Radioactive waste management in Eastern Europe

A look at how five countries are managing "radwaste" from nuclear power operations, medicine, research and industry

by E. Michael Blake

The nations of Eastern Europe have any number of problems. Some of these problems concern nuclear power, as safety concerns grow over some of the reactors that stand as a legacy from the days of dominance by the Soviet Union.

In Bulgaria, the nuclear situation is often the most vital. The six-unit Kozloduy plant might be able, under ideal circumstances, to help the nation through the electricity shortages brought on by the cutoff of power imports from what used to be the Soviet Union, but the early Kozloduy units are expected to undergo long outages for safety upgrades, and the later, larger units have been slow to start up for lack of qualified personnel and the funds to compensate them.

Nuclear waste, however, is generally not a big issue in Eastern Europe, even in the four countries with power reactors. Generally, interim storage is sufficient at the moment. Still, the ultimate disposition of the waste may depend greatly on two factors: how the newly self-governing people will alter processes (like disposal site selection) that in the past would have been controlled centrally; and whether the Russian Federation will live up to the commitment by its predecessor, the Soviet Union, to take spent fuel from Bulgaria, Czechoslovakia, and Hungary. The power cutoff to Bulgaria does not look like an encouraging sign.

Although there are variations — not only now, but also in the days of central planning — the waste programmes in these countries share some characteristics, which are in fact also common in other similarly sized nuclear power nations. Since government ventures produce most of the radwaste, government is considered responsible for it. And since much of the radwaste (a shortened term meaning radioactive waste) production takes place at power plant sites and state-run nuclear research laboratories, either or both generally end up as the storage or disposal points not only for their own wastes, but also for the wastes produced nationwide by nuclear medicine, industry, and so forth.

Bulgaria: Western assistance

The Kozloduy plant is sited on the shore of the Danube River in northwest Bulgaria, about 120 kilometres north of the nation's capital, Sofia. The plant is the country's major radwaste producer, and the plant operator — National Electric — has set up extensive radwaste storage facilities at the site. Low- and intermediate-level liquid waste (i.e. material with activity no greater than 1 Ci/l, or curie per liter*) is stored in stainless steel tanks in three auxiliary buildings. Two of the buildings, OB-1 and OB-2, include five tanks in all, each with 500 m^3 capacity. In the other building, OB-3, the total tank capacity is 3800 m^3. All of the tanks are said to be nearly full. Solid radwaste had been stored in a 1000-m^3 volume in OB-1, now full, and in another storage zone, where 4300 m^3 of the available 4800 m^3 is now occupied.

Even though Bulgaria is short of funds and has appealed for help from other nations to keep Kozloduy running and to upgrade it, enough priority has been placed on the radwaste situation for the Bulgarian Energy Committee to contract Westinghouse Electric Corporation to process low-level waste at Kozloduy. The 2-year deal, announced in November 1991, is said by

Mr Blake is an associate editor of *Nuclear News*, the magazine of the American Nuclear Society (ANS) in the United States. This report, which is based on one first appearing in the February 1992 issue of the magazine, is an outgrowth of a comprehensive book, *World Directory of Radwaste Managers*, on radioactive waste management programmes and key personnel in the main countries using nuclear power. More information about the book is available from ANS, P.O. Box 97781, Chicago, Illinois 60678-7781.

* One curie is equal to 37 giga-becquerel, the unit of international usage.

Westinghouse to be worth more than US $10 million. Westinghouse Energy Systems International, based in Belgium, and Westinghouse subsidiary Scientific Ecology Group will design and start up what is being called Eastern Europe's first low-level waste processing facility. When operation begins this year, liquid waste volume will be reduced by evaporation, and the remaining waste then solidified by cementition. Also, contaminated oil will be burned and solid waste will be compacted. The resulting waste will be placed in Westinghouse-designed Surepak concrete modules for what is still referred to as interim storage (although there has been no indication that Bulgarian authorities intend to send the waste anywhere else for final disposal). Westinghouse has said that some of the transportable equipment it brings to Kozloduy may be used later for radwaste processing outside Bulgaria.

According to the country's nuclear regulatory body — the Committee on the Use of Atomic Energy for Peaceful Purposes — the Soviet Union made good in the past on its spent fuel pledge. Spent fuel from Kozloduy is held onsite for 5 years after discharge from the reactor and then returned (previously to the USSR; now, presumably to the Russian Federation).

Although Kozloduy generates most of Bulgaria's radwaste, it has not become a de facto repository for radwaste produced by all other sources. Institutional radwaste has been disposed of since 1964 — 10 years before the startup of the first power reactor at Kozloduy — in a shallow-land burial site at Novi Han, 30 km east of Sofia. The waste is not treated before burial, but is separated into three groups: dry active waste, biological material, and spent gamma-ray sources.

Czechoslovakia: Shallow-land burial

There are nuclear power plants in both the Czech and the Slovak Republics. Although there is not yet a formal radwaste classification system, it is usually the case that liquid waste with activity less than 1 Ci/l is considered low-level, 1 to 1000 Ci/l is intermediate level, and more than 1000 Ci/l is high-level. In order to be accepted in shallow-land disposal, solidified waste must have no more than 10^{-6} Ci/kg of alpha emitters.

There is one operating four-reactor plant (Bohunice) in the Slovak Republic and another (Dukovany) in the Czech Republic. A radwaste treatment facility opened in 1991 at Dukovany, and another is to open this year at Bohunice. Liquid waste at Dukovany can be solidified by either bituminization or cementition, and the solidified products have activity less than 10^{-3} Ci/kg. Bohunice is also scheduled to add vitrification capability in 1993, in part to assist with the eventual decommissioning of the closed Bohunice A-1 reactor.

Spent fuel from Bohunice A-1 is still in pool storage at the site, but under a longstanding agreement the fuel will eventually be sent to the former Soviet Union. There is no such agreement for reprocessing of spent fuel from the other power reactors. There is an interim storage facility at Bohunice, and another is planned for Dukovany.

A shallow-land burial ground for low-level waste has been prepared for each republic; the Czech Republic disposal facility, with 66 528 m^3 of space, is at the Dukovany plant site. In the Slovak Republic, a 47 520-m^3 disposal facility has been built at Mochovce, where four more power reactors are under construction. Neither disposal site had been licensed to operate as of the end of October 1991. Low-level waste from sources other than power reactors is gathered under the auspices of the Institute for Research, Production, and Application of Radioisotopes, and sent for treatment to the Nuclear Research Institute at Rez, near Prague, where as needed it undergoes evaporation and cementition. The waste, encased in drums, is then sent to a shallow-land burial ground near the town of Litomerice, about 60 km northwest of Prague. The burial ground has a capacity of 8000 m^3, and it is now about 60% full.

In 1990, the Czechoslovak Atomic Energy Commission began an early-stage programme aimed at the development of a repository for high-level waste. The programme is said to be at the stage of regional site screening. There is no set schedule for repository development.

Hungary: Separate approaches

Here, as in Czechoslovakia, waste from power plants and waste from other sources are disposed of separately, which in effect creates waste categories based on origin rather than just activity per amount. There is a disposal site for non-power low-level waste at Puspokszilagy, about 30 km northeast of Budapest, which is fairly convenient to serve the concentration of industry and medical facilities in the capital. The Puspokszilagy site is operated by the Capital Institute of Public Health and Medical Officer Service. (Radwaste regulation in general is carried out by a similarly named, but entirely different agency: the State Public Health and Medical Officer Service).

For a while, low-level waste from the four-unit Paks power plant was also buried at

Puspokszilagy, and of the 3000 cubic metres of low-level waste buried there, 40% is from the power plant. This practice was protested by the public — an indication of how things have changed since the day of Communist rule — and now waste from Paks is kept at the power plant in interim storage pending creation of a specific repository for Paks low-level and intermediate-level waste. Site selection is said to be under way, but no timetable has been set for construction and the start of disposal operations. The Paks power plant is 100 km south of Budapest, and any offsite repository is not likely to be close to the capital.

The waste classifications are as follows, for both liquid and solid waste: low-level waste, less than 5×10^8 becquerel(Bq)/kg; intermediate-level, 5×10^8 to 5×10^{11} Bq/kg. Liquid low-level and intermediate-level waste at Paks is solidified in concrete. Spent reactor fuel has in the past been shipped to the former Soviet Union, but there are feasibility studies being conducted on interim dry storage of spent fuel, perhaps indicating uncertainty over whether Russia will continue to meet obligations established by the Soviet Union. High-level waste from Paks is stored onsite, and will remain there for as long as the plant is in operation. Plans for final disposal of high-level waste have not yet been worked out. The main decision-maker on radwaste, and nuclear policy in general, is the National Atomic Energy Commission.

Slovenia and Croatia: At the fore

Almost almost every aspect of the Yugoslavian radioactive waste issue concerns Slovenia and Croatia, which have taken the lead in establishing organizations to address the issue.

The Krsko nuclear plant, a single 620-MWe pressurized water reactor, is located in Slovenia, but is owned jointly by the publicly owned electric utilities in Slovenia and Croatia. The other significant radwaste sources in Slovenia are the Jozef Stefan Institute (which includes a TRIGA research reactor), near the town of Podgorica, and 71 drums of waste in temporary storage at Zavratec, left from the decontamination of the Oncological Institute in Ljubljana. In Croatia, the major radwaste sources are the Rudjer Boskovic Institute and the Institute for Medical Research and Occupational Health, both in Zagreb. In other republics, there is very little use of radioactive material.

At the federal level the Act on Radiation Protection and the Safe Use of Nuclear Energy does not clearly define and assign responsibility for radwaste management; an agreement was signed in 1984 by the electric utilities and parliaments of all Yugoslav republics at the time on the management of radwaste and spent fuel, but nothing has been done in connection with the pact. Radwaste has not been seen as a major problem; also, because it concerns Slovenia and Croatia almost exclusively, the issue has had little priority at the federal level. The *de facto* arrangement that emerged was that Slovenia and Croatia would take care of their own radwaste, and the other republics would take no immediate action on the issue.

The current radwaste management philosophy is : Keep it where you make it. Every radwaste generating activity maintains its wastes in interim storage onsite. The hope is that a single permanent disposal facility for low- and intermediate-level waste, to serve both Croatia and Slovenia, will be developed soon (the once-sought target of 1995, however, will be missed by several years). Slovenia and Croatia each plan to use a separate approach for finding a site, and the details are still taking form; as of autumn 1991, Croatia's new radioactive waste agency was still operating out of an interim address, and Slovenia's agency was still being organized. This, in part, explains why there are no plans yet of any kind for spent fuel and high-level waste.

Spent-fuel pool storage at Krsko can last until 1995 as it is, and until 2008 with expansion. (Krsko entered service in 1983, so its operational life might go to about 2020 if there are no outside restrictions on operation.)

The radwaste inventory produced at Krsko, through the end of July 1991, totals 8172 drums that occupy 1634 m^3 and have a total activity of 957.6 Ci (for an average of about 0.59 Ci/m^3). About 60% of the volume is evaporator bottoms, but about 70% of the activity comes from spent resins. The radwaste inventory at the other sites in Slovenia and Croatia is much smaller, in terms of both volume and activity.

In Slovenia, the Radioactive Waste Agency (officially, "Javno Poduzece za Zbrinjavanje Radioactivnog Otpada, D.O.O.") has so far screened out unacceptable areas for low-level waste disposal, and had selected potential sites from the remaining land; later, the agency is to focus on three to five potential sites, and after detailed studies is to choose one. In Croatia, the electric utility ordered a study on siting of a number of new facilities, including a radwaste repository and a potential new power plant; parliamentary deliberations on this and other issues have been disrupted by the civil war. The Croatian government has announced, however, that it does not consider a past edict by the federal government against further nuclear plant construction to have any force in Croatia. ❐