A Ten-Year "Blip" in Superfund History? Lessons Learned from Hazardous Substance Research Centers

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In October 1999, a troubled team of forty scientists and engineers met at Mohonk Mountain House in New York's Catskills. They were the lead researchers working in five Hazardous Substance Research Centers that involved 29 major research universities such as MIT, Michigan, Georgia Tech, and Stanford (http://www.hsrc.org/). The centers were formed in 1989 through Superfund to bring fresh ideas to a stagnating US Environmental Protection Agency (USEPA) effort at hazardous waste cleanup. Now the centers themselves were under severe scrutiny from the USEPA and faced a budget shut-down from Congress. What circumstances led to this meeting and what answers could the team bring to the table?

First the background: the earliest major national law to deal with land-based hazardous waste was the 1976 Resource Conservation and Recovery Act (RCRA). RCRA set a framework for regulating the cradle-to-grave system to control the generation, transportation, treatment, and disposal of hazardous wastes. Of the hazardous waste sites that USEPA discovered, 90 percent contained improperly disposed wastes in tens of thousands of abandoned dumps scattered across the country.

Yet, RCRA was not put into practice with any haste. It had low priority in both the Carter and Reagan years. In 1984 citizen lawsuits brought Congress to reauthorize RCRA, now including the Hazardous and Solid Waste Amendments (HSWA). The result was a very prescriptive law that identified specific cleanup technologies: chemical neutralization, physical stripping, biological (aerobic) systems, thermal (incineration), and also landfilling and removal. But high costs, as well as limited technologies, slowed cleanup to a crawl. The cost of depositing one cubic yard of gasoline-contaminated soil in a RCRA landfill ran as high as $200. Remediation of PCB-contaminated soil cost $470 per ton.

The aim of RCRA and HSWA was to prevent future Love Canals, not clean up existing waste sites that numbered in the tens of thousands. Congress, under intense public pressure, addressed these sites in 1980, when it passed CERCLA, the Comprehensive Environmental Response, Compensation, and Liability Act, also known as Superfund. CERCLA directed USEPA to identify sites, rank them according to the hazards they present, and maintain a National Priority List for cleanups. Results were glacially slow. According to political scientist Susan Buck, "The main accomplishment of Superfund was to develop an understanding of the magnitude of the problem."

CERCLA was significantly modified in 1986 by the Superfund Amendment and Reauthorization Act (SARA), now with $9 billion in funding. SARA's Title III included community "right to know" provisions that clamped down on industry. Polluters were required to maintain and make available data about harmful chemicals that were used or stored on the site and to record and report annual emissions of such chemicals. This became the Toxics Release Inventory.

Superfund, authorized in 1980, had faltered from the start: by 1990 a trillion dollars had been thrown mostly at legal shenanigans with little to show in actual cleanups. Only 12 cents of every dollar was used for on-site remediation. At this rate, one estimate said that every American will eventually pay $2,000 for Superfund cleanups. Superfund was also reviled for interminable delays bordering on gridlock. On the average, twelve years passed from the time the USEPA became aware of a dangerous site to a final cleanup. Yet, as early as 1982, USEPA reported that it had already located more than 180,000 places, mostly illegal and unmonitored, where hazardous waste was being dumped.

The centers came into being when the USEPA was forced to look outside its walls for a fresh start. Congress authorized it to apply a million dollars annually of Superfund monies to support the five regional Hazardous Substance Research Centers. Other funding came from other public and private sources. These centers embarked upon an ambitious three-part mission: cutting-edge technological innovation, technology transfer into practical on-site solutions, and community outreach. Their mission included new scientific initiatives of the highest quality as well as bringing a halt to "bad science." Walter Weber of the Great Lakes and Mid Atlantic Center, based at the University of Michigan, also noted that center researchers had to keep academic "cutting edge" technology simple and cheap so that anyone can do it. Funding was refreshed by Congress with $3.5 million in 1994 and the "Dole Initiative" in 1995 for $16 million. But the "Gingrich shutdown" later in 1995 forced the centers directly into the political fray instead of safety under USEPA's umbrella.

By 1999, with reduced funding and revised agendas, the history of the centers revealed a ten-year story that exposed tensions between federal agencies and private interests, that underlined the difficulties of applying cutting-edge engineering to real-world cleanup, and affirmed the need for direct involvement by affected local communities. The Mohonk workshop in October 1999 focused on trouble brewing after ten years of center activity. Would Congress justify new funding at the same or higher levels? Would the USEPA be willing to continue such major research outside its own walls? Had the centers fulfilled their assignment to transfer cutting-edge research into applicable technologies that were acceptable to local communities? The workshop's agenda was also shaped by a simultaneous debate in Washington about continued center funding. The workshop was to report on the current status of the centers and explore their future–"toward HSRC II."

As the Mohonk team assessed its ten years of research, it became clear that by far the biggest across-the-board agenda was bioremediation, which was hardly on the horizon of significant research in the 1970s. A wide range of successful research included a MTBE (methyl tertiary butyl ether)-degrading microorganism, bacteria found to degrade trichloroethylene, and various

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forms of phytoremediation. A related agenda involved natural processes, or intrinsic bioremediation, which was tested at Wursmith Air Force Base and at the industrial site at St. Joseph, Michigan.

The centers thus helped legitimize what environmental historian Samuel P. Hays called "frontier science." This stood in contrast to "conventional" science that required absolute proof before its application. Frontier science involved environmental problems serious enough to require cleanup despite limited proof. When scientists cannot agree on the veracity of their science, should policymakers wait until better information is available before acting? This brings up the "precautionary principle." Yet, if society fails to act according to the precautionary principle or "worst case scenario," the situation may deteriorate rapidly and irreversibly.

The Mohonk team applauded the practical results of several "end runs" around stalemates or intractable problems. If the remediation technology is unavailable or too costly, were there other options? If a local community feared the effects of a toxic waste site, even after remediation, what was the best response? Perhaps the best example was "brownfields," which dramatically changed the agenda by accepting different levels of acceptable remediation depending upon land use, economics, and public perception. It was a model accomplishment that combined public information about risk, acceptance of existing technologies, and collaboration over economic development. Above all, brownfields was a matter of trust among players who have had little reason to trust each other in the past.

The team emphasized that by the early 1990s cost-cutting became a major ingredient in the environmental stew. The claims of the centers were amazing: cleanups costing from 5 times less to 20 or more times less compared to traditional technologies. Biological methods to destroy PCBs were said to be about $111 per cubic yard in-situ compared to $586 to incinerate. Such cost-cutting was similar at fuel-spill sites to degrade carbon tetrachloride. The biggest difference was the use of poplar trees over a site of radioactive rock residue at a cost of less than $200,000 compared to potential liability of some $170 million.

One uphill battle that the workshop wrestled with was the move toward a mutually supportive relationship with the public, often represented by Public Interest Research Groups, which have a history of distrust of government. University researchers in the centers were surprised that the distrust applied to them as well: they were told by affected communities that the technical work done in a university very often did not reflect the needs of the society. Did the universities clog the process? Equally surprising was the tension in public testimony between the university expert, who was seen as a tool of industry and government, versus the well-versed amateurs in the non-governmental organizations and communities. Communities felt disenfranchised.

As a result, the workshop reported that the centers learned that their true clients were not government or industry, but the public. As one workshop participant put it, "The public is our industry." The centers discovered that outreach into the communities was not something they could play down as secondary compared to basic research. They were reluctant to put their efforts toward outreach since it rarely was counted toward promotion or tenure; yet they could not afford not to do it.

The workshop pointed to accomplishments: the involvement of 2,500 students, over 100 projects, 150 outreach programs, over 3,000 publications, and 23 patents or licenses. Center research had demonstrated the necessity of multidisciplinary, collaborative, and synergistic projects that could be applied creatively to real on-site problems. Several center projects had actively emphasized communication with local communities.

According to Larry Erickson of the Great Plains/Rocky Mountain Center, located at Kansas State University, the next ten years–"HSRC II"–must focus not only on site remediation but the entire question of quality of life.

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