10 CASE STUDIES

Introduction

Each of the 10 case studies in this report is drawn from a Record of Decision (ROD), which is EPA's official understanding of the facts from site studies and EPA's explanation of how the facts support its selection of a cleanup technology. Each ROD also includes a summary of how EPA responded to public comment and generally includes a summary of the administrative record (related documents) for the site. EPA can and sometimes does reject, change, and supplement the findings of the contractor(s) who prepare the RIFS and draft the ROD.

Methodology

These 10 case studies were selected from recent RODS, from September 1987 through December 1987, which EPA has acknowledged came under SARA. OTA identified issues in its 1985 study ***Superfund Strategy*** and in the ongoing Superfund Implementation study of which the case studies is just one part. This other work helped in the selection of representative case studies. The 10 cases here were chosen to illustrate different technology selection problems, none of which are unique to these sites, and to illustrate different types of sites and hazards. This report discusses about 10 percent of all recent RODS to which EPA has applied SARA. OTA examined nearly all recent RODs—over a hundred—to verify that the case study sites are representative.

Format for Case Studies

The case studies are presented in a standard format. Following is a sample of the format with explanations, where necessary, of the categories and of the terms and sources used in the case studies. **Unless noted otherwise, the quotations in the case studies are from the site's ROD.** Statements from other RODS, from other case studies, and other Superfund sites are often used in the case studies to illustrate program inconsistencies. To complete each site's history, two EPA data management systems were needed: 1) the CERCLIS inventory of all sites reported to EPA, and 2) the Superfund Comprehensive Accomplishments Plan (SCAP). The latter is a budget management system; OTA used data from SCAP NPL Site Summary reports dated October 27, 1987.

Sample Format

Name, location of site, and EPA region:

Capsule OTA findings:

Key dates:

Entered Superfund system: EPA maintains an inventory of sites called CERCLIS. The date when the region gets notification of a site is recorded is the site discovery date. Many sites new to Superfund come with long histories of contamination and cleanup efforts.

Preliminary Assessment: The Preliminary Assessment is the first screening step in the pre-remedial process; it consists mostly of examination of existing records. It is done by EPA contractors or by States. Sometimes a PA is done after other actions which are supposed to come before it, apparently to satisfy the requirement that it be done.

Site Inspection: The Site Inspection involves some field work and testing to define the nature and scope of the hazard. The S1 is the second screening step in the pre-remedial process and leads to Hazard Ranking System (HRS) scoring of the site. The S1 is done by EPA contractors or States; the initial scoring is by EPA contractors, EPA regional staff, or States.

National Priorities List
- ***proposed date:***
- ***final date:***
- ***site rank:***

Sites that get an HRS score of 28.5 or more go on the NPL and become eligible for remedial cleanup. Initially EPA proposes a site for the NPL, and, after an opportunity for public comment, the site can become a final NPL site. Final sites are ranked by their HRS score; the ranks in the case studies are from the NPL as of July 1987. Then the NPL had 770 ranked sites and more than 200 proposed sites. EPA revises the NPL only periodically, approximately once a year. The significance of the rankings for taking action has not been made clear by EPA. A site can receive various Superfund actions without being on the NPL.

RIFS start and completion: The Remedial Investigation/Feasibility Study (RIFS) provides the information base for the ROD. RIFSS are done by private engineering consulting firms, paid by EPA, responsible parties, or States.

Public comment period before ROD: EPA is required to make available certain documents for public review for 21 days prior to the ROD; the period can be extended.

Signing of ROD: EPA Regional Administrators officially sign RODS, although in a few cases the EPA Headquarters Assistant Administrator, Office of Solid Waste and Emergency Response, may do so,

Estimated complete remediation: The ROD normally estimates when the final action or, if the action is not final, when the whole cleanup will be done.

Total **time:** The total elapsed time of above dates.

Brief description of site:

Major contamination/environmental threat:

HRS scores: EPA's policy is that a site score a minimum of 28.5 to be placed on the NPL. (Once only, States can nominate one site for the NPL regardless of its score.) The maximum subscores for groundwater, surface water, and air are 100, and a formula is used to combine the subscores so that the maximum total score is also 100. (This calculation applies to the version of the HRS used for the case study sites; a newer HRS version, required by SARA, may change this methodology.) There are many concerns about the accuracy of HRS scores and their use in ranking NPL sites; an HRS score may not paint an accurate picture of a site's original or current environmental threat. Sites are not rescored after removal actions or interim remedial measures.

Removal actions: Removals are site actions on non-NPL sites and on NPL sites before (or during) a remedial cleanup. They are usually handled by a different office within the Superfund program than that which handles the remedial cleanup. A variety of removal actions can be taken as emergency or time-critical measures. SARA authorizes more time and money for removal actions than did CERCLA.

Cleanup **remedy selected:**

Satisfaction of SARA statutory requirements:

1) ***Selection of permanent cleanup.—The*** Superfund Amendments and Reauthorization Act of 1986 (SARA) states that EPA shall: 1) "select a remedial action that . . . utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable," and, 2) if this is not done, "publish an explanation as to why a remedial action involving such reductions [in the toxicity, mobility, or volume of the hazardous substance, pollutant, or contaminant] was not selected." (SARA Section 121)

Z) Accurate assessment of land disposal and containment alternatives.—SARA states that EPA shall "take into account:" . . . the long-term uncertainties associated with land disposal; . . . short- and long-term potential for adverse health effects from human exposure;. . . the potential for future remedial action costs if the alternative remedial action in question were to fail . . . " (SARA Section 121)

RIFS contractor: Information on time, cost, and company is normally available from the ROD; if not, OTA obtained it from other EPA sources.

State **concurrence:** Only information reported by EPA in the ROD was used.

Community acceptance: The ROD's responsiveness summary was chiefly used. It does not necessarily reflect the full range of public opinion about a site because it only describes direct interactions through the official public comment process between the community and EPA.

Special comments:

General conclusions:

Case Study 1
Chemical Control Corp., Elizabeth, NJ; EPA Region 2

Capsule OTA findings. -Unproven solidification (chemical fixation)technology was selected to treat in situ highly contaminated subsurface soil, which previous removal actions had left below the water table and covered up with gravel. No treatability studywas used.The cost of incineration was over estimated. The cleanup will leave untreated contamination on the site.

Key dates:

- Entered Superfund system: 5/1/79
- Preliminary Assessment: 5/1/79
- Site Inspection: 4/1/79 - 8/1/82
- National Priorities List
  –proposed date: 10/1/81
  –final date: 9/1/83
  —site rank: #223 out of 770
- RIFS start and completion: 12/31/84 - 6/30/87 (ROD says it began in 11/86, but SCAP has earlier date)
- Public comment period before Record of Decision: 7/6/87 - 8/14/87
- Signing of ROD: 9/23/87
- Estimated complete remediation: 28 to 32 months after ROD (around 4/90)

Totai time.—II years

Briaf description of site.—“The site consists of this 2.2-acre property and the portion of the Elizabeth River adjacent to the property, . . . the water table aquifer at the site [is] saline and tidally influenced. The site is flat and barely above sea level. Chemical Control Corp. operated from 1970 until 1978 hauling, treating, and disposing of a wide variety of industrial wastes. Throughout its operations, it was cited for violations thet included discharging liquids onto the ground adjacent to the Elizabeth River and accumulating thousands of drums of incompatible wastes.”

Major contamination/environmontai tlnat.–” . . . soils beneath those removed by the NJDEP [New Jersey Department of Environmental Protection] are highly contaminated with a variety of organic compounds and to a lesser degree with metals. . . . these contaminants are strongly adsorbed to the soil and are present in the groundwater in relatively low concentrations. The contaminants found in the [river] sediments ., . are not all attributed to the Chemical Control site.” The contaminated layer “averages approximately ten feet thick. . . . some of the more mobile chemicals continue to leach into the groundwater. Significant health threats are posed by direct contact, fugitive dust emission, and volatilization. Contaminants are only leaving the site via the groundwater. . . . direct contact with sediments as well as ingestion of contaminated shellfish are both potential exposure routes. Flooding happens occasionally at the site now . . . “ The ROD indicated a volume of contaminated material of 18,000 cubic yards.

HRS scores.—groundwater O; surface water 18.18; air 79.49; total 47.13

Removai actions.—State removal of large quantities of wastes began in March 1979 and was interrupted by a major fire in April 1980. After the fire, the State removed more material, including 3 feet of surface soil which was replaced with gravel. Also, from November 1980 until July 1981, the State operated a groundwater recovery and treatment system. This action plus groundwater movement and not just the adsorption of contaminants to soil may explain why the subsequent Remedial Investigation found little contamination and why the HRS groundwater score in 1982 was zero. Overall, the State of New Jersey has spent $25 million on the site.

After the site became a Superfund site, four additional initial remedial measures were carried out (in 1984, 1985, 1986, and 1987) to remove more materials from the site.

Cieanup remedy selected.—Other than containment, treatment alternatives considered were soil washing, solvent extraction, and incineration, The selected remedy was in situ fixation (chemical fixation, stabilization, and solidification often are used to describe similar treatments). Fixation chemicals would be injected though an expandable bit drill which would pass through the gravel layer: “A series of overlapping columns would be formed converting all of the contaminated soil at the site into a solid mass. This would inhibit water from flowing through the site, thereby preventing the production of leachate. In addition, some contaminants may be chemically altered and incorporated in the solid matrix formed by this action, reducing the toxicity as well as the mobility of the contaminants. The potential for exposing the contaminated soil would be eliminated. The treatment] will create a solid matrix that will have extremely low permeability. . . . because it is implemented primarily below ground, [the treatment] offers protection against releases during a flood. ”

The estimated cost for the selected remedy is $7.4 million, while the cost for excavation, onsite treatment, and onsite disposal of residues is $14.5 million for fixation and soil washing and $22.3 million for incineration. The ROD also commits to some other relatively minor removal actions and environmental monitoring, “including an evaluation after five years to assess its protectiveness to public health and the environment. ”

Satisfaction **of SARA statutory requirements.**

1) Selection of permanent clean up.—’’The remedial alternative presented in this document is a permanent solution for closure of the Chemical Control site. . . . this remedy satisfies the preference for treatment that reduces toxicity, mobility, or volume as a principal element. . . . this remedy utilizes permanent solutions and alternate treatment technologies to the maximum extent practicable. Based on the input received during the public comment period, this alternative has been selected by the EPA and the NJDEP as the final permanent solution for the site. [The selected remedy] also utilizes an alternative treatment technology that offers a more cost-effective remedy. ”

The fact that the ROD met SARA’s requirement for a five-year review indicates that EPA recognizes that the selected remedy would leave untreated, undestroyed, and toxic wastes onsite. EPA normally responds to the statutory requirement for review for land disposal/containment remedies and when only partial destruction treatment technologies are used at a site. The review has implications for future land use because use of the land might interfere with reviews and because results of reviews might reveal hazards that would block land use.

A major issue with the selected remedy of in situ fixation is that it is not a proven technology; no data exist to show effectiveness for cleanup of a hazardous **waste site** comparable to Chemical Control. No treatability study was conducted prior to the ROD to provide evidence of effectiveness in terms of resistance to long-term leaching or actual toxicity reduction. The diverse set of contaminants at the site would pose a challenge to conventional chemical fixation techniques. The use of ***in situ*** fixation beneath the water table in saline conditions may exacerbate the difficulty of achieving an effective cleanup. Various ROD statements on this issue include:

- “Although in-situ fixation is not yet a standard construction practice, several vendors are available that provide this service. ”
- [64] .*, the in-situ process described in this document is currently being studied for use at other hazardous waste sites. ”
- “The long-term reliability of this alternative is especially ***promising”*** (emphasis added).
- “A treatability study and field test will be required during design to prove the technology . . . “
- [64] environmental samples will be collected **to** monitor the effectiveness of the remedy.” (No specific technical criteria are given.)
- “Although such an application of this technology is fairly new, promising results have been obtained in laboratory tests, and it is being tested **at** other hazardous waste sites and evaluated under the Superfund Innovative Technology Evaluation program. The Chemical Control project will benefit from the experience gained at these sites.”

Despite the last comment, OTA has been only able to identify the evaluation within the SITE program. A vendor in conjunction with General Electric has demonstrated its technology at a GE site in Hialeah, Florida, in April 1988. PCB contaminated soil was treated. A demonstration report is supposed to be available approximately four to six months after the demonstration. OTA contacted the vendor of the in situ chemical fixation technology for the GE site and was told that no tests have been conducted on materials from Chemical Control but preliminary laboratory tests have been successful on material from the Hialeah site. GE will be using the technology to actually clean up the Hialeah site; the cleanup will constitute the SITE demonstration. GE plans to do this cleanup even though EPA has not officially sanctioned its use at Hialeah; the agency has problems in issuing regulatory permits for an innovative treatment technology, necessary because the cleanup is not at a Superfund site. Given the timing of the Hialeah demonstration, it is difficult to understand how the selected remedy can be already judged to satisfy requirements for Chemical Control. Officially, there are no performance criteria to prove the effectiveness of the technology. Moreover, one of the objectives for the SITE demonstration is to determine the "integrity of the solidified soil over a period of five years." (U.S. Environmental Protection Agency, "Superfund Innovative Technology Evaluation (SITE) Program," HWERL Symposium, May 9-11, 1988.)

But when will the technology be completely evaluated? Some innovative technologies have been demonstrated several times and still have uncertainties for broad use. The information available on the SITE demonstration is inconsistent with the schedule for implementation of the selected remedy given in the Chemical Control ROD and seasonal constraints may also delay cleanup.

Moreover, the SITE demonstration will not be performed on a comparable contaminated material. The presence of volatile organics and metals, for example, makes the Chemical Control project significantly different. A positive SITE demonstration result will not, therefore, substitute for a treatability study on Chemical Control material nor should it justify performing a pilot study at Chemical Control.

The EPA decision to use incineration at the Southern Crop Services site in Florida at about the same time of the Chemical Control decision undercuts the use of stabilization for Chemical Control. In justifying its selection of incineration, EPA said: "Solidification and fixation of pesticide contaminated soil was found to be technically unacceptable due to the high detected concentrations and because organic pesticides tend to leach from solidified material. This technology was deemed unacceptable." (U.S. Environmental Protection Agency, Region 4, memorandum, Sept. 8, 1987.) Pesticides are among the many different types of organic contaminants present at Chemical Control. The FS for the Re-Solve site in Massachusetts rejected stabilization because "there has been limited success in chemically fixing organic contaminants such as solvents and PCBS. "

The ROD for the Liquid Disposal site in Michigan, which also selected stabilization for soil contaminated with organic chemicals, said that the hazardous substances "will not be permanently destroyed" and "hazardous chemicals still remain in that [treated] mass. " And the FS for the site said: "Considerable research data exists demonstrating the effectiveness of this technology in immobilizing a wide range of contaminants, primarily inorganic. A substantial amount of data does not exist, however, to accurately judge the long-term reliability of the process." Of particular significance to the use of stabilization at Chemical Control, the Liquid Disposal ROD also selected a slurry wall and impermeable cap around and over the treated material, in part because it is necessary to ***"protect the solidified soil/waste from degradation by upgradient ground water that is slightly contaminated with chemicals"*** (emphasis added).

A recent EPA study found "large losses of organics during the [stabilization] mixing process." (L. Weitzman et al., "Evaluation of Solidification/Stabilization As A Best Demonstrated Available Technology," paper presented at EPA's ***Fourteenth Annual Research Symposium,*** May 1988.) Another EPA study showed that stabilization was not competitive with thermal and chemical treatment technologies and soil washing for organic contamination. (R.C. Thurnau and M.P. Esposito, "TCLP As A Measure of Treatment Effectiveness: Results of TCLP Work Completed on Different Treatment Technologies for CERCLA Soils," paper presented at EPA's ***Fourteenth Annual Research Symposium,*** May ***1988.)*** A demonstration of a stabilization technology under EPA auspices concluded that "for the organics, the leachate concentrations were approximately equal for the treated and untreated soils." (P.R. de Percin and S. Sawyer, "SITE Demonstration of Hazcon Solidification/Stabilization Process," paper presented at EPA's ***Fourteenth Annual Research Symposium,*** May ***1988.)***

Senior EPA people have made an important observation about in situ stabilization:" . . . the decision to use a stabilization technique should be made only after the chemical and physical properties of the solidified waste have been extensively tested to insure that the required properties have been developed. " (D.E. Sanning and R.F. Lewis, "U.S. EPA Research on In-Situ Treatment Technology," ***Anatomy of Superfund,*** proceedings of the 8th National Ground Water Quality Symposium, September 1986.) The ROD for Chemical Control does not meet these requirements.

An educational short course and two recent EPA documents on cleanup technologies make no reference to the selected technology. (U.S. Environmental Protection Agency, "Remedial Engineering of Hazardous Waste Sites," The National Hazardous Materials Training Center, October 1987; "A Compendium of Technologies Used in the Treatment of Hazardous Waste," September 1987; "RCRA/CERCLA Treatment Alternatives for Hazardous Wastes," October 1987.) The latter EPA document is used to teach people implementing hazardous waste programs about waste treatment and says: "Solidification technologies are designed to be used for final waste treatment. This means the technology should be applied only after other treatment techniques have been applied, i.e., incineration, chemical treatment or other."

Another observer has commented on this approach: "Experimental studies have been conducted in the field. The level of treatment achievable is variable, depending on the waste and soil conditions. The potential for long-term immobilization is unknown at this time. The reliability of the treatment is unknown since there is no information on its long-term effectiveness." (R. Sims et al., "Contaminated Surface Soils In-Place Treatment Techniques," Noyes Publishers, 1986.)

The Feasibility Study for the Crystal City site rejected in situ chemical stabilization: "Immobilization, chemical treatment, and physical treatments have not been shown to be feasible for in situ treatment of these contaminants as it is not possible to get a good, uniform, well distributed treatment." The focused FS for the Conservation Chemical Co. site in Missouri rejected in situ stabilization: "Technology [was] attempted and [was] found not feasible at other similar sites. Technology is not sufficiently developed." An addendum study also rejected in situ immobilization (which cannot be differentiated from stabilization): "Technology would not effect organic and other non-metallic contamination; thus, these substances would continue to be a source of contamination. Immobilization reactions are reversible." The FS for the Pristine site in Ohio rejected in situ chemical detoxification: "Treatability study is required to assure effectiveness. It is difficult to ensure proper reactant mixing and verify effectiveness."

The same contractor that prepared the Chemical Control FS has tested in situ chemical stabilization elsewhere. ("Feasibility Study Saltville Waste Disposal Site, Smyth County, Virginia," August 1986.) Successful laboratory and pilot tests led to the fieldtesting of a particular in situ treatment; however, the fieldtests failed and the approach was dropped. This twist illustrates the uncertainty of a technology, even after successful laboratory tests.

The ROD said that the selected remedy "offers a level of long-term protection comparable to or exceeding that of any of the other alternatives." However, if the selected remedy has not been shown to destroy the organic contaminants the way incineration could, is this assertion of ***comparable*** permanence correct? Incineration followed by chemical fixation of the residue to immobilize toxic metals offers a higher level of protection. Therefore, the additional estimated cost for the incineration option (three times more than fixation) does not eliminate its cost-effectiveness. Also, the cost estimate for the selected remedy is unreliable because the technology has not been used before on such a site.

This ROD illustrated the benefit of examining the supporting Feasibility Study. In this case, the FS introduced several new elements:

1. The ROD did not reveal several facts about the site and the selected remedy that ***were*** in the FS: a) the curing time for the fixation material is about one month; b) there is a volumetric increase in the waste after treatment that depends on site materials and conditions; c) "It is unlikely that solidification can be effected in contaminated areas at the interface between the river and the site. This residual contamination will continue to flush from such areas surrounding the solidified mass"; d) "This alternative will not reduce any potential human health or environmental impacts associated with the contamination detected in the gravel cover atop the site"; e) " . . . even under nonflood conditions, the water table is quite close to the surface of the site"; and f) The estimated costs for the bench test and pilot test for the in situ fixation alternative are $770,000.

z. The FS analysis of the selected remedy suggested that there is reliable information on which to base conclusions. The text contained phrases such as: "has been demonstrated," "the available literature, " and "it is reported," suggesting that technical literature and EPA reports were used. But, all the information came from a single vendor (identified in figure 3-6 in the FS). The FS also referred to the GE Hialeah site as a Superfund site, which it is not, and the FS said (in June 1987) that "a field application of the emerging technology is presently underway, " which it was not.

3. The FS analysis of incineration is poor. The unit cost for incineration only (with other costs figured separately) was $750 per cubic yard for the combination of onsite incineration and offsite disposal (where a baseline of 21,000 cubic yards of soil was used) and $00 per cubic yard for the combination of onsite incineration and onsite disposal (where a baseline of 27,000 cubic yards of soil was used). These differences in unit cost and soil volume do not make sense. Other vendors are now quoting less than $3OO per cubic yard for the volume of work at this site and, indeed, $3OO per cubic yard was quoted in the FS for the Davis Liquid Waste site in Rhode Island (where onsite incineration was selected) and $186 per cubic yard was quoted in the FS for the Seymour Recycling site. The Chemical Control FS also stated that "Rotary kiln and fluidized bed incinerators are the only types of mobile units currently available." This statement is not true. According to EPA, there are three other types of full-scale mobile thermal technologies available: circulating bed, infrared, and wet air. (U.S. Environmental Protection Agency, "RCRA/CERCLA Treatment Alternatives for Hazardous Wastes," October 1987.) If $300 per cubic yard were used (with other costs factored in separately) for onsite mobile incineration of 18,000 cubic yards (the same amount of material as for the selected remedy), then the cost would be about $14 million. This cost compares to the ROD cost for onsite incineration with onsite disposal for 27,000 cubic yards at $22 million. The ROD omitted FS low and high cost estimates for the options. Since there is no field experience within situ fixation, its high cost estimate of $14 million is significant as an estimate. Thus it is possible that incineration at $14 million might be about the same cost as the selected remedy and not three times more. More recently, after the ROD, a news story reported that the cleanup project's estimated cost is $10 million, with $750,000 ah located for the one-year design job, an amount which could not account for the cost of the treatability study. ***(Superfund,*** Feb. 1, 1988.)

4. The analytical framework used to evaluate alternative cleanup approaches is inconsistent with commonly accepted practice and with EPA's recommendations. A July 1987 EPA directive clearly recommended the use of nine criteria; an earlier directive was less clear. Only four criteria were used in this FS: technical fea-

sibility, public health and environmental concerns, institutional considerations, and cost. However, analysis using additional criteria, particularly factors such as reliability and implementability which are normally stressed, would have worked against the selected remedy. (Indeed, this analytical result happened in the ROD for the Conservation Chemical Co. site in Missouri, in which the only soil treatment alternative faired poorly on reliability and implementability and thus was rejected.) The Chemical Control ROD evaluated each cleanup alternative separately. An explicit comparison of alternatives weighing relative advantages and disadvantages was not done in the FS or the ROD. (At Conservation Chemical, the ROD comparative analysis of cleanup alternatives was done within individual discussions of evaluation criteria, a very useful approach compared to discussing each alternative for all criteria.)

To sum up, an analysis of the FS **shows that there was little basis to select the in situ chemical fixation alternative and that the FS analysis was biased in favor of the selected remedy and against using onsite incineration. Onsite incineration is a proven, more cost-effective, and more reliable cleanup alternative than the** FS **and ROD indicated.**

2) Accurate assessment of land disposal and containment alternatives.—To a significant extent, the selected remedy ***is*** a land disposal/containment approach because, unless shown otherwise with positive test results, chemical fixation cannot be assumed to detoxify all contaminants. Leaving the contaminated soil onsite and beneath the water table raises questions about future failure. No technical criteria were established to determine failure of the selected remedy. Failure is a real possibility, since the same generic treatment failed at the Conservation Chemical Co. site. A volume increase in the treated waste with the addition of fixation chemicals raises questions about the integrity of the resulting solidified mass within the site with in situ use. Costs were not estimated to repair a failure of the selected remedy.

A traditional containment wall was examined, but the ROD said that a containment wall might need replacement in the future. But the ROD noted that a wall "would offer effective protection if institutional controls were imposed to prohibit any future digging at the site."

Interestingly, in the Chemical Control situation, a containment approach might have made sense—as an interim measure—because there are many other sources of river contamination around the site that could reduce the effectiveness of a remedy that leaves site material vulnerable to recontamination. The ROD noted the risk of recontaminating clean material backfilled into the site. Contaminants from the river might also affect the effectiveness of chemical stabilization.

RIFS contractor.—State-led; NUS Corp. under subcontract to Ebasco Services, Inc.; about $1 million obligated. SCAP indicated a RIFS from 9/28/83 - 2/15/85 at a cost of $208,000, a subsequent ROD on 2/15/85, a Remedial Design at $504,000, and a Remedial Action at $485,000. There was no information in the 1987 ROD's site history on the earlier RIFS, ROD, and remedial action, and SCAP listed separately the interim remedial measures and removal actions with their costs. To confuse things still more, a master EPA list of all Superfund RODS showed an earlier ROD on 9/19/83.

State **concurrence.—**New Jersey agreed with the selected remedy.

Community acceptance.—The ROD said: "The main concern of local officials is that a thorough, permanent remedy be expeditiously implemented." The responsiveness summary also indicated some public concern about the effectiveness of the selected remedy, particularly because of its inattention to toxic metals.

Special comments.—The ROD did not address the problem of highly contaminated river residues. The chief reason is the other sources of contamination: " . . . remediation of the river sediments is premature. " If the river residues are considered part of the Chemical control site, then this ROD does not offer a final permanent cleanup of the entire site.

Why did the State leave the contaminated soil in place in a previous site action and cover it up with permeable gravel? This action complicates a permanent remedy and will contribute to continued leaching of contaminants into the river and its sediments for about 10 years. Even though EPA said that the contaminants adhere to the soil, not ***all*** the contaminants could behave so ideally nor, as discussed in the FS, will all contaminants be treated to reduce their mobility. The ROD gave no data to support the contention that all the contaminants are tightly bound to the soil. The ROD noted: "The NJDEP has also indicated that contaminant concentrations in the soil at Chemical Control exceed State guidelines." It is not clear why an interim containment action at the site, such as a slurry wall and cap, was not implemented years ago.

Other innovative in situ treatment technologies—including biological treatment and vitrification—could have been considered in treatability studies as viable candidates, but were not. The FS rejected in situ vitrification (ISV) on grounds that also could have been used to reject the selected remedy. Yet ISV was selected for the Pristine site, and the Crystal City FS evaluated ISV favorably, although it did not select ISV or any treatment alternative: "[ISV] has been successfully demonstrated in laboratory and bench testing. IISV] was determined to be feasible given the existing information available and is retained for further evaluation. " A recent NJDEP report's discussion on innovative/alternative technologies said: "various technologies presently exist which can adequately address contaminated soil and other contaminated media. For example, waste vitrification (imbedding waste in glass) can immobilize organic or inorganic contaminants while generating residuals that are delistable and environmentally safe." Moreover, the NJDEP report also noted that treatability studies are done during the RIFS to "fill data gaps . . . and supply information needed to select a design alternative." (New Jersey Department of Environmental Protection, "Comprehensive Management PIan 1988-1992," October 1987.) The point here is not whether ISV is the best cleanup technology for the site but that a case could have been made to ***evaluate*** it as the ROD did for in situ stabilization.

The ROD had no summary of the administrative record which, because of the inconsistent information on dates, would have been very useful.

General collusions.–EPA's high confidence and certainty about the selected remedy is unsupported by analysis. In this case as in several other case studies, the ROD did not follow EPA's guidance that ROD analysis "must be based on a specific process within [a] technology category . . . to ground the analysis in hard data." (U.S. Environmental Protection Agency, "Interim Guidance on Superfund Selection of Remedy," Dec. 24, 1986.) The ROD package contained a letter of August 31, 1987, in which EPA told the City of Elizabeth's Director of Health, Welfare and Housing:" . . . we feel that in-situ fixation will protect public health and the environment from any hazards posed by the site." As with the statements in the ROD about the selection being permanent, the statement in the letter was inconsistent with the need to prove the effectiveness of the remedy, through a treatability study, after it was selected but before it is fully applied. In the same letter to the city official, EPA said: "In the event that these tests show that in-situ fixation would fail to offer protection of public health and the environment, the ROD would be amended as necessary. " Examining alternatives, selecting another remedy, amending the ROD, and implementing another remedy would, of course, take considerable time. Indeed, this scenario has happened at other Superfund sites, including the Re-Solve site in Massachusetts, the Conservation Chemical Co. site in Missouri, and at Love Canal in New York.

A systematic bias against incineration was suggested in the site FS evaluation, particularly for cost. Use of mobile incineration might not cost significantly more than the selected remedy, but it would offer more certain effectiveness.

The Chemical Control site illustrates the problem of delaying a treatability study until the design phase. While chemical fixation is consid-