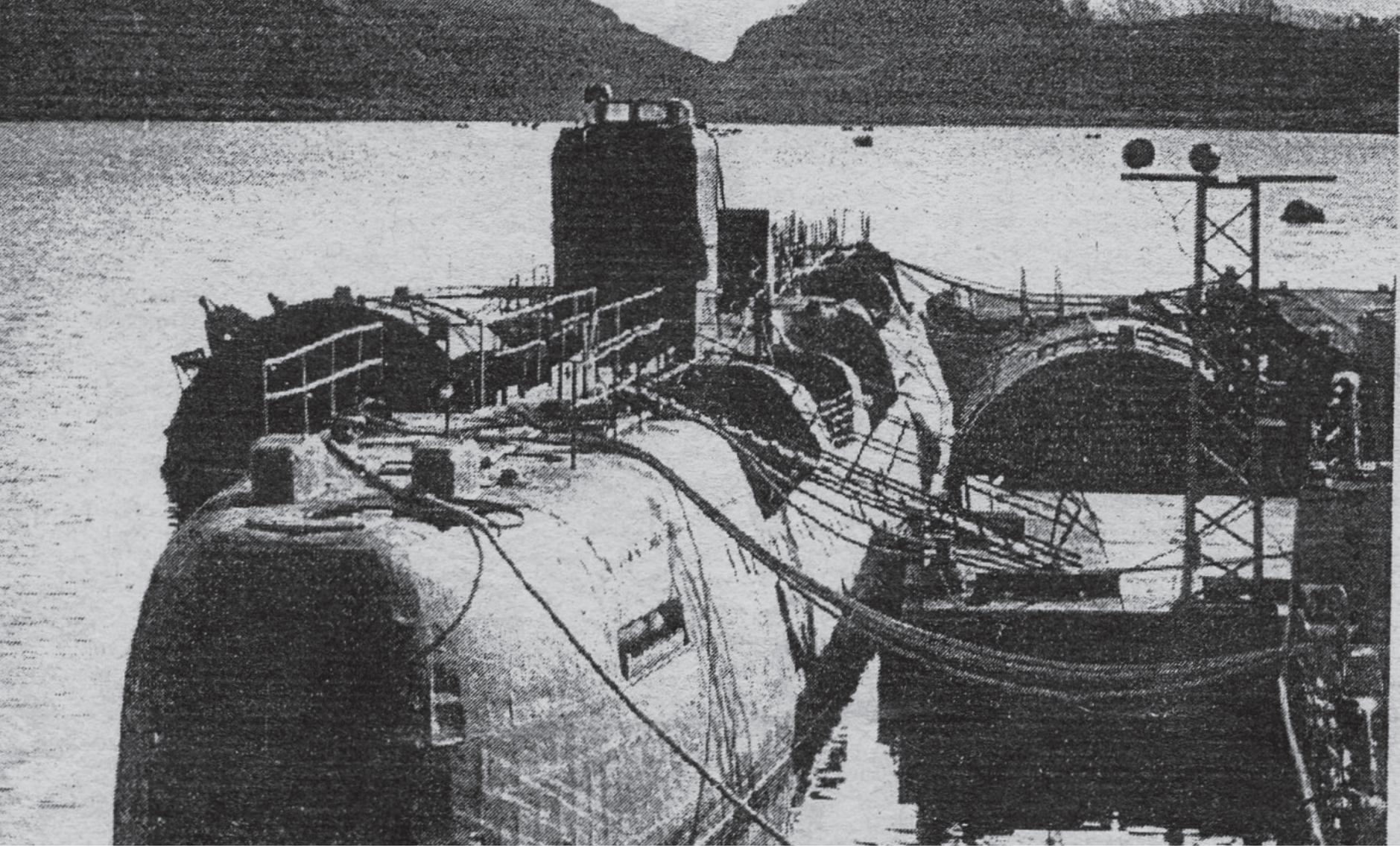


Chazhma Bay, Russia

Nuclear submarine accident

In August 1985, an explosion on a Soviet nuclear-powered submarine caused a massive release of radioactivity in Chazhma Bay. More than 290 people suffered from radioactive exposure and much bay and waterfront were contaminated. The accident was kept secret for many years. The surrounding ocean was also used by the Soviet navy as a nuclear waste dump, adding further to the radioactive contamination of the water. The full extent of environmental damage and health effects may never be fully known.



The wreck of the Soviet nuclear submarine K-431. On August 10, 1985 the submarine's reactor exploded in Chazhma Bay near Vladivostok.



The waterfront at Chazhma Bay, 45km southeast of Vladivostok. Derelict submarines lie here, rotting in the water. Photo credit: Sergey Tymchenko / wikimapia.org.



The town of Dunai near Chazhma Bay is one of many places on the peninsula where people are suffering from the effects of the contamination from the nuclear submarine accident of 1985 and years of nuclear waste dumping. Photo credit: Konstantin Sergeyevich, creativecommons.org/licenses/by-nd/3.0

History

The existence of the Soviet naval base at Chazhma Bay near the port of Vladivostok was classified as a state secret during the Cold War.¹ On the morning of August 10, 1985, the nuclear reactor of the K-431 Echo-II submarine was in the process of being opened, when a wave, created by a passing navy torpedo boat, rocked the ship and caused all the fuel rods to dislodge. This, combined with human error, resulted in an unintentional critical mass leading to a spontaneous chain reaction. The massive explosion blew out the 12 ton upper lid and all of the nuclear fuel assemblies from the reactor compartment, and destroyed the submarine's pressure hull. The radioactive plume rose up to 50m above the submarine and traveled northwest, leaving a trace of nuclear fallout on the Dunai peninsula, 3.5km long and up to 650m wide.² At the same time, the ocean floor and part of the adjoining water front were contaminated by radioactive cobalt-60.¹ A fire broke out on the submarine, releasing further radioactive isotopes such as iodine-131 and manganese-54 for about seven hours.¹ Similar accidents on Russian nuclear submarines were reported in Severodvinsk in 1965, 1968 and 1980 as well as in Nizhny Novgorod in 1970, when a radiation accident occurred during the construction of a nuclear submarine reactor.¹ The Chazhma Bay accident was kept secret until 1993.¹

Health and environmental effects

The explosion killed ten people instantly. Gamma-radiation doses reached five millisievert per hour (about 16,000 times natural background radiation of 0.0003 mSv/h).² The rest of the radiation was released in the form of 259 Peta-Becquerel (Peta = quadrillion) of radioactive particles.¹ This form of radiation is especially dangerous to humans when ingested or inhaled. Particularly relevant for the population was the release of 29 Giga-Becquerel (Giga = billion) of iodine-131, a known cause of thyroid cancer.¹ Because fuel had just been loaded into the reactor, radionuclides such as cesium-137 or strontium-90 were not present in large quantities.¹

About 2,000 workers took part in the emergency and decontamination procedures. According to Soviet documents, 290 of them were exposed to radiation of more than 50mSv, ten of whom suffered from acute radiation sickness. Fire fighters in the submarine received the highest doses: up to 2.2Sv of external irradiation and up to 4Sv to the thyroid gland.³ Using the WHO cancer risk factor for ionizing radiation of 0.2/Sv, it can

be extrapolated that about 44 % of the workers would develop cancer as a result of such high radiation doses.⁴ 205 of the workers were awarded certificates in 1998, entitling them to similar state benefits as the Chernobyl "liquidators" (decontamination workers).

In 1985, the level of gamma-radiation in 80 % of sediment samples from Chazhma Bay exceeded 0.6 mSv/h, or approximately 2,000 times natural background radiation. Even by the end of the 1990s, some radioactive hot-spots in the bay showed levels of up to 60mSv/h, or about 3,000 chest x-rays per hour. Because cobalt-60 is continually being moved by the current to the adjacent Strelak Bay, its concentration in Chazhma Bay is steadily decreasing, while the contaminated area is constantly growing.²

Outlook

Even today, the sunken K-431 submarine continues to be a source of radiation, particularly cobalt-60.² The entire region is heavily polluted, as old and derelict nuclear submarines were scuttled here over a period of several decades and radioactive liquid and solid waste dumped into the sea. High levels of radioisotopes such as cesium-137 and strontium-90 have also been found in sediment samples.^{5,6} The heavily affected Dunai peninsula continues to show radiation levels between 0.6 und 8mSv/h.² This level of radiation corresponds to about 30 to 400 chest x-rays per hour. Five days spent at a place with radiation levels of 8mSv/h (cumulative dose of approximately 1 Sv) could lead to signs of acute radiation sickness and increase the lifetime cancer rate by 20 %.⁷ Also, there is continued run-off from a temporary nuclear waste disposal site into the sea east of Vladivostok.³ Besides the workers and sailors on the naval base, about 30,000 inhabitants of the nearby towns of Putyatin, Dunai and Fokino are most acutely affected by radioactive contamination from the submarine accident and the nuclear waste catastrophe. So far, studies on the long-term health effects of the exposure of this population have not been undertaken. The total number of people affected by radioactive contamination may never be known. These people are also Hibakusha – their health is suffering from the military use of nuclear power. Their fate should not be forgotten.

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