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LETTERS

Radioactive Waste at Ward Valley

The editorial by Philip H. Abelson about the proposed repository for low-level radioactive waste (LLRW) in Ward Valley, California (16 June, p. 1547), can be faulted on several grounds. One of the most serious is his apparent acceptance of the current regulatory classification of waste, which is based on source rather than on actual radioactivity: The lower end of high-level waste is 1 curie per cubic meter, yet the upper end of "low-level" waste is 10,000 curies per cubic meter, a bizarre state of affairs (*1*).

Less than 1% of the total number of curies at the Ward Valley site would arise from medical and academic waste. Most medical waste is rather short-lived, so storage on site for a few months lets its radioactivity decay to zero. The main exceptions are tritium and carbon-14, and hardly anyone opposes properly disposing of such medical waste at a repository.

Abelson does not mention that the proposed facility would accept large amounts of power plant wastes (mostly ion exchange resins, irradiated components, filters, and evaporator bottoms) during its projected life. This could include dangerous amounts of plutonium, if the waste were similar to "low-level" waste previously dumped at Maxey Flats, Kentucky, and Richland, Washington. Moreover, chelating agents used in decontamination of the reactor systems would be part of this waste, and they mobilize plutonium and other radionucides (*2*). A company involved in the proposed construction, US Ecology, Inc. has had a troubled history, with leakage at several of its nuclear waste sites (*3*), and this contributed to their closures.

The design seems to be short on redundant safety features. For example, it calls for mild steel oil drums (plastic for certain wastes) to be dumped into unlined trenches. These would corrode in a matter of years and are not "suitable," as Abelson states. A double-lined trench with drainage and a leachate collection system would seem warranted, as well as drums coated with bitumen. The proposed contractor is responsible for a mere 30 years, after which the State of California would assume obligation for the closed facility. The degree of liability the State of California would have in case of radioactivity release is unresolved.

Although Ward Valley itself is a closed basin with respect to surface water, its aquifer has a hydrological link to the Colorado River. Earlier tests have shown that samples taken at depths down to 30 meters below Ward Valley contain tritium that was created by atmospheric hydrogen bomb tests in the 1950s. Senator Barbara Boxer (D–CA) has enlisted the aid of Lawrence Livermore National Laboratory to replicate and extend these measurements to greater depths in order to determine whether water is likely to percolate down, possibly reaching the water table (*4*). This study should be done.

On 1 July, the Barnwell nuclear waste facility in South Carolina began accepting low-level waste from California and other states. This development extends time for tritium testing or perhaps even to locate an alternative site. The promised evidentiary hearing on Ward Valley has been unaccountably bypassed; now it should be held.

I have no objection to a properly sited and constructed geological repository, but Ward Valley as it is proposed hardly meets these criteria.

*James C. Warf**
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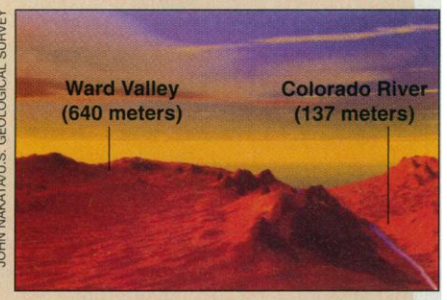
1. R. M. Bernero, presentation to Board on Radioactive Waste Management (Office of Nuclear Materials, Safety and Safeguards, Nuclear Regulatory Commission, Irvine, CA, 15 December 1994).
2. J. L. Means, D. A. Crerar, J. O. Duguid, *Science* **200**, 1477 (1978); J. M. Cleveland and T. F. Rees, *ibid.* **212**, 1506 (1981).
3. E. Schine, *Bus. Week*, 8 November 1993, p. 33.
4. Public letter from Senator Barbara Boxer to Bruce Babbitt, Secretary of the Department of the Interior, and Hazel R. O'Leary, Secretary of the Department of Energy, 8 June 1995.

*Professor of chemistry, emeritus

Ward Valley Pro and Con



The controversy about the proposed disposal facility for low-level radioactive waste at Ward Valley, California (above), continues in five letters that respond to an editorial by Philip H. Abelson of 16 June.

Abelson characterizes the so-called "Wilshire report" (*1*) as an unofficial report by three geologists "connected with the U.S. Geological Survey (USGS)," which "was not peer-reviewed." He also states that "USGS later issued an official peer-reviewed document that in effect" gives a clean bill of health to the site—as does, he writes, a recent National Research Council (NRC) report that assessed the concerns raised by myself and my colleagues.

I would like to clarify the origin and purpose of the "Wilshire report" and its sequel, a more comprehensive report made to the NRC for its review (*2*). I and the other two authors of the "Wilshire report" did not take a position on the suitability of the Ward Valley site for the proposed use. The report and sequel are the only comprehensive peer reviews of the earth science component of the documents prepared by consultants to the site applicant and by contractors for the State of California. My objective was to help ensure that quality science was applied to this important land-use decision. The report by the NRC panel endorsed this goal by recommending that peer review be specifically included in the permitting processes for LLRW disposal sites.

In response to a written request from staff of the Secretary of the Interior, I and two other career USGS geologists forwarded a two-page internal memorandum that listed seven concerns about the Ward Valley site. After 4 months, we learned that the applicant to operate the site had sent the Secretary a detailed rebuttal of our internal memo, which, by mention in a supplemental Environmental Impact Statement (EIS), had been catapulted into the political realm. The information we provided was based on a combined 43 years of geologic investigations at public expense in the Ward Valley area.

After public release of our small memorandum, Senator Barbara Boxer (D–CA) requested that we respond to the applicant's rebuttal. We then prepared the "Wilshire report," which contained a detailed critique of the earth science studies that had served as the basis for the EIS. We were initially asked by USGS officials to obtain two peer reviews, as would be normal for USGS reports, but only a few days later we were instructed instead to respond as private citizens (we were informed that this order came from the Secretary's office). Nevertheless, we obtained peer reviews for it from eight professionals, three of them within the USGS. When the Secretary of the Interior requested that the NRC review our seven concerns, the NRC panel asked for our further input. We then assembled an interdisciplinary team that prepared the second, more comprehensive report (*2*). This 15-chapter critique of the voluminous License Application documents also underwent peer review, again without an official routing sheet.

In the License Application and EIS we found major errors, omissions, and discrepancies. For example, the chloride data, called "crucial evidence" by Abelson, is contradicted by the tritium data, which indicate much more rapid movement of water; also, application of the chloride data requires many untested assumptions. Water chemistry data may indicate recent (within the period of site monitoring) recharge or may be too flawed for use. A careful reader will find that the NRC report concurs with the assessment that the License Application contains many inconsistencies.

The geohydrologic database for the Ward Valley site was practically nil before 1987. The regulations that Abelson cites allow "characterization" of all of its essential properties to take place in 1 year or less and over an area only 1 mile in radius. USGS Circular 1036 (1990) states that such a short period is inadequate for LLRW site characterization. These inadequacies stand in contrast to the intensive study (*3*)

of local and regional hydrology done in an adjacent valley for a gold mine with a projected life of 10 years.

Under the California Environmental Quality Act and the National Environmental Policy Act (4), the California Department of Health Services and the Bureau of Land Management, respectively, are required to verify the accuracy and completeness of scientific information gathered to characterize and evaluate a proposed site for disposal of hazardous wastes on federal land in California. It is evident from the "Wilshire report" and sequel that these duties had not been adequately performed and that the public's interests may not be protected.

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References

1. H. G. Wilshire, K. A. Howard, D. M. Miller, "Description of Earth-Science Concerns Regarding the Ward Valley Low-Level Radioactive Waste Site Plan and Evaluation, Report to U.S. Senator Barbara Boxer" (Menlo Park, CA, 1993).
2. H. Wilshire *et al.*, "Ward Valley, Proposed Low-Level Radioactive Waste Site: A Report to the National Academy of Sciences" (Menlo Park, CA, 1994).
3. Final EIS/EIR, Castle Mountain Project, San Bernadino County, CA (EIS 890053, Environmental Solutions Inc., Irvine, CA, for the U.S. Bureau of Land Management, U.S. Department of the Interior, and the California State Department of Health Services, 1990).
4. 40 Code Fed. Reg., Ch. V, §1502.24; §1506.5(c).

I commend Abelson for pointing out that, through litigation and raising groundless fears, activists may succeed in drastically limiting availability in the United States of low-level, lifesaving radioactive materials in medicine and hinder their use in biomedical research. Public fears have made it extremely difficult to dispose of LLRW, which includes hospital clothing, bedding, diapers, and residues arising from diagnosis and treatment of disease. Trace amounts of radiation in these materials are not health hazards. Neither are wastes from biomedical research materials enriched in carbon-14 or tritium, which laboratory workers can use without special protective equipment. Costly disposal procedures for such wastes add unnecessarily to the nation's health-care bill and deter the use of some medically beneficial procedures.

The NRC's classification system recognizes that LLRWs differ widely in the intensity and type of radiation emitted. In 1990, the NRC proposed to exempt certain LLRW from current requirements, but was prevented from doing so by opposition from activists. Thus, virtually all of these wastes are "legally dangerous," thereby requiring special, expensive disposal sites.

Policymakers should focus on the relative risks of LLRW and set guidelines for those materials that truly need special disposal facilities. The virtually harmless wastes represent about one-third of LLRW by volume and could be disposed of by conventional methods. As states develop plans for the disposal of these wastes, federal policy should reserve special disposal sites for those materials that emit dangerous levels of radioactivity.

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Nuclear medicine examinations of patients produce essentially no waste to send to dumps in the United States. The small nuclear reactors that produce medical isotopes are in other countries or are operated by the U.S. Department of Energy (DOE), and their radioactive waste would not go to Ward Valley. Also, the Barnwell facility in South Carolina will accept LLRW shipments for at least the next 10 years, making Ward Valley even less necessary than before.

Strangely, Abelson does not mention "low-level" radioactive waste from nuclear power reactors. The DOE estimates that

between 1988 and 2020, 80% of the volume and 97% of the radioactivity of all commercial LLRW will come from this source (*1*). Some of this waste, although legally defined as "low level," is sufficiently active to give a fatal dose in a few minutes (*2*). DOE records show that in one recent year (1989) a shipment of LLRW only 1 cubic meter in volume from the Salem, Massachusetts, nuclear power reactor contained 5400 curies of radioactivity (*1*, p. 236). This so overshadows the radioactive waste from medicine and biomedical industry sources that it should be the focus of concern.

The real risk associated with Ward Valley is the potential hazard to public health of long-lived, highly toxic radioactive waste from nuclear power facilities going into unlined trenches near a main water source for much of the Southwest, particularly given the history of leaking nuclear dumps operated by the proposed contractor.

Earl Budin
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References

1. *Integrated Data Base for 1992: U.S. Spent Fuel and Radioactive Waste Inventories, Projections and Characteristics*, publi. DOE/RW-0006, Rev. 8 (U.S. Department of Energy, Washington, DC, 1989), p. 113.
2. T. Taylor, quoted by S. Salesky, in *Bull. Atom. Sci.* **46**, 18 (1990), p. 19.

Abelson criticizes the "Wilshire report" for not being peer-reviewed, while the "USGS later issued an official peer-reviewed document that in effect stated that it is unlikely that leakage from Ward Valley would contaminate the Colorado River." Peer-reviewed by whom? And who selects the peers? Abelson did not mention peer-review of the NRC report. It is my understanding that 13 of the members of the NRC Committee were associated with or "alumni" of the nuclear enterprise. Yet even they say that more measurements are needed and that there appear to be four hydrologic connections from the proposed site to the Colorado River.

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Response: Both Warf and Budin imply that large amounts of nuclear power plant waste would be accepted at Ward Valley. However, according to limitations imposed by the California Department of Health Services (CDHS), only Class A, B, and C wastes will be disposed of at Ward Valley. Most of the waste will be Class A and B, the radioactivity of which decays to very low levels within 100 years. The Class C waste poses no significant risk after, at most, 500 years. Waste stream analysis performed for the CDHS has indicated that only 6% of the radioactivity would come from nuclear power plants.

The performance of US Ecology, Inc. at Ward Valley has been closely specified. More than 130 conditions have been inserted into the license under which the company will operate. Staff of the CDHS will be present at Ward Valley throughout operation of the facility. They will monitor the manifests describing the content of the wastes and inspect and guarantee the quality of the containers. They will also measure the level of emitted radiations outside of the container. They can ban acceptance of wastes not meeting strict criteria.

The National Research Council report on Ward Valley minimizes the possible hazard of plutonium contamination of the Colorado River. The analysis is based on data supplied by the Congressional Research Service and the U.S. Nuclear Regulatory Commission. The report points out that the total amount of plutonium is tiny in comparison with the alpha emitters continually present in the river. Moreover, the CDHS has authority to intervene if larger amounts of plutonium were to be sent to the Ward Valley site.

Additional factors limit the possibility of significant amounts of plutonium reaching the Colorado River. One is a lack of liquid water to move it. A second is limited availability of chelating agents. The CDHS has regulations that limit the concentrations of them in wastes. Were chelaters such as citric acid to be dissolved in water, they would constitute food for microorganisms and during a long journey would be consumed. Additional barriers are reactions with components of the Ward Valley alluvium and ground water. For example, fluoride is abundant. Plutonium fluoride is insoluble.

Annual precipitation at Ward Valley averages less than 15 centimeters (cm). Due to a hot, arid climate and evapotranspiration of more than 100 cm of water, the soil is dry, with a substantial volume of void space. On an occasion when 5.8 cm of rain occurred, the soil was wet to less than 1 meter below the surface. Most of the time the movement of water is up toward the surface, rather than down. Measurements at depths ranging to 30 meters showed that the soil had a large volume of void space. In the experiments in which tiny amounts of tritium were detected, water was collected by pumping 12,000 liters of air from an unknown region. The result is of dubious value. Its significance is trivial in comparison to observations of a long-term accumulation of chloride that indicates a 30,000-year absence of movement of liquid water.

The renewed availability of Barnwell as a waste site for many states may or may not be a godsend. The legislature of South

Carolina enacted a tax for disposition of waste at Barnwell which suddenly doubled the net cost for acceptance to about $300 per cubic foot ($10,770 per cubic meter). The Governor of South Carolina also announced that wastes from North Carolina would not be accepted.

During 12 years, most of the other states or groups of states have made little or no progress in establishing waste sites. As a result, the politicians in South Carolina are in the driver's seat. They could find it feasible and politically necessary to greatly increase their revenues from wastes. They might also suddenly make other arbitrary decisions.

Bruce Alberts, president of the NAS, has stated, "Three members of the Ward Valley Committee—including its chairman—were first recommended to serve on the committee by some of the same environmental organizations that now claim lack of input. None of the committee members that we selected were recommended by advocates of the Ward Valley site." About three-fourths of the committee members are on the faculty of universities. Should their participation have been banned because of a university connection?

More than 130 organizations are on record in support of licensing the Ward Valley facility. Included are leading California universities, the American Medical Association, the League of Women Voters, and about 60 biotechnology companies, among them, Amgen, Genentech, and Syntex.—***Philip H. Abelson***

Corrections and Clarifications

In the letter "Delaney reform" by Samuel M. Cohen *et al.* (30 June, p. 1830), the name of co-author Elizabeth Weisburger was misspelled.

In the article "Indiana: Wrong answers—but no right ones" by Gary Taubes (Special News Report: Conduct in Science, 23 June, p. 1707), the name of Alvin Telser was misspelled.

In the second molecular scheme in the letter "Prebiotic 5-substituted uracils and a primitive genetic code" by S. Black (30 June, p. 1832), the word "Serine" was misspelled.

In the report "Reversal of Raf-1 activation by purified and membrane-associated protein phosphatases" by P. Dent, T. Jelinek, D. K. Morrison, M. J. Weber, and T. W. Sturgill, (30 June, p. 1902), reference 25 on page 1906 should have included, after the first sentence, "Buffers (4) and buffer E contained 0.2% (v/v) 2-mercaptoethanol."