INSTITUTE FOR ENERGY AND ENVIRONMENTAL RESEARCH
Democratizing science to protect health and the environment

Prepared for the International Campaign to Abolish Nuclear Weapons/June 2022

SUMMARY OF HEALTH AND ENVIRONMENTAL IMPACTS OF NUCLEAR TESTING AT NOVAYA ZEMLYA

Arjun Makhijani, Ph.D., President, Institute for Energy and Environmental Research

Test Site Location

The Soviet government selected a northern site in Novaya Zemlya for nuclear testing in 1954; the nearest village, Amderma, was 280 kilometers away. A southern site was also selected; the atmospheric tests were done at the northern site. Only seven of the tests on Novaya Zemlya were done at the southern site; all were underground, between 1973 and 1975 (Bøhmer et al. 2001).

Radioactivity dispersal

The plan for Novaya Zemlya was to do far more powerful tests than those at the Semipalatinsk Test Site. One hundred and four indigenous Nenetz families were evacuated 1,000 kilometers away to the Archangelsk area (IPPNW and IEER 1991, p. 101). More than 100 atmospheric tests were conducted on Novaya Zemlya with a cumulative explosive power of about 239 megatons (compiled from Mikhailov 1996), about 36 times more than the total explosive power of atmospheric tests at the Semipalatinsk Test Site. Using standard coefficients for generation of strontium-90 and cesium-137 and assuming 30 percent of the total power was from fission (the rest being from fusion),[1] the inventory of these two radionuclides in fallout would be 266,000 terabecquerels and 426,000 TBq respectively, dispersed over vast areas, given the immense power of many of the tests. The largest test ever, "Tsar Bomba" in 1961, was 58 megatons. More than three-fourths of this radioactivity would have decayed away by 2020. Unfissioned plutonium-239, essentially all still dispersed in the environment, would be roughly 170 kilograms.

There was also intense deposition of fallout in the sea as a result of the atmospheric tests at Novaya Zemlya. For instance, concentrations of strontium-90 in the Kara sea in 1963 reached as high as 39 Bq/m3, which decreased to 5 Bq/m3 by 1994 (Prăvălie 2014) in part due to decay and in part due to dispersal.

Lack of Health Studies

There are no health studies of the population impacted by atmospheric testing on Novaya Zemlya comparable to the assessments available for the Semipalatinsk Test Site in Kazakhstan. Yet there are

[1] The fission-fusion split from IPPNW and IEER 1991 is used along with an updated value for total explosive power from Mikhailov 1996.

clear indications of serious impacts far and wide. For instance, the peak measured deposition of beta radioactivity (characteristic of many fission products) in 1962 at Naryan Mar near Archangelsk, about 1,000 kilometers away was over 1,300 MBq/km^2, about 460 times more than the peak in 1988. The peak deposition levels in Amderma, the village 280 kilometers from the site, were more than 20 times higher than at Naryan Mar (IPNNW and IEER 1991, p. 102, Table 12).

There was venting of underground tests at Novaya Zemlya. Iodine-131, exposure to which is a cause of thyroid cancer, was detected in the 1980s in both the air and milk. (Bøhmer et al. 2001, pdf p. 64).

Underground Pollution

There is a vast inventory of underground pollution in the former Soviet Union, at the main test sites but also at the 100 or so "peaceful nuclear explosion" sites. The total inventories of strontium-90 and cesium-137 in 2020 would be on the order of 40,000 and 70,000 TBq respectively (decay-corrected values based on IPPNW and IEER 1991, Table 13, p. 104). About 1,200 kilograms of plutonium-239 also remains underground, about 500 kilograms of which is underground at the Semipalatinsk Test Site.[2]

The largest underground test of all time, more than 4 megatons, was also conducted at Novaya Zemlya in 1973. According to Columbia University's Lamont-Doherty Earth Observatory, that "explosion had a seismic magnitude of 6.97 and triggered an 80 million-ton rockslide that blocked two glacial streams and created a two kilometer-long lake." (Lamont-Doherty 2005).

References

Bøhmer et al. 2001	Nils Bøhmer, Alexander Nikitin, Igor Kurdik, Thomas Nilsen, Michael H. McGovern, Andrey Zolotov. The Arctic Nuclear Challenge: Bellona Report Volume 3. Oslo, Norway: The Bellona Foundation, 2001, at https://bellona.org/publication/the-arctic-nuclear-challenge
IPPNW and IEER 1991	International Physicians for the Prevention of Nuclear War and Institute for Energy and Environmental Research. *Radioactive Heaven and Earth: The Health and Environmental Effects of Nuclear Weapons Testing In, On, and Above the Earth*. New York: Apex Press 1991, at http://ieer.org/wp/wp-content/uploads/1991/06/RadioactiveHeavenEarth1991.pdf
Lamont-Doherty 2005	Lamont-Doherty Earth Observatory, "**Frozen in Time: A Cold War Relic Gives up its Secrets," Columbia University News, New York, 28 November 2005, at** https://web.archive.org/web/20200916080615/https://www.ldeo.columbia.edu/news/2005/11_28_05.htm
Mikhailov 1996	V. N. Mikhailov, head of editorial board. *USSR Nuclear Weapons Tests and Peaceful Nuclear Explosions 1949 through 1990. Sarov, Russia: The Ministry of the Russian Federation for Atomic Energy, and Ministry of Defense of the Russian Federation, 1996, at* https://web.archive.org/web/20060622055801/http://npc.sarov.ru/english/issues/peaceful/peaceful_e.pdf
Prăvălie 2014	Remus Prăvălie. "Nuclear Weapons Tests and Environmental Consequences: A Global Perspective", *Ambio*, 2014, at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4165831/

[2] While critically important to understanding the ecological impact of nuclear activities, the radioactivity that has been dumped and discharged in the general area of the Arctic Ocean around Archangelsk region is a significant issue discussed in Bøhmer et al. 2001.