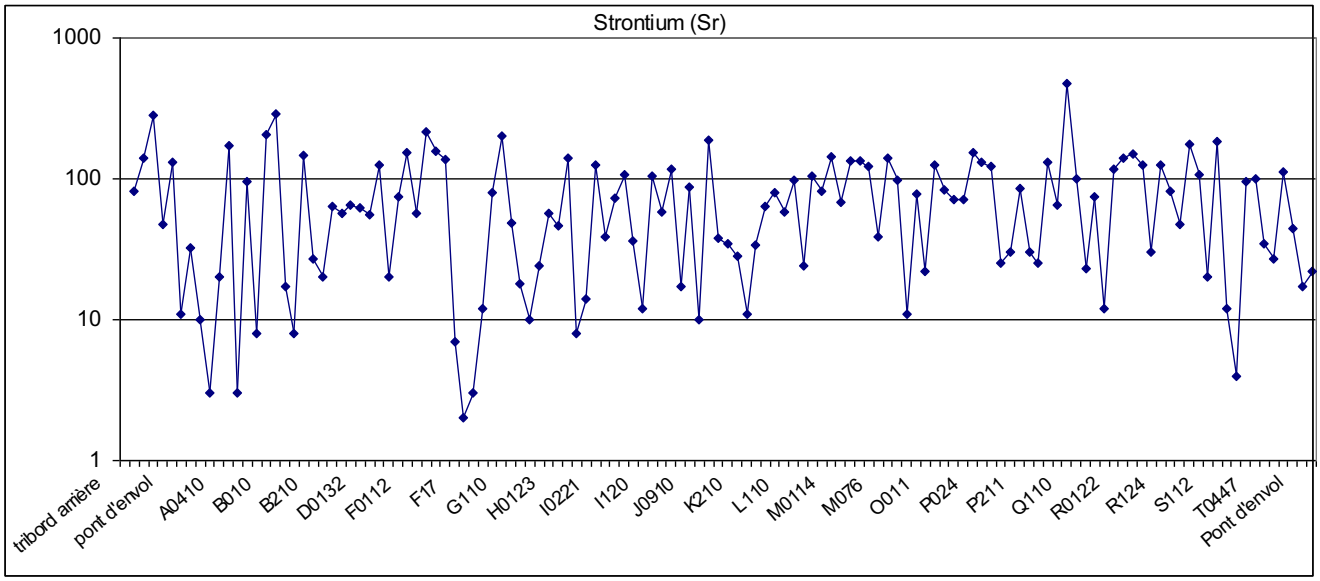






tribord arrière = rear starboard, babord avant = forward port, pont d'envol = flight deck





tribord arrière = rear starboard, babord avant = forward port, pont d'envol = flight deck

The toxicological records of these five heavy metals indicate a danger on ingestion or even inhalation, a danger for the environment and, for some, high toxicity for the marine environment.

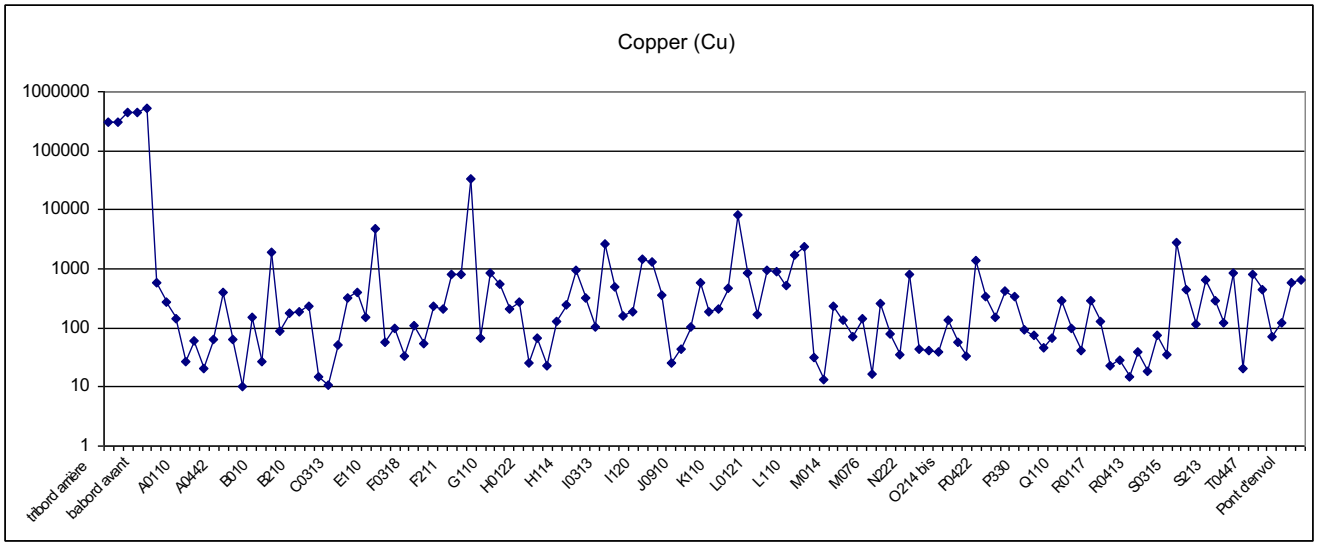
The only regulation thresholds available are expressed for a gaseous form, therefore the danger associated with dust, in this case paint flakes, will have to be mentioned.

Rec 35.:	It is recommended that aerial discharges (dust) or discharges in solution be limited for all paints.

Copper

This element is not mentioned in the list of paints additives.

The graph (on a logarithmic scale) represents the results of the analyses by room.



tribord arrière = rear starboard, babord avant = forward port, pont d'envol = flight deck

However the high concentration observed in the immersed hull samples must be noted. The state of the hull paintwork (see photos) is dealt with in the impact report.

Rec 36.:	It is recommended that the evolution of the hull paintwork be monitored.

Rec 37.:	It is recommended that monitoring of the impact of the hull on the quality of water be maintained.

Rec 38:	It is proposed that interior paintwork be considered to be overall not very polluted by copper, as well as the paintwork external to the block.

6.3 OBSERVATIONS ON DISTRIBUTIONS

The dual campaign (laboratory analysis, detection by mobile control) which was carried out for lead allowed the conclusion on the following points for lead:

- A measurement carried out on one bulkhead can not be generalised to the room. Let us cite as an example the Admiral's gangway: of the three internal bulkheads, two are highly charged with lead (level 22 on the mobile control, around 100,000 ppm).
- A measurement on one wall cannot be generalised to the bulkhead, as it is possible that the latter has been repainted locally: on the external gangway of deck 09, within a circle with a radius of 1 metre, two measurements are negative and two are positive, one of which is at level 3 on the mobile control (around 7000 ppm); moreover, three of the measurements are carried out on the same plate (respectively: polluted, not polluted, polluted).

This reasoning is no doubt transposable directly to zinc.

6.4 SUMMARY FOR PAINTWORK

The search for heavy metals was carried out by testing based on available information. Table 1B of the IMO resolution will specify the locations analysed.

Steel manufacturers use a European scrap classification directive (March 1995).
The heavy metals contents measured on the Q790 do not exceed the limits specified by that directive.

However, all the heavy metals considered may have very high local concentrations and their discharge without precautions could have an impact for workers and for the environment.

Rec 38.: It is recommended that precautions be taken for all operations involving paintwork.

7. RESULTS OF THE SURVEYS: MATERIALS CONTAINING PCB, PCT, PBB

7.1 POLYCHLORINATED BIPHENYLS (PCB)

Polychlorinated biphenyls (PCBs) are a category of chlorinated aromatic hydrocarbons which bring together 209 different so-called congeneric molecules.

The toxicity of some PCBs has not yet been completely evaluated. A dozen of them have a toxicity similar to that of dioxins, others have other action mechanisms.

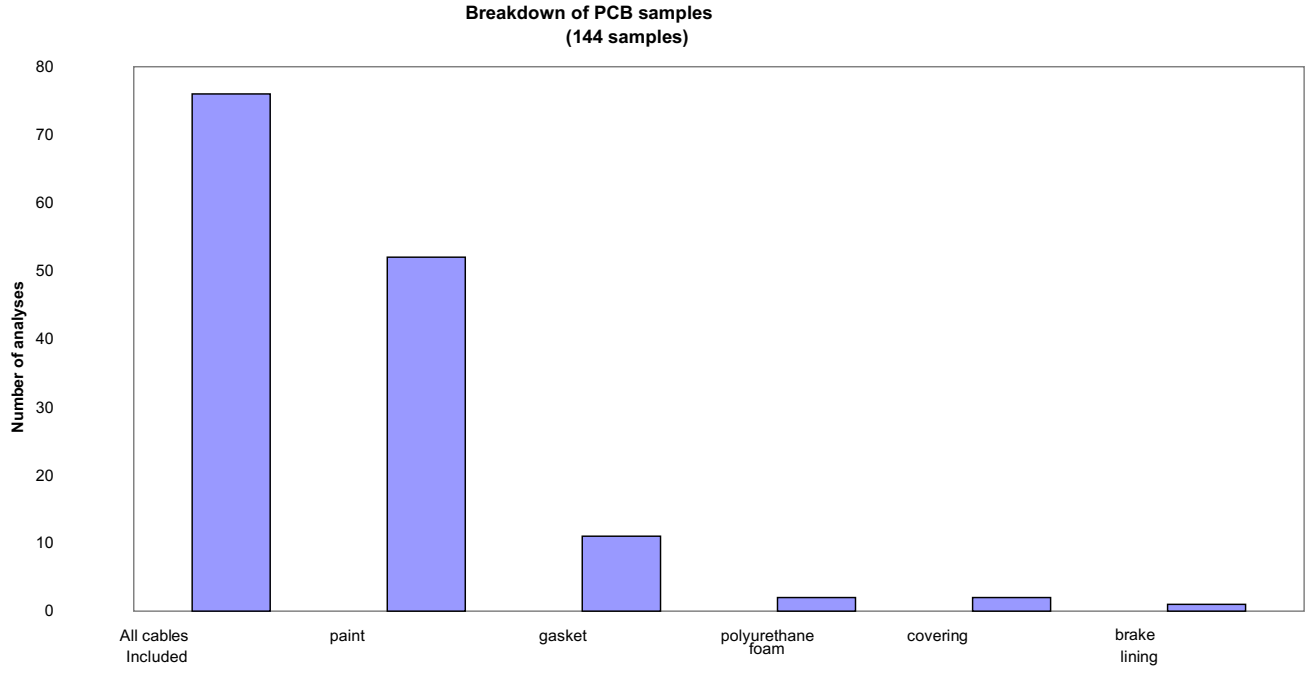
It must be noted that PCBs dispersed into the environment can be concentrated along the whole of the food chain, in particular in fish, because of their stability and their lipophilic nature.

Until 1975, they were used as plasticisers, fireproofing agents, adhesives, lubricants. Highlighting of the toxicity of mixtures (action on the nervous system, immuno-depressive effects, carcinogenesis promoter and activators, etc.) led to restrictions on use.

7.2 THE SURVEY

The survey concerned principally the possibility of presence of PCBs as additives in plastic materials, rubbers and paints.

The graph below summarises the different types of materials analysed.



The breakdown of the number of samples was carried out in the following manner:

- Electric cables in large quantities and presenting high heterogeneity account for half of the samples, namely 76 samples;
- Paints also presenting high heterogeneity account for nearly a third of the samples (52 items) with particular attention to the plant rooms associated with electricity;
- Gaskets being strongly typified, one or two samples were done per type of gasket;
- Polyurethane foam being homogeneous, two different samples were carried out;
- Linoleum flooring and the pipe lagging polyurethane being homogeneous, two different samplings were carried out;
- Brake linings being in small numbers and homogeneous, only one sampling was carried out.

Analyses were also done on work zones which may have been polluted during hot working through PCBs; in fact, PCB is a toxic product which, when burnt at a temperature between 400 and 800 degrees, produces dioxin.

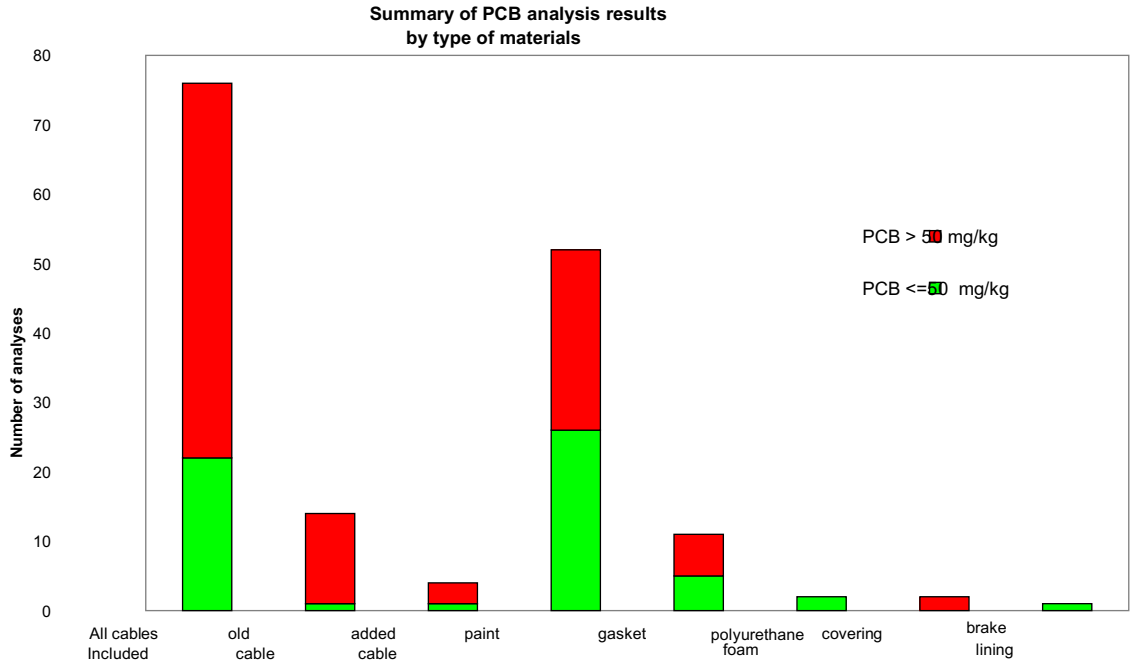
The analyses (see annex C) give a PCB content which covers the PCB, PCT and PBBT families.

7.3 ESTIMATION OF MATERIALS CONTAINING PCB PRESENT ON BOARD

The regulation threshold for PCB concentration is fixed at 50 mg per kg of non-metallic material.

No transformer containing a dielectric fluid was found.

The graph below summarises the distribution by type of materials from the analyses results.



71% of the samples of cables analysed (out of 76 available) and 50% of the paint samples analysed (out of the 52 available) show a content greater than 50 mg/kg.

Moreover, when the information is available, the cables were able to be split between old cables (fitted in the ship's trial period) and added cables (installed with the addition of equipment): samples of old cables are almost all polluted (93%) and more than 70% of the samples of added cables are as well.

PCBs are present in the following items:

Electric cables

71 % of the samples of electric cables have a content higher than the regulation threshold.

The samples were taken in different formats, from different types and from different places for different uses; this was recorded by the photographs.

In several places, the remains of electric cables casings are available. Sorting was carried out so as to be able to analyse all the existing types.

Moreover, samplings were carried out on site to be able to have data according to the time of installation or the type of certain cables (for example, used in cable tunnels).

Analysis of the detailed results shows that the external appearance of cables does not enable them to be discriminated (see examples in annex D).

Paint

Samples were taken principally in the plant rooms and holds.

A grey paint identified in these rooms presents content higher than the regulation threshold:

- in electrical plant rooms (lift cage, electric motor);
- in the hangar frame spaces voids.

From an inaccurately referenced site (E105 in H0112 bis to be confirmed) but apart from the grey paint described above, some burnt paint was sampled below cut electric cables. The analysis results indicate a content higher than the regulation threshold. It must be assumed that during cutting works harmful chemical reactions took place.

On one site (E43 in I0223) with some of the grey paint described above, some burnt paint was sampled at the edge of a plate section. The analysis results indicate a content above the regulation threshold. It must be assumed that during plate cutting works harmful chemical reactions took place.

Some paint samples from the propulsion-energy rooms have a content above the regulation threshold; similarly for samples of paint from rooms associated with munitions or the oil tanks.

Concerning paint from non-plant rooms, the samples do not present a content above the regulation threshold, except for accidents (burnt zone for example).

Miscellaneous

The two linoleum flooring samples analysed present a content above the regulation threshold.

A fraction (55%) of the samples of rubber gaskets (doors of rooms, escape hatch, flame-arrester stopper) present a content above the regulation threshold.

Condensers likely to contain a dielectric fluid (neon starter, electronic boards) are to be treated using the specialist procedure.

7.4 READING OF RESULTS

The results of the analyses are attached in annex C.

Bearing in mind the technical difficulties due to the very high content of some samples (nearly a thousand times the threshold), it was decided, during the survey, to limit the dosages to the search for a content at least ten times greater than the regulation threshold. This is why some results are expressed as having values “greater than x”.

7.5 OBSERVATIONS ON THE BREAKDOWNS

7.5.1. Electric cables casings

The samples of the electric cables analysed come from two different populations:

- Cables cut on site for analysis.
- Cable casings grouped in piles in several different rooms and for which a photographic identification was carried out.

All cables (old or more recent, of any use) of the first type have a content greater than the regulation threshold, with some of them having very high content (for example 23,350 mg/kg).

71% of the cable casings (old or more recent, of any use) of the second type have a content greater than the regulation threshold, with some of them having very high content (for example 41,000 mg/kg).

Study of the photographs of the samples (40% of samples photographed) does not enable the establishing of any identification rules enabling discrimination of cables with PCB from visual criteria.

Let us remember also that some casings contain asbestos fibres. (See chapter 5).

The burnt cables (following hot working) examined present a content above the regulation threshold.

Rec 39.:	It is recommended that the electric cables be considered to be polluted by PCBs. Specific precautions are to be taken concerning cutting and handling (possible presence of asbestos, a generic problem with cables of the time).

7.5.2. Paints

The paint samples come from four different populations:

- Samples taken from rooms with electrical equipment, for example containing an electric motor, a lift cage, a repair workshop,
- Samples taken from rooms presenting the same colour paint as that used in the rooms of the first category, for example the frame space voids of the hangar,
- Samples taken from plant rooms (for example: propulsion-energy, oil tank) or associated with munitions (for example hold or assembly zone),
- Samples taken from external parts of the ship or on board (for example accommodation area).

All samples from the first three categories have a content higher than the regulation threshold, with some of them having very high content (for example 23,350 mg/kg).

The results of 27 samples, including some for plant rooms or propulsion-energy, are below the regulation threshold.

Rec 40.:	It is recommended that the grey paint of the plant rooms or voids be considered to be polluted by PCBs, as well as the paint burnt under the cuts realised previously.

Rec 41.:	It is proposed that the exterior paint be considered to be free from PCB. Precautions are, however, to be taken regarding waste during any cutting.

Rec 42.:	It is proposed that the paint from accommodation areas be considered to be free from PCB. Precautions are, however, to be taken regarding waste during any cutting.

7.5.3. Burnt areas

Several samples of burnt paint or burnt cables have a content 2 to 3 times higher than the regulation limit.

Work with a naked flame must have taken place at at least three sites (passage openings, works in a room, cutting of an under-deck reinforcing support). Naked flame work should have been prohibited in these areas.

For the first two cases, the zone was identifiable by the grey colour of the paint. For the last case, there is no character specific to the room, with the exception of a burnt electric cable close to the area where the paint was sampled.

Rec 43.: Specific precautions are to be taken for the cutting and handling of plates.

7.5.4. Gaskets, flooring and miscellaneous

Several samples of gaskets were analysed by family. The PCB content is often 2 to 3 times higher than the regulation limit, with a content of at least 8 times the authorised limit for one watertight door gasket.

There does not appear to be any regular changing of the gaskets which could have modified this distribution; from three samples of door gaskets, only one is below the threshold.

The two linoleum samples (flooring) showed a high PCB content.

The presence of electronic boards and neon tubes fitted was established.

Rec 44.: It is recommended that linoleum coverings and rubber gaskets be considered to be polluted by PCB

Rec 45.: It is recommended that the electronic boards containing condensers and the neon condensers be treated using the specialist procedures.

7.6 SUMMARY CONCERNING PCBS

The IMO resolution clearly indicates the admissible threshold in the title of the table.

More than 60 % of the samples have a PCB content above the threshold and among the latter 50% have a content 10 times the threshold.

8. OTHER POTENTIALLY HAZARDOUS MATERIALS

This chapter concerns the materials from the following IMO resolution classification paragraphs:

- 1C PLASTIC MATERIALS,
- 1E SEALED GASES present in the ship's machinery and equipment,
- 1F CHEMICAL PRODUCTS present in the ship's machinery and equipment,
- 1G OTHER SUBSTANCES present in the ship's machinery and equipment,
- 2 OPERATING WASTE present,
- 3 STOCKS AND PROVISIONS present.

The tables per compartment (annex A) present all the information gathered concerning the pollutants indicated in the list and not yet treated.

Plastics (section 1C):

Plastics encountered on board are in the form of drums, filled rubbish bags, miscellaneous furniture, materials or equipment, but in low quantity.

The drums surveyed are indicated in the table by compartment and are to be treated as operating waste; the absence of indication is frequently to be noted (rubbed out, covered over, peeled off).

Some rooms give the impression of having been used as storage areas during earlier works (for example, the lift pit, the rear port exterior gallery. Waste stored in those areas is indicated in the table by compartment and is to be treated as potentially containing asbestos.

Sealed gases (section 1E):

Gas bottles were identified in equipment in passageways, in the hangar or in the refrigeration plants. The tanks of the refrigeration plants are still in place and may contain sealed gases.

The instrumentation of the bottles or tanks has not enabled a verdict on how full they are. They seemed to have been emptied previously, some of them even being without a top.

No bottles have been observed installed on mobile or dismantling supports.

Chemical products (section 1F):

Reservoirs or tanks liable to contain chemical products were identified.

No external information (of probe type) enabled a verdict to be reached on how full these were.

Chemical products (section 1G):

The lead batteries referenced are listed in the tables (annex A).

A particular precaution is to be taken for the catapults lubricant circuit, some traces of which were found sunken under the stagnant water in the room. This lubricant is given as being corrosive.

Internal equipment circuits and supply circuits from a daily service fuel tank are to be treated with care; the circuits are not drained.

Some thermometers were noted (see annex A) some of which are broken. It is possible that the contacts of the hold probes are filled with mercury. Care is to be taken when dismantling.

With regard to radioactive material, the finding is as follows:

- The documentary examination does not call up any specific search.
- Regarding hull welding, the constructor indicated to us that no welding process involving radiating metallic particles was used (such as TIG with rhodium plated cathode), this process not being used for hull welding and not being in use at the time of construction.
- 38 luminescent plates were found during the course of the survey and mentioned the same day to the Naval Base (Q790 "Security" unit) with a view to their removal and treatment using the specific procedure.
- Fire detectors are given as possibly containing an ionising source; they are to be treated using the specific procedure.

Rec 46.: It is recommended that the fire detectors be treated using the specific procedure.

Waste (section 2):

No dry operating residue was found in the open rooms.

No waste, debris or rubbish other than that resulting from earlier works was found (see annex A). The presence of CO in the sonar well of unknown origin must be noted.

The fuel bunkers are reckoned to be degassed and are either filled with fresh water or empty. Gaseous emanations must however be noted for the TR5 tanks. Generally speaking, the various pipes supplying the equipment, the intermediate tanks or inside equipment may contain fuel products, as shown by some run-offs coming from the pipes dismantled in the machine room.

The bottom of the propulsion-energy compartments presents water laden with fuel and also asbestos and must therefore be treated as products containing asbestos.

Rec 47.: It is recommended that the liquids present in the bottoms of the propulsion energy compartments be treated as products containing asbestos.

The oily rags of the propulsion energy compartments are to be treated as products containing asbestos.

Several other types of waste were found on board:

- Piles of electric cable casings, in five or six plan positions.

Rec 48.: It is recommended that waste consisting of piles of electric cables casings be treated as PCB material.

- Piles of rubbish bags with unknown contents, in three or four plan positions, in particular in the lift pit where wooden pallets, ventilation shafts and some remnants of dubious-looking lagging were found.

Rec 49.: It is recommended that the various waste sacks be treated as material containing asbestos.

- Asbestos mattresses stocked either in a prohibited volume, or in the closed vessel of a boiler. To be treated as material containing asbestos.

Rec 50.: It is recommended that the asbestos mattresses stored be treated as material containing asbestos and that the room where the volume is so polluted be cleaned.

- Remnants of lagging in the main sites, to be treated as material containing asbestos.

Rec 51.: It is recommended that waste consisting of remnants of lagging be treated as material containing asbestos.

Stocks (section 3):

No information was found on the stocks of gas other than the bottles identified in section 1E. The Q790 having been laid up for nearly 10 years, it may be supposed that the gases have been exchanged with the atmosphere. Particular precautions are to be taken regarding principally the gas units used for dedicated equipment (for example, the cold plant tanks, balloon dedicated to fire prevention).

No information was found on the stocks of chemical products other than the drums identified in sections 1C, 1F and 1G. The Q790 having been laid up for nearly 10 years, it may be supposed that those chemical products were disembarked at the time of it being laid up.

No information was found on the stocks of other products other than some fuel drums in the engine room and some batteries (see annex A).

9. PRINCIPAL RECOMMENDATIONS

- The documentary analysis therefore enabled definition of the inspection methodology as:
  - deterministic for the measurements of the following systems and networks: pipe lagging, ventilation shaft lagging, hull and bulkhead insulation, flooring; in order to quantify per room the amount of material potentially polluted by asbestos.
  - statistical to determine the ratio of polluted products of the same type and to reduce the error band of some estimations made on documentary or feedback bases (e.g.: electric cables, paintwork surfaces).
- The initial results of the analyses showed that the same system could contain asbestos in one room and not contain asbestos in an adjacent room without the external appearance changing.
- The result of the analysis of a sample from a given support in a room is extended by analogy to identical supports in adjacent rooms.
- In case of uncertainty, this report recommends using the most safety-conscious option.
- The on board inspection shows that the insulations were homogeneous in the different rooms inspected.
- It is recommended that all munitions-lift door gaskets be considered to contain asbestos.
- It is recommended that all door gaskets be considered to contain asbestos.
- It is recommended that all bunker deadlight gaskets be considered to contain asbestos.
- It is recommended that all pyrotechnic locker gaskets be considered to contain asbestos.
- It is recommended that all hangar door gaskets be considered to contain asbestos.
- It is recommended that all pipe flange gaskets be considered to contain asbestos.
- It is recommended that all mineral wool insulation be considered as potentially polluted by the underlying asbestos felt.
- It is recommended that all stuffing-box gaskets be considered liable to include materials containing asbestos.
- It is recommended that all electric stuffing-box gaskets be considered to contain asbestos.
- It is recommended that all electrical equipment be considered to contain asbestos because of some of its components.
- It is recommended that all rotating shaft brakes be considered to contain asbestos.
- It is recommended that all felts and insulations of electrical apparatus be considered to contain asbestos.
- It is recommended that all cooled water systems be considered to contain asbestos.
- It is recommended that all jointing pipes be considered to contain asbestos.
- Zones containing sprayed asbestos or asbestos board are to be treated as specific sites.
- There is a high risk of presence of asbestos felt in numerous rooms, either stuck under the plates of reinforcements or mixed with original mineral wool. Identification of those felts is not possible before dismantling the insulations; those felts are therefore not identified.

- The usual prudence and precautions during dismantling of the cement floor slabs remain appropriate.
- It is recommended that all floor slabs and glue be considered to contain asbestos.
- Although not a material containing asbestos, linoleum is to be treated in a specific procedure.
- It is recommended that ventilation frame damper felts be considered to contain asbestos regardless of the status of the ventilation system in place.
- It is recommended that flame retardant gaskets be considered to contain asbestos regardless of the status of the ventilation system in place.
- It is recommended that the paintwork of sea water tanks, oil tanks, forward and rear structures and the bottoms of machine and boiler rooms be considered to contain asbestos.
- It is recommended that all water present in the machine / propulsion / auxiliary rooms be considered to contain asbestos.
- It is proposed that water from the fuel-oil holds, TR5 (fresh water) and runoff water (rain water) be considered not to contain asbestos.
- Electric cables present a dual pollution potential: asbestos and PCB.
- It is recommended that interior paintwork be considered to be globally polluted by lead, as well as paintwork external to the block.
- It is proposed that the paintwork of the hull and of the flight deck be considered not to be polluted by lead.
- It is recommended that all paintwork be considered to contain zinc.
- It is recommended that monitoring of the impact of the hull on water quality be maintained.
- It is recommended that aerial discharges (dust) or discharges in solution be limited for all paintwork.
- It is recommended that the evolution of the hull paintwork be monitored.
- It is recommended that monitoring of the impact of the hull on water quality be maintained.
- It is proposed that interior paintwork and paintwork external to the block be considered to be globally not very polluted by copper.
- It is recommended that precautions be taken for all operations involving paintwork.
- It is recommended that electric cables be considered to be polluted by PCBs. Specific precautions are to be taken concerning cutting and handling (possible presence of asbestos, a problem generic to cables of the time).
- It is recommended that grey paintwork of the plant rooms or voids be considered to be polluted by PCBs, as well as the paint burnt under the cuts carried out previously.
- It is proposed that exterior paintwork be considered as free from PCB. Precautions are, however, to be taken regarding waste when carrying out any cutting.
- It is proposed that the paintwork of the accommodation area be considered as free from PCB. Precautions are, however, to be taken regarding waste when carrying out any cutting.
- Specific precautions are to be taken for the cutting and handling of plates.
- It is recommended that linoleum coverings and rubber gaskets be considered to be polluted by PCB.

- It is recommended that electronic boards containing condensers and neon condensers be treated using the specialist procedures.
- It is recommended that fire detectors be treated using the specific procedure.
- It is recommended that liquids present in the bottoms of energy propulsion compartments be treated as products containing asbestos.
- It is recommended that waste consisting of piles of electric cable casings be considered as PCB material.
- It is recommended that miscellaneous sacks of waste be considered to contain asbestos material.
- It is recommended that the asbestos mattresses stored be treated as material containing asbestos and the room or volume so polluted be cleaned.
- It is recommended that waste consisting of remnants of lagging be treated as material containing asbestos.

SUPPORTING DOSSIER

- **VOLUME 2:**

ANNEX A – DETAILED TABLES PER ROOM OF THE SURVEY RESULTS

- **VOLUME 3:**

ANNEX B – CARTOGRAPHY BY DECKS

ANNEX C - RESULTS OF LABORATORY ANALYSES

ANNEX D – SURVEY PHOTOGRAPHIC DOSSIER