

ing the government's attempts to have a private party fund the cleanup.

As with the Compass Industries Superfund site directly across the Arkansas River from Sand Springs, little attention was given to possible groundwater contamination from the remedial action for the present hazardous material and to the risks to downstream water users from cumulative discharges into the river.

Case Study 9

Schmalz Dump Site, Harrison, Wisconsin, EPA Region 5

Capsule OTA findings.—A simple compacted earth cover over the soil contaminated with lead and chromium was selected. Solidification/stabilization treatment was rejected, although this was a textbook example of appropriate use of the technology. Voluntary well abandonment and monitoring was chosen over pumping and treating contaminated groundwater.

Key dates:

- Entered Superfund system: 5/1/83
- Preliminary Assessment: 5/23/83; (5/1/83 in CERCLIS)
- Site Inspection: 5/23/83; (5/1/83 in CERCLIS)
- National Priorities List
 - proposed date: 9/1/83
 - final date: 9/1/84
 - site rank: #190 out of 770
- RIFS start and completion: 12/28/84 to 8/14/87
- Public comment period before Record of Decision: 8/17/87 to 9/8/87
- Signing of ROD: 9/30/87
- Estimated complete remediation: 20 months (around 6/89)

Total time.—6 years

Brief description of site.—The ROD said: “The Schmalz Dump Site is located on the north shore of Lake Winnebago in the Town of Harrison. The site occupies approximately 7 acres in the Waverly Beach Wetlands area. The neighboring city of Appleton, with a population of 60,000, has its drinking water intake approximately 1200 feet from the shore of Lake Win-

nebago, in close proximity to the site.” Various types of waste were disposed there from 1968 to 1979.

Major contamination/environmental threat.—According to the ROD, there was “Initial on-site sampling by the State of Wisconsin and the U.S. Army Corps of Engineers in early 1979 . . . Lead and chromium were also detected in relatively high concentrations at several sampling stations. Lead and trivalent chromium [the least toxic form of chromium] were found throughout [soils at] the site at concentrations ranging from detection limits to 1940 milligrams per kilogram (mg/kg) and 964 mg/kg respectively . . . lead and [trivalent] chromium in soils . . . with concentrations greater than 14 mg/kg and 100 mg/kg respectively, pose an unacceptable lifetime risk from direct contact.” The ROD indicated a volume of contaminated material of 8,000 cubic yards.

The second environmental threat was contaminated groundwater. “. . . the silty sand aquifer beneath the site appears to be separated from the lower aquifer by a fairly thick, continuous clay layer. It is therefore unlikely that contaminants from the site would enter the lower aquifer and reach residential wells. The shallow aquifer beneath the site contains levels of trivalent chromium above background but not above the MCL [Maximum Contaminant Level]. . . the water table is three to five feet below the land surface and direction of flow is . . . towards Lake Winnebago.” Regarding the ability of lead and chromium to leach from the soil, the ROD said: “Results of the tests show that very low levels of both lead and chromium are leachable. . . trivalent chromium has an affinity to fine grained, silty soils like those found in the site area.” A groundwater modeling study “indicates that in fifty years, groundwater containing chromium would have migrated just beyond the site boundary.”

A complex technical issue for this site is that there are two different chemical forms of chromium: the more toxic hexavalent form and the less toxic trivalent form. The analysis for soil contamination recognized that even trivalent chromium is toxic. However, the analysis of

the groundwater threat discounted the hazard from trivalent chromium or from it turning into hexavalent chromium.

HRS scores.—groundwater 27.62; surface water 80.00; air 0.00; total 48.92

Removal actions.—Earlier operable unit cleanup involved removal of PCB contaminated materials in 1987; Remedial Design, \$81,000 and Remedial Action, \$2.6 million.

Cleanup remedy selected.—This ROD is the second one for the site. The first ROD in August 1985 addressed PCB contamination at the site and selected “removal of construction debris and sediments containing elevated concentrations of PCBs.”

Alternatives examined included: 1) groundwater pumping with treatment, slurry wall and cap; 2) a RCRA cap; and 3) solidification/stabilization treatment of soil and onsite disposal of residues. The ROD said: “The preferred alternative involves the installation of a low permeability, compacted earth material cap over approximately seven acres of lead and chromium contaminated soils, and implementation of groundwater monitoring for lead and chromium. A voluntary well abandonment program for nearby wells is also proposed.”

Estimated costs for the groundwater treatment alternative were \$3.4 million; for solidification and/or stabilization, \$2.8 million; for a RCRA cap, \$2.4 million; and for the selected remedy of a soil cover \$800,000. (In the body of the ROD the selected remedy is called a soil **cover**, but in the beginning of the ROD it is called a **cap**. Soil cover is more accurate because a cap implies a more complex, engineered approach to containing hazardous waste.)

Satisfaction of SARA statutory requirements:

1) **Selection of permanent** cleanup.—The Schmalz ROD was straightforward: “The statutory preference for treatment set forth in . . . SARA is not satisfied because treatment was found to be impracticable due to questionable technical feasibility, inadequate short-term protection, and inappropriate site conditions.” With regard to overall environmental protec-

tion, the ROD said the selected remedy “would provide adequate protection from contaminated soils on site.” Treatment was rejected for both contaminated groundwater and soil. The ROD noted for both treatment approaches: “Treatability or compatibility testing is required . . . prior to design and construction.”

EPA has said, however: “Toxic metals represent a long term threat in the soil environment. This threat can be reduced considerably if the heavy metals can be permanently immobilized by either chemical or physical methods.” (U.S. Environmental Protection Agency, *Review of In-Place Treatment Techniques for Contaminated Surface Soils*, vol. 2, November 1984.)

The ROD acknowledged that solidification/stabilization of excavated soil could be “a permanent remedial action to limit the off-site mobility, volatility [an unusual term instead of volume] and toxicity of the heavy metals.” The selected remedy “is expected to significantly reduce the mobility of lead and chromium by containment in the site soils, but do nothing to reduce toxicity or volume of contaminants.” The chief reasons for rejecting solidification/stabilization were that:

- Excavation is risky “due to potential airborne migration of dusts from the site.”
- “The reliability . . . is unknown principally due to the lack of data documenting long-term success or failure of similar projects.”
- It . . . is not expected to significantly minimize risks associated with ingestion of soils without additional restrictions on use of the site (e.g., additional fencing).”
- . . . there is considerable research data to suggest that silicates used together with a cement setting agent can stabilize a wide range of materials including metals. However, the feasibility of using silicates for any application must be determined on a site specific basis, particularly in view of the large number of additives and different sources of silicates which maybe used,” (Interestingly, the paragraph is verbatim from the book *Hazardous Waste Treatment Technologies*, by Gerald Rich and Kenneth

Cherry, 1987; the statement is a good explanation of the need for a treatability study for solidification.)

- “Based on the content of soils on the site . . . [the alternative] maybe difficult to implement. Contaminated soils consist of solid waste, wood, brick, and car bodies, which would make implementation difficult.”
- its “. . . reliability. . . is unknown. ”
- it” “. . . is not conducive to a wetlands environment. Capping and vegetation of the site is. ”

With the groundwater problem, there are two subtle issues. First, the ROD emphasized the sampling data for chromium concentration in the shallow aquifer, which ranged from 14 to 48 micrograms per liter ($\mu\text{g/l}$) and the fact that the values are below the MCL of 50 $\mu\text{g/l}$. However, the highest value is close enough to the MCL value to worry about the precision of sampling and the possibility of future increases in concentration. Indeed, EPA work indicates that chromium can be underreported by more than enough to make the 48 $\mu\text{g/l}$ observation above the standard. (K.A. Aleckson et al., “Inorganic Analytical Methods Performance and Quality Control Considerations,” *Quality Control in Remedial Site Investigation*, American Society for Testing and Materials, 1986, pp. 112-123.) The ROD said: “Groundwater was determined not to be a public threat because chromium concentrations are below [Safe Drinking Water Act] drinking water standards. However, leaching of chromium and/or lead to groundwater could potentially cause drinking water standards to be exceeded. Based on the above discussions [of small amount of leaching according to standard tests and affinity to soil], onsite soils are not likely to ever increase chromium and lead concentrations in the ground water to greater than the drinking water MCLs of 50 $\mu\text{g/l}$. However, because there is a remote possibility that this pathway could later become a concern, it was determined that groundwater should be monitored over time. In addition, residents in the vicinity of the site will be asked to voluntarily abandon any existing wells. This is a

precautionary measure to ensure that no potential for exposure exists should contaminant levels in groundwater increase in the future.”

The ROD’s case is supported by the results of leachability tests which found low levels of both lead and chromium; however, the test employed does not necessarily describe long-term effects under actual site conditions. The ROD also noted that the background groundwater level for chromium is 5 $\mu\text{g/l}$; therefore, there is contamination from the site. However, the ROD also said: “groundwater contamination is not above MCLs and there is no leachate release.”

The ROD for the Tower Chemical Superfund site in Florida, where there is chromium contamination in the groundwater, had a target cleanup level for the treatment of 100 million gallons of water of 0.05 $\mu\text{g/l}$ even though the groundwater standard is 50 $\mu\text{g/l}$. The public health threat there is considered minimal.

The second groundwater issue is a second plume of contamination which the ROD described as “an isolated off-site anomaly west of the Schmalz Site.” Two concentrations reported for the location are 185 $\mu\text{g/l}$ and 1140 $\mu\text{g/l}$ of dissolved chromium. The contamination “appears to emanate from a localized point source. Based on the history of dumping in the area, this phenomenon is not unusual.” It seems that a narrow definition of the site boundary kept these higher concentrations from being considered a significant factor in selecting the cleanup remedy. Information in the ROD clearly indicates that the second plume would also flow into Lake Winnebago.

Overall, the critical ROD conclusion was: “Based on the rate of groundwater movement, and taking into consideration the dilution that would occur once ground water discharges to the Lake, the levels of chromium in the groundwater should never pose a threat to Appleton’s water supply. ” Groundwater treatment was also rejected because “several problems can occur at each component stage. This could result in delays or inability to implement the alternative. ”

In summing up its comparison of alternatives, EPA said that groundwater treatment “does not protect against direct contact” and that the solidification/stabilization treatment of the soil “would be protective upon implementation, however, there are several problems associated with implementation of this alternative that make it undesirable.” The use of a slurry wall and cap or a RCRA cap are “not cost effective because they provide excess protection for groundwater.”

2) ***Accurate assessment of land disposal and containment alternatives.***—The word permanent was not used to describe the overall selected remedy. The ROD said that the cap is protective and that the groundwater monitoring “will provide protection from potential future releases.”

Regarding permanency of the selected remedy, the ROD said that “. . . the only potential need for replacement is seen to be that of the cap or soil cover. This need could occur if the original cap was washed out by some storm event, if heavy equipment were to abrade the cover, or if unforeseen subsidence were to occur.” No restrictions on future land use were set, and the ROD noted that EPA has legal authority “to issue an order for corrective action, should the owner make an attempt to damage the cap.” A letter from the State said, “the cap could be damaged by the landowner, who has indicated a desire to build on the site.” The ROD for the Tower Chemical site in Florida eliminated the alternative of using a soil mixture cap because: ***“This technology is unproven and has extensive monitoring requirements. Development of dessication cracks could cause failure. High failure potential”*** (emphasis added).

In the FS for the French Limited site (in EPA Region 6), use of a slurry wall and cap to contain hazardous waste was described as a “temporary solution” for which the “volume and toxicity would not be affected . . . [and] . . . the potential would always exist for failure of either the cap or the slurry wall allowing for the movement of unstabilized wastes contained onsite.”

The decision not to use a RCRA cap was inconsistent with statutory requirements about satisfying current regulations, and it raises significant uncertainties about future failure, Official EPA guidance notes: “A key task of cover design is the selection of suitable materials. The cover usually will include a synthetic membrane and a large volume of soil or soil-like material . . . “ (U.S. Environmental Protection Agency, “Project Summary-Design, Construction, and Maintenance of Cover Systems for Hazardous Waste: An Engineering Guidance Document,” November 1987.) The selected cover is very simple and poses substantial uncertainty about future risks. In the ROD for the Pristine site EPA defends its rejection of capping by saying “. . . there are no data available on the long term effectiveness and permanence of RCRA caps.” Clearly the situation is worse for a simple soil cover.

With regard to groundwater monitoring: “Any increase in existing levels of chromium or lead will be evaluated as to whether corrective action is necessary based on levels found.” The ROD did not give any specific technical criteria for deciding when other remedial actions will be necessary.

There was no discussion of the possible future oxidation of trivalent chromium to the more toxic and mobile hexavalent chromium. EPA research has noted: “under conditions prevalent in many soils, Cr(III) can be oxidized.” (U.S. Environmental Protection Agency, ***Review of In-Place Treatment Techniques for Contaminated Surface Soils***, vol. 2, November 1984,) Such oxidation constitutes a potential mode of failure for the selected remedy, especially in the context of future land use. Although OTA does not know whether the site soil poses this problem, it is an important enough issue to have been examined by EPA. Another potential effect is that trivalent chromium in water can be oxidized to the hexavalent form in certain types of chlorination treatments; therefore, leaching of trivalent chromium into groundwater that eventually enters a drinking water supply can be a problem, especially if it is unexpected.

RIFS contractor.—Camp Dresser and McKee; over \$600,000 for all of the RIFS work.

State concurrence.—“The State of Wisconsin supports our preferred alternative, however it has several concerns related to implementation of the remedy. . . . due to the excess cost involved, they do not feel that a groundwater treatment alternative is warranted. The State has concerns over whether adequate cap protection is available for alternatives involving capping the site. . . . the State has agreed to attempt to obtain a voluntary agreement from the landowner.”

Community acceptance.—The ROD said the “community does not perceive the site as an immediate danger. . . . at least some residents feel that a full RCRA Subtitle C Cap should be installed.”

Special comments.—Although the ROD said the selected soil cover had a low permeability, unlike some other RODS no specific permeability value was given.

Documents obtained from EPA on the use of treatability studies show that a study was completed for the Schmalz site in April and May 1987; the study focused on “surface water contaminated with PCBs, Cr [chromium], and Pb [lead].” This attempt to verify physical and chemical treatment may have been done as part of the earlier operable unit cleanup for PCBs, but the results are relevant to groundwater cleanup for the Schmalz ROD, which does not mention the study.

In the RIFS, the detection limit for hexavalent chromium was 20 times higher than for trivalent chromium, which might explain why hexavalent chromium was not found, if it was present.

Some of the estimated costs for the rejected cleanup alternatives look high. For example, the estimate of \$2.8 million for stabilization is higher than estimates at other Superfund sites. With a figure of \$200 per cubic yard for total stabilization costs, consistent with data at the Sand Springs and Liquid Disposal sites where stabilization was selected, the correct value for Schmalz is probably about \$1.6 million.

The body of the ROD includes a part of the selected remedy that is not in the remedy’s description at the beginning of the document. That is the recommendation that “adjacent property be evaluated under the pre-remedial program.” Presumably this action refers to the hot spot of contamination just outside the site boundaries used by EPA. Such an examination might, therefore, open up the possibility of another site cleanup, but the ROD only recommended the evaluation instead of requiring it.

General conclusions.—The Schmalz site is definitely *not* one of the worst Superfund sites. But even though the environmental threat from the site is not severe, the handling of the remedial cleanup raises important questions. The degree of certainty expressed by EPA for the long-term effectiveness of its selected remedy is inconsistent with the technical limits of the remedy. A good example of EPA’s over optimism is in the responsiveness summary: “Following implementation of the selected remedy, exposure to contamination from the Schmalz Site will be *eliminated*” (emphasis added). This statement is inconsistent with the technical limitations of a soil cover and with uncertain failures, responses to monitoring results, and land use.

Moreover, ROD statements that the “groundwater is not contaminated” are incorrect. The issue is whether the risks estimated by EPA are correct and stable or whether groundwater cleanup is warranted now or whether it may become necessary. EPA seemed to place heavy emphasis on a technicality, namely that contamination within the bureaucratic boundaries of the site was slightly below the current regulatory standard for allowable chromium contamination in drinking water. What if the measured chromium contamination goes up the 5 percent necessary to bring it over the standard? Moreover, the ROD’s selected remedy omits the statutory requirement of reexamining the site at least every 5 years because untreated hazardous waste will be left onsite.

The volume of contaminated soil (8,000 cubic yards) at Schmalz is relatively small for a cleanup site. Nevertheless, various ROD statements indicate that minimizing cleanup costs