BOOK REVIEWS

LOW-LEVEL RADIOACTIVE WASTE REGULATION: SCIENCE, POLITICS AND FEAR edited by Michael E. Burns. Chelsea, Michigan: Lewis Publishers, 1988. Pp. 311. $39.00.

With nuclear power supplying a significant share of the world's energy needs, and with nuclear medicine and research assuming increasing importance, much debate has focused on the safe disposal of nuclear waste. For many people, even those favoring nuclear power, the issue of safe waste disposal often seems unsolvable. Can we safely contain such debris for generations, using current technology? And who should decide where and how to store this waste? Unfortunately, most of us have only a superficial understanding of the causes of, and potential solutions to, the problem. *Low-Level Radioactive Waste Regulation: Science, Politics and Fear* deals exclusively with low-level waste and explains with common sense the problems involved in its disposal.

High-level waste is the domain of the federal government, but Congress has allowed individual states to handle their own low-level commercial waste.[1] The book does an excellent job of describing the political difficulties emerging from that decision. Another prominent theme in the book is the simple, but intractable, dilemma of nuclear fission power: radioactive waste is unavoidably produced, but its disposal is fraught with technical problems. Overall, the book deftly clarifies for the lay reader the social, political and scientific jumble surrounding low-level radioactive waste (LLRW).

Low-Level Radioactive Waste Regulation is a collection of articles by various authors, each dealing with a different aspect of LLRW. Each chapter has a bibliography at its end for easy reference. The front of the book contains the credentials and biographies of the individual authors, and of the editor. The authors have impressive backgrounds: the list includes physicists, policymakers and a Nobel Laureate. The back of the book contains a glossary with definitions of technical terms, a list of abbreviations, and an index. These fea-

1. Peckinpaugh, *The Politics of Low-Level Radioactive Waste Disposal*, in LOW-LEVEL RADIOACTIVE WASTE REGULATION: SCIENCE, POLITICS AND FEAR 47-51 (M. Burns ed. 1988) [hereinafter LLRW REGULATION].

tures, combined with effective tables and photographs, make the book accessible to readers lacking a technical background.

Chapter One contains an historical overview of the discovery and early regulation of radioactivity. The second chapter then describes the difference between high-level and low-level radioactive waste.[2] High-level waste consists mainly of highly radioactive spent fuel rods from nuclear reactors, and the liquid derived from the reprocessing of these rods. LLRW, on the other hand, derives from comparatively "harmless" sources. LLRW consists primarily of contaminated equipment and tools, such as used protective clothing, machinery, vials from radiopharmaceuticals, "scintillation" vials from biomedical research, and materials used to produce such items as luminous watch dials, syringes and smoke detectors.[3] Nuclear industry and medical uses generate roughly equal amounts of LLRW. LLRW decays more rapidly than high-level waste, and therefore less stringent laws govern its disposal. In the United States, generators dispose of LLRW in (generally unlined) shallow trenches covered by a cement slab and three or more feet of soil.[4]

Legal definitions of nuclear waste appear in the Code of Federal Regulations. 10 C.F.R. § 61.2 defines "wastes" as: "those low-level radioactive wastes containing source, special nuclear, or byproduct material that are acceptable for disposal in a land disposal facility."[5] LLRW is classified as level A, B or C, depending on its concentrations of long-lived and short-lived radionuclides. The author of Chapter Four, Frank L. Parker, points out the problems of defining radioactive wastes based on radionuclide concentrations instead of based on an assessment of the risks to health and environment.[6] For example, some wastes, such as ion-exchange resins from the cleanup at Three Mile Island, are more radioactive than level C wastes, but do not fall within the category of high-level waste. Such wastes are treated on a case-by-case basis, and only recently have rules been proposed which would provide for the disposal of greater than level C wastes.[7]

---

2. *Id.* at 45.

3. *Id.* at 45-46; Welch, Siegel, Eichling & Mathias, *Low-Level Radioactive Waste at University Medical Centers*, in LLRW REGULATION, *supra* note 1, at 112.

4. Burns & Briner, *Setting the Stage*, in LLRW REGULATION, *supra* note 1, at 34-38.

5. Licensing Requirements for Land Disposal of Radioactive Waste, 10 C.F.R. § 61.2 (1988).

6. Parker, *Low-Level Radioactive Waste Disposal*, in LLRW REGULATION, *supra* note 1, at 105.

7. Disposal of Radioactive Wastes, 53 Fed. Reg. 17,709 (1988) (to be codified at 10 C.F.R. pt. 61) (proposed May 18, 1988). This proposed amendment by the Nuclear

Another category falling outside the regulatory scheme is mixed radioactive and hazardous waste.[8] Radioactive waste is regulated by the Nuclear Regulatory Commission (NRC)[9] but "hazardous waste" is regulated by the Environmental Protection Agency (EPA), and the separate disposal requirements are very different.[10] For example, Class C waste, considered to be the most harmful, must remain under institutional control for one hundred years, and protected for five hundred years from intruders at the disposal site. But hazardous waste must be protected at the dump for only thirty years and need not be protected from intruders. Also, while controlled releases into the environment of certain radioactive substances may be allowed,[11] hazardous substances may not be released in this manner.[12] Parker suggests that classifications based on care-

---

Regulatory Commission would require disposal of greater than class C waste in deep geologic depositories unless alternative disposal is approved by the Commission.

8. Parker, *supra* note 6, at 90.

9. Widespread dissatisfaction with the NRC has led to the introduction in Congress of legislation to reorganize the NRC. H.R. 3285, 100th Cong, 1st Sess., 133 CONG. REC. H7552 (daily ed. Sept. 16, 1987); 134 CONG. REC. H818-21 (daily ed. Mar. 10, 1988) (statements of Reps. Moorehead, Bilirakis, Oxley, Dannemeyer, Callahan & Barton). Recently the Senate passed a bill which, among other things, provides for reorganization of the five-member Commission into an organization headed by a single administrator to be appointed by the President, and an Office of Inspector General to supervise its decisions. 134 CONG. REC. S11,078-90 (daily ed. Aug. 8, 1988) (statements by various Senators). The changes are a response to the perceived need to improve management and establish clear accountability:

> [Having] five independent and coequal leaders of the Commission, each of whom has their own independent agenda and interpretation of the responsibilities of the Commission . . . has led to the development of factions within the Commission which in turn has conveyed mixed and confused signals to the 3,000 NRC employees and the industry. . . . [I]f nuclear power is to play the necessary and important role in our future . . . Congress must reorganize the Government's regulator of this technology to bring predictability, stability and accountability in this system.

134 CONG. REC. E632-33 (daily ed. Mar. 14, 1988) (statement of Rep. Lloyd). The NRC has been criticized for being too cozy with the industry it regulates and lax in enforcing safety regulations. The NRC staff has been accused of limiting its internal Office of Investigations, and there is a strong feeling in Congress that an independent investigative agency is needed to alleviate the problem. Appointing an Inspector General is one measure which may assure the integrity of the agency. 134 CONG. REC. E618-20 (daily ed. Mar. 10, 1988) (statement of Rep. Gejdenson). Promoters of nuclear power feel that the NRC is responsible for some of the setbacks of the industry. A combination of accidents, cost overruns and citizen opposition has all but stifled development, and proponents feel that a single administrator may be better able to move things along. It thus seems likely that a major rehabilitation of the NRC will be enacted in the near future.

10. Parker, *supra* note 6, at 90-91.

11. *See* Licensing Requirements for Land Disposal of Radioactive Waste, 10 C.F.R. § 61.6-.7 (1988).

12. *See* Solid Waste Management Act, 42 U.S.C. § 6923 (1982).

ful analysis of the disposal site, regional weather patterns, and risks to human health would be superior to rigid classifications based on the waste's concentration of radionuclides. Fortunately, Parker notes, attempts are now being made to classify waste in this fashion.[13]

Until Congress passed the Low-Level Radioactive Waste Disposal Act of 1980, only the federal government could dispose of radioactive waste. In Chapter Three, Robert L. Glicksman describes how the Supremacy and Commerce Clauses of the Constitution limit state power to control nuclear waste.[14] The Supremacy Clause provides that the federal Constitution and federal laws made under it are supreme, so that state statutes in conflict with federal laws are invalid.[15] Congress may also preempt state legislative authority in certain areas, as it did with the Atomic Energy Act of 1954. The Act earmarked the entire area of nuclear energy research and development for almost exclusive federal control.[16] Relying on this statutory grant of federal control, the federal appeals court in *Illinois v. General Electric Co.*[17] invalidated an Illinois law prohibiting storage in Illinois of spent nuclear fuel generated outside that state.[18] The action arose when Southern California Edison, which had a continuing contract to ship spent nuclear fuel to General Electric's Morris, Illinois facility, brought suit against Illinois, seeking a declaration that the Illinois Spent Fuel Act was unconstitutional.[19] The court held that the Illinois law was preempted by the Atomic Energy Act.[20]

The Commerce Clause provides another avenue for ensuring federal control of LLRW. It empowers the federal government to regulate trade between the states, and restricts the states from interfering with the free flow of trade.[21] Applying this clause, the

13. Parker, *supra* note 6, at 91-92. Parker does not mention the effect of the Low-Level Radioactive Waste Policy Amendment Act of 1985, 42 U.S.C. § 2021 (Supp. IV 1987), which now requires assessment of risk to humans. Although his article may be slightly outdated, the EPA and the NRC still have much to do before they can implement risk-based categories for mixed waste and waste below regulatory concern. Meanwhile, Parker's criticism of current standards is relevant.

14. Glicksman, *Interstate Compacts for Low-Level Radioactive Waste Disposal: A Mechanism for Excluding Out-of-State Waste*, in LLRW REGULATION, *supra* note 1, at 65-67.

15. *See* U.S. CONST. art. VI, cl. 2.

16. *See* Atomic Energy Act of 1954, 42 U.S.C. §§ 2012-2015 (1982).

17. 683 F.2d 206 (7th Cir. 1982), *cert. denied*, 461 U.S. 913 (1983).

18. *Id.* at 213-15.

19. *Id.* at 208.

20. *Id.* at 215.

21. *See* U.S. CONST. art. I, § 8, cl. 3.

court in *General Electric* ruled that the Illinois spent-fuel statute also violated the Commerce Clause. The statute fell outside the scope of legitimate state regulation because it discriminated against out-of-state waste generators.[22]

In Chapter Two, Peckingpaugh describes the political background for the enactment of legislation in 1980 which gave the states responsibility for solving their own LLRW problems.[23] In 1979, there were only three permanent disposal sites for LLRW in the United States: Barnwell, South Carolina, Beatty, Nevada and Hanford, Washington. The public in those three states felt that it was being forced to take a disproportionate amount of the nation's waste. Responding to pressure from their constituents, the governors of Nevada and Washington temporarily closed their sites in 1979 to show their discontent. However, a federal court forced both states to reopen the sites, holding the closures unconstitutional under the Supremacy and Commerce Clauses of the Constitution.[24]

The closures at the Beatty and Hanford sites, however, helped focus attention on the LLRW problem, and in 1980, Congress passed the Low-Level Radioactive Waste Policy Act (LLRWPA).[25] The Act made each state responsible for the disposal of its own low-level radioactive waste, and encouraged states to form regional compacts for the purposes of establishing and operating storage facilities for the waste generated within each region. Each compact must be ratified by Congress before it can become operative. The Act established January 1st, 1986 as the date on which a compact-member state with access to an already approved LLRW site could legally refuse to accept wastes from non-compact states. Peckinpaugh explains that the deadline was set to encourage speedy formation of compacts, since the alternatives for non-compact states would be either to stop producing LLRW or to be forced to develop a site inside the state.[26]

The legislative history of the LLRWPA reflects, Peckinpaugh suggests, excessive compromise. After negotiations on radioactive waste (including high-level waste) had broken down, Congress enacted the less controversial provisions relevant to LLRW just before the close of the Ninety-Sixth Congress. The Act was passed with

22. *See General Electric*, 683 F.2d at 213-14.

23. Peckingpaugh, *supra* note 1, at 45-46.

24. *Id.* at 46. *See* Washington State Bldg and Constr. Trades Council v. Spellman, 684 F.2d 627 (9th Cir. 1983), *cert. denied*, 461 U.S 913 (1983)

25. *See* Low-Level Radioactive Waste Policy Act, Pub L. No 96-573, 94 Stat 3347 (1980) (codified as amended at 42 U.S.C. § 2021 (1982 & Supp IV 1987))

26. Peckinpaugh, *supra* note 1, at 47.

little formal consideration, and as a result, certain critical issues—such as what to do with mixed radioactive and hazardous waste—were not resolved.[27]

At the end of 1985, forty-two states had ratified regional compact agreements. However, no compact had become operative before the 1986 deadline. According to Peckinpaugh, the reason for this was that many states were reluctant to search for new storage sites while the existing sites remained open. It was politically safer to stall new development than to tell local voters that they might have to suffer a radioactive waste dump in their backyard. And since members of Congress from non-sited states constituted a majority, they were not likely to close down the existing sites.[28]

As the deadline passed and nothing happened, it became apparent that the LLRWPA was ineffective. A compromise was reached with the passage of the Low-Level Radioactive Waste Policy Amendments Act of 1985,[29] which provides for much more effective enforcement of the original Act's goals. The Amendments Act mandates access for out-of-state generators to the existing storage sites. In return, those states lacking a disposal site must meet certain milestones, such as completing a detailed plan for the siting of a new disposal facility by January 1, 1988, and filing an application for a license for the disposal facility by January 1, 1992. Failure to comply results in double or treble surcharges added to the fees paid by generators to the licensed disposal sites. Finally, if a state lacking a disposal site has not provided for a disposal facility by 1996, the state must take title to and possession of all LLRW in that state, and is obligated to pay any damages resulting from its failure to comply. But penalties are not the only method of enforcing the act. States also receive rebates when they comply with each milestone of their plans for new facilities. Thus, a twenty-five percent rebate of the amount of money generators paid in surcharges (if any) will be refunded to the state when the milestone is met.[30]

On the bright side, according to Peckinpaugh, there are three features of the recent amendments that should help make this legislation a success. First, Congress approved seven ratified regional compacts (involving thirty-seven states) together with the 1985 amendments. These compacts are now "operative" law which can

27. *Id.* at 47, 56.

28. *Id.* at 48-49.

29. Low-Level Radioactive Waste Policy Amendments Act of 1985, 42 U.S.C. § 2021 (1986).

30. Peckinpaugh, *supra* note 1, at 49-54.

be enforced by the sited regions.[31] Second, the incentives and penalties associated with the milestones will hopefully encourage non-sited states to develop their own sites. Third, the backup requirement that states take title to their own waste after the 1996 date also may spur site development.[32]

LLRW disposal still poses problems, however. As was the case with the 1980 Act, the Amendments Act was passed in the last hours of the Ninety-Ninth Congress. Again, the critical issue of treatment of mixed radioactive and hazardous waste remains unresolved.[33] In addition, Peckinpaugh concludes that state development of compacts and sites to dispose of the waste will probably continue to be sluggish, as few members of Congress want to be responsible for the politically unpopular decision to designate sites within their own states. Many states may decide that it is easier to pay the surcharges rather than to develop local sites, and sympathetic members of Congress may press for exemptions and exceptions for certain regions.[34]

Chapter Eleven authors E. William Colglazier and Mary R. English conclude that, while the 1985 amendments have successfully catalyzed the formation of compacts, the actual process of siting a disposal facility is an entirely different problem which has yet to be solved.[35] In addition to technical problems, there is the general hostility of the public and its elected representatives to local placement of a nuclear waste dump.

The experience of the Southeast Interstate Compact is illustrative of the technical problems involved in choosing a host. Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee and Virginia agreed to alternate as host states. After careful technical analysis, North Carolina was found to be best suited as an initial host, but the state raised a number of technical objections, the resolution of which has further postponed selection of the first dump site. Even if the party states can agree on a host,

---

31. 42 U.S.C. § 2021 (1982 & Supp. IV 1987). When Congress passed the 1985 amendments, it also approved seven compacts consisting of 37 states. Since the 1985 amendments, only one new compact has been passed into law by Congress. The Appalachian Compact, comprised of Pennsylvania (host), Delaware, Maryland and West Virginia, was finally approved by Congress and signed by the President in 1988. Appalachian States Low-Level Radioactive Waste Compact Consent Act of 1988, Pub. L. No. 100-309, 102 Stat. 471 (1988).

32. Peckinpaugh, *supra* note 1, at 57-58.

33. *Id.* at 56.

34. *Id.* at 58.

35. Colgazier & English, *Low-Level Radioactive Waste: Can New Disposal Sites Be Found?*, in LLRW REGULATION, *supra* note 1, at 229-30.

the selected host state must still chose an appropriate location. As the political fights in Texas, New York and Massachusetts show, choosing a location within a state can also prove very difficult.[36] Michael E. Burns in Chapter Fourteen predicts that Texas, which already has a site and the requisite legislative backing, may not meet the 1988 deadline due to community resistance and will have to start paying surcharges. Furthermore, Burns believes that unless Massachusetts and New York, who are major waste producers, agree to be hosts, no other states will be interested in joining into a compact with them. At the writing of this book, both states had yet to site a disposal facility.[37]

Mixed wastes controlled by the EPA and the NRC present another siting problem. Although they constitute only one to three percent of total low-level waste, there are no disposal options for them, because the two agencies have been slow to agree on regulations. In April, 1987, the two agencies finally issued a joint guidance document containing eleven guidelines for siting LLRW mixed waste facilities. However, the guidelines are voluntary, and the law still officially ignores mixed wastes. Burns notes that as the waste generators wait for regulations, the number of disposal options is shrinking. For example, in 1985, the Hanford site stopped accepting mixed wastes when told that it would have to comply with both the hazardous and radioactive waste regulations. While they wait for concrete rules, generators are forced to store mixed waste temporarily on-site.[38]

Burns also suggests that Congress acted irresponsibly when it dumped the burden of finding a permanent storage solution for LLRW on the states in 1980. Local governments have particular political difficulty with designating a constituent's "backyard" as a future disposal site. Burns argues that disposal of radioactive wastes ought to be a federal responsibility since society in general receives the social benefits of the radioactive waste-producing activities (i.e., the development of new drugs, radiopharmaceutical diagnostic and treatment techniques, and, of course, nuclear power). To minimize the volume of waste, he advocates federally-operated national disposal sites, conservation, recycling, and deregulation of low-level wastes with short half-lives.[39]

---

36. *Id.* at 220-29.

37. Burns, *Living the Past, Facing the Future*, in LLRW REGULATION, *supra* note 1, at 284-85.

38. *Id.* at 286-87.

39. *Id.* at 290-96.

Another major theme in *Low-Level Radioactive Waste Regulation* is the issue of just how dangerous LLRW really is. The book critically reviews research and studies done on the dangers of LLRW, and questions the public's objectivity in resisting low-level disposal facilities in its vicinity.

The 1985 amendments to the LLRWPA now require assessment of risk to human health as a predicate to regulation.[40] The author of Chapter Eight, Don G. Scroggin, and the author of Chapter Twelve, Rosalyn S. Yalow, feel that the scientists calculating public health risks (as number of additional cancer deaths per year beyond those normally occurring in the population) often draw a needlessly dangerous picture, which leads to undue public and regulatory concern about the dangers involved. Scroggin and Yalow do not share Parker's[41] positive view of risk assessment; they find fault with the way in which scientific calculations of the risk are done.

For example, almost all cancer risk assessments are presented as upper bound estimates, rather than as a lower and upper limit, between which the actual risk is presumed to lie.[42] Scroggin suggests that assessments showing only "the extreme upper limit of the estimated range of risk tend to assume a false appearance of precision and certainty—in the minds of the public."[43] He feels that the failure to disclose uncertainties affects legal outcomes. In the toxic tort area, for example, a new awareness of uncertainties would translate into additional difficulties to plaintiffs seeking compensation for disease or injuries allegedly caused by exposure to hazardous substances. The added difficulty would come from "victims" having to prove potential injury within a range of probabilities that go as low as zero, rather than relying merely on one number (such as a risk of one in ten).[44] Scroggin welcomes the EPA's recent adoption of the Science Advisory Board's recommendation to expressly disclose all uncertainties and assumptions in their studies. He feels that disclosure will help agencies efficiently direct their limited resources to where they are most needed, rather than spending them on risks that are minor or are based on dubious assumptions.[45]

The lack of available, verifiable human data also makes health risk assessments difficult. A large part of the supporting research is

40. *See* 42 U.S.C. § 2021(g), (h), (j) (1982).

41. *See* text accompanying note 10.

42. Scroggin, *Low-Level Radiation: Cancer Risk Assessment and Government Regulation to Protect Public Health*, in LLRW REGULATION, *supra* note 1, at 162-64.

43. *Id.* at 164-67.

44. *Id.* at 170.

45. *Id.* at 168.

performed on animals, assuming of necessity the similarity of their reactions to those of humans. Such research employs almost exclusively large doses of radiation, applied as single doses or over a short period of time. (Exposure to small doses over longer periods of time would be more realistic, but has proven impractical). Scientists then use linear correlation to estimate what doses are safe for human exposure. The linear method assumes that any dose will cause harm in proportion to that shown at high levels. Scroggin argues that this linear assumption may unduly affect the decision making processes, since animal research is often done with doses of radiation "thousands of times higher than those actually encountered in the environment," and it is unknown whether a linear relationship actually exists between such high doses and the lower doses for which the risk estimates are calculated.[46]

In Chapter Twelve, Yalow clearly shows the reader how little is known about the effects of low doses of radiation absorbed over a significant length of time (such as would be the case with exposure to a leaking LLRW dump facility). The average natural background radiation dose in the U.S. is about one-tenth rem per year (a rem is a unit of absorbed energy). Studies of human-beings suggest that there may be no discernible effect on health from doses over ten times higher than this average background dose, and observations of populations in high exposure areas have revealed no deleterious health effects, even after generations have lived at the same location.[47] Yalow calculates that over a twenty-five year period, these exposures equal the acute exposures of the Hiroshima-Nagasaki survivors, whose whole-body dose averaged twenty-five rem.

Yalow believes that the prevalent experimental approach inaccurately evaluates the effects of radiation, because it lacks random selection and controls, and because not enough subjects are included in the samples. "[T]he data presented simply do not have statistical significance, and subtle sources of bias could well account for purported observed effects," she explains.[48]

For example, Yalow describes one large group study with controls (although perhaps not with random selection) of 36,000 hyperthyroid patients, 22,000 of whom were treated with radiation and the rest with surgery. The results revealed no significant difference in the incidence of leukemia (a common radiation affliction) be-

46. *Id.* at 166-67.

47. Yalow, *Biological Effects of Low-Level Radiation*, in LLRW REGULATION, *supra* note 1, at 240-42.

48. *Id.* at 244

tween the groups, despite whole-body doses totalling five to fifteen rem, half of which were given within a week.[49] Studies such as these, Yalow contends, contradict the findings of other studies, such as the one which discovered increased cancer in men exposed to less than three rem in nuclear test explosions at the Nevada and Pacific test sites.[50] The reader may begin to suspect that radiation danger may not be as serious as we have been led to believe: Scroggin and Yalow argue strongly that the risks of LLRW have been overestimated and that the public's concerns are basically unfounded.

Letty G. Lutzker, in Chapter Nine, goes a few steps further. He ridicules environmentalists and others, who instead of applauding technological progress and increased longevity, ignore these real advances and focus only on imagined dangers from radioactive and toxic waste—like modern day Chicken Littles. He argues that cancer is a disease of old age, and since traditional causes of death have been largely eliminated through medical progress, it is only natural that proportionately more cancer deaths should occur as the population ages.[51] Lutzker goes so far as to accuse skeptics of actually undermining American society. Unfortunately, Lutzker does not discuss either low- or high-level radioactive wastes. Instead he focuses on the slim chances of nuclear catastrophes at power generators, which is irrelevant to the subject matter of this book. It seems to this reviewer that Chapter Nine is an expendable part of *Low-Level Radioactive Waste Regulation.*

Notwithstanding scientific uncertainties, the greatest problem facing those responsible for establishing the LLRW facilities has become the incredible amount of public resistance.[52] Confused by the lack of scientific consensus, many people feel that the safest strategy is to oppose all disposal sites. Richard J. Bord, author of Chapter Ten, outlines two factors which increase public resistance to the establishment of disposal sites: 1) the questionable effectiveness of waste disposal and long-term management, and 2) the anti-nuclear stance of influential entertainment films. Incidents such as Love Canal and Three Mile Island also feed this skepticism.[53]

The 1969 National Environmental Policy Act, whose provisions usually apply in the LLRW siting problem, mandates opportunity

49. *Id.* at 245.

50. *Id.* at 248-53.

51. Lutzker, *Making the World Safe for Chicken Little, or the Risks of Risk Aversion,* in LLRW REGULATION, *supra* note 1, at 175-92.

52. Bord, *The Low-Level Radioactive Waste Crisis: Is More Citizen Participation the Answer?,* in LLRW REGULATION, *supra* note 1, at 193.

53. *Id.* at 196-97.

for written comment and public hearings on any federally funded government proposal that may have significant environmental impact.[54] Bord suggests that public caution increases when the public can access more information and can understand the uncertainties involved in waste management. He concludes that public participation has led to the current stalemate in disposal site selection.[55] Citing a Pennsylvania survey, Bord suggests that giving local citizens monitoring and shut-down power over waste facilities, as well as somehow guaranteeing nearby property values, may overcome the "not in my backyard" (NIMBY) syndrome. The flip side of this solution is, according to Bord, that it will give communities greater ability to say "no" to the waste disposal.[56]

Bord feels that public participation is at odds with the nature of the industry. Some of the proposals presented by environmental organizations (such as above-ground storage for easy monitoring) are expensive, and create separate problems themselves.[57] However, some countries, such as France, have made major investments in "safe" storage of their radioactive waste by pre-treating the waste and building complex structures containing concrete, sand and clay barriers intended to stop leaching from the site. Other countries, like Germany, Switzerland and Sweden, contain their low-and intermediate-level waste in closed structures buried deep in the ground or below the seabed, a practice standing in sharp contrast to licensed U.S. shallow land burial disposal methods. Parker suggests in Chapter Four that such methods are required before the public will accept nuclear waste dumps. Parker also suggests that the time and money otherwise spent on obtaining public approval outweigh the costs of the more socially acceptable solutions which require extensive treatment and deep burial.[58]

Bord, however, questions the effectiveness of the European models and whether the implementation of sophisticated technology will solve any problem in the United States. He argues that the public will be distrustful of any form of storage no matter what technology is used. He suggests that since the states seem unable to solve the dilemma and since strengthened public power is likely to continue the stalemate, the federal government may have to assume responsibility for the siting and development of storage facilities for LLRW.

54. 42 U.S.C. § 4321 (1982).
55. Bord, *supra* note 52, at 200-01.
56. *Id.* at 204-09.
57. *Id.* at 210.
58. Parker, *supra* note 6, at 100-05.

The federal government may have to use its eminent domain powers and it may have to implement expensive, stringent controls for "safe" disposal in order to get the job done.[59]

So where does this combination of scientific uncertainties, politics and public opposition leave us? According to *Low-Level Radioactive Waste Regulation*, not any closer to a solution within the LLRWPA and the 1985 amendments. However, government, public and industry efforts have produced some positive results: new approaches to reducing the carcinogenity and the volume of LLRW have been developed, and alternative ways of storing waste long-term are evolving. Without the staunch opposition by state politicians and their constituents, these developments might not have occurred as quickly.

The authors of this book do not write from an environmentalist's perspective, but they do give the reader valuable insights into the complexities of low-level waste disposal, and the obvious flaws in attempting to formulate policy based on incomplete research. The book also forces one at least to question deeply entrenched assumptions about the dangers of radiation. Whether or not one agrees with all of its contributors' conclusions, *Low-Level Radioactive Waste Regulation* makes for valuable reading.

*Anna H. Waendelin**

59. Bord, *supra* note 52, at 209-11.

* J.D. 1990, University of California, Los Angeles; B.A. 1987, California State University, Los Angeles.