Chemical weapons dumps in the Baltic

About 40,000 tonnes of chemical munitions were dumped into the Baltic Sea after the Second World War. It is estimated that these chemical munitions contained some 13,000 tonnes of chemical warfare agents (this figure does not take into account the dilution and degradation which have taken place). No new information on these dumps has been reported in recent years.

Chemical warfare agents are chemical compounds which through chemical or biochemical reactions interfere with the physiological functions of the human organism in such a way that the combat capability of soldiers is impaired or that death is caused. Chemical warfare agents are gaseous, liquid or solid substances for anti-personnel use. They are mostly contained in shells and bombs.

HELCOM's actions

The Helsinki Commission has made a thorough report on the dumping sites as well as quantity and quality of the chemical munitions in the Baltic Sea already in 1994:

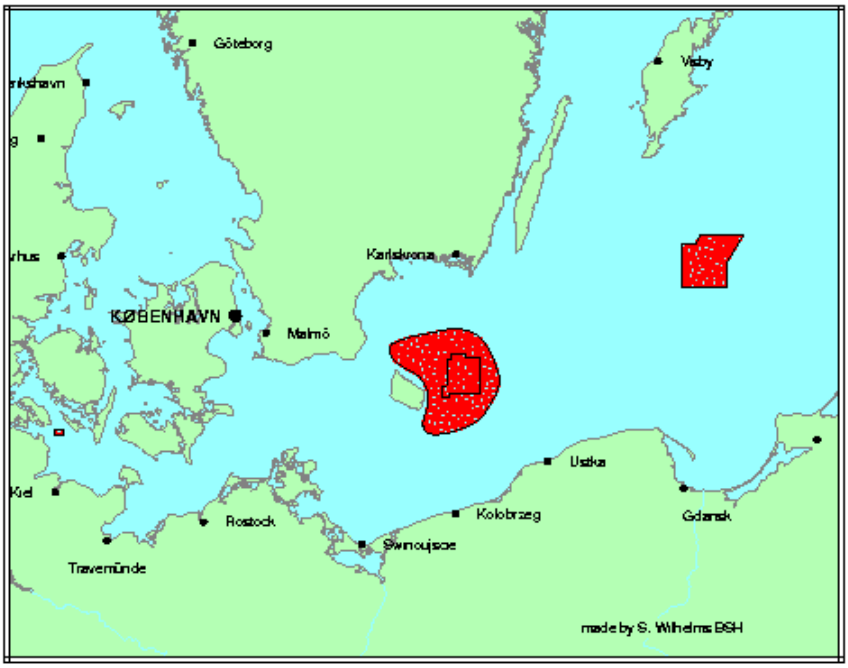
- The Final Report of the *ad hoc* Working Group on Dumped Chemical Munitions (HELCOM CHEMU) to the 16th Meeting of the Helsinki Commission (1995)

- Report on Chemical Munitions Dumped in the Baltic Sea, Report to the 15th Meeting of Helsinki Commission 8-11 March 1994 from the ad hoc Working Group on Dumped Chemical Munitions (HELCOM CHEMU), January 1994.

Denmark acts as a Lead Country for this activity and collects information submitted by the other Helsinki Convention Contracting Parties. The Eleventh Meeting of the Heads of Delegation to HELCOM decided that based on the latest information submitted by the Contracting Parties, the recommendation in the aforementioned Report are still valid.

Dumping sites

The location of dumped munitions is nowadays well known. The main dumping areas are south-east of Gotland (south-west of Liepaja), east of Bornholm and south of Little Belt. During transport to the dumping areas east of Bornholm and south-east of Gotland munitions have been thrown overboard while ships were en route. As some munitions were dumped in wooden cases some have drifted outside the area where they were dumped. A relocation of munitions by hydrographic conditions such as currents is unlikely. Therefore, a threat to coastal areas of the Helsinki Convention Area from residues of warfare agents or chemical munitions washed ashore is unlikely.



Areas A, B, C, D and E shown on the map and delimited between following parallels and meridians:

	Parallel	Parallel	Meridian	Meridian
A	**55° 50' north**	**55° 40' north**	**18° 30' east**	**20° 00' east**
B	**54° 50' north**	**55° 30' north**	**14° 30' east**	**16° 30' east**
C	**54° 45' north**	**54° 52' north**	**10' 00' east**	**10° 20' east**
D	**58° 10' north**	**58 ° 25' north**	**09° 10' east**	**09° 50' east**
E	**58° 07' north**		**10° 47' east**	

Numbers of incidents reported where chemical munitions have been caught by fishermen

The HELCOM Lead Country for dumped chemical munitions, Denmark, has reported the following incidents:

Year	Numbers of incidents	Weight of active gas in kg
1995	**6**	**40**
1996	**10**	**210**
1997	**9**	**184**
1998	**5**	**290**
1999	**3**	**185**
2000	**11**	**512**
2001	**11**	**514**
2002	**10**	**345**
2003	**25**	**1110**
2004	**4**	**160**
2005	**4**	**105**

Effects on the marine environment

Chemical warfare agents break down at varying rates into less toxic, water-soluble substances. Some compounds, however, show an extremely low solubility and slow degradability (*e.g.* viscous mustard gas, Clark I and II, and Adamsite). These compounds cannot occur in higher concentrations in water, so wide-

scale threat to the marine environment from these dissolved chemical warfare agents can be ruled out.

Current research activities

An EU FP6 funded project "Modelling of ecological risks related to sea-dumped chemical weapons" (MERCW), is currently carried out by scientist in Finland, Russia, Belgium, Germany, Latvia and Denmark. The aim of the project of the project is to carry out focused research and technology developments on three dump sites in the Baltic Sea in order to model the transport pathways and migration spreading of toxic agents in marine sediments and the marine environment. The final goal is to assess the ecological safety for the ecosystem and people of the coastal states near the dump sites. More information of the project is available on their website: mercw.balticseaportal.fi.

Fishermen may be at risk

Over the period 2000-2005 about 10 incidents a year were reported where chemical munitions were netted by fishermen, showing that these chemicals are still a risk for the crews of fishing vessels operating in this part of the Baltic.

Do not anchor or fish with bottom tackle in the risk areas A, B and C. Fishing is prohibited in certain parts of the areas at risk as shown by markings on nautical charts.

Why:

Mustard gas, sternutators, lachrymators and suffocating agents have been dumped in areas A and B. Nerve agents and suffocating agents have been dumped in area C. Mustard gas and possibly other types of chemical munitions have been dumped in areas D and E. However, the majority of findings has been mustard gas.

How:

When fishing with bottom tackle or nets permanently placed on the sea bed in areas A, B and C, it is a requirement that vessels are equipped with protective or first-aid equipment. In area C the requirement for first-aid equipment also includes atropine/oxime (e.g. obidoxim or oxime) injectors for nerve agents protection.

In areas D and E chemical munitions were dumped at great depths in sunken vessels. For this reason there are no requirements for vessels fishing in this area to be equipped with protective and first-aid equipment

Additional information

Preventive measures and first aid

After World War II large amounts of chemical munitions were dumped in the Baltic Sea.

Simply touching chemical agents or inhaling of the vapours is very dangerous, and fishermen should therefore carefully follow the instructions in this leaflet in the event of chemical munitions being caught.

Chemical munitions may contain explosives and should therefore be treated with great care.

What to do?

1. Read this leaflet before fishing in the risk areas, and pay special attention to the sections on first aid.

2. Be alert for abnormal conditions when bringing in the haul, for example

- whether tackle or fish smell unusual - whether there is a stinging sensation in the eyes - whether there are any corroded containers or suspicious clay-like lumps.

3. If there is any suspicion of chemical bombs in the tackle when bringing in the haul, the tackle should be cut away and the position marked. The nearest national contact point or the national contact point of a fishing vessel shall be informed accordingly. The list of national contact points is contained in the summary chart of dumping and risk areas.

4. Contact the national contact point if chemical munition is caught and give all the information you can, including your own opinion about the situation. The national contact point can be contacted via the coastal radio.

5. Anybody who has come into contact with chemical agents must start decontaminating immediately, even if no adverse effects are felt at the start.

6. Crew who have to work in a contaminated area of the vessel must use clean protective gloves and breathing masks. Do not spread the contaminants. Be careful when going to the toilet.

7. Close doors and hatches to the contaminated area, and stop all ventilation systems. If possible, let the wind carry fumes and contaminants away from the area with people. Close the hatch to the hold and leave all fish on deck together with the tackle.

8. Fishing vessels which have come into contact with chemical agents must not bring the fish ashore, including roe, livers and everything else, until the catch has been checked and released by a relevant national authority. Fish which has been contaminated by chemical agents is unsuitable for human consumption and as animal feed.

9. The vessel and tackle must not be used until they have been decontaminated and approved by a relevant national authority.

10. All injuries caused by finds of chemical warfare agents must be reported to a relevant national authority.

Chemical munitions can occur in the form of bombs or clay-like lumps and in artillery shells

The nature of the objects caught varies a great deal. They can be bombs or parts of bombs. The metal shell of the bombs is usually corroded through. Shells which are relatively intact have also been found. Bombs which are caught are in one of three stages of decomposition.

Type 1: The outer shell of the bomb is only partly corroded, but the metal shell can easily collapse, which would allow the warfare agent to escape.

Type 2: The outer shell of the bomb is almost completely corroded away. This type of bomb usually consists of a yellow shell of partly converted warfare agent and/or adhesive substance. Liquid yellow or brown chemicals are often found in the centre of the bomb. The bomb falls apart in small and large pieces very easily, which can open sections with active warfare agent.

Type 3: Yellow or brown lumps of varying sizes (up till 100 kg), many with a clay-like consistency. Most of the lump is converted warfare agent and/or adhesive substance, and there is normally no liquid phase. In the case of cracking, sections with active agents will be exposed. Several lumps of varying sizes are often caught at the same time, as the trawl may have broken a large lump into smaller pieces.

All the above ammunition types may contain explosives and should therefore be treated with great caution, but so far no explosions have occurred.

First aid is emergency aid

First aid must be given quickly and correctly in order to limit the extent of damage and injuries. It is therefore necessary for everyone on board to know where the first-aid equipment is kept.

Medical help is necessary at the latest when the vessel arrive in port, and in some cases it may be expedient to contact a doctor on the radio or, in serious cases, to get medical assistance by helicopter as soon as possible.

First-aid equipment for chemical warfare agents

At least the following first-aid equipment for such agents must be on board vessels fishing in the areas at risk:

l. One "gas box" for every three crew members.

The "gas box" should contain the following:

- five tongue spatulas - four packets of 10 g containing absorbent cotton - three 100 ml bottles containing either 5 % solution of dichloramine in dichloroethane or 5 % solution of 1,3-dichloro-5,5-dimethylhydantoine in dichloroethane. The bottles should be marked clearly "Gas-decontamination liquid" and the composition stated. - three powder sprays containing 50 g of fine pulverized compound of calcium of lime and magnesium oxide, adjusted to a content of 25 % active chlorine. The spray should be marked clearly "Anti-gas powder" and the composition stated. - one 75 ml bottle containing a solution of copper sulphate. The bottle should be marked "Anti-phosphorus liquid" and imprinted with instructions "approved by the appropriate authority" - one copy of the National Leaflet on "Fisheries and Warfare Agents - Preventive measures and first aid".

2. Ten atropine/oxime automatic injectors for every three crew members on vessels fishing in the risk area C and using bottom tackle or tackle which is permanently fixed on the seabed.

- Breathing masks (full-face mask with filter, speech membrane and panoramic screen) and spare filters should be available on board, e.g. one mask and one spare filter, for every crew member. Breathing masks and filters should be appropriately approved. - One pair of long isobutylene/isoprene rubber gloves per crew member.

Information about approved breathing masks and filters as well as on dealers who sell such equipment and isobutylene/isoprene rubber gloves can be obtained from the appropriate national authority.

In case of mustard gas poisoning

WARNING:

Mustard gas penetrates very easily into the body via the skin, mucous membranes and respiratory tract.

An unusual property is that the symptoms do not appear immediately!

Often the injuries do not appear until several hours after the exposure!

It is therefore of uttermost importance that decontamination starts immediately after contact with mustard gas!

WARNING:

Do not rub your eyes, even if they are stinging.

If there is the least sign of a contamination, the following precautions must be taken:

1. Avoid touching tackle and haul. Do not spread the contaminants on board.

2. Eye-cleaning

WARNING:

Eyes should only be cleaned, if they are stinging. If there is no stinging in the eyes, the skin should be cleaned immediately.

a) Wash the eye out with plenty of water (e.g. from flushing hose) for at least 15 minutes. Washing out should be done from the root of the nose outwards as shown in the drawing:

b) Close the eye and carefully clean the surrounding skin area with soap and water.

c) Never rub your eyes, even if they are stinging or itching. Do not use eye ointment and do not dress the eye.

WARNING: Gas cleaning liquid and anti-gas powder must not be used on the eyes.

3. Skin-cleaning where the skin is contaminated by grease-like substances

a) Carefully remove work clothing and leave it where it is.

b) Remove the grease-like substance from the skin immediately by scraping with a knife or similar instrument. Be careful not to rub the substances into the skin or spread it.

c) Clean the contaminated skin using cotton wool moistened with gas cleaning liquid.

d) Rub anti-gas powder into the affected skin area as soon as possible.

e) Wash the skin thoroughly with soap and water.

f) Carefully dry the skin with a clean towel and rub gas powder into the affected skin area again.

4. Skin cleaning in other cases

a) Quickly rub anti-gas powder onto hands, arms and face.

b) Remove work clothing and leave where it is.

c) Once again rub anti-gas powder onto the affected areas and wash it off again after half an hour. Be careful not to spread the contamination, e.g. when you go to the toilet.

5. Any blisters must not be punctured. They should only be covered with a clean dressing.

6. Move the vessel into a position which allows the wind to carry any gas fumes away from the affected people on board. Close doors and hatches to the contaminated area.

7. Contact the national contact point via the coastal radio station to get information on what to do next. Medical assistance may be required.

8. Make the vessel ready. If this cannot be done without coming into contact with the contaminated area, the crew must use safety equipment.

In case of nerve agent poisoning

Nerve agent poisoning has not yet occurred during fishing in the Baltic Sea, but it needs to be treated very quickly if it does occur.

If nerve agent poisoning is suspected or in case of severe difficulty in breathing and/or cramps, atropine/oxime should be injected into the thigh immediately - through the person's work clothing, if necessary.

When going to the aid of an injured person, you must wear a protective breathing mask and gloves. Otherwise follow the same procedure as described for mustard gas.

Unless the symptoms of poisoning disappear within 10 minutes, another injection of atropine/oxime in the thigh should be given. No more than three injections may be given without medical advice. A good sign of the atropine having worked is dryness in the mouth.

If atropine/oxime is taken without the person being poisoned by nerve agent, it can cause blurred vision and palpitations. Instructions for use of atropine/oxime can be found on the injector itself.

In case of suffocating agent poisoning

Suffocating agents affect the respiratory system. In case of suffocating-agent poisoning, the poisoned person must not smoke, eat or drink, and must stay calm.

In case of phosphorus poisoning

Note: PHOSPHORUS is not a warfare agent and can thus also be found outside the dumping sites. Extinguish any burning phosphorus particles by keeping the affected area under water. Scrape off the particles using a knife. Then keep the affected area covered with a wet cloth until it can be bathed in anti-phosphorus liquid. Finish by applying a dry dressing.

General precautions

Decontaminating a fishing vessel after contamination with chemical agents must only be carried out by a relevant national authority, never by the fishing vessel's crew. Caught chemical munitions and contaminated hauls must not be moved or touched by the crew. If chemical munitions are caught or this is suspected, work must cease immediately, and only work which is necessary to ensure the safe sailing of the vessel may be carried out in the area of the vessel which is contaminated with warfare agents. During such work, the crew must wear isobutylene/isoprene rubber gloves and breathing masks. This safety equipment must not be used with a view to decontaminate the vessel, etc., but only for the most necessary work in order to ensure the safe sailing of the vessel. The safety equipment can also be used. to go for the assistance of injured people.

Description of the warfare agents

Mustard gas is, in its pure form, a transparent, slightly volatile, oily substance with a sweet smell. Mustard gas normally occurs with impurities which give it a brown colour. The smell is very similar to cress, horseradish or mustard. The smell gradually becomes less noticeable, as one's sense of smell is weakened by the gas.

Mustard gas in liquid form is able to penetrate ordinary clothing and leather. Ordinary rubber and many types of plastic only provide brief protection.

Mustard gas in liquid and vaporised form easily penetrates the skin without it being noticed straight away, because the symptoms do not appear until a few hours later in the form of reddening of the skin, itching or a stinging sensation in the affected areas. The reddening may turn into liquid-filled blisters which can burst and turn into sores which heal very slowly.

In both liquid and vaporised form, mustard gas can affect the eyes. If the gas gets into the eyes in liquid form, it will cause permanent blindness. In its vaporised form, the gas will cause the eyes to close up and result in temporary blindness after a few hours, and it may cause conjunctivitis, reddening and watery eyes. Inhalation of mustard gas vapours can cause serious damage to the windpipe and lungs. The risk of injury from mustard gas is greatest during warm, calm weather and in enclosed rooms, and the longer one is exposed to the gas. The symptoms of poisoning are a runny nose, hoarseness, coughing, a sore throat,

general unwellness, vomiting, fever and lethargy.

Mustard gas finds off Bornholm and Gotland (Areas A and B) show often high viscosity due to the addition of thickeners. These make the mustard gas sticky and difficult to remove.

Injuries caused by mustard gas can take a very long time to heal - which makes it very important to start first aid as soon as possible.

Lachrymators are volatile substances which affect the mucous membrane of the eyes and cause watery painful eyes. They may irritate the skin and cause local injuries. The effects do not last very long after the affected person has been removed from the gas.

Sternutators affect the mucous membranes of the nose, throat and respiratory passages and causes sneezing, coughing, a runny nose and watery eyes. These effects can last from 15 minutes to a couple of hours after the affected person has moved away from the gas and into fresh air.

Note: Mustard gas has sometimes been mixed with lachrymators or sternutators, and this type of gas mixture will cause the symptoms of all its constituent parts.

Nerve agent of the tabun type is, in its pure form, a transparent and odourless glycerine-like substance. However, impurities sometimes make the liquid dark and give it a fruity smell, and any additives to it may also affect its smell.

Nerve agents are easily absorbed through the skin, respiratory organs, eyes and the gastrointestinal tract. Nerve agents in liquid and vaporised form easily penetrate all textiles and leather. Ordinary rubber and many types of plastic only provide brief protection. A small dose of nerve agent will cause headaches, painful eyes, blurred vision, pupil contractions, a running nose and a feeling of weight on the chest.

A large dose will cause the above symptoms followed by cramps, difficulty in breathing, a slow pulse, and may be fatal as a result of respiratory or cardiac arrest. If a person is exposed to a large dose, the entire poisoning process is very quick, usually between 5 and 10 minutes, unless the patient is treated. Suffocating agents

A typical suffocating agent is phosgene, which is a colourless gas. At temperatures of less than 8° C, phosgene is a liquid. In low concentrations it has a rather sweet, not unpleasant smell, which is reminiscent of newly cut hay.

In high concentrations the smell becomes sharper and irritating. The fumes are heavier than air. The substance is very insidious, and harmful quantities can be inhaled without the person noticing anything. For the first few hours after a person has been exposed to phosgene fumes, the only effect is irritation of the mucous membranes in the respiratory passages.

The symptoms of poisoning are difficulty in breathing, coughing, a feeling of suffocation, thirst, vomiting, pain in the chest, lips turning blue, foaming at the mouth, extreme weakness, mental disturbances followed by unconsciousness. The reason for this is that phosgene causes pulmonary oedema and prevents oxygen absorption because of damage to the lung tissue.

The mucous membranes of the eyes are also affected by phosgene, which can result in permanent eye damage, even though there are no symptoms of this at the start. Smoke-generating agents contain often phosphorous compounds. A mixture of sulphur trioxide and chlorosulphonic acid is another powerful smoke generator.

In its liquid form it is extremely corrosive on contact with the skin. In its vaporised form, it consists of small particles of hydrochloric acid and sulphuric acid, which irritate the skin, eyes and respiratory organs. Phosphorous is found in smoke ammunition where the whole charge or part of it consists of yellow (white) phosphorous. When phosphorous is taken out of the water and comes into contact with the oxygen in the air, it ignites. Phosphorous sores heal very slowly.