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Threat to people posed by the removal of chemical ammunition dumped in the Bornholm depth

Introduction

According to the content of the publications it is known that during the years after the war following the decision of Potsdam Conference (August 2, 1945) on dumping the chemical ammunition (containers comprising toxic warfare agents BST) in water found in the territories then-occupied by Germany. As a matter of fact poisonous resources classified in the first half of the past century are presently considered to be industrial toxic waste (TSP) and thereby they were removed from the arsenal of chemical weapon. Nevertheless their toxicity has changed and they are still posing threat to people's life and health.

Bornholm Depths

This area is located in the Southern Baltic region covering 92 795 sqm area. It is divided into the Western Basin 9 westwards of the Bornholm island) and the Eastern part (eastwards of Bornholm Island). The Bornholm Depth (105m) is characteristic for the Eastern Bornholm Basin. This place seemed to be the then- appropriate for dumping the lethal cargo. At the border of the Bornholm Basin there are two points Zatoka Pomorska (Pomorska Bay) (15m) in the west and Rynna Słupska (Słupska Trough) (9,5 m) . and further Zatoka Gdańska (Gdańska Bay) (118 m).

Toxic Warfare Agents in the Bornholm Depth

In the area of the Depth during the years of 1947 – 48 32 thousands of Mg chemical ammunition were submerged which had earlier been found in the area of occupational zone by the Russians.

Other, earlier information proves that the Russians dumped 36 000 to 50 000 Mg (tones) in the two regions of the Baltic two depths (Bornholm and Gotland); it is assumed that 2 tones of chemical ammunition had been submerged in the Bornholm Depth as shown on the graph no 1. It was supposed to contain nauseous, vesicant and phosgene. According to the fact that no documents were found proving this state of matters the factual mass of the submerged ammunition is difficult to establish. Characterization table covering the chemical ammunition submerged in the Bornholm Depth is shown on table no 1 underneath. However, the graph showing the types of chemical ammunition and toxic warfare agents mass submerged in this area is shown on table no 2.

Table 1

Characterization table covering the chemical ammunition submerged in the Bornholm Depth

No.	**Amunition type**	**Number/quantity**
1	2	3
1.	Containers with sulphur mustard gas: - 1 500 kg containers - L - 100 and L – 150 barrels	 1 004 529 Total **1 533**
2.	Artillery missiles with sulphur mustard gas: - 75 mm caliber and 6,2 kg mass; - kalibru 105 mm caliber o masie 14 kg mass; - kalibru 150 mm caliber o masie 39 kg mass	 30 460 295 181 82 924 Total **408 565**
3.	Chemical bombs: - KC - 250 with sulphur mustard gas; - KC – 250 with chloroacetophenone ; - KC - 500 with chloroacetophenone; - KC - 250 with arsenic compounds; - KC - 250 with Clark I; - KC - 500 with Clark I; - KC - 50 with adamsite;	 71 469 4 719 430 5 197 3 340 522 8 027 Total **93 704**
4.	Chemical explosives of 20 kg	**34 162**
5.	Chemical shells do 85 kg	**6 777**
6.	Fog chemical bombs of 50 kg	**430**
7.	Fog chemical bombs of 100 mm and14 kg	**10 420**
8.	Fog chemical bombs of 3 kg	**35 040**
9.	Chemical shells in chests	**518**
10.	Assault poisonous resources: - cyanogen salts; - chloroarssenic, cyanogen arsenic (derivatives); - of unknown composition; - L - 100 and L - 250 barrels with Clark I; - 125 kg barrels with adamsite - Prussian acid(cyklon B)	 **75 Mg** **85 Mg** **5 Mg** **922** **7 518** **7 860 cans**

Table 2.

The types of chemical ammunition and warfare agents (Mg) submerged in the region eastwards from Bornholm

Chemical munitions types	**Types of toxic chemical warfare**					
	Mustard gas	**Arsenates**	**Adamsite**	**Chloroacetophenone**	**Other**	**Total**
Air bombs	5 920	906	591	479	-	7 896
Demolition bombs	314	-	-	-	-	314
Arillery shells	671	-	61	36	-	768
Mines	42	-	-	-	-	42
Fog granades	-	-	65	-	-	65
Containers, drums	80	1 127	711	-	74	1992
Total	**7 027**	**2 033**	**1 428**	**515**	**74**	**11 077**

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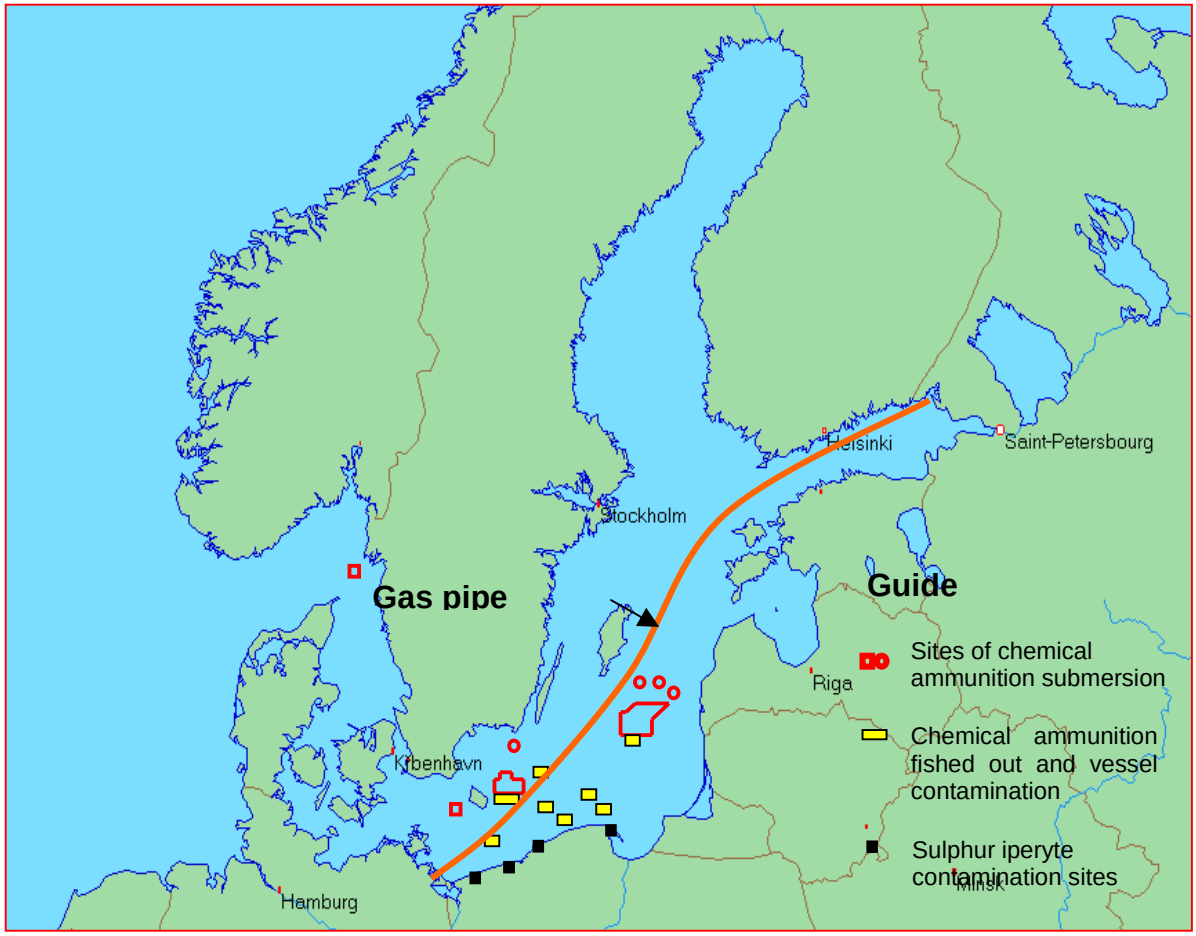
The selected points presenting the characterization of toxic chemical warfare submerged in the Bornholm Depth are essential in relation to the Nord Stream gas pipe construction. Planned gas pipe location is presented on graph 1. Presented map shows that the Nord Stream is being constructed in the region of the submerged chemical warfare or may cross its rim. Not only the places of chemical warfare submersion prove this but also the warfare found by Polish fishermen. It further proves the idea of its deposition and that the border of the submersion is not accurate. It is also worth mentioning that this gas pipe is being built in the Exclusive Economic Zone being a matter of dispute between Poland and Denmark.

Threats caused by the release of toxic chemical warfare (BST) into the marine environment.

As it is being estimated the biggest threat toward marine environment is posed by the following toxic warfare:

- Mustard gases:
  - *sulphur mustard*
  - *sulphur iperyte (concentrated)*
  - *nitrogen iperyte*
- with arsenic compounds
  - *lewisite,*
  - *Clark I,*
  - *Clark II,*
  - *adamsite.*



Graph 2 Sites of fishing out and casting onto the shore toxic warfare agents and chemical munitions in The Polish Economic Zone and planned course for Nord Steam gas pipe .

Iperyte does not dissolve well in water especially seawater. The released iperyte agglomerates and the surface of such agglomeration becomes covered with a multiple compounds layer, more or less toxic in character establishing at the same time water-impermeable barrier. Dissolution of arsenic compounds is rather small. Nevertheless after some time it passes into sea water.

Toxic characterization of submerged toxic warfare.

Sulphur Iperyte

It was discovered by Meyer in 1886 and since then it has been playing a major factor role in the warfare arsenals of many countries. Being submerged (e.g.: the Baltic Sea) its toxic character may last for many years especially when being remained in a stagnant water.

Sulphur iperyte is toxic in the steam, liquid and solution form.
It is a strong necrosis factor. It passes into the body through skin, respiratory and digestive tract. It is harmful to the eyes. The skin paralysis starts from the dose of 0,01 miligram per square centimeter (vapours are detected at the concentration of 0,001/0,002 mg/dm-3) The first paralysis symptoms of the skin reveal themselves as inflammation, they appear after 4 to 24 hour period depending on the dose. After a 24-hour period blisters appear tending to form one huge blister fulfilled with a serum liquid. Then the blister bursts after a several days and a difficult – to- heal wound appears. Those wounds are vulnerable to virus and bacteria infections thus the treatment period turns to be long (up to several months) and requires sterile environment. The healed wounds leave scars and brown stains.
The terminal sulphur iperyte dose when its activation through skin is considered equals to 40 / 60 mg/kg-1, and a lethal dose equals toLD50 – 20 miligrams per bodyweight kilogram.
The symptoms of organism paralysis caused by sulphur iperyte activated through respiratory tract appear after 4 to 6 hours in the form of painful dry cough, fading voice, or pneumonia. The mean paralyzing dose ICt50 equals to 150 mg/min/dm -3 and terminal one equals to LCt 50 -400 /1500 mg/min/dm-3, depending on the intensity of breathing.
Staying in the atmosphere characterized by the concentration of this gas at the level of 0,03 mg/d-3 in the period of 3 to 5 minutes results in death. Eye paralysis by sulphur iperyte vapours of 0,0012 mg/dm-3 concentration appears after one-hour –exposition.
Sulphur iperyte has general toxic qualities. They appear when vast areas of skin are contaminated exceeding 20 % of its total area.
Its influence on human body leaves enduring weakness, known as post iperyte weakness. The treatment in any case requires medical care. The research conducted showed that iperyte may have cytotoxic and cancerogenous effect.

Nitric iperyte

The toxic qualities of nitric iperytes are similar to sulphur iperytes. The paralysis symptoms are also comparable. Latent activity of nitric iperytes are shorter than sulphur one they may last a few minutes.

Nitric iperytes and their first form tri 9 2 chlorethyl amine), as the research conducted in 1942 in the US showed, may be used in cancer chemotherapy. Active alkyl radicals of nitric iperyte may react with organic and non organic anions in the cells and with nucleic acids.

Lewisite

Lewisite (there are three types of Lewisite) passes into the body through skin and respiratory tract. Its qualities are toxic and necrotic. As the effect of skin contamination the light burning may be felt immediately in the contaminated areas. At the dose of 0,2 mgcm-2 cherry red blisters appear after several hours (in the similar way to the vapours of nitric iperyte at the concentration level of 10 mg/dm-3 during 15-minute-exposition). Then the blisters burst after 2 -3 hours leaving vast open wounds. Mean terminal dose of nitric iperyte equals to 20 miligrams per 1kg of body weight.

Nitric iperyte action through respiratory tract gives cough symptoms, suffocation, fading voice and, as frequently observed, pneumonia. 30-minute-expostion at 0,05 mg/dm-3 is terminal, however paralyzing mean dose (ICt50) equals 300 mg/min/m-3 and a lethal one to (LCt50) – 1300 mg/min/m-3. The repeat contaminations with nitric iperyte have much more difficult course than the primal ones which is also symptomatic for sulphur iperyte.

Chloroacetophenone.

It is irritating to mucous membranes of the eye (lacrimator). Its concentration equal to 5 . 10-4 dm-3 causes tear flow effect. At higher level of concentration exceeding 2 . 10 -3 dm-3 facial skin becomes irritated. Contamination symptoms disappear as soon as the contaminated area is abandoned without any health consequences.

Clark I

Clark I (diphenylochloroarsine), Clark II (diphenylocyanoarsine) and adamsyte belong to the toxic irritants (sternity). Clark I seriously irritates eye mucous membranes as well as those of respiratory tract. The irritation symptoms are following: tears, cough, sneezing, pain in the lungs and difficulty in breathing with a tendency to ease off, all those symptoms disappear without any further effects after several hours. At the concentration of Clark I in the air exceeding 10-4 mg. dm-3 the first irritation symptoms appear. High concentration around 2 mg . dm -3 may prove to be terminal due to the permanent respiratory tract irritation effect.

Clark II

Toxic activation of Clark II in the human body is similar to that of Clark I. The toxication symptoms are also similar. Aerosol concentration in the air of Clark II showing the value of 10-5 mg.dm-3 results in the primary paralysis symptoms (10 times less than Clark I). The irritation concentration of Clark II exceeds 5 . 10 -4 mg . dm -3 .

Adamsite

Adamsite is the third toxic agent from the sternity group. Adamsite aerosol strongly irritates respiratory tract and eye mucous membranes. The irritation symptoms are as follows: immediate excessive saliva production, and after a short period of time the pain in the lungs appears, the respiration is obstructed. After several hours the symptoms recede without any consequences to the health. The threshold concentration of adamsyte is felt at 10-3 /2 .10-4 mg . dm -3.

Findings:

Toxic warfare agents submerged in the Baltic Sea in relation to their toxic qualities may cause concern since every direct contact with them induces paralysis in the human body. Moreover in the summer conditions, at high temperatures of the air the toxic vapour of those agents may prove to be harmful due to their high volatility. The release of BTS toxic warfare agents may take place in the places considered to be safe. This concept may be justified in the following way:

- lack of accurate map showing toxic agents sites
- submersion was conducted out of planned area
- ammunition deposition caused by bottom currents
- re-submersion of the fished-out – ammunition out of the indicated area

There is a concern that the release of the toxic agents from the ammunition (containers with BTS toxic warfare agents) may lead to the marine wildlife contamination lasting for several decades. The organisms which are in the direct contact with those agents will suffer most (iperyte, arsenic). Such cases may have negative impact on economic results of the entities dealing with fishing. The exemplary image of the chemical ammunition erosion is shown on the photograph 1.

Photo 1 Submerged ammunition picture

Conclusion

Thus it is difficult to foresee the final effects of the Nord Stream gas pipe construction. Nevertheless it may be argued that the release of toxic agents caused by containers erosion will accelerate degradation of marine environment caused by the increase of toxic substances in water. This factor will not be indifferent to the Baltic wildlife and in the wider scope to all users of the region. Higher concentration of arsenic is observed not only in the areas of submersion but also in the area of transport routes. The opened containers with toxic agents may be found on the beaches. This state may result from their erosion caused by sea waves.

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