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Central Intelligence Agency

Washington, D.C. 20505

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MEMORANDUM FOR: See Distribution

SUBJECT: Problems With Radioactive Waste at Soviet Defense Sites

The attached memorandum was prepared at the request of the Department of Energy to support the upcoming visit of nuclear waste management experts to the Soviet Union. The information used is widely available in the Soviet Union and is the focus of the current public debate on Soviet defense waste management practices.

Director
Scientific and Weapons Research

Attachment:
SW M 90-20028

CIA/SW 90-20028 M

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DIRECTORATE OF INTELLIGENCE

30 May 1990

USSR: Problems With Radioactive Waste at Defense Sites

Summary

Environmental problems caused by radioactive waste exist at the Soviet plutonium production complexes at Chelyabinsk-40 and Tomsk. Complete disregard for the potential hazards of radioactive waste in the late 1940s and continuing until the 1960s created contamination problems in extent and severity that are rivaled only by the Chernobyl' disaster. At the plutonium production site at Krasnoyarsk, there is controversy over a plan to inject radioactive waste from a power reactor fuel reprocessing plant into the ground.

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This memorandum was prepared by , Office of Scientific and Weapons Research. Comments and questions may be directed to OSWR

SW M 90-20028

Background

The Soviet Ministry of Nuclear Energy and Industry, which was established in the summer of 1989, controls the sites producing defense waste. Before the Ministry's formation, all aspects of the nuclear fuel cycle, all defense-related nuclear sites, and a few power reactors were under the Ministry of Medium Machine Building (MSM). The remaining power reactors had been operated by the Ministry of Atomic Power since 1986. Until then, when control was shifted in response to the Chernobyl' accident, the Ministry of Power and Electrification had owned and operated most Soviet power reactors. Although Yevgeniy P. Velikhov urged that the MSM name be retained for sentimental reasons, the expanded organization was renamed the Ministry of Nuclear Energy and Industry. Although the ministry name change occurred almost a year ago, discussions in local papers and debates still refer to the defense nuclear sites as being run by the MSM.

Problems with the handling and disposal of wastes at three defense sites currently are being debated. At Chelyabinsk-40, near Kyshtym, and at Tomsk, the problems are with stored defense waste from plutonium production. At the plutonium production site at Krasnoyarsk, the controversy is over a plan to inject radioactive waste from a power reactor fuel reprocessing plant into the ground.

Chelyabinsk-40

Chelyabinsk-40 is not marked on maps of the Soviet Union. Once the city bore the name of Beria. Today, the city, and the adjacent defense enterprise, the Mayak (Banner) Chemical Combine, are usually called Chelyabinsk-40. It was at this site that Igor Vasilyevich Kurchatov, working under Beria, built the Soviet Union's first plutonium production reactor. Here also, Academician V. G. Khlopin and workers from the Radium Institute completed the first chemical plant for the separation of plutonium from irradiated uranium.

The first reactor, "A" reactor, was graphite moderated with 1,168 channels. (In comparison, the first US plutonium production reactor, B-Reactor at Hanford, has 2,004 channels.) "A" reactor, sometimes referred to as "Anna," began operation on 19 June 1948. The reprocessing plant began operation later that year. The second reactor at Chelyabinsk-40 was heavy water moderated. Shortly after this reactor, which was designed by Academician Abram Alikhanov, began operation, the heavy water in the two heat exchangers froze. Yefrim Pavlovich Slavskiy, then complex chief engineer and later Minister of Medium Machine Building, claims he had to enter the radiation area and place his hand on one of the heat exchangers to convince the designers that the heavy water had frozen.

A total of five graphite-moderated reactors were built at Chelyabinsk-40. The 701 reactor, a small 65-megawatt (MW) reactor with 248 channels, began operation on 22 December 1951. On 15 December 1952 the 501 reactor began operation. The "A" reactor and the 701 reactor were decommissioned in 1987. Two other larger graphite-moderated plutonium production reactors are located in a separate area of the complex. One of these reactors was decommissioned on 12 August 1989. That reactor, which has 2,001 channels, is larger than the "A" reactor.

A nuclear fuel reprocessing and storage factory for power reactor fuel, submarine reactor fuel, and fuel from nuclear icebreakers also is located at the complex. Radioactive waste from this plant is converted into special glass, placed in stainless steel containers, and stored in cans in a special storage facility at the site.

Discharge of Waste into the Techa River

According to the official report, "During the first years of the operation of the enterprise in this branch of industry there was no experience or scientific development of questions of protecting the health of the personnel or the environment. Therefore, during the fifties there was pollution of individual parts of the territory and around the enterprise." These bland words actually mean that from its beginning in 1948 through September 1951 all radioactive waste from the radiochemical plant that reprocessed irradiated fuel and recovered the plutonium was discharged directly into the Techa River.

In 1951, after radioactivity was found as far away as the Arctic Ocean, a new solution was adopted. Instead of discharging the radioactive waste into the Techa River, the wastes were dumped into Karachay Lake. The Techa River and all its floodlands were excluded from use. The inhabitants of some settlements were evacuated, in other affected settlements, work was performed to supply people with water from other sources. A series of artificial reservoirs were created to isolate water from the most contaminated areas. The first reservoir was erected in 1951 and the fourth in 1964.

Lake Karachay

Beginning in 1951 "medium-level activity" waste, including nitrate and uranium salts, was discharged into this natural lake. The lake eventually accumulated 120 million curies of the long-lived radionuclides cesium-137 and strontium-90. In the 1960s it was discovered that radioactivity from the lake was entering the ground water. Efforts to eliminate the reservoir began in 1967. The lake still exists, although its area has been reduced. Today, radioactivity in the ground water has migrated from 2 to 3 kilometers from the lake. On the lake shore in the region near the discharge line, radioactivity is about 600 roentgens per hour.

Waste Explosion in 1957

For two years radioactive waste had been stored in 300--cubic-meter vessels were called "permanent storage containers." These containers had walls that were 1.5 meters thick and lined with stainless steel. The containers had a special ventilation and cooling system. The cooling failed in one of the containers, however, and the waste began to dry out. Nitrates and acetates in the waste precipitated, heated up, and, on 29 September 1957, exploded. The meter-thick concrete lid was blown off, and 70 to 80 tons of waste containing some 20 million curies of radioactivity were ejected. About 90 percent fell out in the immediate vicinity of the vessel. The remaining 2 million curies formed a kilometer-high radioactive cloud that was carried through Chelyabinsk, Sverdlovsk, and Tumen Oblasts. About 23,000 square kilometers were contaminated. Radiation levels within 100 meters of the crater exceeded 400 roentgens per hour. At a kilometer the levels were 20 roentgens per hour, and at 3 kilometers the levels were 3 roentgens per hour. Guards received the largest reported dose, about 100 roentgens.

There were 217 towns and villages with a combined population of 270,000 inside the area contaminated to 0.1 Curie-per-square-kilometer or greater (map). Virtually all water-supply sources were contaminated. Calculations indicated that the cumulative dose over the first month for the three most contaminated villages would range from 150 to 200 roentgens. These villages, in which about 1,100 people lived, were evacuated, but evacuation was not completed until 10 days after the accident.

The next wave of evacuations was conducted over a half year period beginning about one year after the accident, from areas where the strontium-90 contamination exceeded 4 Curies-per-square-kilometer. These people consumed contaminated foods for three to six months without restriction and continued to consume some contaminated food until their evacuation. Inhabitants of 19 populated areas, about 10,000 people, were evacuated.

The maximum average dose of radiation received before evacuation reached 17 roentgen equivalent man (rems) from external radiation and 52 rems of equivalent effective dose. One-fifth of the people living in the area affected by the release showed reduced leucocytes in the blood, and, in rare cases, thrombocyte levels also were reduced. No deviations in the incidence of diseases of the blood and in the incidence of malignant tumors have been registered.

1967 Contamination Event

In 1967 wind dispersed radioactivity from the shores of Lake Karachay around the reactor site, creating strontium-90 levels of up to 10 curies per square kilometer.

The Situation Today

Parts of the site have a dose rate of up to 15 milliroentgens per hour. The average value for the remainder of the site is in the range of 10 to 30 microroentgens per hour. The Techa River is cordoned off with a wire fence and people are forbidden to catch fish, pick mushrooms or berries, or cut the hay. There are 450 million cubic meters of radioactive water in open reservoirs.

The South Urals Project

The South Urals Nuclear Power Station is, in the words of Selskaya Zhizin, "in a bright birch grove, which guards the secret of the Ural [radioactive] trace." The nuclear station was being built by the Ministry of Medium Machine Building. Two BN-800-type liquid-metal-cooled, fast-breeder reactors were under construction and a third was planned. The nuclear power station was intended to provide employment for the skilled workers who have lost or will lose their jobs as plutonium-producing reactors are shut down.

The production complex, by consuming contaminated water for its needs, regulates the water level in the lakes. With three reactors shut down and two others to close, a new danger was identified--overfilling the reservoirs with natural water and possibly even failure of the dams, sending contaminated water into the rivers of the Ob basin. The South Urals nuclear power station was to avert this sort of catastrophe by using radioactive water to cool turbine condensers, thus increasing evaporation.

Public protests and questions raised by Oblast officials have at least temporarily halted construction, although some critics claim that the real reason is that the Ministry ran out of funds. In the public mind, constructive dialog on the nuclear power station is impossible without learning the truth about the ecological impact of Mayak Chemical Combine, particularly the 1957 explosion.

Tomsk

The closed city of Tomsk-7 is the location of the Siberian Atomic Power Station. In 1955, at the International Conference on Peaceful Uses of Atomic Energy, the Soviets described the reactors at this station as being solely for electric power generation. In 1981, A. M. Petrosyants, then Chairman of the State Committee for Utilization of Atomic Energy, admitted that these reactors served a dual purpose--plutonium production and power generation. Not until 4 May 1990 did the Soviets reveal that the reactors were at Tomsk. The reactors described in 1955 were graphite moderated, water cooled, and with 2,101 channels. Thus, they are slightly larger than the reactor shut down in 1989 at the Chelyabinsk-40 complex.

Problems with defense waste at Tomsk date back to the 1970s. At that time, a senior engineer for "monitoring stocktaking and storage of special output" discovered a "vast quantity of radioactive output" at the plant. Izvestiya claims that his letter to the Central Committee and L. I. Brezhnev only resulted in his reprimand and threatened expulsion from the party. Not until 18 April 1990, when Tomsk-7 radio warned that people had been contaminated, did the public learn of this problem.

Izvestiya also reported that the radioactive waste burial site is poorly fenced and contaminated water areas are not fenced at all. Elk, hare, duck, and fish are contaminated, and 38 people were found to have higher than permissible levels of radioactive substances in their body. Of these 38, four adults and three children have been hospitalized.

Krasnoyarsk

In the early 1950s, Stalin authorized the building of a "radiochemical enterprise" for producing plutonium on the mountainous shores of the Yenisey River in the Siberian taiga. Thus was born the mining-chemical combine and, along with it, a closed city.

Fifteen years ago it was resolved to add an irradiated fuel-storage facility and a reprocessing plant for 1000—MW pressurized water reactor fuel (VVER-1000) and "other" reactors at this site. Controversy about the 1,500-metric-ton-per-year reprocessing plant, known as site 27, has resulted in the project being postponed. In June 1989, Komsomolskaya Pravda reported that some 60,000 people in Krasnoyarsk signed a protest. In part, they were angered by the revelation that the scientific study justifying the appropriateness of the site was actually produced nine years after construction started. The site is about 30 percent complete and was originally scheduled to start reprocessing in 1997.

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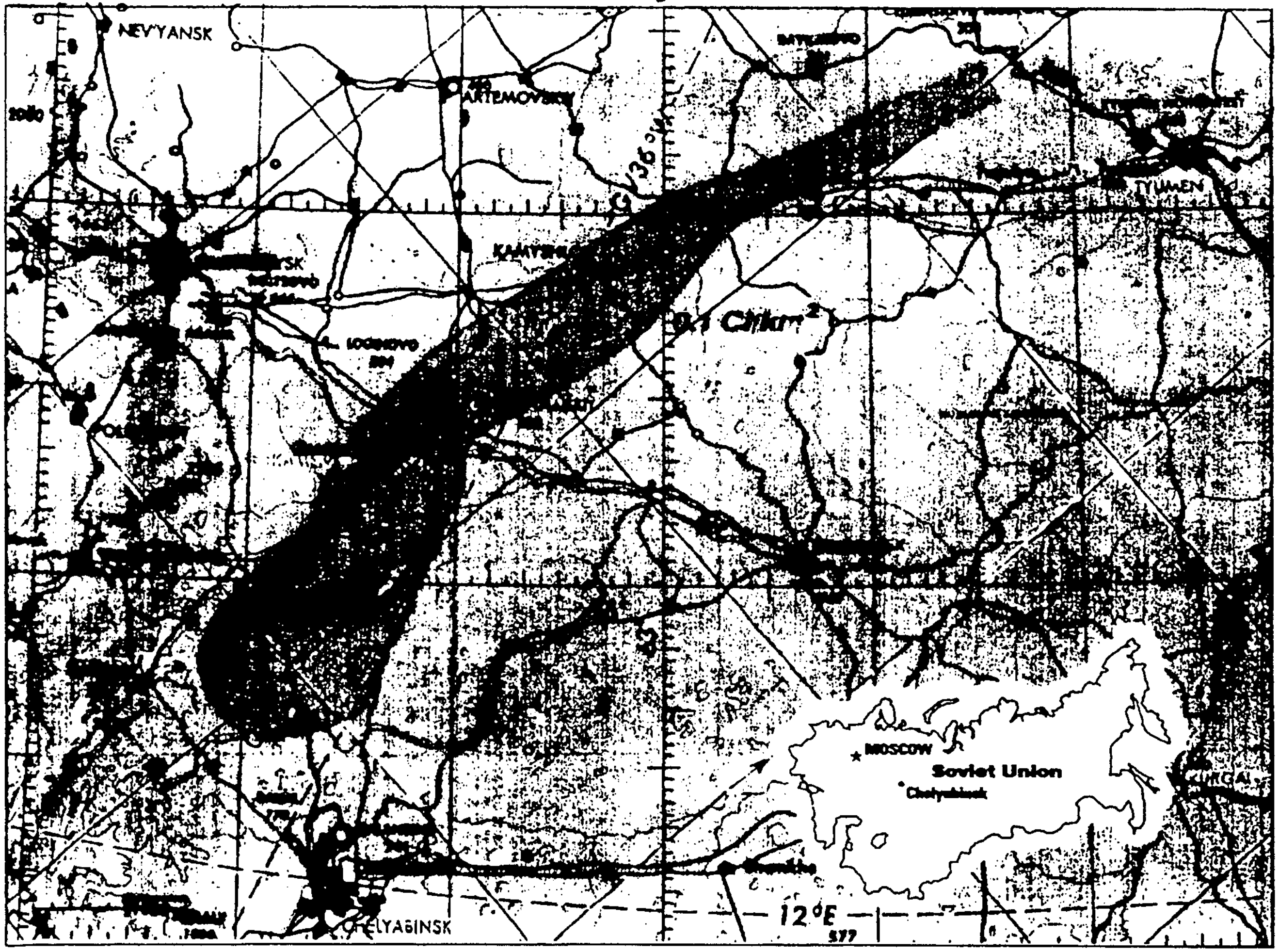
Radioactive Contamination Near Chelyabinsk



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A key feature of the site is the method of handling radioactive waste. According to Moscow Trud, waste is to be injected between layers of clay at a depth of 700 meters. The injection location is some 20 km from the site of the reprocessing plant on the opposite side of the Yenisey River. Some 50 meters under the river, a tunnel has already been completed to carry the waste. It is the tunnel and the decision to inject liquid waste into the ground that is the focus of the controversy.