Gelbes Kreuz

No poison gas in the Baltic.

Contents:

The problem in a nutshell

"There's a chemical time bomb ticking away on the seabed", warns Boris Porfiriev from the Russian Academy of Sciences. With that he means the danger which chemical weapons dumped in the Baltic after the Second World War pose for humans and animals – a subject that periodically surfaced in the media over the last few decades whenever fishermen found grenades riddled with corrosion or lumps of poison gas in their nets and were injured – often seriously.

As far back as 1992, Prof. Dr. Gerd Wibberenz, director of the Institute for Pure and Applied Nuclear Physics at the Christian Albrecht University in Kiel, Germany, pointed out just how explosive this problem is.

Ten years afterwards, nothing has changed. Since then the international community has signed a convention prohibiting the production of poison gas and demanding the disposal of existing new stocks, but the question as to the disposal of old neglected deposits still remains unanswered.

Munitions found in the water and on the beach: they are collected and most of them are thrown back into the sea.

There is a very real danger that the canisters, bombs and grenades containing warfare agents are now in a highly corroded state and that the seabed and the ground water will be permanently contaminated once the canisters have rusted through completely:

The Baltic is a time bomb ticking away. The toxic substances involved are a source of great danger for our whole environment. This is why "Das Gelbe Kreuz e.V" aims at making the problem public and finally eliminating the present deplorable state of affairs regarding the legacy of the poison gas.

There's no time to lose.

Deadly silence

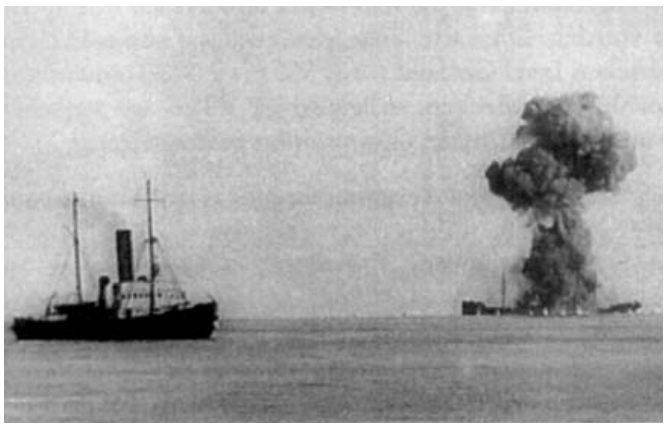
However, anyone who tries to take a closer look at the problem is faced with a wall of silence. It often takes years, if not decades, until important information gets through to the public. In the then Soviet Ministry of Defence, the documentation of the warfare agents dumped in the Baltic was strictly classified information. Glasnost made some military archives accessible to a certain degree, but we can only guess at the true extent of the sinkings. Especially in connection with the dumping of more recently produced poison gas munitions in the Baltic in the 60s and 70s, partly by the National People's Army of the former German Democratic Republic, the silence is as daunting as ever. Also, the fact that Russia refused until 1997 to ratify the Paris Convention outlawing chemical weapons has led to speculation that the Baltic may have served as a cheap dumping place for unwanted relics of the Cold War up until that date. Scientists and military personnel from the former Soviet Union are repeatedly speaking up and pointing out new dumping places for warfare agents as well as the risks they pose.

The quantities of poison gas dumped in the Baltic have been underestimated, too. The wall of silence in this connection is difficult to break, especially since Western authorities also try to sweep the problem under the carpet, not intervening until it's nearly too late and "children are stepping in lumps of mustard gas".

The Baltic – one big arms dump

One hundred thousand tons of warfare agents – this problem can't just be swept under the carpet. There are no exact statistics as to the total quantities of poison gas munitions dumped. However, it is an established fact that approx. 300,000 t of chemical warfare agents were sent to the bottom of the Baltic in the form of bombs, canisters and grenades in the period immediately following the Second World War – sometimes whole ships or ship's hulls were filled with the deadly cargo and then sunk. Besides German chemical weapons, the Allies also dumped part of their own stocks there after the war. The instance responsible for this was a control body for chemical weapons set up by the four victorious powers France, the UK, the US and the USSR.

We have no precise information on the quantities of poison gas dumped later (especially in the 60s and 70s, but probably also up until the 90s). However, a classified Soviet document of the Central Committee of the Communist Party of the Soviet Union dated 19 October 1989 claims that Baltic units dumped a total quantity of 356,872 t of poison gas in the Baltic up until the year 1978: this is at least five times the amount from German production which existed in the Soviet zone after the war ended. The same document recommends sinking an additional 112,523 t of poison gas in 1989/90. Considering that Russia took until 1997 to ratify the Paris Chemical Weapons Convention (1993), we should fear the worst and assume that poison gas was still being dumped in the Baltic up until the early 90s.



According to information obtained from the Russian Ministry of Defence citing a total number of 50 known dumping areas for warfare agents (including conventional munitions), poison gas canisters containing phosgene, mustard gas and tabun were dumped at 13 different locations. The Russian scientist Maxim S. Wonski from the Cytological Institute at the University of St. Petersburg claims that a quantity of 20,000 t of sarin was also dumped about 50 km off the coast of Latvia comparatively recently.

Are large stretches of the Baltic contaminated? Please see the following map showing areas where warfare agents are known to have been dumped. These include the fishing grounds to the east of Bornholm, to the south-west of Gotland, in the Little Belt, off Lysekil (Sweden) and off Arendal (Norway). The water depth varies between 30 m in the Little Belt, 100 - 150 m in the central Baltic and approx. 700 - 800 m in the Norwegian Channel in the Skagerrak.

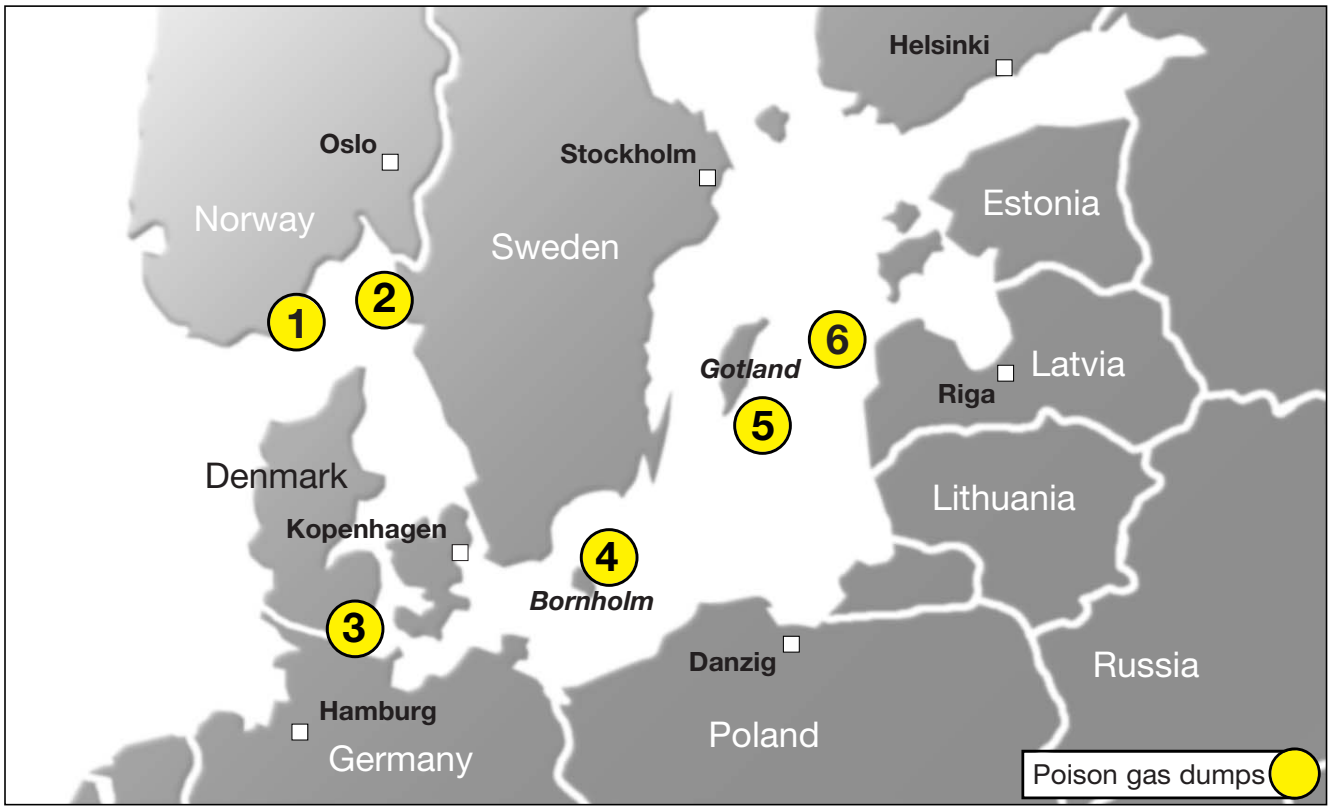
A seagoing tug belonging to the GDR People's Navy with a Danish wreck full of poison gas on its way to the dumping area to the east of Bornholm.

Disposal of chemical weapons in the Skagerrak: the British order a captured German ship to be blown up.

A wreck also tugged into the area is sunk using four explosive charges.

Eckernförde Bay and the entrance to the Kiel Firth were other places in which toxic munitions were dumped at a depth of less than 30 m. A newspaper report from 1960 claims that at least 28,000 (or even 60,000 to 80,000 according to other sources) gas grenades filled with the nerve gas tabun were recovered from a wreck lying off the Kiel Firth and from one lying off the Flensburg Firth, encased in concrete in special drums and thrown back into the sea 300 miles to the west of the coast of northern Spain.

In addition, the German Wehrmacht dumped 90 t of tabun grenades in the North Sea three sea miles to the south of Heligoland just before the end of the war.



1. 150,000 t
Mustard gas and other warfare agents dumped in the Norwegian Channel (depth: 600 to 800 m)

2. 30,000 t
Chemical weapons, mainly mustard gas, dumped at a depth of 200 m in the vicinity of the town of Lysekil

3. 5,000 t
Warfare agents, mainly tabun und phosgene, dumped at a depth of 30 m to the south of the Little Belt

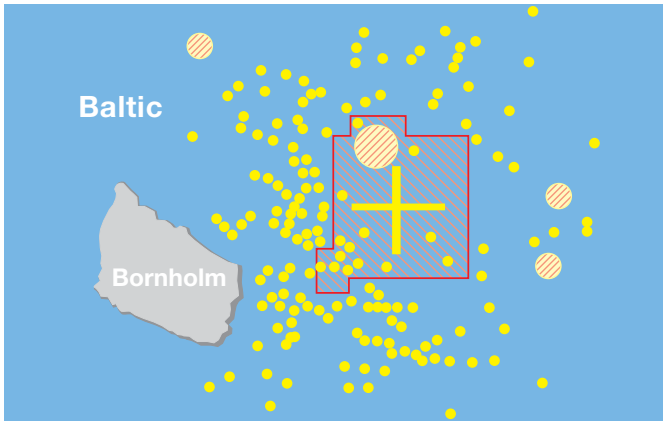
4. 120,000 t up to 1948, + 400,000 t after 1948
Chemical weapons, mainly mustard gas and substances containing arsenic, dumped at a depth of 70 to 100 m off Bornholm

5. 2,000 t
Mustard gas and other chemical weapons dumped at a depth of 70 to 120 m in the Gotland Basin

6. 20,000 t
Sarin dumped at a depth of 80 to 100 m

We know where the main dumping areas are, but the question as to the location of a large number of individual wrecks sunk complete with their highly dangerous cargo remains unanswered until the present day. Eye-witnesses of the sinkings report that many of the ships and large parts of the deadly cargo did not even get to the official dumping areas. Bad weather conditions, lack of fuel, technical problems due to the often extremely bad condition of the barges used as well as lack of time and money for disposal often meant that the

munitions or the ships were sunk outside of the prescribed locations complete with their toxic cargo. The available information on the depth at which the warfare agents are located varies accordingly. For example, those dumped to the east of Bornholm were originally intended to be dumped at a depth of approx. 200 m. Inquiries made by the regional authority of the People's Police in Rostock showed as far back as 1953 that a large part of the warfare agents are located at a depth of no more than about 80 m. As parameters such as oxygen content, water temperature and the strength of ocean currents vary with the depth of the water, it is especially important to know the exact depth in order to be in a position to estimate the life span of the canisters containing warfare agents and estimate their possible drift. There is another problem in that now, 50 years later, the munitions in question must not necessarily still be located where they were originally dumped. As far back as 1954, a bomb was found on the beach at Sellin on the island of Rügen. By now there have been a few hundred cases in which fishermen have found residual stocks and poisons in their dragnets in waters adjacent to the prohibited zones. As far back as 1984, one newspaper headlined "Baltic – 5,000 km2 are contaminated". The Danes are particularly concerned about the toxic munitions dumped to the east of Bornholm, said to amount to between 100,000 and 125,000 t. It was there, on the beach of Dueodde on Bornholm, that walkers found a 5-cwt bomb containing mustard gas in February 1992. 193 bombs of this size were sunk off Bornholm as recently as 1962 by the People's Navy of the former GDR. We also have no definite information on the extent to which the canisters have moved or drifted out of the prohibited areas as a result of trawl nets, ocean currents or storms with high seas.



Unpredictable danger: ocean currents and storms have now already caused tonnes of warfare agents to drift away from the original dumping areas.

List of known dumping areas/munitions/poison gas

Period	Sunk by	Dumping Area	Quantity	Warfare agent
Up to 8 May 1945	Wehrmacht	Little Belt	approx. 5,000 t	Phosgene, tabun
	Wehrmacht	Heligoland	90 t	Tabun
1945	Royal Navy	Kattegat	approx. 2.500 t	Sulfur mustard, adhesive mustard
1945	Royal Navy	Doggerbank Fladengrund	approx. 12.000 t	Sulfur mustard, adhesive mustard
1945	Royal Navy	Skagerrak	46.342 t	Sulfur mustard, adh. mustard, Clark I, Clark II, phosgene
1946	Royal Navy	Skagerrak	67.137 t	Sulfur mustard, adh. mustard, Clark I, Clark II, phosgene
1946	Royal Navy	SW of Bornholm	approx. 15.000 t	Unknown
1946	U.S. Navy	Skagerrak	approx. 10.000 t	Unknown

1947	Royal Navy	Skagerrak	34.109 t	Sulfur mustard, adh. mustard, Clark I, Clark II, phosgene
1947	French Navy	Norwegian channel	approx. 30.000 t	Unknown
1947/48	U.S.Navy	Skagerrak	approx. 12.000 t	Unknown
1945-1947	Baltic Fleet	Bornholm Basin	35.500 t	Sulfur mustard, adh. mustard, Clark I, Clark II, adamsite chloracetophenone
1945-1947	Baltic Fleet	Bornholm Basin	approx. 7.800 t	Phosgene, nitrogen mustard, tabun, sarin
1945-1947	Baltic Fleet	Gotland Basin	2.000 t	Unknown
1948	Royal Navy	Skagerrak	2.000 t	Mustard, adh. must.
1947/48	Soviet Zone	Bornholm Basin	31.650 t	Mustard, tabun
Total dumpings after the end of the war:			**313.038 t**	
1959	GDR People's Navy	Bornholm Basin	12 t	Mustard
1960	GDR People's Navy	Bornholm Basin	10 t	Mustard
1962	GDR People's Navy	Bornholm Basin	48 t 3 t	Mustard, phosgene
1963	GDR People's Navy	Bornholm Basin	6 t	Mustard
1948-1978	Baltic Fleet	Bornholm Basin	283.922 t	Mustard, adhes. mustard, sarin, phosgene, adamsite
	Baltic Fleet	50 km off the coast of Latvia	20.000 t	Sarin
Since 1989 (presumed)	Baltic Fleet	Bornholm Basin	112.523 t	Mustard, adhes. mustard, sarin, phosgene, adamsite
Total of more recent dumpings			**416.524 t**	
Total dumpings:			**729.562 t**	

Source: Politz

Lethal poison

No-one on earth can really describe the effects of these cynical warfare agents. Since poison gas had such disastrous effects in the First World War, humanity has been spared the further large-scale use of war gas. The effects of the poison gases dumped in the Baltic, “improved” versions of those used in the First World War, shall only be given a brief mention here. We shall also show how the substances in question behave when immersed in seawater.

Phosgene (carbon dichloride oxide) belongs to the Green Cross class, a designation for pulmonary injurants which are almost always fatal when absorbed into the body. Symptoms: irritation of the mucous membranes, destruction of the pulmonary tissue, increased precipitation of fluid in the lung and impairment of oxygen exchange. The long-term effects include lung damage and the resulting susceptibility to illness (asthma, allergies). Phosgene is a raw material used in the chemical industry, where it is processed to make insecticides and other products. The gases released in the chemical catastrophe in Bhopal included this chemical.

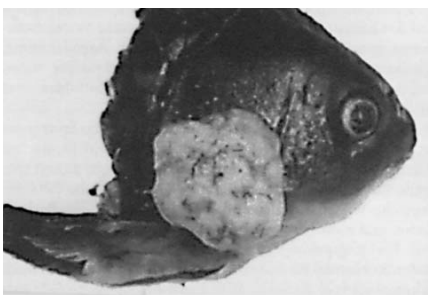
When it comes into contact with seawater, phosgene decomposes to form carbon dioxide and hydrochloric acid, substances which are absorbed by the electrolytic seawater without great problems.

Mustard gas (also known as lewisite, Yperite or dichlorodiethyl sulfide) belongs to the Yellow Cross class used to designate caustic warfare agents and skin poisons. Mustard gas takes effect via contact with the skin. The symptoms are blistering, burns, chemical burns which heal very slowly, extreme pain, disfigurement of the parts of the body involved and the interruption of cell division. The damage caused to the inner organs heals very slowly if at all. The general weakening of the immune system leads to infections. In the long run, the effects of mustard gas show certain analogies to the effects of nuclear weapons as they can cause impairment of the chromosome structure and irreparable mutagenic changes.

Mustard gas is solid at a temperature of -10° C and liquid at +20° C and is heavier than water. 45 % of all German stockpiles of chemical weapons consisted of mustard gas, so this forms the main component of the toxic substances dumped in the Baltic. When bombs are damaged by corrosion or rust, mustard gas escapes in the form of a heavy oil which is deposited on the seabed and decomposes on the surface of the lumps over a period of years to form thiodiethanol. It dissolves in water with difficulty, parts of it not dissolving at all. When it is mixed with sand, the lumps which form have a hard crust, are solid on the outside and contain mustard gas. When the lumps are cracked open, the contents become fully active and can have disastrous effects as much as a century later. Mustard gas is too heavy to drift in seawater, but bonded with algae and seaweed and with the help of gas bubbles it can obtain the buoyancy it needs to float up to the surface. Hydrologists also confirm that storms in the Baltic cause long waves which can reach down as far as the relatively shallow seabed and throw up tough, viscous, adhesive lumps of mustard gas: once washed ashore, these lumps can cause horrific accidents as consistency and colour make them easy to confuse with amber.

Adhesive mustard gas in the form of lumps as it is still encountered in the Baltic today and the effects of contact with the skin: large-surface blisters form, causing considerable pain.

Baltic fish after direct contact with this poison gas.

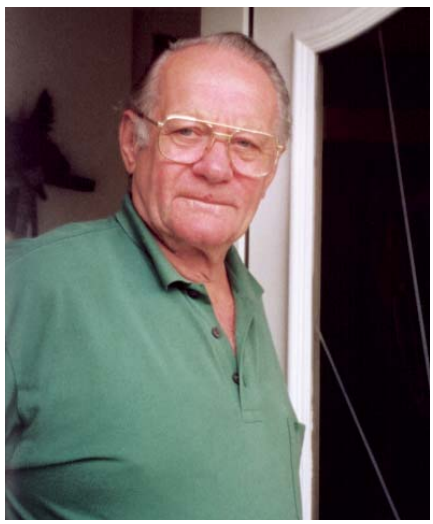


Also, some of the stockpiles of mustard gas dumped in the Baltic were made viscous with the help of rubber and other substances (adhesive mustard gas) in order to adhere better to clothing and the skin. Textiles and rubber clothing are penetrated after a few minutes. The mustard gas was partly mixed with arsenic to increase its effectiveness or enriched with explosives. This fact causes a further dramatic increase in the dangers connected with lumps of mustard gas which have been dredged up or washed up, especially considering that the explosives used largely regain their explosive potential after drying. There is not one single plant for the disposal of stocks of mustard gas mixed with explosives in any of the states bordering onto the Baltic.

Tabun, sarin and soman are nerve agents whose effects are lethal even in low concentrations. The toxicity of these three warfare agents increases from left to right. Symptoms: respiratory paralysis, nausea, vomiting, diarrhoea, muscle cramps and sudden changes in the blood count (caused by the destruction of the autonomic nervous system).

To make them keep longer, some of the tabun grenades were mixed with chlorobenzene, a substance with an extremely toxic effect on marine organisms. The principal decay product is prussic acid. Some of the sarin and soman, the new warfare agents developed by the Germans during the Second World War, was not dumped along with the others, instead being stockpiled by the Allies for their own use. However, it is almost certain that all of the stocks which came into the possession of the Russians will have ended up in the Baltic by now.

Clark I and II are nose and throat irritants containing arsenic. They are included in the Blue Cross class. These warfare agents are not lethal as such, but they can cause serious physical injury and were therefore also known as “mask-breakers”: atomized to form extremely fine particles suspended in air, they quickly gave soldiers unbearable coughing fits often leading to vomiting and causing them to tear the gas masks off their faces. Symptoms: a burning sensation in nose and larynx, strong headaches behind the forehead, respiration problems and vomiting, sometimes also unconsciousness. Clark is of relevance for the situation in the Baltic as relatively large quantities of arsenic can be released from broken grenades.



During his 3 years as a forced labourer, Mr. Ziegler had to dump poison gas in the Baltic on a total number of 10 voyages; as Ziegler says: “I had no shoes – they were totally in shreds. All of a sudden one day, we all got brand-new work shoes. As we were usually worth less than cattle, I knew something was wrong. And I was right: we had to go aboard ship and load up poison gas.” In the course of his work, Mr. Ziegler was injured by escaping mustard gas: “The blisters on my feet were as big as fists and I could hardly walk”.

Risks for man and nature

We can only speculate as to the true extent of the dangers posed by these large quantities of highly toxic substance, partly in high concentrations. We should first make a distinction between the effects on human beings who come into direct contact with the poison gas under the conditions described and the long-term effects it will have on the ecological system of the Baltic. These are especially hard to assess. On the whole, the risks still posed by the individual warfare agents now, over 50 years after dumping in some cases, vary considerably. According to a commission of experts, phosgene poses the lowest risk of all. It decomposes to form carbon dioxide and hydrochloric acid when it comes into contact with seawater, and these two substances are absorbed by seawater relatively easily. Laboratory experiments have shown that tabun in its pure form decomposes when it comes into contact with water and is neutralized after a few hours or days. The prussic acid formed in a transitional phase also decomposes in seawater to form carbon dioxide.

After diving down several times to the original sinking spot at the southern exit of the Little Belt, experts came to the conclusion that the warfare agents dumped there should no longer pose a threat. The bombs which used to be filled with tabun had rusted through and were now empty, they said, and all of the grenades but one had become pervious to water, presumably causing the tabun to dissolve in the seawater and thus become neutralized. However, the samples taken were not at all representative, especially as only a fraction of the stocks dumped there was examined, a quantity which was easy to recover due to having been dumped in shallow water.
Also, according to a Danish study, we do not know much about the effects of the chemicals on fish etc. Scientists have pointed out that the substances formed through the hydrolysis of certain nerve gases are virtually as toxic as the original poisons but one hundred times as resistant to decomposition via hydrolysis. It is said that some of the by-products will still be toxic for another 400 years.

The cumulative impact of the highly toxic substances on the environment can damage its defences, cause genetic changes and, via the food chain, have consequences for humans too. It is therefore urgently necessary to conduct laboratory tests and carry out measurements in situ, especially in view of the stocks of sarin dumped there in recent times by the Soviet Union.

"The warfare agents dumped in the Baltic are a dramatic example showing the consequences of man's recklessness with regard to nature. The dumping of warfare agents is also a cautionary tale demonstrating the negligence and indifference of the human race and the results of causing irreversible damage to nature."
Berndt Heydemann, former Minister of the Environment for Schleswig-Holstein

The quantities and effects of the arsenic contained in some warfare agents are another controversial aspect. Arsenic is a component of several warfare agents dumped in the Baltic, for example Clark I and II, and of certain mustard gas compounds. Arsenic is one of the strongest poisons we know; by nature, it cannot decompose as an element in water, instead entering into new compounds. It accumulates in plants and marine animals, posing a considerable threat to the food chain. Recent measurements have detected extremely high concentrations of mustard gas, arsenic and heavy metals off Lysekil on the south-west coast of Sweden. Tests made as early as 1992 showed that samples of seawater taken in the vicinity of the dumped poison gas contained ten times the arsenic levels normal for the Baltic.

Subsequent laboratory tests also detected high concentrations of the warfare agent Clark which – against all expectations – had not decomposed in the water even after several decades.

"The last time I went diving in the Baltic, I saw the horror of it all from a few meters away – the bombs looked as if they had just been dumped there yesterday." Jürgen Patzer, diving teacher

Porfiriev gives the following warning: "If drastic measures are not taken soon, we could be faced by a big catastrophe between 2002 and 2005" – in this period, he believes, most of the grenades dumped between 1945 and 1947 will have rusted through.

However, the greatest risks for human beings are posed by the stocks of mustard gas dumped in the Baltic, especially adhesive mustard gas: as far back as 1954, a mustard gas bomb was found on the beach at Sellin on the island of Rügen. On the Usedom peninsula, miles of beaches had to be cordoned off in the 1970s. The reason was that holidaymakers had collected sparkling lumps off the beach and suffered chemical burns in the process. What the beachcombers thought were pieces of amber turned out to be lumps of mustard gas. Professor Karl-Heinz Lohs, who worked as a toxicologist and analytical chemist for warfare agents at the University of Leipzig, remembers up to 50 people who were injured by the lumps of mustard gas which were occasionally washed up on the Baltic coast of Mecklenburg-Vorpommern.

A number of accidents involving fishermen dredging up mustard gas have also been confirmed. “No Fishing” zones were established to protect the fishermen, and the Danish fishing authorities prepared a brochure entitled: “Fiskeri og krigsgas” (“Fishing and poison gas”) containing instructions for what to do if poison was found, but the “catches” of poison gas made outside of the zones marked are now increasing in number. It is estimated that about 2 t of corroded toxic grenades and bombs are fished out of the Baltic (and thrown back again) every year. Up to now about 200 fishermen and soldiers have been injured in Denmark alone. As the German Sunday newspaper “Welt am Sonntag” reports: “There is not one single fishermen on the island of Bornholm who has not yet come into contact with the stuff.“ In Poland, several hundred fishermen are said to have been injured, some seriously.

Chemical warfare agents from a medical point of view – effects and possible treatment –

Chemical warfare agents are poisons designed to injure humans and animals by chemical means. Depending on their effects, we usually distinguish the following groups:

I. Eye, nose and throat irritants
II. Lung injurants
III. Blood and nerve injurants
IV. Vesicants and mucosa injurants

I. Irritants are usually not lethal when used in the field. The injuries caused by these substances are usually of a temporary nature, but they force those affected to protect themselves from their effects via suitable aids, especially by putting on a gas mask.

The principal **eye irritants** are chloracetophenone, bromobenzoic cyanide and bromacetone.

Contact with substances of this type soon causes strong irritation of the conjunctiva with immediate lachrymation as well as closing of the eyes due to spasms of the eyelids, accompanied by temporary impairment of the eyesight. In high concentrations, especially in closed rooms, these substances can cause inflammation and swelling of the conjunctiva or clouding of the cornea.

Emergency measures: wipe splashes off the skin with dry gauze or organic solvents (benzene, benzole or alcohol); then apply boron cream. Rinse splashes from eyes with a lot of water, a 3% solution of boron hydride or a 3% solution of bicarbonate of soda, then apply an alkaline eye cream.

The principal **nose and throat irritants** are Clark I (diphenylarsine chloride), Clark II (diphenylarsine cyanide) and adamsite (diphenylamine chlorarsine).

Mustard gas victim

“However, all cases which we lose due to death two or three hours after the attack on our positions are a horrible sight to see. Respiration problems and coughing fits increase until the victims suffocate. The initial small amount of sputum soon makes way for watery, frothy sputum which gradually becomes more and more blood-coloured and finally flows out of the nose. The appearance of the poison victim deteriorates and he dies almost fully consciously as a result of the pulmonary oedema.”
Alfred Schroth, doctor with the 35th Pioneer Regiment, on the subject of a British phosgene attack

Contact with substances of this type leads to acute severe and painful irritations of the conjunctiva, the nasal mucous membranes and the throat as well as to strong convulsive coughing fits with exudate. Other effects are nausea, respiratory problems and anxiety. In high concentrations, the substance can cause serious illnesses of the respiratory tract and the lungs (acute toxic pulmonary oedema). The arsenic contained in these substances can also cause inflammatory diseases of the gastrointestinal tract as well as disorders of the nervous system, dazedness and complete loss of consciousness.

Emergency measures: spray a 3% solution of boron hydride or a 3% solution of bicarbonate of soda or of solutions containing menthol into nose or throat; carefully sniff ammonia or inhale the fumes of a smelling agent composed of 40% alcohol, 40% chloroform, 15% ether and 5% ammonia. Drink warm tea or warm milk.

All irritants can form blisters or nodules when they come into contact with the skin, but in contrast to the skin damage caused by mustard gas, these usually heal again quickly.

III. In opposition to irritants, whose effects on health are usually of a temporary nature, the intake of lung injurants generally causes serious illness.

The principal **lung injurants** are: chlorine, phosgene, PER (trichloromethyl chloroformate) and chloropicrin.

The immediate effects of these substances are as follows: irritation of the conjunctiva and of the mucous membrane of the upper respiratory tract as well as the impairment of pulmonary tissue, including respiration disorders. Other effects are long-term changes in the composition and circulation of the blood and the resulting damage to other organs. High chlorine concentrations can also cause reddening of the skin and inflammations; chloropicrin also frequently leads to vomiting. The destruction of the pulmonary tissue caused by high phosgene concentrations leads directly to immediate cardiac arrest and almost immediate death. With diluted warfare agents, the lung usually fills with fluid and respiration and circulation gradually collapse. The clinical picture in these cases usually does not develop until 4-8 hours after inhaling the warfare agent. In more serious cases, symptoms of severe illness appear within 2-3 hours: respiratory problems, discolouring of the skin from blueish-red to the most intense lividity. Thick frothy liquid flows from mouth and nose. The pulmonary oedema can cause death within a short time. 80% of the deaths occur within 4 hours to 4 days of exposure to the warfare agent in question. Frequently, however, there is a temporary improvement followed by pneumonia or broncho-pneumonia. In rarer cases, dry or festering pleurisy can occur.

Frequent late sequelae are heart, kidney, bronchial and asthmatic disorders which occur as a result of the anatomical changes taking place in the lung.

Emergency measures: there is no known antidote or chemical able to neutralize this warfare agent. The treatment of the individual symptoms must be adapted to each separate case. The only possible first aid measures are still just to change one's clothes, keep warm, relax the muscles, inhale oxygen and take codeine against the coughing fits.

"...you couldn't exactly say they were crying – they shreaked like hoarse roosters, in approximate fifths, as if they had whooping cough, but more severely and without being able to stop. The men there had been taken by surprise by a wave of gas at the bottom of the valley, you see. You could hear them coughing, but there wasn't much you could do for them – pink froth came out of their mouths... From time to time we had a look at the dying men who had been gassed. They were all in the same posture, with their hands held in a cramped position in front of their chest." A French soldier describing the gas attack using phosgene grenades in the battle of Pied du Gravier near Souville on 22 June 1916

"An ecological catastrophe is imminent" – Boris Jeltzin, former Russian president, speaking on the dangers posed by the warfare agents dumped in the Baltic

"There is the very real danger of an ecological catastrophe which our children and our children's children will never forgive us for""
Boris Surikow, retired major general Of the Russian air force

III. In contrast to the abovementioned types of poison gas, **blood and nerve injurants** do not immediately damage the respiratory organs, instead not taking effect until the substances have been absorbed into the blood circulation. Important examples in this group are arsenic hydride and prussic acid (hydrocyanic acid).

Arsenic hydride does not work as a local injurant on eyes, respiratory tract, lungs or the skin, instead having a direct damaging effect on the blood cells. Liver, kidneys and central nervous system are affected indirectly as a result of anoxemia and the products of haemolysis. In high concentrations, however, this toxic substance also has more direct effects. Tiredness, headaches, backache, nausea and vomiting are some of the first signs of slow poisoning due to arsenic hydride. Reddish-bronze discolouring of the skin going as far as jaundice, diarrhoea and vomiting blood are signs of progressive poisoning. Increasing decomposition of the red blood cells causes respiration problems and suffocating cramps which are finally fatal.

Emergency measures: warmth, immediate blood transfusion, artificial respiration with oxygen.

Prussic acid causes so-called “inner suffocation” – the oxygen in the blood can no longer be used for oxidation; respiratory problems, vomiting and cramps quickly cause breathing to stop, leading to death after a few minutes. Lower doses cause anxiety, vertigo, staggering, vomiting and an increased respiration rate.

Emergency measures: artificial respiration, intravenous cardiazol or intravenous or intramuscular nicethamide, intravenous glucose.

IV. **Vesicants (blistering agents) and mucosa injurants** are mainly dichlorodiethyl sulfide (also known as Yperite or mustard gas) but also nitrogen mustard gas (trichlorotriethyl amine) as well as lewisite I (chlorovinylarsine dichloride), lewisite II (dichlorovinylarsine chloride) and lewisite III (trichlorovinylarsine).

Mustard gas is a cytotoxin which damages the cells and the capillaries. The cells affected by it fall into a state of pathobiosis (similar to a lingering illness) and finally necrosis (death of tissue). The capillaries are paralysed. The effects of mustard gas cannot be compared with chemical burns like those caused by acids. In many respects the damage caused has certain similarities with that caused by radiation. Mustard gas is most dangerous for the skin, the eyes and all accessible mucous membranes, especially the respiratory tract and the respiratory epithelium. This toxic substance usually does not take effect until several hours after first contact with it, starting with inflammatory reddening of the skin in conjunction with light swelling accompanied by painful itching which can increase to a burning sensation in the parts of the skin affected. The blisters which form after one or two days fill up tightly with fluid, at first clear and then cloudy due to the cells it contains, and often do not heal for weeks. Further spreading of the lesions leads to fever, illnesses of the gastrointestinal tract, diarrhoea with vomiting, spastic constipation with considerable loss of weight and liver damage in the long term. When the eyes are afflicted, the victims see bright lights, sties form and conjunctivitis develops which can in severe cases cause total loss of eyesight. In the region of the respiratory tract, the effects include hoarseness, difficulties swallowing, respiratory problems, reddening and swelling as well as pseudomembranous

deposits in the region of the mucous membranes in nose, throat and larynx. The resulting closure of the bronchi can cause choking attacks. Pneumonia, pulmonary oedema and pulmonary gangrene can develop. Resorptive damage can also occur, manifesting itself in a reduction in the number of white blood cells in some cases and in extreme leukopenia and toxic granulation of the leukocytes. Death often only comes after several weeks. Recovery usually takes months.

Whereas nitrogen mustard gas has approximately the same effects as sulfur mustard gas, apart from the stronger resorption, the effects of lewisite are felt much more quickly. Itching and stinging occur after a few minutes only. The poison undergoes easier resorption by the skin, but injuries of the skin heal more rapidly. In higher concentrations, lewisite has a similar effect to arsenic.

Emergency measures: change the clothes and immediately clean the skin carefully, in the case of lewisite preferrably with alkaline substances such as soap. This is followed by stationary treatment depending on the individual symptoms.

Recovery and disposal: a daunting task!

For a variety of reasons, the correction of this deplorable state of affairs via far-reaching recovery efforts and expert disposal of the poison gas legacy is a daunting task:

The exact location of the dumping areas is still largely unknown today: even during transport during and after the war, a considerable proportion of the deadly cargo did not even reach the regions earmarked as dumping areas. There is also much uncertainty as to the degree in which the canisters, some of which have been lying on the seabed for 50 years now, have by now been transported out of the dumping areas by sea currents and dragnets or have drifted out by themselves. Partly as a result of the abovementioned strategy of secrecy, especially on the part of the former countries of the Warsaw Pact, we do not even have sufficient information on all areas which may be affected. This makes it unavoidable for us to take stock of the dumping areas as comprehensively as possible.

The unknown state of corrosion of the bombs and grenades: reliable statements cannot be made as to the state of corrosion of the canisters. As yet there has been no confirmation of forecasts made in the past as to when the canisters dumped will have finally rusted through completely. Low oxygen contents and low water temperatures in deeper water have given the canisters dumped there a considerable degree of durability. As recently as 1990, the Scandinavian toxicologist Frode Fronnum from the Norwegian Institute for Defence Research examined part of the Norwegian Channel about 30 km off the small harbour town of Arendal. The wrecks lying at a depth of 500 m and their cargo were still “in a good state of repair“, he said.

The process of decay proves to have been more rapid in the warmer and more highly oxygenated shallow coastal waters; however, the sample taken in the south of the Little Belt in the early 70s, which showed that 14 of the 15 grenades recovered had rusted through completely, is by no means representative. Another problem is that the dumping of warfare agents went on until quite recent times in some areas, the state of corrosion of the canisters differing greatly as a result.

It is therefore imperative to carry out a thorough examination of the state of corrosion of the canisters in all of the dumping areas.

Unknown risks run during recovery operations: recovering intact munitions is always connected with considerable danger for the salvage crews. Also, the recovery of burst mustard gas canisters or lumps of it continues to be an even greater source of danger as the salvage crews risk severe burns.
More problematic still is no doubt the fact that, in the areas in which warfare agents were dumped until quite recently, salvage crews will be encountering canisters of differing generations whose state of corrosion can stretch from complete decay to “as new” condition.

This makes it necessary to develop or refine methods for the safeguarding and hazard-free recovery of the various warfare agents in order to minimize the dangers which the neutralization or recovery of the munitions poses for the safeguarding and salvage crews.

The problem of ultimate disposal or incineration: besides the technical difficulties inherent in salvaging the warfare agents while minimizing the risks, there is also the problem of their ultimate disposal or destruction. There are at present no facilities suitable for incinerating munitions in the entire Baltic region. The facilities existing near to Munster in Germany would not meet the necessary requirements, given the enormous quantities to be disposed of, not to mention the problems which transport would entail. There is probably only one facility worldwide which could handle quantities of this kind: the “Tooele Chemical Agent Disposal Facility” in Tooele near to Salt Lake City in Utah in the US, but here, too, there are still enormous transport problems.

This is why there is an urgent need to construct a facility (or more if possible) suitable for the disposal of the warfare agents recovered and to choose a location which will ensure their safe transport.

Problems of responsibility and legal issues: by pointing to the complex legal situation and the difficulty of finding anyone to accept liability for the poison gas, all countries bordering on the Baltic were for decades able to shirk their responsibility for the problem. An initiative taken by the Danish government in 1985 to solve it on an international level failed due to the resistance of Poland, the Soviet Union and the Federal Republic of Germany. At least 290,000 t of the poison gas munitions dumped in the Baltic up to now (no matter when this took place) was produced by the Germans. It was mostly the Allies who carried out the dumping, and it was not always done within German

territorial waters, but it could be possible to make the Federal Republic legally responsible at least for the stocks dumped by the People's Navy of the GDR in the 50s, 60s and 70s.

Considering the risks it poses for man and nature, the practice now usual in the countries surrounding the Baltic of taking the remains of poison gas and poison gas cylinders found or dredged up and throwing them back into the sea for legal reasons is quite simply unacceptable.

Recover it or leave it where it is – how are we dealing with the menace?

In view of the horrendous dangers for man and the environment and the unforeseeable long-term consequences of the contamination of the Baltic, the call for the recovery and expert disposal of the poison gas legacy is becoming harder and harder to ignore, even among the public.
As early as 1969, Kurt Jäckel, a corvette captain appointed to compile a report for the Danish embassy, came to the following conclusion: "The approx. 50,000 t of warfare agents dumped in the Bornholm Basin 20 years ago are now still as dangerous as ever, if not more so. We require rapid and effective action on the widest possible front if we are to avert unforeseeable damage, especially for the population of the coastal regions and the fishermen."
In the period which followed, journalists and leading scientists tried repeatedly to point out the urgency of a rapid solution to politicians and representatives of trade and industry, but their calls for action fell upon deaf ears. Unfortunately, we have nothing to add to this state of affairs today.

Even 50 years after the first dumpings, the poison gas legacy is as dangerous as ever.

As we have already explained, if the Baltic is to be taken into consideration as an "ultimate disposal site" at all, then for phosgene only. In contrast, tabun und sarin pose considerable problems, especially considering that these substances were being dumped there up to quite recent times – there are thus no grounds whatsoever for the assumption that they will have by now decomposed completely as a result of hydrolysis. Warfare agents containing arsenic such as Clark I and II and their decay products pose a considerable threat to the food chain as a result of bio-accumulation; finally, the properties of mustard gas, especially in its adhesive form, make it especially unsuitable for "ultimate disposal" in seawater, so it will pose a considerable risk for many centuries to come.

If we follow the public discussion over a period of more than 50 years, we can see that virtually every "find" of poison gas (especially if people were injured) caused the demands for the ultimate disposal of the warfare agents to be expressed more vehemently for a time. There is never any lack of politicians

prepared to support a project of this kind, but after a while others come to the conclusion that it would be better to leave the poison where it is. However, this is most likely dictated by lack of money and can by no means be regarded as a reasonable course of action – or is it "reasonable" to accept several hundred, or more probably several thousand, serious casualties or even deaths in future, just so that we can continue to shirk the responsibility of the recovery and disposal of the poison gas legacy? Not to mention the Baltic as a living environment – which it will probably no longer be once the last canister has rusted through.

Who is responsible?

The frantic attempts of politicians to play down the problem in view of the expense involved in recovery and disposal are not at all convincing if we consider the lethal nature of the risks which the warfare agents dumped in the Baltic pose more than ever today.

Even less convincing is the argument which negates that anyone is actually responsible for the dilemma. This responsibility may well be debatable from a legal point of view, but this is more than just a legal issue – it's a question of survival.

The historical responsibility, the responsibility of this generation for the ones to come and the responsibility for Creation as a whole lies with all of us!

What are we to do?

All past attempts to solve the problem have failed. The efforts of the authorities to store and neutralize the poison gas found by fishermen, especially in Denmark, were all abandoned in the end – partly for reasons of cost and partly due to technical problems in the disposal process. The problem of transporting the poison gas also seemed impossible to solve due to the frequent evacuation measures which it would entail. This is why all "finds" are thrown back into the Baltic.

Against this background, anything else but the global elimination of the contaminations would be intolerable in the long run.

The NPO "Das Gelbe Kreuz e.V."

Without claiming to be the only one to know the solution to the problems of the Baltic, the non-profit organization "Das Gelbe Kreuz e.V." with its headquarters in Frankfurt (Main) aims to put an end to the discussions as to whether something should be done about the dramatic poison gas time bomb that is the Baltic. This is why its articles of assocation include the following passage:

"The purpose of the NPO is to co-operate with the responsible public institutions in the detection, charting, analysis, recovery and disposal of toxic waste in the world's oceans as well as to give support and medical attention to the victims of accidents involving toxic substances.

(...)

The purpose of the articles is achieved in particular by:

1) The collection and assessment of all available information on the location of dumping areas for toxic substances and the conduction of the necessary research.

2) The investigation and scientific evaluation of the canisters in which toxic substances have been deposited on the seabed.

3) The elaboration of concepts for the safeguarding and (if possible) recovery of toxic waste in conjunction with the relevant authorities.

4) The ensuring of the proper and environmentally sound disposal of the poisonous substances recovered.

5) The development of concepts for preventing the improper sinking of toxic substances in the seas in future.

6) The establishment of a qualified emergency and information service providing measures for confronting the health hazards caused by contact with toxic substances."

It goes without saying that founding a NPO of this kind can only be a beginning. However, after 50 years in which the authorities made no attempt to present solutions to the problems described, what we need are people who have the courage of their convictions and are prepared to take an active part in remedying this deplorable state of affairs.

"Das Gelbe Kreuz" takes care of the interests of environmental protection and the needs of human beings, regardless of what their nationality is or where they come from, who every day run the risk of coming into contact with the lethal effects of the warfare agents dumped in the Baltic.

We must not let the Baltic die!

The history of chemical warfare agents:

Whereas poisons were used only occasionally in military conflicts in the early days and the Middle Ages, mostly for sabotage or attacks, substances of this kind were increasingly developed in the second half of the 19th century for use as weapons of mass destruction. In the late 19th century, their inhumane effects caused more and more people to call for them to be outlaws completely – a desire which seems to be coming true at last. The following overview presents a few facts and figures showing the development of this sinister chapter of "modern" weapons systems:

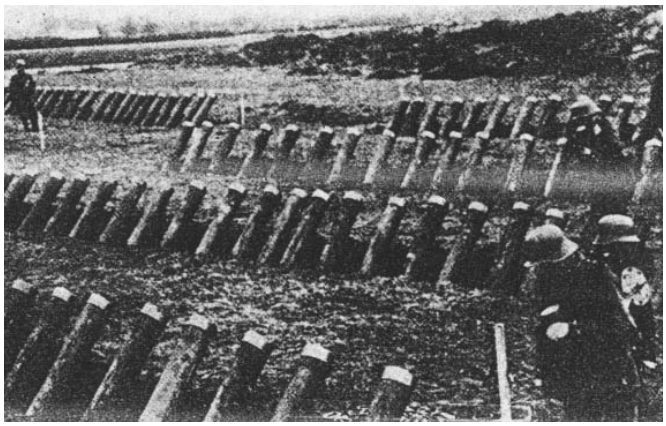
1899: The Hague Peace Conference – Germany, France, Austria-Hungary, the UK, Russia, Japan and 21 other countries agree to prohibit the use of shells whose sole aim is to spread suffocating or toxic gases.

1907: The Second Hague Conference – confirmation of the results of the First Conference; later expanded to form a general ban on the use of poisons or poisoned weapons.

22 April 1915: First large-scale use of chlorine gas by imperial German troops at the front in Ypres. At least 3,000 dead and 7,000 injured by gas.

In the period which follows (1915-1917), the Germans carry out an approximate total of 50 attacks with chlorine gas partly mixed with phosgene. British units follow suit in September 1915, the French from February 1916 on and the Russians starting in October 1916.

German gas-throwing positions in 1918



10 July 1917: First recorded use of diphenylarsine chloride (Clark I) belonging to the Blue Cross class as a "mask-breaker" immediately followed by a bombardment with phosgene grenades belonging to the Green Cross class. This combination of Blue and Green Cross munitions causes a high death toll.

13 July 1917: First recorded use of 2.2 dichlorodiethyl sulfide (also known as mustard gas, Lost or Yperite) at the Front in Ypres. The attack is responsible for the deaths of 2,229 British and 348 French soldiers, 87 of which die in terrible pain.

End of the First World War: the number of soldiers wounded by gas in the First World War is estimated at approx. 1 million, about 65,000 of whom die.

17 June 1925: The Geneva Protocol bans poison gas causing asphyxiation as well as other gases and the use of bacteriological agents in warfare.

1928-1939: Germany and Russia in particular make intensive preparations for a possible gas war. In 1939, monthly production in Germany goes up to approx. 200 t of mustard gas. When war breaks out, Germany has about 10,000 t of chemical warfare agents in its possession. Russia produces similar amounts during the same period, but there is no exact information on the available stocks. In contrast, the UK only has approx. 500 t of mustard gas, whereas the U.S., France and Italy have similar stocks, but also in the form of phosgene.

3 September 1939: Following an enquiry made by the UK, which itself claims to be bound by the Paris Convention for as long as no other state infringes it, Germany responds with a similar statement.

British soldiers poisoned and some of them blinded by mustard gas in the spring of 1918

The trenches at Langemarck on 23 April 1915 after the first gas attack.

1939-1942: The production of poison gas increases considerably in all participating countries in the first years of the war. For example, the United Kingdom has over 11,394 t of warfare agents in its possession in the autumn of 1941, 10,340 t of which are mustard gas. At about the same time, Germany reaches a monthly production of up to 1,500 t, 800 t of which are mustard gas. The total quantity available in May 1941 is given as approx. 32,000 t, about one third of which has already been filled into grenades, bombs and mines. The total quantity of toxic substances available in 1942 is given as approx. 40,000 t, about 30,000 t of which have already been filled into grenades, bombs and mines, and 10,000 t of which are stockpiled.

10 May 1942: Churchill warns Hitler against using chemical warfare agents on the Soviet front, threatening him with all-out chemical war if he does not comply. In July 1942, Germany increases the quantities produced to up to 3,900 t, even deciding to produce 7,000 t per month for the year 1943.

1942-1945: Germany commences with the production of the newly developed warfare agents tabun and sarin. Approx. 500 t of tabun und about 100 t of sarin are produced every month in 1944.

End of the Second World War: when the war ends, Nazi Germany has approx. 70,000 t of chemical warfare agents in its possession, around 31,650 t of which is mustard gas. At the same time, the USA possesses approx. 146,000 t of poison gas, around 85,000 t of which is mustard gas. The United Kingdom has about 35,000 t of poison gas at this point.

1947: USA, Canada and the UK sign a research agreement for the improvement of chemical warfare agents which is also signed by Australia in 1965. Research continues into the 80s.

1961-1970: The USA uses chemical warfare agents in the war in Indochina. From 1965 on, around 55,000 t of the highly toxic defoliant "Agent Orange" and about 9,000 t of CS gas are used.

1963-1967: Egypt uses approx. 40 different chemical warfare agents in Yemen, killing about 1,400 people.

1983 -1989: Iraq uses approx. 3,000 t of chemical warfare agents in course of the Iran conflict. Between 1981 and 1991, Iraq is said to have produced about 4,500 t of these warfare agents.

1972: The USSR presents the draft of a convention to outlaw chemical weapons. However, after long years of negotiations, the disarmament conference is not able to present the final text until 1992. This is ratified by 150 states in 1993 and comes into effect in 1997.

The consequences of the preparations made for the gas war: protective devices for babies and small children.

Gas exercises carried out in the grounds of the Militärärztliche Akademie in Scharnhorststrasse, Berlin. Gas alarm exercises at the Auerwerke in Oranienburg, 1932.

1995: In 1995, the USA still possesses approx. 31,000 t of chemical warfare agents whereas the states of the former USSR still have around 41,000 t. Unknown quantities of chemical warfare agents are assumed to be in the possession of China, Iran, Libya, Vietnam, Syria, North Korea, Myanmar and Israel.

2007: All stocks of poison gas belonging to the signatory states to the Geneva Convention are to be destroyed by 2007.

Members of the NBC Defence Battalion 120 of the German Federal Army in "lightweight NBC protective suits"

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