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NATO INTERNATIONAL SECRETARIAT – DEFENSE INVESTMENT DIVISION

HEALTH CARE WASTE MANAGEMENT PROCEDURES ABOARD NATO NAVY VESSELS

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Promulgated on 31 October 2008

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RECORD OF CHANGES

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FOREWORD

1. The purpose of this document is to provide information to MCG/7 members and to other NATO committees having an interest to the subject.

2. This Allied Maritime Environmental Protection Publication, AMEPP 9, has been prepared by AC/141(MCG/7) on Maritime Environmental Protection.

3. This AMEPP is part of the AMEPP series on Maritime Environmental Protection which also includes the other following documents:

- Guidance about NATO Navy Pollution Abatement Policies
- National Navy Regulations for the Disposal of Waste,
- Shipboard Pollution Abatement Equipment Catalogue,
- Ship Design Guidance for the integration of MEP functional requirements,
- Hazardous Material Offload Guidance,
- Guidance about Alternative Non-Ozone Depleting Solvents and Cleaning Agents,
- Glossary of Terms and Definitions used in the AMEPP series,
- Guidance about Military Uses of Ozone Depleting Substances (ODS) in NATO.

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This AMEPP belongs to a series of AMEPPs that were prepared by AC/141(MCG/7) on Maritime Environmental Protection. These AMEPPs cover various aspects of Maritime Environmental Protection.

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(This document is produced for information and does not substitute to national practices)

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HEALTH CARE WASTE MANAGEMENT PROCEDURES ABOARD NATO NAVY VESSELS

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1. INTRODUCTION

a) Integrating medical and technological breakthroughs, medical engineering applied to naval programs is critical to optimise medical support at sea for navy warships crews and troops deployed ashore (sea basing). Adequate medical support technologies have to be known to achieve better medical service at sea and to be compliant with present and future emerging regulations. Health care waste (HCW) management is one of these new technical issues.

b) At NATO level, in the framework of STANAG-2510, the EPWG ("*Environmental Protection Working Group*") has already produced preliminary technical information about "*Health Care Waste Management*" by military forces (see annex 1 of the present report). This work has been conducted with the help of MMMP-WG ("*Medical Material and Military Pharmacy Working Group*") belonging to the COMEDS ("*Chief of Military Medical Services*"). MMMP's main objectives are: the definition of common policies, procedures and principles regarding military Health Care activities, the definition of common specifications and requirements for medical equipment, the definition of recommendations on cooperation and interoperability. The plenary meetings are annual.

c) The aim of the present document is to provide further knowledge on national practices, such as legislative contexts, shipboard procedures and technical responses in force or that may be implemented aboard NATO navies' vessels and land bases. This document may also be used by health professionals (doctors, nurses, dentists, surgeons …), engineers and military staff wishing to share their experiences, determines their requirements and constraints and find long term solutions. National responses in term of strategies and national points of contact are given in annex.

2. PROBLEM AREAS AND CHALLENGES

a) The potentially frequent presence of viruses, spores, fungi and bacteria inside medical waste (bandages, needles, syringes, tubes, perfusion materials, catheters, blood bags, gloves …) makes their management by health professionals the new major challenge at the beginning of the 21st century. The medical staff has imperatively to address this risk, considering that this waste has to be managed differently from other domestic garbage (packaging, food waste …).

b) Many military naval forces and naval bases health services (hospital wards, operating theatres, intensive care units and medical laboratories) meet the same difficulties as civilian organisations to comply with current legislation and guidance on shipboard medical waste management. This issue is particularly essential during long periods at sea (from a few weeks up to several months), due to inadequate processing equipment or insufficient medical waste storage space on board the ship.

c) Shipboard integration may first require compliance of the medical waste treatment equipment with the following technical requirements: on-site treatment of a wide range of medical waste, no contamination risks during transportation, normal waste disposal of residues after treatment, autonomy in service, easy set up and deployment, very low maintenance and running costs. Some NATO navies may also have to comply with other priority practices and/or national legislation.

3. LAWS, REGULATIONS AND POLICIES

a) Considering the existence of the Basel Convention on the transboundary movements of hazardous wastes, health care waste management may also comply with comparative specific legislation. Additionally, national practices may require the enforcement of several principles: "*polluter pays*" principle, "*precautionary*" principle, "*duty of care*" principle, "*proximity*" principle.

b) Health professionals who have legal responsibilities for their own activities inside the medical complex are submitted to these 4 principles. They have to justify the final destination of the medical waste that is continuously produced during health cares.

c) According to national policies, the marketing of adequate equipment may become increasingly necessary for shore-side activities. In some cases, additional requirements may be requested for obtaining an official certificate from a national health authority, proving the compliance of the equipment with the legislation in force, a highly efficient decontamination reduction capability and the contribution in the fight against infection and contagion.

4. POTENTIAL TECHNICAL RESPONSES

a) According to national legislation and policies, health professionals from the civilian and military sectors either use containment procedures in which the medical waste is directly stored in dedicated containers (encapsulation process), or contamination reduction processors in which the medical waste is fully decontaminated (incineration, steam autoclave, microwave, chemical and/or mechanical treatment, combined treatment …). Typical examples of affordable treatment and disposal procedures are described in the annex 1 of the present report (source: MMMP-WG).

b) To address this problem, some NATO navies may have initiated specific shipboard medical waste R&T program to explore existing technologies for handling and treating shipboard medical waste. In general, the goal of such programs is to identify and evaluate commercially available systems for processing shipboard medical waste that are produced under peace and/or crisis time by their Fleet. Experimentation on-shore and/or at sea may also be organized, if need be.

5. CONCLUSIONS

a) Some nations have already promulgated national, federal or provincial legislation and guidelines for a secured management of medical waste by health professionals (doctors, nurses, dentists, surgeons ...), particularly the infectious health care waste, at a civil and/or military level.

b) At a NATO level, this issue has also been considered for a long time, particularly by the medical expert team belonging to the MMMP working group who has conducted an analysis on HCW management by the military forces (Army, Navy …) in the framework of STANAG-2510.

c) In response to this context several navies have adopted compliant strategies to meet present and prospective (inter)national regulations. This information is developed in the annex 2 of the report.

6. QUESTIONNAIRE SUBMITTED TO NATIONS

a) Current and planned national-local legislation (standards in force inside civil sector, specificities for military sector…).

b) Current and planned shipboard management procedures onboard Navy vessels (collect-storage-treatment equipments & procedures, autonomy at sea, interfaces with ship-to-shore facilities…).

c) Present and planned R&T programmes (market study, technical research, test and trial at sea…).

7. WEB SITES

http://www.healthcarewaste.org

http://www.who.int

ANNEX A - TECHNICAL INFORMATION ABOUT HEALTH CARE WASTE MANAGEMENT BY MILITARY FORCES (NAVY, AIR, ARMY)

(This part is issued from the work conducted by MMMP-WG for the draft #3 of STANAG-2510)

1. HEALTH CARE WASTE MANAGEMENT

Health Care Waste (HCW) is defined as waste from medical, dental or veterinary treatment activities. Infectious Health Care Waste is Hazardous waste. It includes all the waste generated by health-care establishments, research facilities, and laboratories. It also includes waste originating from minor or scattered sources such as that produced in any health care unit at any level.

2. CLASSES OF WASTE (CATEGORY DESCRIPTION AND EXAMPLES)

Infectious Waste is waste suspected to contain pathogens e.g. laboratory cultures; waste from isolation wards; tissues (swabs), materials, or equipment that have been in contact with infected patients; excreta.

Cultures and stocks of highly infectious agents, waste from autopsies, animal bodies, and other waste items that have been inoculated, infected, or in contact with such agents may be classified as highly infectious waste Pathological Waste Human tissues or fluids e.g. body parts; blood and other body fluids; foetuses.

Sharps: sharp waste, e.g. needles; infusion sets; scalpels; knives; blades; broken glass.
Pharmaceutical Waste: waste containing pharmaceuticals e.g. pharmaceuticals that are expired or no longer needed items contaminated by or containing pharmaceuticals (bottles, boxes).
Genotoxic Waste: waste containing substances with genotoxic properties e.g. waste containing cytostatic drugs (often used in cancer therapy) and/or genotoxic chemicals.
Chemical Waste: waste containing chemical substances e.g. laboratory reagents; film developer; disinfectants that are expired or no longer needed solvents.
Radioactive Waste: waste containing radioactive substances e.g. unused liquids from radiotherapy or laboratory research; contaminated glassware, packages, or absorbent paper; urine and excreta from patients treated or tested with unsealed radio-nuclides; sealed sources.
Wastes With High Heavy Metal Content: batteries, broken thermometers blood-pressure gauges, etc.
Pressurised Containers: gas cylinders, gas cartridges aerosol cans.

3. COLOUR–CODING AND GENERAL PRACTICES

a) Recommended Colour-Coding For Health-Care Waste:

Type of waste	Colour of container and markings		Type of container
Highly infectious waste	Yellow, marked "Highly infectious waste"		Strong, leak-proof plastic bag, or container capable of being autoclaved
Other infectious waste, pathological and anatomical waste	Yellow		Leak-proof plastic bag or container
Sharps	Yellow, marked "SHARPS" Sharps are considered infectious waste whether contaminated with infectious agents or not.		Puncture-proof container 
Chemical and pharmaceutical	Brown		Plastic bag or container
Radioactive waste			Lead box, labelled with the radioactive symbol
General health-care waste	General health-care waste		Plastic bag

b) In addition to the colour coding of waste containers, the following practices are recommended:

1	General health-care waste should join the stream of domestic refuse for disposal.
2	Sharps should all be collected together, regardless of whether or not they are contaminated. Containers should be puncture-proof (usually made of metal or high-density plastic) and fitted with covers. They should be rigid and impermeable so that they safely retain not only the sharps but also any residual liquids from syringes. To discourage abuse, containers should be tamper-proof (difficult to open or break) and needles and syringes should be rendered unusable. Where plastic or metal containers are unavailable or too costly, containers made of dense cardboard are recommended (WHO, 1997); these fold for ease of transport and may be supplied with a plastic lining.
3	Bags and containers for infectious waste should be marked with the international infectious substance symbol.
4	Highly infectious waste should, whenever possible, be sterilised immediately by autoclaving. It therefore needs to be packaged in bags that are compatible with the proposed treatment process: red bags, suitable for autoclaving, are recommended.
5	Cytotoxic waste, most of which is produced in major hospital or research facilities, should be collected in strong, leak-proof containers clearly labelled Cytotoxic wastes.
6	Small amounts of chemical or pharmaceutical waste may be collected together with

	infectious waste.
7	Large quantities of obsolete or expired pharmaceuticals stored in hospital wards or departments should be returned to the pharmacy for disposal.
8	Other pharmaceutical waste generated at this level, such as spilled or contaminated drugs or packaging containing drug residues should *not* be returned because of the risk of contaminating the pharmacy; it should be deposited in the correct container at the point of production.
9	Large quantities of chemical waste should be packed in chemical resistant containers and sent to specialised treatment facilities (if available). The identity of the chemicals should be clearly marked on the containers: hazardous chemical wastes of different types should never be mixed.
10	Waste with a high content of heavy metals (e.g. cadmium or mercury) should be collected separately.
11	Aerosol containers may be collected with general health-care waste once they are completely empty, provided that the waste is not destined for incineration.
12	Low-level radioactive infectious waste (e.g. swabs, syringes for diagnostic or therapeutic use) may be collected in yellow bags or containers for infectious waste if these are destined for incineration.

4. WASTE MANAGEMENT PLAN FOR A HEALTH CARE ESTABLISHMENT

A waste management plan is also required for every health-care establishment. Even very limited waste management measures can dramatically reduce this environmental and health risk:

a) Effective confinement of waste and safe handling measures provide significant health protection. All these measures to reduce risk are relatively simple and cheap and should be considered by any health-care establishment.

b) At the local level, the following basic actions should be taken:

1	Assessment (quantitative and qualitative) of waste production.
2	Identification of any existing waste facilities and local regulations.
3	Identification of segregated waste handlers and recyclers.
4	Segregation of waste in different fractions.
5	Establishment of internal rules for waste handling.
6	Assignment of responsibilities within the military establishment.
7	Choice of suitable or better treatment and disposal options.

c) The proper management of health-care waste depends largely on good administration and organisation but also requires adequate legislation and financing, as well as active participation by trained and informed staff.

5. WASTE MINIMISATION AND TRANSFORMATION

Significant reduction of the waste generated in health-care establishments and research facilities may be encouraged by the implementation of certain policies and practices. Source **Reduction, Recyclable Products, Good Management and Control Practices and also Waste Segregation** will be considered as appropriate measures. In addition are the following:

a) **Waste Segregation**: careful management of stores will prevent the accumulation of large quantities of outdated chemicals or pharmaceuticals and limit the waste to the packaging (boxes, bottles, etc.) plus residues of the products remaining in the containers. These small amounts of chemical or pharmaceutical waste can be disposed of easily and relatively cheaply, whereas disposing of larger amounts requires costly and specialised treatment, which underlines the importance of waste minimisation.

b) **Reduced Toxicity:** reducing the toxicity of waste is also beneficial, by reducing the problems associated with its treatment or disposal. For example, the Supply Officer could investigate the possibilities of purchasing PVC-free plastics that may be recycled or of goods supplied without unnecessary packaging.

c) **Waste Transformation**: any device or process allowing potentially infectious Solid Healthcare Wastes (SHW) to be pulverised and sterilised and transformed into general waste, which any Nation could dispose of as solid urban waste, should be introduced and framed into field hospital facilities.

6. WASTE IDENTIFICATION, COLLECTION, SEGREGATION, TREATMENT AND STORAGE

The key to minimisation and effective management of health-care waste is **segregation** (separation) and **identification** of the waste. Appropriate handling, treatment, and disposal of waste by type reduces costs and does much to protect public health. Segregation should always be the responsibility of the waste producer, should take place as close as possible to where the waste is generated, and should be maintained in storage areas and during transport. The same system of segregation should be in force throughout the country. Here is the key for Infectious Waste, Pathological Waste and Sharps Waste:

a) **Education of health care workers:** The waste management system in a hospital should be clearly set out in a Waste Management Plan (WMP). An infection control or Hygiene Committee and specialist infection control personnel, where they exist, are the most appropriate people to be given responsibility for establishing a safe approach to the management of health care waste throughout a health care institution. In addition, in every medical department someone should be responsible for ensuring good waste management procedures at every stage from generation to final disposal of health care waste. It should be regarded as the professional responsibility of all medical staff to use a waste segregation system and to dispose of waste properly, since it is part of the continuing need to maintain good hygiene within hospitals to control infection. Every new member of staff should be trained in his or her responsibilities with regard to achieving good waste management in their area. If a person is not shown what to do, the hospital management cannot expect him or her to do it properly. If, after being shown the procedures, a member of staff fails to observe the correct methods for handling waste, it should become a management or disciplinary matter.

b) **Colour Coding:** Use distinctly different colours for general and potentially infectious wastes. WHO recommends Black for general waste and Yellow for potentially infectious wastes. Ultimately all bags, containers, bag holders and trolleys should be either black or yellow to reinforce the separation of these two types of waste. Once separated, the two waste streams should be handled and disposed of separately and not recombined.

c) **Waste Handling and use of Correct Waste Receptacles:** To reinforce the importance of separating waste in medical departments the yellow and black waste bags should be located in separate places. One, or no more than two, yellow bags should be in use at any time in most medical departments. They should be located away from patient areas and usually at the nurses' station or room and (if one exists) possibly in a treatment room. Sharps containers should be in the same locations and not in the patients' areas where they could be interfered with. There should be a fixed schedule for the collection of waste bags and containers from each medical department. This is to ensure the regular removal of waste from each location and to avoid misunderstandings between medical staff and cleaning or housekeeping staff. The minimum frequency of waste removal should be once a day, and preferably at least once per working shift. There should be separate schedules and separate collection times for black bags and yellow bags/sharps containers. No bag or sharps container should be more than three-quarters full when it is replaced. It should preferably be replaced when it reaches two thirds full. The reason for this is to reduce the risk of plastic bags splitting open and of an injury from a protruding sharp item in sharp containers.

d) **Labelling:** All bags leaving a medical area should be sealed and labelled. The label should show, as a minimum, the name of the responsible medical person from the medical area (usually the head or charge nurse), the date and department name. This labelling is to enable managers and other personnel to trace any waste bag to its source if a problem is found (e.g. used sharps are contained in a bag or general and potentially infectious wastes are mixed in the wrong bags). It also allows medical managers to gather data on the amount of waste produced in each medical department and so ensure that the typical quantities of each waste type do not suddenly change. A sharp container should be labelled "SHARPS" in the relevant language to remind medical staff what it contains. When filled to no more than three-quarters full, a sharp container should be sealed and sent for disposal with potentially infectious waste. To ensure that this disposal route is used, some hospitals require sealed sharps containers to be placed into yellow bags, tied and placed in the yellow temporary storage container (if used) or taken to the central storage area for potentially infectious waste. To reinforce the use of a colour coding system, all bag holders, pedal bins and waste transporting trolleys should be either black or yellow. Where this is not possible, clear signs should be placed on the bag holders, bins and trolleys to indicate whether they should be used for general waste or infectious waste.

e) **Temporary Storage**: In medical areas producing a high quantity of waste, bags can be filled reasonably quickly. The use of rigid containers such as a two-wheeled 240-litre container with a lid is recommended for temporary storage within or near these areas. Sealed and labelled yellow bags containing waste are placed in this container and then removed at the scheduled collection times by cleaning or housekeeping staff. The use of a rigid container as a temporary storage point avoids filled waste bags being piled on the floor where they could be knocked and split open. One yellow temporary storage container should be available to each medical department for potentially infectious waste. Sometimes more than one medical department on the same floor can share this temporary storage point. The temporary storage point should be located away from patient areas.

f) **Internal Transport**: If waste bags are carried to a Central Storage Area in trolleys touring different medical departments, separate trolleys should be used for general waste and potentially infectious waste. Yellow and black bags should not be carried mixed in the same trolley. If both types of bag are carried this increases the possibility of wastes becoming mixed and being transported along inappropriate disposal routes. The use of closed trolleys with lids is recommended. Waste bags should not be hand-carried around a hospital since this increases the risk of injury to the legs, arms and torso from incorrectly disposed sharps or other items.

g) **Storage Points:** These are locations in special areas or in the grounds of a hospital where larger containers, e.g. 1.1 m^3 four-wheeled bins (Eurobins), are used to store waste until it goes for final disposal either on- or off-site. To ensure that waste is kept separated; the central storage containers for black bags should be black or at least clearly marked "for general waste only". Similarly, the central storage containers for yellow bags should be yellow or at least clearly marked "for infectious waste only". There may be one or more central storage points for yellow and black bags depending on the layout and size of each hospital. The central storage point(s) for the two types of waste should be geographically separated on the hospital site. Waste from the separate central storage points for general waste and potentially infectious waste should go to different final disposal facilities. In hot, arid and tropical areas all waste should be disposed of within 24 hours in the hot season and a maximum of 48 hours in the cool season. Therefore, the storage time at a central storage point should be short. In temperate climates, WHO suggests that all waste should be disposed of within a maximum of 72 hours (in winter), although recent experience has shown that a maximum period of 48 hours is more desirable in case of occasional unforeseen delays. These time periods assume that central storage points are not refrigerated.

h) **Recommendations for Storage Facilities for Health-Care Waste:**

1	The storage area should have an impermeable, hard-standing floor with good drainage; it should be easy to clean and disinfect.
2	There should be a water supply for cleaning purposes.
3	The storage area should afford easy access for staff in charge of handling the waste.
4	It should be possible to lock the store to prevent access by unauthorised persons.
5	Easy access for waste-collection vehicles is essential.
6	There should be protection from the sun.
7	The storage area should be inaccessible for animals, insects, and birds.
8	There should be good lighting and at least passive ventilation.
9	The storage area should not be situated in the proximity of fresh food stores or food preparation areas.
10	A supply of cleaning equipment, protective clothing, and waste bags or containers should be located conveniently close to the storage area.

i) **Handling and Collecting Highly Infectious Waste**: Some medical areas produce health care waste that may be reasonably suspected of being potentially contaminated with highly contagious pathogens. Such sources include: all laboratory samples containing body fluids, tissues or faeces; isolation patients; and medical research facilities handling class 3 or

higher pathogens. Waste from these sources should be autoclaved first (or possibly chemically disinfected) and then placed into yellow bags before entering the system for disposing of potentially infectious waste in the hospital. In some places, highly infectious waste is not pre-treated by autoclaving or disinfecting. Instead, it is directly taken to an on-site incinerator and immediately burnt. This is not recommended because severe problems may occur if a bag of untreated highly infectious waste splits while it is being transported around a hospital.

j) **Pharmaceutical Waste**: A series of steps need to be taken when disposing of unwanted pharmaceuticals, and these are briefly summarised below:

1	**Decision**: A pharmaceutical programme is to be established by the Chief Pharmacist Officer of the medical facility during the planning process to decide when action needs to be initiated, because of an accumulation of unwanted pharmaceuticals which are unfit for human consumption and for veterinary treatment.
2	**Approval**: Approval and sanctioning of disposal of pharmaceuticals must be sought from the appropriate authority. The guidelines are particularly useful in emergency situations or for HN in transition where official regulations have not yet been developed. In non-emergency situations when significant quantities of donated pharmaceuticals are disposed of, for whatever reason, it may be necessary and judicious to inform the donor.
3	**Planning:** Planning, in terms of funding, necessary expertise, human resources, professional time, space, equipment, material and available disposal options will be required. This is essential before practical steps can be taken to start disposal. To obtain a rough estimate of the volume of materials to be sorted, it is recommended that measurements are made using a tape measure, and conversion from volume of material to weight is made using a density figure of 0.2 metric tons/cubic metre.
4	**Forming Work Teams**: Teams should conduct work consisting of supervising pharmacists and general medical workers, who are preferably pharmaceutical technicians. The size of each team, and the ratio of experts to workers, will be determined by the volume and composition of the stockpiles, and working conditions at the sites.
5	**Health and Safety At Work Teams**: All workers should wear appropriate protective equipment including overalls and boots at all times, and gloves, masks and caps when appropriate. Masks should be worn when tablets or capsules are being crushed as part of the disposal technique (for example, inertisation) and when there is a risk of powders being liberated. Particular care is required when handling antineoplastics.
6	**Sorting**: The objective of sorting is to separate the pharmaceuticals into separate categories for which different disposal methods are required. The separation should be made into those that can be safely used and returned to the pharmaceutical supply system and those that require disposal by different methods. For example, controlled drugs (e.g. narcotics), antineoplastic drugs and antibiotics all require special methods of disposal. Substantial investment in human resources may be required for identifying and separating pharmaceuticals.
7	**Disposal**: Disposal options vary considerably according to situations and the ideal solution may not be feasible.

8	**Security**: Controlled substances (e.g. narcotics and psychotropics) require tight security and control and should be disposed of in accordance with national regulations. In some countries, scavenging of material from landfills is a frequent problem, and, disposed drugs may be recovered and sold by the scavengers. Measures are therefore necessary to prevent diversion during sorting, and pilfering of drugs from landfills. Immobilisation (through either encapsulation or inertisation) is the best method of preventing pilfering from a store or landfill. If, as a last resort, pharmaceuticals must be discarded direct to a landfill then they must be covered immediately with a large quantity of municipal waste.
9	**Genotoxic, Chemical and Radioactive:** Waste Cytotoxic waste should be stored separately from other health-care waste in a designated secure location. Radioactive waste should be stored in containers that prevent dispersion, behind lead shielding. Waste that is to be stored during radioactive decay should be labelled with the type of radionuclide, the date, and details of required storage conditions. Further information is provided in an appropriate following section, which addresses methods of treatment and disposal of radioactive waste.

7. WASTE TREATMENT (THERMAL PROCESS, DISINFECTION PROCESS, CONTAINMENT PROCESS)

For health-care establishments with few resources and applying minimal, waste management programmes, affordable treatment and disposal methods for hazardous and highly infectious waste may be classified into three categories: thermal processes, chemical disinfection or containment processes.

a) Thermal processes:

1	**Static Grate Single Chamber Incineration**: Waste may be burned in a simple furnace, with a static grate and natural airflow. De-ashing, loading, and unloading operations are carried out manually. The low heating value of properly segregated health-care waste is high enough for combustion, but addition of a small quantity of kerosene may be needed to start the fire and blowing of air may also help in establishing optimal combustion. The burning efficiency may reach 90-95%; i.e. 5-10% of the material may remain unburned in the ashes and slags. The operating temperature will be around 250 °C, which will kill most micro-organisms but will be insufficient to destroy thermally resistant chemicals or pharmaceuticals.
2	**Drum or Brick Incinerators:** Where a single-chamber incinerator is not affordable or available, simple confined burning may be applied. A steel drum or walls of bricks or concrete can be erected over a screen or fire grate and covered with a second screen to prevent dispersion of ashes or light material. The waste is placed inside and burned with the help of manual ventilation and addition of kerosene if necessary. Constant supervision is essential to prevent any spread of the fire to the surrounding area. The combustion efficiency may reach 80-90% and kill 99% of micro-organisms. The temperature of the fire will not exceed 200 °C, and this process should be used only in emergency situations or when other treatment methods cannot be implemented.
3	**Open-air burning**: Open-air burning of infectious waste (excluding pathological waste) should be carried out only as a last resort, in rural dispensaries, isolated health posts, or emergency situations. If possible, the burning should take place in the pit of final disposal (i.e. where the residues will be buried), and the person responsible for waste management should supervise the process in the health-care facility. It should be performed downwind, and as far as possible from, the facility or other communities. The area within which the burning is carried out should be fenced to prevent unauthorised persons and animals from entering. Confined burning, e.g. in a drum incinerator, should always be preferred, as the risk to personnel of contact with the waste or with partly burned residues is lower. The advantages and drawbacks of open-air burning are the same as for drum or brick incinerators, but there is the additional disadvantage that burning may be incomplete and non-uniform.
4	**Wet Thermal Disinfection**: Wet thermal disinfection is based on exposure of shredded infectious waste to high-temperature, high-pressure steam. Shredded waste is introduced into a reacting tank, vacuum conditions are established, and steam is introduced. Precise operating procedures have to be followed by qualified technicians for efficient disinfection. Only health-care establishments with sufficient technical and

	financial resources and where incineration in single-chamber or drum/brick incinerators is unacceptable, for example because of air pollution problems, should consider wet thermal disinfection.
5	**Autoclaving**: Autoclaving is an efficient wet thermal disinfection process. Typically, autoclaves are used in hospitals for the sterilisation of recyclable items, and these units allow for the treatment of only limited quantities of waste. They are therefore generally used only for highly infectious waste, such as microbial cultures and sharps. Even a general hospital with very limited resources should be equipped with an autoclave, but a district hospital may well not have one.

b) Chemical disinfection: Chemical disinfection is an efficient process, but costly if the prices of disinfectants are high. For safe operation it requires trained technicians provided with adequate protective equipment and is therefore not recommended for treating all infectious health-care waste. However, the process can be useful in specific cases, such as disinfection of recyclable sharps or disinfection of stools from cholera patients.

1	**Chemical Sterilisation of Recyclable Sharps**: Chemical sterilisation of scalpels syringes with needles, and other recyclable sharps may be considered as an alternative or complementary method to thermal sterilisation. After thorough cleaning and drying, the sharps are placed in a tank and exposed to a strong disinfecting gas or liquid, such as ethylene oxide, formaldehyde and glutaraldehyde.
2	**Chemical Disinfection of Stools from Cholera Patients**: *Vibrio cholera*e, the causative agent of cholera, is not very resistant and its elimination does not require the use of very strong chemical disinfectants. Buckets containing stools of patients with acute diarrhoea may be disinfected through addition of chlorine oxide powder or dehydrated lime oxide (CaO). Other liquid or powder disinfectants may also be used. In case of a cholera epidemic, hospital sewage must also be treated and disinfected. Where there is sufficient space, sewage may be treated through lagooning, followed by effluent disinfection with sodium hypochlorite. In cholera epidemics in emergency situations these disinfection measures should also be applied in field hospitals to prevent the spread of the disease.

c) Containment processes:

1	**Landfilling in Municipal Disposal Sites**: Waste may be landfilled in Host Nation Municipal Disposal Sites if it cannot be treated before disposal. However, health-care waste should not be deposited or scattered on the surface of open dumps. If landfilling is planned, the following minimal requirements should be met: a) Measures established with local Host nation authorities for the rational and organised deposit of municipal wastes that could be used to dispose of health-care wastes. b) If possible, engineering work instigated by both SN and local Host nation authorities to prepare the disposal site to retain wastes more effectively. c) Rapid burial of the health-care waste, so that human or animal contact is as limited as possible. In addition, it is recommended that health-care waste is deposited in one of the following two ways: - In a shallow hollow excavated in the mature municipal waste, in the layer below the base of the working face, where it is immediately covered by a 2m layer of

	fresh municipal waste; scavenging in this part of the site must be prevented. - Deeper pit (1-2 m) excavated in mature municipal waste (at least 3 months since being landfilled) which is then backfilled with the mature waste that was dug out; again, scavenging in this part of the site must be prevented. d) Alternatively, a specially constructed small burial pit could be prepared to receive health-care waste only. The pit can be 2 m deep and filled to a depth of 1 m. Each load of waste should be covered with a soil layer 10-15cm deep (Lime may be placed over the waste if coverage with soil is not possible.) In case of a disease outbreak involving especially virulent pathogens (such as the Ebola virus), both lime and soil cover may be added. Access to this area should be restricted and closely supervised by the responsible staff to prevent scavenging. Before health-care wastes are sent for land disposal, it is prudent to inspect the proposed landfill site to ensure that there is satisfactory control of waste deposition.
2	**Safe Burying Inside Premises** a) In certain health-care establishments in remote locations, temporary refugee camps, and areas experiencing exceptional hardship, safe burial of wastes on hospital premises may be the only rational option available at times. To limit risks to health and of environmental pollution, some basic rules should be applied: - Access to the disposal site should be restricted to authorised personnel only. - The burial boundary should be lined with a material of low permeability (e.g. clay), if available. - Only hazardous health-care waste should be buried. - Large quantities (over 1 kg) of chemical wastes. - The burial site should be managed in the same way as a landfill, with each layer of waste being covered with a layer of earth to prevent development of odours and infestation by rodents and insects. b) The safety of waste burial relies critically on operational practices. Safe on-site burial is practicable for only relatively limited periods of time, e.g. 1-2 years, and for relatively small quantities of waste, say up to 5-10 tonnes in total. Where these limits are exceeded, a longer-term solution, involving treatment of the waste or disposal at a municipal solid waste landfill, will need to be found.
3	**Encapsulation**: Encapsulation is recommended as the easiest technology for the safe disposal of sharps. Sharps are collected in puncture-proof and leak-proof containers, such as high-density polyethylene boxes, metallic drums, or barrels. When a container is three-quarters full, a material such as cement mortar, bituminous sand, plastic foam, or clay is poured in until the container is completely filled. After this material has dried, the container is sealed and may be landfilled, stored, or buried inside the hospital premises. It is also possible to encapsulate chemical or pharmaceutical residues together with sharps.

8. MANAGEMENT OF HAZARDOUS HEALTH-CARE WASTE BY WASTE CATEGORIES

a) **Infectious waste and sharps**: Incineration in single-chamber incinerators should be the method of choice in establishments that apply minimal waste management programmes. Highly infectious waste, such as cultures and stocks of infectious agents from laboratory work, should be sterilised by wet thermal treatment (e.g. autoclaving) at the earliest stage, i.e. inside the health-care establishment, and soon after production, if possible. For other infectious health-care waste, disinfection to reduce microbial concentration is sufficient. Sharps should also be incinerated whenever possible and can be incinerated together with other infectious waste. Encapsulation is also suitable for disposing of sharps. Blood should be disinfected before discharge to the sewer (unless there is an adequate wastewater treatment plant) or may be incinerated. After incineration or other disinfection process, residues may be landfilled.

b) **Pharmaceutical waste**: Sound management of pharmaceutical products, with a view to waste minimisation, is of prime importance. Small quantities of chemical or pharmaceutical waste can be disposed of easily and relatively cheaply, but large amounts may require special, more costly treatment, such as high-temperature incineration. The Chief Pharmacist Officer of the health-care establishment should supervise comprehensive management of pharmaceutical stores. Small quantities of pharmaceutical waste are usually collected in yellow containers together with infectious waste and therefore follow the same disposal pathway, being either incinerated or safely buried. It should be noted, however, that temperatures reached in a single-chamber furnace might be insufficient to disintegrate thermally resistant pharmaceuticals. Small quantities of pharmaceutical waste, such as outdated drugs (except cytotoxics and antibiotics), may also be discharged to the sewer but should not be discharged into natural waters (rivers, lakes, etc.). Significant quantities of pharmaceutical waste may be disposed of by the following methods:

1	Incineration (if an incinerator able to reach a combustion temperature of 800 °C is available); the incineration residues may be landfilled.
2	Discharge to the sewer. Water-soluble, relatively mild pharmaceutical mixtures, such as vitamin solutions, cough syrups, intravenous solutions, eye drops, etc., may be diluted with large amounts of water and then discharged to sewers (where sewerage systems exist). This process should *not* be used for antibiotics.
3	Encapsulation. When incineration is not feasible and water dispersion is not recommended, pharmaceutical waste should be encapsulated.
4	Return to the original supplier if possible.

Note: Cytotoxic drug residues and other cytotoxic waste should *never* be mixed with other pharmaceutical waste, but should be processed separately

c) **Chemical Waste**: As for pharmaceutical waste, improved management of chemical waste starts with waste minimisation efforts. The Chief Pharmacist Officer of the healthcare establishment will supervise the proper management of chemical stores. The hospital Infection Control Officer, Chief Hygienist, or Chief Pharmacist Officer should be designated to supervise the use of chemicals throughout the health-care establishment. The main users of chemical disinfectants, which are among the most hazardous chemicals used in the establishment, are likely to be the Infection Control Officer/Chief Hygienist and his or her staff. Small quantities of chemical waste will include residues of chemicals in their packaging, outdated or decomposed chemicals, or chemicals that are no longer required.

These are generally collected in yellow containers, together with infectious waste, and follow the same disposal pathway (either incineration or safe burying). Large quantities of chemical waste should *not* be collected in yellow plastic bags or containers. There is no safe and cheap method for their disposal; the treatment options are the following:

1	**Subcontracting incineration with a public or private agency equipped for the safe disposal of hazardous chemical waste**: The thermal reactivity of the waste should be checked; certain solvents will burn and can therefore be incinerated in simple incineration units, although it must be remembered that those containing halogens could cause air pollution.
2	**Return to the original supplier** (if the supplier has facilities for safe disposal): In this case, appropriate provisions should be included in the original purchase contract for chemicals.
3	**Exportation to a country with the expertise and facilities to safely dispose of hazardous chemical waste or return to home country:** Shipment of chemical waste should comply with international agreements, such as the Basel Convention and the United Nations Recommendations on the transport of dangerous goods.
4	All three options are costly and may be unpractical, which makes it particularly crucial that chemical waste is minimised. The following recommendations should also be observed: - Hazardous chemical wastes of different nature should never be mixed. - Hazardous chemical waste should not be disposed of in sewer systems. - Large amounts of chemical waste should not be buried as they may contaminate groundwater. - Large amounts of chemical disinfectants should not be encapsulated, as they are corrosive and sometimes flammable.

d) **Cytotoxic Waste**: Cytotoxic drugs are highly hazardous to the health of the individual and to the environment. Disposal options are the following:

1	Return to the original supplier: incineration at high temperatures, e.g. in rotary kilns or high-performance double-chamber pyrolytic incinerators (if available), or chemical degradation.
2	The following recommendations should also be observed: - Residues from cytotoxic drugs or other cytotoxic waste should never be mixed with other pharmaceutical waste. - Cytotoxic waste should never be discharged into natural water bodies or landfilled

Nota: In countries where the above disposal procedures are cytotoxic and radioactive, products should be restricted to university research and teaching hospitals.

e) **Radioactive Waste:** For safety reasons, medical use of radioactive isotopes should be restricted to university hospitals, and any hospital that uses radioactive products should appoint a qualified Radiation Officer.

f) **Pressurised Containers**: Undamaged pressurised containers should be returned to the supplier for refilling, and adequate provision for this should be included in the original purchase contracts. If return is not possible, containers may be buried safely. Any residual

pressure should be released before disposal. Aerosol containers cannot usually be refilled and should be buried. Pressurised containers should never be burned or incinerated because of the severe risk of explosion.

g) **Pressurised Containers**: Undamaged pressurised containers should be returned to the supplier for refilling, and adequate provision for this should be included in the original purchase contracts. If return is not possible, containers may be buried safely. Any residual pressure should be released before disposal. Aerosol containers cannot usually be refilled and should be buried. Pressurised containers should never be burned or incinerated because of the severe risk of explosion.

h) **Used batteries and Thermometers**: Batteries, thermometers, and various items of measuring equipment may have a high metal content, including toxic heavy metals such as mercury or cadmium. Disposal options are as follows:

1	Recycling by specialised cottage industries. This is the best disposal solution when available.
2	Exportation to a country with the expertise and facilities to dispose safely of hazardous chemical waste. Conditions of shipment should comply with the Basel Convention.
3	Encapsulation. If neither of the two options above is feasible, encapsulated waste may be disposed of in an impermeable landfill (if available) or other landfill.

Nota: This type of waste should not be incinerated because of the toxic metallic vapours emitted, nor should it be buried without encapsulation as this may cause pollution of groundwater. However, if the quantities of wastes with high heavy-metal content are minimal (similar to the quantities in municipal waste) and there are no opportunities for reuse of heavy metals within the country, they may also join the municipal waste stream.

9. RESPONSIBILITIES AND TRAINING

a) **Health and safety practices for health-care personnel and waste workers:** Health-care waste management policies or plans should include provision for the continuous monitoring of workers' health and safety to ensure that correct handling, treatment, storage, and disposal procedures are being followed. Essential occupational health and safety measures include the following:

1	Proper training of workers.
2	Provision of equipment and clothing for personal protection. Establishment of an effective occupational health programme that includes immunisation, post-exposure prophylactic treatment, and medical surveillance. Training in health and safety should ensure that workers know of and understand the potential risks associated with health-care waste, the value of immunisation against viral hepatitis type B, and the importance of consistent use of personal protection equipment. Workers at risk include health-care providers, hospital cleaners, maintenance workers, operators of waste treatment equipment, and all operators involved in waste handling and disposal within and outside health-care establishments.
3	Any staff producing health care waste (HCW) should be responsible for its segregation, and should therefore receive training in the basic principles and practical applications of segregation. Waste is generated by a large number of personnel,

	many of whom are directly involved in patient care, often in conditions of urgency; management of the waste generated in such circumstances may thus seem of little importance. Training should make staff aware of the potentially serious implications of the mismanagement of waste for the health of waste handlers and patients, provide them with an overall view of the fate of waste after collection and removal from the ward, and teach them the importance of proper segregation of the different categories of waste.

b) **Training of Waste Handlers**

1	Check that wastes storage bags and containers are sealed; no bags should be removed unless properly labelled and securely sealed to prevent spillage.
2	Bags should be picked up by the neck only. They should be put down in such a way that they can again be picked up by the neck for further handling. Manual handling of waste bags should be minimised whenever possible.
3	Waste bags should not touch the body during handling and collectors should not attempt to carry too many bags at one time—probably no more than two.
4	When moving of waste bags or containers is complete, the seal should again be checked to ensure that it is unbroken.
5	To avoid puncture or other damage, waste bags should not be thrown or dropped.
6	Sharps may occasionally puncture the side or bottom of a polypropylene container; the container should therefore be carried by its handle and should not be supported underneath with the free hand.
7	Bags for hazardous health-care waste and for general waste should not be mixed, but segregated throughout handling; hazardous waste should be placed only in specified storage areas.
8	Appropriate cleaning and disinfection procedures should be followed in the event of accidental spillage; any such incident should be reported immediately to the responsible member of staff.
9	Adequate protective clothing should be worn during all waste handling operations.

10. WASTE TRANSPORTATION

a) **Regulation and Control System**: The health-care waste producer is responsible for safe packaging and adequate labelling of waste to be transported off-site and for authorisation of its destination. Packaging and labelling should comply with national regulations governing the transport of hazardous wastes, and with international agreements if wastes are shipped abroad for treatment. In case there are no such national regulations, responsible authorities may refer to Recommendations on the transport of dangerous goods published by the United Nations. The control strategy for health-care waste should have the following components:

1	A consignment note should accompany the waste from its place of production to the site of final disposal. On completion of the journey, the transporter should complete the part of the consignment note especially reserved for him and return it to the waste producer. The transporting organisation should be registered with, or known to, the waste regulation authority.

2	Handling and disposal facilities should hold a permit, issued by a waste regulation authority, allowing the facilities to handle and dispose of health-care waste.
3	The consignment note should be designed to take into account the waste control system in operation within the country. The Multimodal Dangerous Goods Form recommended by the United Nations may be taken as an example.
4	If a waste regulation authority is sufficiently well established, it may be possible to pre-notify the agency about the planned system of transport and disposal of the health-care waste and obtain the agency's approval. Anyone involved in the production, handling, or disposal of health-care waste has a general "duty of care", i.e. an obligation to ensure that waste handling and associated documentation comply with the national regulations.

b) **Special packaging requirements for off-site transport:** In general, the waste should be packaged in sealed bags or containers, to prevent spilling during handling and transportation. The bags or containers should be appropriately robust for their content (puncture-proof for sharps, for example, or resistant to aggressive chemicals) and for normal conditions of handling and transportation, such as vibration or changes in temperature, humidity, or atmospheric pressure. In addition, radioactive material should be packed in containers whose surfaces can be easily decontaminated. The United Nations recommends further packing requirements for infectious substances. For infectious health-care wastes, it is recommended that packaging should be design type-tested and certified as approved for use. Health-care waste that are known or suspected to contain pathogens likely to cause human disease should be considered as "*Infectious Substances*" (UN No. 2814: "INFECTIOUS SUBSTANCE, AFFECTING HUMANS". The packaging recommended for most health-care wastes, with a relatively low probability that infectious substances are present and which are not likely to cause human disease (UN No. 3291: "CLINICAL WASTE, UNSPECIFIED, NO.'S, OR (BIO) MEDICAL WASTE, NO.'S, OR REGULATED MEDICAL WASTE, NO.'S."), is simpler. However, since these packaging requirements are relatively complex, it is suggested that the United Nations recommendations are consulted directly for further details (United Nations, 1997).

c) **Labelling**: All waste bags or containers should be labelled with basic information on their content and on the waste producer. This information may be written directly on the bag or container or on pr-printed labels, securely attached. According to the United Nations recommendations for Class 6.2 substances, the following indications should appear on the label.

1	The United Nations substance class, e.g. Class 6.2 for infectious waste.
2	The United Nations packaging symbol, e.g. the international symbol for infectious substances.
3	The proper shipping name and the UN.
4	The total quantity (mass or volume) of waste covered by the description.
5	The country authorising the allocation of the label (identified by international code system used on motor vehicles).

It is also recommended that the last two digits of the year of manufacture of the packaging specified by the competent authority are marked on the package, as well as a special code

designating the type of packaging (for details see United Nations, 1997). For health-care waste, the following additional information should be marked on the label:

6	Waste category.
7	Date of collection.
8	Place in hospital where produced (e.g. ward).
9	Waste destination.

In case of problems involving questions of liability, full and correct labelling allows the origin of the waste to be traced. Labelling also warns operative staff and the general public of the hazardous nature of the waste. The hazards posed by container contents can be quickly identified in case of accident, enabling emergency services to take appropriate action. Cytotoxic waste should be marked with the label “CYTOTOXIC WASTE”.

d) **Labelling for Radioactive Waste**: Three labels have been designed by the UN/IAEA for radioactive material, providing information on the levels of activity of a given package. Unless the package is large (and it is assumed here that all packages containing radioactive waste do not exceed $1m^2$ in cross-sectional area. This categorisation is as recommended in Regulations for the safe transport of radioactive material (IAEA, 1996). For large packages or higher activity levels than those dealt with here, these regulations (IAEA, 1996) should be consulted directly

e) Preparation for Transportation: Before transportation of the waste, dispatch documents should be completed, all arrangements should be made between consignor, carrier, and consignee, and, in case of exportation, the consignee should have confirmed with the relevant competent authorities that the waste can be legally imported and that no delays will be incurred in the delivery of the consignment to its destination.

f) **Transportation Vehicles or Containers**: Waste bags may be placed directly into the transportation vehicle, but it is safer to place them in further containers (e.g. cardboard boxes or wheeled, rigid, lidded plastic or galvanised bins). This has the advantage of reducing the handling of filled waste bags but results in higher disposal costs. These secondary containers should be placed close to the waste source. Any vehicle used to transport HCW should fulfil the following design criteria:

1	The body of the vehicle should be of a suitable size commensurate with the design of the vehicle, with an internal body height of 2,2 metres.
2	There should be a bulkhead between the driver’s cabin and the vehicle body, which is designed to retain the load if the vehicle is involved in a collision.
3	There should be a suitable system for securing the load during transport.
4	Empty plastic bags, suitable protective clothing, cleaning equipment, tools, and disinfectant, together with special kits for dealing with liquid spills, should be carried in a separate compartment in the vehicle.
5	The internal finish of the vehicle should allow it to be steam-cleaned, and the internal angles should be rounded.
6	The vehicle should be marked with the name and address of the waste carrier.
7	The international hazard sign should be displayed on the vehicle or container, as well as an emergency telephone number.

Vehicles or containers used for the transportation of health-care waste should not be used for the transportation of any other material. They should be kept locked at all times, except when loading and unloading. Articulated or demountable trailers (temperature-controlled if required) are particularly suitable, as they can easily be left at the site of waste production. Other systems may be used, such as specially designed large containers or skips; however, open-topped skips or containers should never be used for transporting health-care waste.

Where the use of a dedicated vehicle cannot be justified, a bulk container that can be lifted on to a vehicle chassis may be considered. The container may be used for storage at the health-care establishment and replaced with an empty one when collected. Refrigerated containers may be used if the storage time is too long or transportation times are long. The finish of these bulk containers should be smooth and impervious and permit easy cleansing or disinfection. The same safety measures should apply to the collection of hazardous health-care waste from scattered small sources. Health-care establishments that practise minimal programmes of health-care waste management should either avoid off-site transportation of hazardous waste or at least use closed vehicles to avoid spillage. The internal surfaces of any vehicle used for this purpose should be easy to clean.

g) **Routing**: Health-care waste should be transported by the quickest possible route, which should be planned before the journey begins. After departure from the waste production point, every effort should be made to avoid further handling. If handling cannot be avoided, it should be pre-arranged and take place in adequately designed and authorised premises. Handling requirements can be specified in the contract established between the waste producer and the carrier;

International infectious substance symbol : WHO 98570 symbol	

11. REFERENCES

a) Safe Management of Wastes from Health Care Activities (Edited by A. Prüss, E. Giroult, P. Rushbrook. Geneva, World Health Organization, Edition 1999, 228 pages).

b) Guidelines for Safe Disposal of Unwanted Pharmaceuticals in and after Emergencies (World Health Organisation), Edition 1999.

c) Starting Health Care Waste management in medical institutions, a practical approach (World Health Organisation Regional Office for Europe Copenhagen).

d) EU Strategy for Waste Management 7 May 90.

e) Council Directive n° 91/689/EEC on Hazardous waste.

f) US Regulated Medical Waste Regulations: Army Regulation (AR) 40-5 (REF 9), 29 Code Federal Regulation (CFR) 1910.1030, Medical Command (MEDCOM) Regulation 40-35, Army Regulation (AR) 190-51 Para 4-20.

g) Basel Convention on transboundary movements of hazardous waste and their disposal (Council Directive 93/256/ECC article 16).

h) CEPA Canadian Environmental Protection Act and EIHWR Export and import of Hazardous Waste regulations. ECRI: The Certified Healthcare Environmental Manager.

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ANNEX B - NATIONAL PROCEDURES ABOUT SHIPBOARD HEALTH CARE WASTE MANAGEMENT BY NATO NAVY FORCES

AUSTRALIA

1. **National legislation and policy**:

   Australia manages clinical wastes in accordance with Australian and New Zealand Standard "*Management of Clinical and Related Wastes*." AS/NZS 3816:1988.

2. **Current and future practices**:

   The RAN manages wastes on ships in accordance with AS/NZS 3816:1998. This standard sets out requirements for the identification, segregation, handling, storage and disposal of clinical wastes. Currently, the ships segregate and store wastes in appropriately marked and coloured containers. All clinical waste is removed from the ships, under contract, for final disposal.

3. **R&T programmes**:

   Nil.

BELGIUM

1. **National legislation and policy**:

   Health care waste comes under the authority of the region and obeys specific texts according to the regions: Flanders (VLAREA), Brussels (AGB 23/03/94), Wallonia (AGW 30/06/94). The terms used are sometimes different (special waste, dangerous waste,…), but gather the same categories (anatomic, infectious waste, …) and the same requirements regarding package (yellow boxes, …), gathering/transport/elimination (registered firms).

2. **Current and future practices**:

   The Infrastructure department of the General Directorate of Material Resources (DGMR Infra) manages a long-term open-market contract (currently 2002-2005) for the destruction of outdated drugs, reactive products and hospital waste (150 k€ per year). The successful bidder (MEDIPAGE) is responsible for collecting and eliminating and provides the required packages to process waste:

   - **The Hygiene Service of Nivelles technical medical unit** collects and sorts the different types of waste categorised in the contract (different prices according to the category) from the different bases and units (drugs and raw materials, Baxters and perfusion solutions, *non-chlorinated and chlorinated organic solvents, mineral and organic chemical reactives*, *biologically contaminated and non-contaminated hospital waste* i.e. *outdated*, mattress, bedding, domestic waste, *contaminated biological waste*). Written in italic characters are the categories whose transport to the elimination centre is assumed by the successful bidder, the other categories being transported by the Defence sector to incinerators or container depots specified in the contract.
   - **The military hospital of Neder-over-Hembeek** (hospital waste is directly collected in the yellow boxes with regard to the high tonnage: this prevents the transfer to the technical medical unit).

3. **R&T programmes**:

   Studies are envisaged on devices allowing the processing in situ of health care waste, diminishing their volume (compaction) and dangerousness (disinfection) in order to make them similar to household waste during their evacuation.

BULGARIA

1. **National legislation and policy**: .
2. **Current and future practices:** .
3. **R&T programmes:** .

CANADA

1. **National legislation and policy:**

   Canada manages bio-hazardous waste in accordance with the Canadian Council of Ministers of the Environment (CCME), which is based on the Canadian Environmental Protection Act.

2. **Current and future practices:**

   The Canadian Navy manages wastes on ships in accordance with Maritime Command Order G-18, which is based on the CCME guidelines and MARPOL 73/78.

   This standard sets out requirements for the identification, segregation, handling, storage and disposal of clinical wastes. Currently, the ships segregate and store wastes in appropriately marked and coloured containers. All clinical waste is removed from the ships and transferred to the Base Hospital. The waste is then sent to a contractor for final disposal.

3. **R&T programmes**:

   A Feasibility Study is being conducted to assess the installation of a HYDROCLAVE in the Dockyard for the sterilization of medical wastes and international wastes.

DENMARK

1. **National legislation and policy**:

   The Danish guidelines (http://www.mst.dk/udgiv/Publikationer/1998/87-7810-997-3/pdf/87-7810-997-3.PDF) for disposal of healthcare risk waste is harmonised with EU directives.

2. **Current and future practices**:

   The Danish Navy vessels generally generate only a small amount of healthcare risk waste. Needles, scalpels and syringes are disposed in special designed yellow labelled plastic boxes, which are delivered to the infirmary at the naval based. Other infectious healthcare risk waste is collected onboard in accordance with the legislation for healthcare risk waste. The hazardous waste is delivered to shore at the naval base. For vessels with an incinerator onboard, the infectious health care waste is burned in the incinerator.

   Before entering civilian harbours, the harbour authority is contacted for information regarding handling over the healthcare risk waste to shore facilities. The way of handling the healthcare risk waste is the same as if the vessel was returning to the naval base.

3. **R&T programmes**:

   None known.

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ESTONIA

1. **National legislation and policy**: .
2. **Current and future practices**: .
3. **R&T programmes**: .

FRANCE

1. **National legislation and policy**:

   The current legislation in force is the decree n° 97-1048, dated November 6th 1997 about "*Disposal of infectious health care waste and anatomic waste*" and the order of September 7th 1999 about "*Infectious health care waste and anatomic waste disposal facilities*". These texts are directly linked to the Public Health Code (new Chapter V-III): they give some definitions of specific terms and define the procedures to be used by health professionals from the knowledge of the quantities of wastes.

   The French Health Ministry has also promulgated several circulars: circular n° 554 DGS/VS3 of 1st September 1998 about the "*safety of the personnel against hazards due to infectious cutting edges*", and circulars n° 2000-216 DGS-VS3/DPPR of 19th April 2000 and n° 2000-322 DGS-VS3/DPPR of 9th June 2000 about the "*acceptance procedures of the current medical waste processors*".

   The French Superior Council for Public Hygiene (CSHPF) has already granted several decontamination devices for industrial and medical usage (circular DGS/DPPR n° 2000/292 of May 29th 2000). The French Research and Safety National Institute (INRS) has updated in June 2005 the “ED 918 Guidelines” report of June 2004 about HCW management, by adding the updated list of granted HCW pre-treatment devices.

2. **Current and future practices**:

   The health professionals from the French Navy Staff (navy vessels, military hospitals) currently use conventional encapsulation processes according to the current legislation in force (particularly about the marking and the colour code that has to be applied for the infectious medical waste containers). A contractor then removes these infectious wastes from the ships for final disposal by civilian facilities.

   Due to some change in the national regulations, the need for disinfecting devices has been identified. In 2001 a first list of French Navy vessels was defined to be fitted with infectious medical waste disinfecting processors (app. 50 units for the Fleet) in compliance with CSHPF guidelines, particularly the circular n° 2002-472 DGS-SD7/DPPR of September 2nd 2002. This list of vessels has been reviewed during 2005, in the frame of a procurement plan for the French Navy Fleet (20 current vessels, plus new constructions). The procurement plan for such disinfecting processors has been planned by the French Navy (2006-07).

3. **R&T programmes**:

   Some industrial surveys have been conducted from 1998 to 2000 to identify existing and CSHPF granted medical waste processing technologies that would facilitate shipboard medical waste treatment and residue storage. Some basic details have been provided by the manufacturers in order to evaluate the suitability of their equipment for shipboard application (size, footprint, weight, energy, maintenance, cost) from the knowledge of factory laboratory tests (hazards, safety,…) that were conducted under the surveillance of the Health French Ministry. This database is regularly up-dated with the help of CSHPF.

Between 1999 and 2001, some trials at sea were first conducted onboard LPD *Ouragan*, AC *Foch* and Frigate *La Fayette* with *Occigerm* and *MDS* processors. During 2004, complementary trials at sea have been successfully conducted with *Sterigerms* processor aboard Frigate *Cassard*. A procurement contract has been granted in 2006 to *Sterigerms* Company for several disinfecting units which have been delivered during summer 2007, intended to be integrated aboard the selected French Navy vessels. Complementary analyses are currently conducted for fitting other vessels (conservative measures have been adopted for new vessels under design, construction or acceptance).

GERMANY

1. **National legislation and policy**:

   GE Navy manages clinical and medical wastes in accordance with the following national laws:
   - Kreislaufwirtschafts- und Abfallgesetz (KrW-/AbfG): the Federal Law on Recycling and Waste Management.
   - Abfall-Verzeichnis-Verordnung (AVV) : the European Waste Catalogue.
   - Bundesseuchengesetz: the Federal Law on Epidemics.
   - Chemikaliengesetz: the Federal Law on Chemicals.

2. **Current and future practices**:

   The GE Navy manages wastes on ships in accordance with Navy Regulation MDv 160/1. This standard sets out requirements for the identification, segregation, handling, storage and disposal of all kind of wastes.

   Medical and clinical waste is to be handled in accordance with the upper mentioned laws and regulations.

   The ships segregate and store these wastes in appropriately marked and coloured containers. All clinical waste is removed from the ships for final disposal.

3. **R&T programmes**:

   Nil.

GREECE

1. **National legislation and policy**: .
2. **Current and future practices**: .
3. **R&T programmes**: .

ITALY

1. **National legislation and policy**:

   The medical and sanitary waste management procedures are regulated by the President of the Italian Republic Decree n° 915 issued in the 1982, Articles 13 and 14 "*Elimination of Solid Urban Toxic and Noxious Waste*".

2. **Current and future practices**:

   Medical and sanitary waste management procedures onboard ITL vessels consist in the simple on-board storage, in proper medical waste little capacity containers, of the minimal quantity of all waste usually produced during naval activity. Those containers are ordinary sanitary bins

with a double bag inside. When filled up, the internal bag is sealed up and the bin is stopped with a rigid cover.

Once a ship come back to her naval base, all containers are sent to local harbour sanitary facilities in order to be destroyed according to the decree indicated in §.1.

3. **R&T programmes**:

   Nil.

LATVIA

1. **National legislation and policy**:

   In general, the Latvian Navy comply with national Waste management law which have interrelation with EU Directives 75/442/EEK and 91/689/EEK.

2. **Current and future practices**:

   The Latvian Navy collects its hazardous and health care waste in special packages that are disposed of to a certified contractor to be burned under special conditions.

3. **R&T programmes:**

   Not known.

LITHUANIA

1. **National legislation and policy:** .
2. **Current and future practices**: .
3. **R&T programmes:** .

NETHERLANDS

1. **National legislation and policy**:

   The handling and disposal of health care waste is integrated in the National Environmental Control Act and is defined as hazardous waste. Hazardous waste must be packed and labelled in special package with stringent requirements and disposed of to registered firms.

2. **Current and future practices**:

   The Royal Netherlands navy collects its health care waste in special package to be disposed of to the navy hospital in Den Helder and from there it will be disposed of to a certified contractor to be burned under special conditions.

3. **R&T programmes:**

   Nil.

NORWAY

1. **National legislation and policy**:

   In general the Norwegian civil regulations comply with EU-directives. The Navy further on applies civil regulations, if it has not made its own more stringent regulations. With regard to Health Care Management, so is not the case. The following main regulations are in force:
   - Law about protection against infectious diseases (LAW-1994-08-05 no.55).

- Regulation for import, transport and related management of materials contagious for human beings (REG-1996-09-12 no. 903).
- Regulation for recycling and management of waste (REG-2004-06-01 no. 930).

2. **Current and future practices**:

   The Norwegian Navy vessels generally produce relatively small amounts of infectious health care waste. Needles, scalpels, syringes are disposed of in special-made yellow labelled boxes of plastic material. Remaining infectious health care waste is disposed of together with the hazardous waste onboard. All the waste mentioned is finally incinerated in a civil refuse incineration plant ashore. The ward at the main base disposes of infectious waste in special-made cardboard boxes with inner special-made plastic bags, all yellow and labelled. This waste, too, is incinerated.

   For Norwegian hospital vessels, it is planned to purchase a heater device based on microwaves heating water to obtain 120 °C within the waste. Thereafter this waste will be managed together with the vessels non-infectious waste. On our future frigates, special-made yellow and labelled equipment will be used for collecting infectious health care waste: this collected waste will then be compressed and stored in a refrigerated and ventilated room.

   Health Care Waste Management, we have to admit, has so far not had optimum priority. We realise that there is potential for improvement in this respect, both for updating of regulations and for standardisation of good practice.

3. **R&T programmes**:

   None known.

POLAND

1. **National legislation and policy:** .
2. **Current and future practices**: .
3. **R&T programmes:** .

PORTUGAL

1. **National legislation and policy:**

   In general, the Portuguese Navy comply with national civil legislation. The following main regulations are in force:
   - Dispatch nº 242/96-7 July: Classification of medical waste in groups (4).
   - Decree nº 239/97-9 September: Rules for waste management.
   - Decree nº 335/97-16 May: Waste handling and transport.

2. **Current and future practices**:

   Medical wastes produced on board and on shore, are divided in four groups. Wastes from group 1 and 2 (non-infectious waste is segregated and managed with the general solid waste stream, ex: paper, cardboard) are free from cares of any kind. Wastes from group 3 (wastes with biological hazard, ex: cotton waste) and from group 4 (wastes with chemical hazard, ex: syringe) are handling and picked up from hospitals and vessels only by private company with authorisation for final destruction.

3. **R&T programmes:**

   Nil.

ROMANIA

1. **National legislation and policy**: .
2. **Current and future practices**: .
3. **R&T programmes:** .

SPAIN

1. **National legislation and policy**:

   Legislation in force is as follows:
   - Decree n° 2263/1974, dated July 20th 1974, subject "*Sanitary Mortuary Policy Regulations*",
   - Royal Decree n° 952/1997, dated June 20th 1997, subject "*Toxics and dangerous wastes*",
   - Law n° 10/1998, dated April 21st 1998, subject "*Wastes*",
   - Decree n° 83/1999, subject "*Medical Wastes*",
   - NTP-372: "*Medical Wastes Treatment*" from the National Institute of Safety & Hygiene at Work".

2. **Current and future practices:**

   Spanish Navy Health professionals apply conventional procedures according to civil legislation in force (7 kinds of waste classification, kind number 3 divided into 9 groups, and the use of colour code and adequate labelling of waste containers). The containers are picked up from hospitals and vessels only by private enterprises with government authorisation for final destruction.

   Presently, there is no project concerning to medical waste procedures in progress in the Spanish Navy.

3. **R&T programmes**:

   At this time, there isn't in Spanish fleet any industrial survey program on medical waste treatment and residue storage.

TURKEY

1. **National legislation and policy:**

   Turkish Armed Forces manage the medical wastes in accordance with the Directive MY 433-1(A) "*Turkish Armed Forces Directive for the Control of Medical Wastes*".

2. **Current and future practices:**

   Turkish Navy manages the wastes onboard Turkish Navy vessels in accordance with the Directive MY 433-1(A) "*Turkish Armed Forces Directive for the Control of Medical Wastes*". This directive sets out the requirements for the identification, segregation, handling, storage and disposal of medical wastes.

   Currently, the ships segregate and store medical wastes in red coloured 150-micron thick bags. Additionally, the Navy vessels are equipped with "*sharp boxes*" for the storage of used injectors. When navy vessels arrive at ports, they send their medical waste bags to the medical waste units of the hospitals.

3. **R&T programmes:**

   Currently, there is no survey program on medical waste treatment.

UNITED KINGDOM

1. **National legislation and policy**:

   UK national policy on the disposal of Health Care or Clinical waste is based upon the European Hazardous Waste Directive 91/689/EEC.

   The Special Waste Regulations 1996(as amended) are designed to provide an effective system of control for wastes that are difficult to handle. They ensure that dangerous wastes are correctly managed from their production to their final destination for disposal or recovery. It is the responsibility of the waste producer to ensure that any waste they produced is correctly disposed and therefore their duty of care does not end when the waste is transferred to a waste disposal contractor.

   This Policy is encompassed in Royal Navy Book of Reference (BR) 1991 – Instructions for the Royal Naval Medical Service Chapter 10 and Commander In Chief Fleet - Fleet Legal and General Orders (FLAGOs) Chapter 19.

2. **Current and future practices:**

   Biomedical waste/clinical waste incorporates a wide range of elements from human tissues to pharmaceutical products. These items are not to be disposed of at sea but should be landed ashore for disposal, usually by incineration via a licensed waste contractor. Ships can undertake incineration of products only if their incinerator has been certified for such activities under MARPOL.

   Until landed ashore, biomedical wastes should be managed in a manner to protect individuals from the contents and to protect against accidental disposal at sea. As a guide the wastes should be packaged for disposal in a manner that is described below:

   a. **Clinical waste sacks**: Yellow plastic sacks printed with an appropriate bio-hazard warning. These are used for human tissues/body fluids/wastes, soiled surgical dressings/swabs/… or non-sharps waste where they may be a risk of infectious disease contraction. When ¾ full these should be “double-bagged”, sealed with a plastic tie (or similar) and clearly labelled with the ships name and date of sealing.
   b. **Plastic sharps disposal boxes:** These are usually yellow and also printed with an appropriate bio-hazard warning. They are used to contain sharps originating from medical use, such as needles, glass vials, scalpel blades or cannulas. When ¾ full the boxes should be changed with the full box labelled with the ships name and date, and sealed in a manner to prevent access to the contents.
   c. **Cardboard boxes**: These are often used to contain non-contaminated glass items or used empty aerosols and will be clearly labelled as such. These will usually be disposed of via recycling facilities or to landfill as with refuse disposal.
   d. **Maceration to sewage**: If facilities exist onboard, items such as disposable bedpans/urinals containing urine, faeces or other bodily secretions will be disposed of via this route. Alternatively dispose of contents down sewerage system and place the disposable items in clinical waste bags as at a. above. If the articles are non-disposable, dispose contents and then clean and disinfect ready for re-use.
   e. **Sanitary products**: These are usually held within a specific sanitary bin and must only be disposed via port agents.
   f. **Special procedures**: Items such as life expired or unwanted pharmaceutical products and full or part used aerosols, are generally returned to the ships home port for disposal. These

items generally require specific accounting procedures and therefore should be kept onboard until completion of voyage.

3. **R&T programmes:**

Advanced incineration and pyrolysis have both been identified as potential methods for the disposal of clinical/sanitary waste although it has not yet to be trialled. There are still potential problems over safe shredding prior to the incineration process, which is being investigated.

UNITED STATES

1. **National legislation and policy**:

National legislation:

- United States Public Vessel Medical Waste Anti-Dumping Act, 33 U.S.C. Chapter 38, prohibits public vessels from dumping potentially infectious medical waste into the ocean except under certain emergency conditions.
- The Occupational, Safety and Health Administration's (OSHA) Occupational Exposure to Bloodborne Pathogens Standard, 29 CFR 1910.1030 (as amended), establishes workplace procedures to limit occupational exposure to blood or other potentially infectious material since any exposure could result in transmission of bloodborne pathogens which could lead to disease or death.

National legislation:

- OPNAVINST 5090.1B (Series), Chapter 19-8: This instruction governs shipboard handling of medical waste. In accordance with this policy, medical waste is categorised into infectious medical waste and non-infectious medical waste and handled accordingly. Infectious medical waste is liquid or solid waste that contains pathogens in sufficient numbers and with sufficient virulence to cause infectious disease in susceptible hosts exposed to the waste. Non-infectious medical waste includes all other disposable medical supplies and materials that do not fall into the category of infectious medical waste. This document references the Afloat Medical Waste Management Guide.
- BUMEDINST 6280.1A: This instruction reiterates the guidance documented in the Afloat Medical Waste Management Guide for segregating, packaging and handling, storing, transporting, and disposing of infectious medical waste. Furthermore, it contains a section documenting the requirements for introducing new infectious waste treatment systems. This instruction requires BUMED approval before a new system can be purchased or leased for the use of infectious medical waste treatment.

2. **Current and future practices**:

Current practice:

- Non-infectious waste is source segregated and managed with the general solid waste stream aboard ship: plastics, paper and cardboard, and metal and glass waste are handled individually.
- Infectious medical waste must be steam sterilised, suitably packaged and stored for ultimate disposal ashore.
- Medical waste must be sterilised within four days of generation.
- Disposal of waste through incineration is limited to paper and cloth-based materials that have been steam sterilised, contain no plastic, and have a low moisture content.

- Blood, blood products, and other liquid infectious medical wastes must be discharged into the marine sanitation device through a designated laboratory type sink only beyond 50 nautical miles from shore; or transported to a U.S. Navy facility for disposal.
- Currently, only autoclaves are approved for sterilisation of infectious medical waste.

Future practice:

- Implement alternate technologies or systems for sterilising infectious medical waste aboard ship.

3. **R&T programmes**:

The US Navy Shipboard Medical Waste Management Program is identifying and evaluating infectious medical waste processing alternatives for use aboard ship.

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ANNEX C - LIST OF NATIONAL POINTS OF CONTACT - NAVAL SECTOR (1/3)

NATION	Name	Organisation/Address	Phone	Telefax	E-mail
AUSTRALIA	Lyn FLETCHER	Defence Science and Technology Organisation - PO Box 4331, Melbourne, 3001	(61) 3 9626 8422	(61) 3 9626 8341	lyn.fletcher@dsto.defense.gov.au
BELGIUM	Capt Pha Marc BADOUX	COMOPSMED/IMETEC Service Hygiene	(32) 67 89 2092	(32) 67 89 2091	marc.badoux@nv.smd.be
BULGARIA					
CANADA	LCdr Ian FLEMING	Deputy Chief of Staff, Force Health Protection	(1) 613-945-6724		fleming.IM@forces.ca
DENMARK	M. Sc. Mech. Eng. Jens Søgaard	Naval Material Command, Lautrupbjerg 1 – 5, 2750 Ballerup	(45) 72 57 33 39	(45) 72 57 51 23	j_soegaard@mil.dk
ESTONIA					
FRANCE	Médecin en Chef (MC) Pascal LAFROGNE	Antenne Programmes de l'EMM à Toulon, Section Facteur Humain, BP 55 - 83800 - Toulon Naval	(33) 4.94.02.06.14	(33) 4.94.02.17.00	antprogfh@wanadoo.fr
GERMANY	LtCol Bethke	Federal Forces Support Command NBC Protection, Department II - Environmental Protection and Occupational Health Care - Section II2 Fliegerhorst WAHN 505 Postfach 90 61 10 - 51127 Köln	(49) 2203 908-1445	(49) 2203 908 -1013	
GREECE					
ITALY	Commander Claudio ZANOTTO	Military Hospital Milano			farmacia.ommi@tiscalinet.it

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ANNEX C - LIST OF NATIONAL POINTS OF CONTACT - NAVAL SECTOR (2/3)

NATION	Name	Organism/Address	Phone	Telefax	E-mail
LATVIA	Health Care Department	Latvian Defence Forces HQ 9/11 Krusta baznicas Street Riga, LV 1473	(371) 707 1940	(371) 707 1007	medicina@mil.lv
LITHUANIA					
NETHERLANDS	Rien BOSSARD	Defence Materiel Organisation Department Naval Architecture & Marine Engineering Knowledge Center Occupational Health & Safety, Chemical Technology & Environmental Control PO BOX 20702 – 2500 ES The Hague	(31) 70 316 3115	(31) 70 316 3131	mc.bossard@mindef.nl
NORWAY	Surg Commander s.g., Vilhelm F. KOEFOED	RNON Medical Services KE/SAN Sea Haakonsvern N-5886	(47) 55 50 48 96 Cell Phone : (47) 90 72 75 27	(47) 55 50 48 90	vkoefoed@broadpark.no
POLAND	Chief of Medecine, Captain Janusz TOCZEK	Polish Navy HQ ul. Slwer Kosciuszki 8 81-912 Gdynia 12	(48) 58.6263374	(47) 58.6263487	
PORTUGAL	Director	Centro Medicina Naval Base Naval de Lisboa 2810-001 Alfeite	(351) 212 594 548	(351) 212 594 598	
ROMANIA					
SPAIN					
TURKEY	Healthcare Department, Planning Branch Manager	Turkish Navy Headquarters, Healthcare Department, Planning Branch, 06100 Bakanlıklar-Ankara/TURKEY	(90) 312 4032625	(90) 312 4173065	

ORIGINAL

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ANNEX C - LIST OF NATIONAL POINTS OF CONTACT - NAVAL SECTOR (3/3)

NATION	Name	Organism/Address	Phone	Telefax	E-mail
UNITED KINGDOM	Lt Cdr Rick Stead RN, SO2 Med Inter	Defence Medical Services Department - Level 7, Zone F, Main Building, Whitehall London SW1A 2HQ	(44) 207 8070378	(44) 207 2181447	
UNITED STATES OF AMERICA	Michael Chapkovich, Program Manager Shipboard Environmental R&D Program (SEA 05M4R)	Naval Sea Systems Command 1333 Isaac Hull Avenue, SE Washington Navy Yard, D.C. 20376	(1) 202-781-1749	(1) 202-781-4747	michael.chapkovich@navy.mil