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## Sources to radioactive contamination in Russian Counties of Murmansk and Arkhangelsk

The Kola peninsula contains the worlds largest concentration of nuclear reactors and weapons. In this report you will get a complete survey of the extent of the nuclear problems on the Kola peninsula regarding civil nuclear powered vessels, dumping of waste, the Kola nuclear power plant, nuclear explosions and various other sources. Accidents in these area can have very widespread consequences.

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# Dumping of radioactive waste

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## 4.0 Dumping

Radioactive waste has been dumped in the ocean ever since the Soviet U their first nuclear-powered submarine at the shipyard of Severodvinsk in waste arises from operation of both nuclear-powered submarines and civ In all, the former Soviet Union, now Russia, has dumped more than twic radioactivity as other countries having dumped radioactive waste at sea. nations having dumped radioactive waste into the ocean are: Belgium, Fr Japan, South-Korea, the Netherlands, New Zealand, Switzerland, Swede USA. [2] The Soviet/Russian dumping has, as opposed to that of other n shallow waters, north of the 50th latitude, and on the continental shelf.

## 4.1 Rules and conventions

Dumping of radioactive waste into the ocean is regulated by internationa London Convention). Furthermore, a number of Soviet (presently Russia from different ministries and the Naval Command have been passed. Th Northern Fleet has broken the country's own set of regulations for dumpi as well as acted in defiance of international regulations a number of time

as well as acted in defiance of international regulations a number of time Soviet Union has given erroneous information on the country's dumping into the ocean to the International Atomic Energy Association (INEA), whether the countries having signed the London Convention observe the has put together the following chronological survey of the development national regulations and international conventions limiting dumping:

**1960**

The first document permitting dumping of liquid radioactive waste isotopes is written by *The Soviet Ministry of Medium Machine Co* operation with the third main directorate in *The Soviet Ministry of*

**1962**

A new version of the 1960-permission becomes operational. [4] T dumping of liquid radioactive waste by prohibiting dumping of m metres, and specifies that the radioactivity may not exceed 1,850 k isotopes, and 370 kBq/l for long-life isotopes. The total level of ra exceed 370 GBq (10 Ci). Dumping directly from nuclear-powered permitted in emergencies.

**1966**

The regulation of 1962 is replaced by the more detailed *VSTZ-66-r* the Navy and *The Soviet Ministry for Health Care*. The regulation dumping is to take place in certain areas, and that the radioactivity regularly monitored in these areas. During 1966-67, the Northern solid radioactive waste is to be dumped in bays on the eastern coas and liquid radioactive waste in limited areas of the Barents Sea.

**1972**

The London Convention limiting the dumping of radioactive wast signed by a number of nations, among them the Soviet Union. The operational in 1975, and bans dumping of high level radioactive w things. Furthermore, it limits the dumping of low- and medium lev Dumping of such waste is limited by the IAEA's demands, stating take place outside the continental shelf, on waters deeper than 4,0 between latitudes of 50° S and 50° N.[5]

**1975**

The Soviet Union ratifies the London Convention, which becomes 29th of January 1976. In spite of signing the agreement, the Soviet dumping of solid and liquid radioactive waste. Furthermore, react dumped in the Kara Sea in both 1981 and 1988.

**1979**

The Soviet Union draws up a plan concerning the limitation of du waste, in order to comply with the London Convention. [6] A new prohibiting regular dumping of radioactive waste from ships, airer formulated, and becomes operational in 1983. The prohibition is b effects the dumping in the sea might have on the environment. Th up in co-operation with *The Soviet Ministry for Fisheries*. At the s draws up regulations for dumping of radioactive waste in the sea.

**1983**

The London Convention carries a temporary prohibition on all du waste. The Soviet Union waives its vote. *The Soviet State Committ Hydrometrology* refuses to approve of the Northern Fleet's further the Kara Sea.

**1987**

PS-82 is withdrawn the 1st of December 1987, and further regulati established by the Navy.

established by the Navy.

### 1988

The 21st of July 1988, the Soviet delegates at the London Convention dumping of radioactive waste in the sea is prohibited by Soviet law. The Soviet Union has never dumped radioactive waste in the sea and it intends to do so in the future. [7] Only a few weeks later, the North Atlantic Treaty Organization submarine reactors containing fuel in the Kara Sea.

### 1992

The 24th of October, president Boris Yeltsin signs a decree, appointing a commission to investigate the information concerning dumping of radioactive waste. The commission is presided by the president's environmental councillor.

### 1993

In November 1993, the London Convention agrees on making the prohibition a permanent prohibition. England, France, Belgium, Canada waive their votes.

## 4.2 Dumping performed by the Northern Murmansk Shipping Company

The Russian Northern Fleet (formerly the Soviet) has since 1960 dumped radioactive waste in the Barents Sea and Kara Sea on a regular basis. This comprises solid radioactive waste, and nuclear reactors with and without fuel. Furthermore, nuclear reactors have been dumped in the Barents Sea and Kara Sea from the civil state-run Murmansk Shipping Company's fleet of nuclear icebreakers. The navy has also dumped radioactive waste in the Japan Sea, Pacific Ocean, and Baltic Sea. In all, Russia (former Soviet Union) has dumped between 115,000 TBq (3.1 million Ci) and 333,000 TBq (9 million Ci) of radioactive waste. In comparison, all other countries put together have dumped 46,000 TBq (1.2 million Ci) of radioactive waste in the period of 1946-1982. [10]

### 4.2.1 Liquid radioactive waste

Liquid radioactive cooling water from the ship reactors and storage tanks assemblies has since 1959 been dumped at sea. The last dumping of liquid radioactive waste took place November 1991, and this practice may be resumed if no alternative is found. According to regulations set forth by the Soviet Navy in 1968, the waste should have a maximal concentration of radioactivity of 370 Bq/l of long-life isotopes, and 1850 kBq/l of short-life isotopes. [11] Whether this has been observed, is not known.

The liquid waste of the highest radioactive concentration has been dumped in fields furthest to the north in the Barents Sea, while the less radioactive waste has been dumped outside the shore of the Kola Peninsula.



gif, 6K

Map: *Dumping areas for liquid radioactive waste*

From 1959 up to 1991, 3.7 Tq (100 Ci) liquid radioactive waste has been dumped in the White Sea, 451 Tq (12,171 Ci) in the Barents Sea, and 315 Tq (8,500 Ci) [12] 430 Tq (11,600 Ci) radioactive water has leaked out in the sea following the concern concerning storage of fuel assemblies, submarines, and the civil nuclear power. The radioactivity of the liquid waste dumped in the Barents Sea, Kara Sea, and 880 Tq (23,771 Ci).

The amount of radioactivity in the liquid waste dumped at different points is considerably different.

The tanker *Amur* is a radiological auxiliary vessel put into use by the Northern Fleet. The *Amur* has cleansing facilities for radioactive cooling water from submarines. The cooling water is then dumped in the ocean. After the *Amur* was put into service and 975 tons of radioactive cooling water. [13]



Photo: *The tanker "Amur" dumping liquid radioactive waste in the Barents Sea*. gif, 105K, jpg, 23K

Photo: *The tanker "Amur" dumping liquid radioactive waste in the Barents Sea*

The *Amur* is at present at the Northern Fleet's naval shipyard Nr. 10 Shk rebuilding. Another tanker similar to the *Amur* will be delivered to the Northern Fleet. At the new tanker, evaporation as opposed to filter-cleansing will be used. The radioactivity of the cooling water prior to its dumping in the ocean. Liquid radioactive waste has also been dumped from vessels of the 1783A-type (Vala design).

#### 4.2.2 Solid radioactive waste

The Northern Fleet has sunk a total of 17 ships and lighters containing radioactive waste in the Barents- and Kara Sea. Aboard the ships there are different types of radioactive waste with varying levels of radioactivity, made up mainly of containers with radioactive parts, and other contaminated equipment. The dumped containers are mostly low and medium radioactive waste, such as contaminated metal parts from the reactor sections, clothes, and equipment used for work at the reactors. Major items dumped, are cooling water pumps from reactors, generators, and varying amounts of these are placed aboard ships and lighters before these were sunk.

Of special interest is the fact that Cargo boat no. 4, sunken in the Techen Bay at the same position as reactor section no. 538, also sunk in 1988. This may imply that reactor section was aboard the cargo boat when it was sunk.

Solid radioactive waste in and without containers has since 1965 to 1991 been dumped in different bays off the eastern coast of Novaya Zemlya, and in the Kara Sea. The Northern Fleet and the civil fleet of nuclear icebreakers in Murmansk have dumped waste in these areas.

According to the Jablov Report, a total of 6,508 containers of radioactive waste have been dumped directly in the Kara Sea. [14] The Northern Fleet has dumped 47,000 containers of the Murmansk Shipping Company, dumping of 11,090 containers has been recorded. This implies the company has dumped 1,867 individual containers. The remaining 9,223 containers are placed aboard lighters and ships before they are dumped.

During the first dumping missions in the 60's, many containers did not sink floating at the surface. The crew aboard the boats carrying out the dumping by shooting at the containers with machine guns, causing water to seep into them to sink. [16] This took place in Abrosimova Bay on the south-eastern coast of Novaya Zemlya. Furthermore, reports have been made concerning repeated finds of contaminated waste floating in the Kara Sea. One container was found ashore on Nova Zemlya. In later dumping missions the problem has been solved by placing rocks along with the radioactive waste in the containers to make them sink.

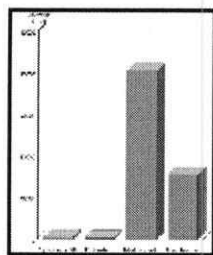
Moreover, 155 major radioactive items have been dumped. Some of these were aboard the lighters and cargo boats with radioactive waste dumped. These containers hold 0.5 to 1 cubic metre waste, and are made of plain iron. Some are lined with concrete.

In addition to radioactive waste dumped in bays on the eastern coast of the island of *Nikel* was sunk by the island of Kolgoyev in the Barents Sea (69:34' N, 30:30' E). The ship was loaded with 18 radioactive items corresponding to 1,100 cubic metres of radioactive waste with a radioactivity of 1.5 TBq (40 Ci).

A total of 31,534 cubic metres solid radioactive waste of a radioactivity of 1.5 TBq (40 Ci) is dumped, made up of 6,508 containers, 17 ships, and 155 major items.

### 4.2.3 Dumped nuclear reactors

13 nuclear reactors from submarines have been dumped in the Kara Sea. All reactors have been dumped with used fuel aboard. All reactors come from submarines that have had serious accidents where the reactors have been a radiation protection failure. They were so wrecked, and the radiation so strong that the nuclear fuel was impossible to remove. This is the reason why the fuel is not removed before the reactors are dumped. The submarine reactors, three reactors from the nuclear icebreaker *Lenin* [18]



gif, 5K

Photo: Comparison of dumped radioactive waste. From left to right: liquid with/without fuel

The dumped reactors had been stored for from one to fifteen years from the time of the accident to when they were dumped in the Kara Sea. 5 of the submarine reactors were stored with protective material of steel, cement, and polyester to prevent radiation from entering the marine environment. According to Russian reactor constructors, this protection is good for up to 500 years. As very little technical data on the different nuclear reactors is available, the amount of radioactivity represented by the nuclear reactors is hard to calculate. Calculations made by Russian experts based on the information available in the Commission's report estimate the total radioactivity to be 85 PBq (2,300 Ci) for the 5 submarine reactors containing fuel and the 3 reactors from *Lenin*. [20]

Calculations made by the Lawrence Livermore National Laboratory in the USA.

Calculations made by the *Lawrence Livermore National Laboratory* in t however, that the amount of radioactivity dumped in the Kara Sea may b stated in the Jablov Commission' s report. The laboratory has made ca available information on the reactor's power production, assumed runnin isotope composition of the used fuel. The results of the American calcul radioactivity of the reactors dumped with used fuel and the 3 reactors fro been 178 PBq (4,800 kCi) at the time of the dumping. The radioactivity reactors without fuel is estimated to about 3,7 PBq (100 kCi) per reactor.

As shown in the survey of dumped, nuclear reactors, dumped ships, item radioactive waste, plus the survey of dumped liquid radioactive waste, th of radioactivity at the different dumping fields are considerable. If it's as without fuel represent a radioactivity of 3,7 PBq (100 kCi), then more th total radioactivity is dumped at the Abrosimova Bay (52 per cent) and at the Kara Sea (30 per cent). At the Blagopoluchy Bay, Oga Bay, and Sedo hand, only minor amounts of radioactivity have been dumped.

| Source   | Activity (Ci/T) |
|--|-----------------|
| Fallout following the Chernobyl accident and nuclear testings. | 6,300 TBq       |
| Eroding from the rivers Ob and Jenitsej [22]                   | Some millions   |
| The Golf Stream, mainly from Sellafield.                       | 7,400 TBq       |
| Dumping in the Barents- and Kara Sea.                          | Between 3 and   |
| Under water nuclear testings.                                  | No available i  |
| Possible le  |                 |

Calculations made by the Lawrence Livermore National Laboratory in the USA conclude, however, that the amount of radioactivity dumped in the Kara Sea may be higher than what is stated in the Jablovkov Commission's report. The laboratory has made calculations based on available information on the reactor's power production, assumed running time, and assumed isotope composition of the used fuel. The results of the American calculations indicate that the radioactivity of the reactors dumped with used fuel and the 3 reactors from Lenin might have been 178 PBq (4,800 kCi) at the time of the dumping. The radioactivity of the submarine reactors without fuel is estimated to about 3,7 PBq (100 kCi) per reactor. []