

BOOKS

A Parade of Horribles: The Soviet/Russian Nuclear-Waste Record

Behind the Nuclear Curtain: Radioactive Waste Management in the Former Soviet Union

Don J. Bradley
Battelle P., Columbus, Ohio,
1997. 716 pp. \$95.00 hc
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Reviewed by Thomas B. Cochran

Don Bradley has demonstrated that he is the undisputed heavyweight authority on what is known in the West about the management, or more appropriately the mismanagement, of radioactive materials in the former Soviet Union. For years Bradley and his colleagues at Battelle's Pacific Northwest Laboratory have been collecting and analyzing data on nuclear waste and related topics in the former Soviet Union for the US Department of Energy. (See the article by Bradley, Clyde Frank and Yevgeny Mikerin in *PHYSICS TODAY*, April 1996, page 40.) This latest book represents an update of Bradley's three-volume *Radioactive Waste Management in the USSR*, released in 1990–92 by Pacific Northwest Laboratory.

Behind the Nuclear Curtain is an exceptional piece of work. It now becomes the paramount reference book on the subject. Written primarily for nuclear and health-physics professionals, Bradley's book is well researched, and the data are extensively referenced. There are some 300 tables, figures and photographs, which make it a particularly valuable resource.

After an introduction and overview, Bradley provides us with a short chapter on waste management agreements between the US and the USSR and its successors; this material should have been relegated to an appendix. This is followed by a description of the

Russian Ministry of Atomic Energy and other institutions with nuclear waste management responsibilities. The next 16 chapters review the entire Soviet/Russian nuclear fuel cycle—both civil and military—from uranium mining to high-level nuclear-waste management. There are separate chapters devoted to the principal plutonium production sites—Ozersk (Chelyabinsk-65), Seversk (Tomsk-7) and Zheleznogorsk (Krasnoyarsk-26)—as well as to the Chernobyl accident, nuclear weapons testing, naval waste management and ocean dumping, and waste transportation.

Two things are striking about this work: what is revealed and what remains secret. *Behind the Nuclear Curtain* reveals that, historically, the management of Soviet/Russian nuclear waste was both criminally negligent and tragic, and that this tragedy continues. At Chelyabinsk-65, at least 130 million curies of radioactivity have been released directly to the environment, some 120 million curies of it directly into Lake Karachai. To put this into perspective, 120 million curies is about 50% of the high-level waste-tank inventory at DOE's Hanford site in Washington state and about three times the total cesium-137 and strontium-90 released as fallout from worldwide atmospheric nuclear testing. As a result of planned and accidental releases at Chelyabinsk-65, about 500 000 people received an "elevated radiation dose," and about 18 000 were relocated.

During the two-year "recovery" period following the 1957 waste-tank explosion at Chelyabinsk-65, approximately 30 000 workers received radiation doses greater than 25 rems. At both Tomsk-7 and Krasnoyarsk-26, over a period of more than 30 years, about 1.5 billion curies of liquid high-level waste have been injected into aquifers several hundred meters deep, a practice that continues to this day without clear evidence that this practice will not have a significant long-term human health impact. Krasnoyarsk-26 operates a dual system of injection and discharge wells; as radioactive waste is pumped in, underground water is drawn off for civilian needs.

Anyone versed in the language of nuclear technologists can find a parade

of other horrors in *Behind the Nuclear Curtain*. Bradley leaves it to others to translate these into the human health consequences understandable to a lay audience. Given the limited distribution of these data in Russia, *Behind the Nuclear Curtain* should be translated and distributed there, along with its yet-to-be written sequel for public readership.

It is clear from *Behind the Nuclear Curtain* that much, if not most, of Russia's nuclear legacy remains a dark secret. Bradley reveals that the Tomsk-7 site has several ponds that rival or possibly exceed the contamination in Lake Karachai. Yet there is no discussion of these in the unclassified literature. Also, there is no discussion of the plutonium fires, accidents and environmental releases from the plutonium-pit manufacturing facilities at Chelyabinsk-65 or Tomsk-7.

A single shortcoming of *Behind the Nuclear Curtain* is that it does not include data more closely associated with nuclear weapons. For example, the inventory of plutonium in spent civilian fuel is estimated, but there are no estimates of the plutonium and tritium produced by the military production reactors, even though these estimates could have been easily derived and would be useful to the arms control community. Also, the nuclear weapons laboratories are all but forgotten, and there is no mention of weapons assembly or disassembly plants. These omissions are unlikely to have been oversights, but are more probably a consequence of Pacific Northwest Laboratory's intelligence mission, the Department of Energy's classification rules and PNL's and DOE's desire to retain a good working relationship with the Russians. On the other hand, no other organization could have produced such a fine book on this subject.

The Sun as a Star

Roger J. Tayler
Cambridge U. P., New York, 1997.
242 pp. \$64.95 hc (\$24.95 pb)
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(0-521-46837-X pb)

With first light at the 60-inch telescope at Mount Wilson Observatory in 1908,

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