

## Hazard from Soviet nuclear dumps assessed

In the wake of recent revelations concerning the Soviet Union's dumping of nuclear reactors and radioactive waste into the ocean, Russian scientists met last week in Anchorage with experts from several Arctic nations to detail the history of disposal and discuss plans to assess the hazard. Although expeditions this summer will provide more complete information, Norwegian and Russian researchers' preliminary measurements indicate that concentrations of dangerous radionuclides remain relatively low near the sunken reactors, suggesting that major leaks have not yet developed.

These studies and others presented at last week's Interagency Arctic Research Policy Committee workshop on Arctic pollution suggest that the reactors and waste pose no immediate danger and will not threaten North America or other regions outside the immediate vicinity of the dump sites. However, Russian scientists described facilities inside Russia that have far greater quantities of nuclear waste stored in insecure reservoirs and a lake that could leak into rivers flowing into the Arctic. Although the issue of ocean dumping has captured considerable media attention, many scientists at the meeting expressed more concern about the disaster that could result from a dam break or other accidents at nuclear

water in the Kara Sea, off the eastern coast of the Novaya Zemlya. The Soviet Navy sank two other empty reactors in the Sea of Japan, off eastern Russia.

The commission also reported that the Soviet Union discharged major quantities of less radioactive forms of solid and liquid waste in the Barents and Kara seas and in the Pacific Ocean. That practice continues at low levels to this day, in violation of Russian law and international agreements, Vitali N. Lystsov told attendees of the Anchorage workshop. Lystsov was a member of the Yablokov commission and is an expert on radiological safety at the Russian Environment Ministry in Moscow.

"We have to stop this process," Lystsov acknowledged. Yet the Russian Navy currently lacks the capacity to store and dispose of the nuclear waste generated by ships. "As I see the situation now, the production is going on and liquid radioactive waste is overflowing the tanks. It could be more dangerous [to store the waste] than to go to the sea and release low-activity waste," he says.

The commission calculates that the USSR dropped a total of 2.5 million curies (Ci) of radioactive waste into ocean waters after 1965. That figure represents more than double the combined amount that 12 other nuclear nations have reported dumping

over the last 45 years. For comparison, the explosion at Chernobyl released 80 million Ci.

According to the commission, nuclear reactors containing fuel rods present the greatest ecological hazard of all the sunken waste. Most of these reactors lie in shallow inlets at depths of only 20 to 50 meters. One sits at 300 meters in a depression off the Novaya Zemlya coast.

Six of the loaded reactors came from nuclear submarines; the seventh came from the *Lenin*, a nuclear-powered icebreaker. In every case, the reactor core suffered damage that prevented removal of the spent nuclear fuel. Before sinking all but one of such vessels, technicians filled the reactor compartments with a self-hardening polymer called furfural, which they believe will isolate the fuel rods from seawater for centuries after the ships' hulls have corroded.

"We have estimates that the furfural will protect the fuel for 500 years, but of

course it is only an estimate," Yablokov told *SCIENCE NEWS* in a visit to the United States two weeks ago. His commission could not provide any information on the state of the sunken vessels or their reactors because no studies have investigated such sites for at least 25 years.

Last summer, a joint Russian-Norwegian research team visited the Barents and Kara seas to collect water samples around the area of the then-rumored dumps. The expedition made measurements as near as 12 kilometers from the dump sites, but the Russian Navy prohibited closer access.

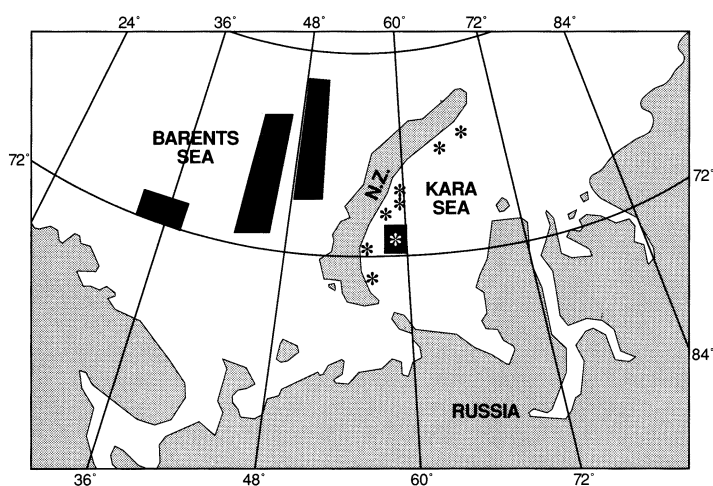
Lars Føyen, chief Norwegian scientist on the cruise, reported last week that concentrations of cesium-137 near the dump sites remained at or below 20 becquerels (Bq) per cubic meter ( $m^3$ ) of water ( $1 \text{ Bq} = 2.7 \times 10^{-11} \text{ Ci}$ ). In all but one instance, cesium-137 concentrations detected last year fell well below those measured in the same area in 1982, perhaps reflecting the decrease in nuclear waste discharges by all nations. Of the radionuclides in the reactors, cesium-137 is particularly dangerous because it dissolves easily in seawater and is stored in biological tissues.

Føyen, an oceanographer from the Institute of Marine Research in Bergen, compared such measurements in the Barents and Kara seas with those from the North Sea, where studies have shown concentrations more than 10 times those detected near the sunken reactors. Russian standards allow a top concentration of 550 Bq/ $m^3$  in drinking water.

Føyen says measurements near the dump sites indicate that the reactor containers have not developed any large leaks. "If there had been major leaks, we would have detected that," he says. The low levels measured in the Kara Sea may result from leftover fallout from nuclear tests or emissions from European nuclear facilities, Russian scientists suggest.

Besides chronicling decades of nuclear waste dumping, the Yablokov commission provided details about the *Komsomolets*, a nuclear-powered submarine that caught fire on April 7, 1989, and sank in 1,680 meters of water near the edge of the Barents Sea. In addition to a nuclear reactor, the vessel has two torpedoes armed with plutonium, raising concern that this particularly deadly radionuclide could enter the food chain and contaminate one of the world's most productive fishing grounds. The commission reports that investigations of the wreck by submersibles in 1991 and 1992 have led Russian scientists to project that the plutonium could begin leaking by 1995.

The commission determined that the *Komsomolets*' reactor does not present an immediate danger, but it described the imminent plutonium leakage as alarming. Quoting an estimate by Russian fishing experts, the commission announced that the plutonium could con-



Stars show locations of dumped nuclear reactors east of Novaya Zemlya. Black areas indicate liquid waste discharges.

facilities in the Russian interior.

Rumors of Soviet nuclear waste dumping have circulated for years, but the leadership of the former USSR had long denied any such activity. Official recognition of the disposal came in March with the release of a report by a special commission headed by Alexey V. Yablokov, environmental adviser to Russian Federation President Boris Yeltsin.

The 46-member commission announced that, starting in 1965, the Soviets dumped 18 nuclear reactors — seven loaded with nuclear fuel — into shallow

taminate commercial fish with twice the allowable limits for this radionuclide, causing millions of dollars in damage.

Yablokov repeated these concerns during his visit. When asked what he regarded as the most threatening source of nuclear contamination detailed in the report, Yablokov focused on the *Komsomolets*.

But many scientists at last week's meeting argued that the danger from the *Komsomolets* has been exaggerated. Lystsov downplayed the estimate of economic damage, saying, "The margin of error for this analysis is very big. It's a rather theoretical exercise."

Føyn had stronger words for the estimate: "That's just rubbish." The *Komsomolets* holds only a few kilograms of plutonium and is far from the fishing grounds, he says. The submarine also lies at a significant depth, and water from that level does not readily reach the upper layer where fish live, Føyn adds.

Scott W. Fowler of the International Atomic Energy Agency in Monaco presented a rough estimate of the radionuclide threat from the *Komsomolets* and from the dumped reactors in the Kara Sea. Using an extremely simple model of mixing between different ocean basins, Fowler and his colleagues calculated that a gradual leakage of radionuclides would give people far from the dump sites less than 1 percent of the international recom-

mended top dose for cesium-137 over a period of 50 years.

"According to this analysis, it's not a significant contributor to the radiological hazard of the population at large, outside the local area right around those bays [where the reactors were dumped]," says Fowler. His analysis, however, does not examine the effect of a catastrophic leak, nor does it assess the danger to people near the dump sites.

Regardless of whether the submarine and dumped waste truly present a hazard, Føyn and others believe the issue could exact a serious economic toll if the public misunderstands the danger. Norwegians, in particular, have expressed great concern over their fishing industry, and some have even called for an effort to raise the *Komsomolets*, an act that most experts reject outright because of damage to the ship's hull. After planned expeditions to the wreck this summer, Lystsov says Russia will decide whether to leave it alone or to take action by retrieving the torpedoes or sealing the submarine with a polymerizing gel.

As for the nuclear reactors in the Kara Sea, scientists at the meeting said that while the available information suggests they do not represent a grave threat to the greater Arctic, more information is needed to determine any potential future hazard and to decide whether to raise the

reactors for storage on land.

"The problem is that people are very concerned about the threat, and so we have to deal with this in a reliable way," says Føyn, who will participate in another joint Russian-Norwegian expedition, which this year has received permission to investigate at least one of the dump sites.

The U.S. Congress has appropriated \$10 million to the Defense Department to organize a program for rapidly assessing the threat from the dumped Soviet waste. Louis A. Codispoti of the Office of Naval Research in Arlington, Va., says several expeditions are planned for this summer. One initiative will take measurements off Alaska to determine whether radionuclides are reaching U.S. waters. Another group of U.S. researchers may join a Russian team in the Kara Sea that hopes to collect samples at the dump sites there.

Russian scientists and experts from other countries cautioned that a surge in concern over the dumped waste should not overshadow other pollution problems in Russia that could prove far more threatening, both to Russians and to people across the Arctic. In particular, scientists focused on the Mayak military complex in the southern Urals.

After the Chernobyl accident in 1986, Westerners began learning about a more damaging explosion at Mayak in 1957 and another nuclear accident there a decade later. At the meeting last week, Igor L. Khodakovsky of the Vernadsky Institute of Geochemistry and Analytical Chemistry in Moscow confirmed previous reports that 120 million Ci of radioactive wastes discharged from Mayak have accumulated in the water and sediments of nearby Lake Karachai. That represents nearly 50 times the radioactivity of the waste dumped into the ocean by the Soviet Union.

A subsurface plume of pollution from Lake Karachai is seeping toward the nearby Misheliak River at a rate of 80 meters per year and will soon reach the river, says Khodakovsky. The Mayak facility also has 200,000 Ci stored in a system of reservoirs that are in danger of overflowing an earthen dam, he reported.

Water from this region ultimately drains into the Ob River, which flows north into the Arctic Ocean. As yet, Western scientists know little about how much radionuclide pollution has leaked into the Ob and into the Arctic from this and other military facilities. Lystsov says that Russian scientists are currently investigating the problem but cannot yet issue a report.

Lystsov also warned that the Russian Navy currently lacks the facilities for storing the spent nuclear fuel from their operating vessels and the nuclear reactors from dozens of decommissioned nuclear submarines. — R. Monastersky

## Feds reluctantly accept Delaney ruling

Last year, a federal court revoked the Environmental Protection Agency's interpretation of the nation's food-additives law — one involving acceptable amounts of known animal carcinogens in processed foods. On May 7, the Agriculture Department, the Food and Drug Administration, and EPA jointly stated they would yield to the court. Thus, EPA will no longer grant pesticide-use exemptions in violation of the Delaney clause.

That clause, a 1958 amendment to the Food, Drug, and Cosmetic Act, prohibits the sale of processed foods containing higher concentrations of carcinogens than existed in the raw ingredients.

Over the past 35 years, improvements in analytical techniques have made possible detection of many toxic agents at concentrations below those believed to constitute health risks. The result, EPA and certain FDA officials have argued, is that science has gone beyond the Delaney clause (SN: 2/15/92, p.105).

At the suggestion of the National Academy of Sciences (SN: 6/6/87, p.361), EPA began coping with the problem in 1988 by offering select exemptions to pesticide-use rules — but only when residues of the potential carcinogens involved appeared to pose a "de minimis" (negligible) health risk.

Last year, the U.S. Court of Appeals for the Ninth Circuit ruled that however reasonable that may be, only Congress can change the law (SN: 7/18/92, p.39).

Because this ruling "leaves us little choice but to deny emergency exemptions to pesticides that would be covered by the Delaney clause," EPA Administrator Carol M. Browner announced last week, her agency will revoke five exemptions it had previously granted for potentially carcinogenic pesticides and will turn down requests for 16 more. However, she added, "We continue to believe that the pesticides affected...pose only a negligible risk to public health."

"It is critical for consumers to understand that this is a *legal issue*, not a food safety issue," asserts Jay J. Vroom, president of the National Agricultural Chemicals Association in Washington, D.C. Foods that had been protected with these products "are safe to eat," he maintains.

But EPA may yet get back its de minimis exemptions to the Delaney clause if legislation introduced on April 1 by Reps. Richard H. Lehman (D-Calif.), Thomas J. Bliley Jr. (R-Va.), and J. Roy Rowland (D-Ga.) becomes law. Their bill already has more than 80 bipartisan cosponsors. — J. Raloff

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