

PICKING UP THE PIECES: THE AQUA-TECH/GROCE LABORATORIES CLEANUP

William A. Stephens, P.E.
Presentation Author

Paul A. Furtick
Co-Author

David M. Comen
Co-Author

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ABSTRACT

Until August of 1991, Aqua-Tech Environmental, of South Carolina, Inc. operated the Groce Laboratories facility near Spartanburg, South Carolina as a commercial waste treatment and recycling facility under RCRA interim status authorization.

In May 1991, Aqua-Tech began notifying generators that they should consider retrieving their wastes because of anticipated financial inability to continue operation. In August 1991, the South Carolina Department of Health and Environmental Control (SC DHEC) took control of the site, declaring that it "posed an imminent hazard to public health and the environment."

When SC DHEC took control of the site, they found that the \$178,000 included in the closure trust fund for the site would be a "drop in the bucket" compared to the actual cost to deal with the nearly 6,000 drums, 100 tanks, and 1,300 compressed gas cylinders accumulated on the site.

In February 1992, 108 "potentially responsible parties" selected RMT to act as Removal Action Manager and Agent for the PRP Group. Laidlaw Environmental Services was selected as the Removal Action Contractor. RMT and Laidlaw started work on the Removal Action on May 4, 1992.

The largest challenge posed in the Removal Action was the identification and characterization of the thousands of hazardous and ultra-hazardous items.

When the Team took control of the site, they tackled a large warehouse jammed full of lab packs. It took nearly a year for Laidlaw's Lab Pack Team to sort through and repack 1,350 of the lab packs. Only 70 percent of the laboratory packing slips were available for identification.

These were found in the records or in the lab packs themselves.

Thirteen hundred compressed gas cylinders containing materials like phosgene, arsine, phosphine, fluorine, and hydrogen bromide comprised the toughest material category, and perhaps the most imminent threat to health. Many of the cylinders were badly deteriorated, had damaged valves, and were either unlabeled or had conflicting markings.

Shortly after beginning the Removal Action in May of 1992, RMT and Laidlaw selected Earth Resources Corporation (ERC) to address the removal of the cylinders. Over the next ten months, ERC analyzed the contents of each cylinder and treated cylinder contents using carbon adsorption. Molecular sieves, scrubbers, and thermal destruction equipment, was connected as needed for each cylinder. ERC's equipment protected site personnel from injury in two explosions that occurred during the project.

Blasting caps, dynamite, picric acid, hydrazines, crystallized ether, and numerous other explosives and shock-sensitive materials were found by Laidlaw during the Removal Action. In April 1993, Code Environmental Services was brought in to deal with the shock-sensitive and explosive materials. Code chemically deactivated most of the materials, and the rest were safely destroyed in controlled detonations.

More than one-third of the drums of bulk waste on-site contained high-strength cyanide wastes. The Team completed the removal of 1,400 drums of cyanide waste during the first five months of the Removal Action.

Nearly 100 tanks, ranging in size from 500 to 20,000 gallons, had been used by Aqua-Tech to store or treat wastes in the fuels blending, solvent recycling, or treatment

operations. Laidlaw sampled and arranged for disposal of over 100,000 gallons of various hazardous wastes stored in the tanks then decontaminated, and either salvaged or disposed of all tanks.

When the last container of waste leaves the site, only a handful of structures will remain. Most of the 20-acre site was underlain by municipal solid waste landfill. The US EPA is now considering whether to propose the site for the National Priorities List. As part of the final stages of the Removal Action Project, RMT is conducting a soil sampling program. Remediation of soil and groundwater is an issue that remains to be addressed.

This article discusses the removal action at Aqua-Tech in detail, RMT's role as Removal Action Manager, and the lessons learned as a result of this herculean effort. Included are descriptions of the waste quantity and type, the various hurdles encountered, the project performance, and the end results of the activity.

THE SITE

While being named a "Potentially Responsible Party" (PRP) for a CERCLA site is never a positive experience, an environmental manager's worst nightmare begins with receiving a PRP notification letter for cleanup of a commercial hazardous waste treatment, recycling, or disposal facility (TSD).

The PRP paid once for proper management of hazardous waste at a permitted, government-regulated commercial hazardous waste facility. Now, asked to pay again, the costs would be several times the first due to US EPA procedures for CERCLA cleanups.

Many companies and PRP Groups, particularly those who have attempted to interface directly with contractors to complete a removal or remedial action, express concern over management of cleanup work. With millions of dollars at stake for many remedial actions, companies fear they lack control over quality and spending. Too often in the past, remedial work has been initiated with vague goals, removing the hazard without sufficiently understanding the owners' expectations and standards.

The Aqua-Tech Environmental, Inc. Site, also known as the Aqua-Tech/Groce Labs Site, is a former hazardous waste treatment and recycling facility. In 1980, Groce Laboratories, Inc., acquired RCRA interim status with one of the most extensive Part A Permit applications on file anywhere in the United States. The site operated commercially under RCRA interim status authorization, never receiving its Part B Permit. In April 1987, the operation was sold to Aqua-Tech Environmental of South Carolina, Inc. Aerial photographs show that Aqua-Tech began to accumulate a large volume of untreated wastes in

1990 and 1991. In May 1991, Aqua-Tech began notifying generators that had sent wastes to the site that they should consider retrieving the wastes because Aqua-Tech anticipated that it would soon be financially unable to continue operations.

In August 1991, the South Carolina Department of Health and Environmental Control (SC DHEC) had revoked Aqua-Tech's interim status and took control of the site, declaring that it posed an imminent hazard to public health and the environment. They found that the \$178,000 included in the closure trust fund for the site was insufficient to cover the cost of removing the materials accumulated on-site.

US EPA's Emergency Removal and Response Branch assumed control of the site in January 1992 and began to contact Potentially Responsible Parties to determine whether a privately funded cleanup could be negotiated. Managers of 108 organizations received PRP notification letters for the Site. The PRPs quickly organized into a functioning group and began to solicit proposals from consulting and remediation firms to conduct the Removal Action required by the US EPA. RMT was selected as Removal Action Manager and Agent for the Group, and Laidlaw Environmental Services (FS), Inc. was selected as the Removal Action Contractor.

THE REMOVAL ACTION

Information supplied by the US EPA and SC DHEC indicated that approximately 5,700 drums of hazardous wastes and laboratory chemicals, 600 cylinders of compressed gas, and 100 tanks containing hazardous wastes and treatment residuals were located at the site. Aqua-tech operations owners had a reputation for managing hazardous wastes that other RCRA facilities would not accept, including military ordinance, water-reactive and air-reactive wastes, shock-sensitive chemicals, and highly poisonous gasses.

One-third of the materials sent to the site came from the U.S. Military and defense contractors. Aqua-Tech had openly solicited ultra-hazardous wastes and munitions from all segments of society. Laboratory chemicals sent by medical institutions, research facilities, colleges, high schools, and a variety of other sources comprised the nearly 1,300 laboratory packs which contained over 100,000 individual items. Some of the items were extremely sensitive to heat and shock, and many incompatible materials were found packaged together.

Former site operators had, reportedly, requested access to the records be restricted, since some of the nearly 100 file drawers contained proprietary information. SC DHEC and US EPA representatives had provided a copy of Aqua-Tech's electronic inventory, but the Agencies believed that the data

would be of questionable value and, in fact, highly inaccurate. RMT hired a former employee of Aqua-Tech to assist in using the database and advise the Removal Action Team on the content and value of the paper records.

Proper identification and characterization of thousands of hazardous and ultra-hazardous items was the single biggest challenge posed in the Removal Action.

By mid-June, the Team was making daily use of the electronic files and paper records to establish priorities, update health and safety plans, coordinate with local emergency responders, and extract generator-assigned waste codes for the manifestation of hazardous wastes to off-site commercial treatment and disposal facilities.

Every container on-site was sampled. Fingerprint and hazard category analyses were performed at Laidlaw's on-site laboratory while commercial waste companies did extensive sampling and analytical work both on-site and at their own facilities to assure proper waste characterization.

As US EPA and SC DHEC had suggested, the records were not 100 percent accurate. RMT and Laidlaw found that in the instances the information did not match the physical appearance or chemical composition of fingerprint analyses, the differences were often dramatic, indicating that either the container was mislabeled or the record was in error. All information and discrepancies were recorded in a database that is now used both for proper waste identification and for cost allocation purposes.

When RMT and Laidlaw took over the Removal Action from the US EPA, the Agency concern over cylinder and lab packs was high. The whole thrust of any Removal Action Program is the quick and safe removal of the source that is posing a threat.

The Removal Action Team and the PRPs agreed from the start that the health and safety of the workers, the neighbors, and the community were the first and essential priority, and that no other consideration -- including cost, schedule, or technical resources required -- would be allowed to change that priority.

Cylinder Challenge

Thirteen hundred compressed gas cylinders containing materials like phosgene, arsine, phosphene, fluorine, and hydrogen bromide comprised the toughest material category, and perhaps the most imminent threat to health. Many of the cylinders had damaged valves, were deteriorated, and were either unlabeled or had conflicting markings.

Shortly after beginning the Removal Action in May of 1992, RMT and Laidlaw selected a cylinder specialist, Earth Resources Corporation (ERC), to deal with all of the

cylinders. ERC immediately began with an inspection and inventory. By early June, the Team had a plan for cylinder handling, sampling, and treatment. Over the next 10 months, ERC kept a steady pace, analyzing the contents of each cylinder using on-site gas chromatography/mass spectrometry (GC/MS).

ERC's equipment was designed to contain small to moderate explosions. Treatment trains using carbon adsorption, molecular sieves, scrubbers, and thermal destruction were connected as needed to treat the contents of each cylinder after laboratory analysis. Use of ERC's equipment protected site personnel from injury in two serious reactions during the treatment process. Tensions were heightened when one of the PRPs notified RMT partway through the cylinder work that three people had been killed at another site handling a cylinder similar to the 50 they had sent to the site. Aqua-Tech records showed some of these cylinders still remained on-site.

Shock-Sensitive Materials

Shock-sensitive items were dispersed throughout the lab pack containers and were found in numerous drums of bulk wastes. During the period Aqua-Tech had operated the site, there was a serious incident in which two barrels of explosive waste detonated during repackaging, seriously injuring two workers. Blasting caps, dynamite, picric acid, hydrazines, crystallized ether, and numerous other explosives and shock-sensitive materials were found by Laidlaw during the Removal Action. In April of 1993, Code Environmental Services was brought in to deal with the shock-sensitive and explosive materials on the site. Code staff used their extensive knowledge of waste chemistry to chemically deactivate most of the materials, and the rest were safely destroyed in controlled detonations.

Cyanide Disposal

Over one-third of the drums of bulk wastes on-site contained high-strength cyanide wastes. After the initial inventory early in the project, the Team segregated the cyanides from the acids to avoid a release of cyanide gas that might be caused by accidental commingling. The Team made cyanide waste removal a high priority, reaching a pace of several truckloads per week shipped off-site for disposal in June of 1992, completing the removal of cyanide waste in the third quarter of 1992. CyanoKEM of Detroit provided an on-site technical representative to assist with sampling, fingerprinting, and manifesting the cyanide waste. Their "one price fits all" approach to the cyanide waste saved over \$300,000 on disposal fees compared to the best prices currently in effect for similar waste being disposed.

Several other commercial waste companies, including ENSCO, ThermalKEM, Battery Disposal Technologies (BDT), Heritage Environmental Services, and Laidlaw's TSD Facilities were instrumental in securing highly

competitive pricing and disposal "acceptance windows" for the large quantities of wastes.

Storage And Processing Tanks

Operations at the site included nearly 100 tanks ranging in size from 500 to 20,000 gallons. Some tanks stored a variety of wastes, while others functioned in the fuels blending, solvent recycling, or treatment operations. Laidlaw sampled and arranged for the disposal of over 100,000 gallons of various hazardous wastes stored in the tanks, and carried out the decontamination, disassembly, and salvage/disposal operations for the tanks.

Lab Packs: First And Final Frontier

When the Team mobilized to the site on May of 1992, a large open-sided warehouse was jammed full of lab packs. It took nearly a year for Laidlaw's Lab Pack Team to sort through and repack 1,350 of the lab packs. While about 70 percent of the laboratory packing slips were found in the records or in the packs themselves, 30 percent of the time there was no information available to the technicians on the contents of a lab pack before unpacking it for inventory. The lab pack technician had to sort through tens of thousands of individual containers in Level B protection (impervious suits and air tanks). Routinely encountering highly hazardous materials in unmarked and deteriorated containers, Laidlaw had to make certain that handling procedures were safe.

Laidlaw's professional lab pack technicians from the Reidsville, North Carolina facility did the "lion's share" of the work. Signal Environmental Services, a remediation firm that specializes in dealing with lab pack unknowns and other types of ultra-hazardous situations, was called in to deal with nearly 7,800 lab pack unknowns. This was the last major activity required to complete the removal of containerized materials as part of the Removal Action Project.

THE CONTRACT

In February of 1992, the PRP Group received proposals from eight Removal Action Teams. RMT was selected to act as Removal Action Manager and Agent for the PRP Group, and Laidlaw Environmental Services was selected as the Removal Action Contractor. Detailed planning documents for the Removal Action were prepared by RMT and Laidlaw in less than 30 days. RMT and Laidlaw started work on the Removal Action on May 4, 1992.

The contract negotiated between the PRP Group and RMT established criteria to judge RMT's performance throughout the project. The criteria were discussed and selected based on the aspects of the project over which RMT had control and which the PRP Group believed to be the most critical for successful completion of the project. The five criteria for evaluating performance were: cost control,

schedule control, quality, community relations, and responsiveness. The intention was for RMT to perform in an extraordinary manner such that the PRP Group's costs and/or liability was reduced.

It must be noted that management of health and safety issues was not a measurement of performance. The PRP Group and the Project Team agreed up front that health and safety matters were the first and most essential priority, and that no consideration to cost or schedule could be allowed for in decision making until health and safety needs had first been satisfied. This is not to say that dangerous tasks were not undertaken, but rather that health and safety concerns had to be addressed before considering which options were cost-effective and/or saved the most time. RMT purposefully maintained in the Project Team members a heightened awareness of the potential dangers on-site. The PRP Group agreed not to question actions which favored a conservative approach to health and safety.

The overall quality philosophy for the Aqua-Tech project has been the involvement of all participants in ensuring that project goals, requirements, and performance standards are in compliance with the expectations of both the clients and the Project Team. The Group and RMT spelled out all expectations up front and established a method of measuring RMT's performance. RMT was required to evaluate and provide documentation of its performance, and the Group's Steering Committee was required to render a sober and diligent judgement of award. Based on comments from the Group, RMT had to take action on real and perceived problems and improve performance when necessary.

THE HURDLES

Cost Control

The greatest hurdle for cost control was a lack of a thorough inventory of wastes. As it turned out, the preliminary estimates provided by the Agencies were far short, especially on the number of cylinders. When Laidlaw began to open drums for sampling, they discovered over two hundred drums that contained cylinders. The number of compressed gas containers requiring treatment rose from 600 to over 2,000, including several hundred small canisters.

RMT's Removal Action Workplan, approved by US EPA, specified a full inventory of waste materials in the first days of the PRP-led cleanup. However, the Agency was under too much pressure to show immediate action at the site, and the Group was directed to begin simultaneous action on the cylinders, drums, and lab packs without taking the time required for an inventory. Consequently, the initial weeks of the cleanup were conducted with little knowledge of the nature and quantity of the waste streams left on-site.

Schedule Control

The lack of inventory also impeded proper planning for schedule control. But the greatest hindrance to schedule control was the nature of laboratory wastes found at the site.

As Laidlaw began to inspect and unpack drummed laboratory chemicals and containers, they discovered that many lab packs contained chemicals without labels, packing slips, or identification of any kind. Over 6,600 laboratory-quantity containers lacked identification.

For disposal off-site, each unidentified waste had to be characterized to determine such potential hazards as flammability, reactivity, and corrosivity. That meant that each unidentified container had to be opened and tested individually, or mixed into batches for testing, with potentially disastrous reactions. To compound the problem, Laidlaw began to encounter and accumulate chemicals that were known or suspected to be shock-sensitive or explosive.

These wastes required treatment on-site. These two unanticipated waste removal activities were discovered well into the project schedule.

Quality

The greatest hurdle to project quality was the lack of a specific definition of the measure of quality. Quality became a catch-all term for overall satisfaction for the Group with respect to RMT's performance. Unfortunately for RMT, that overall satisfaction was also associated with such contentious issues as allocation of project costs. At times RMT was asked to render technical judgements on issues that frequently were decided in favor of the Group's interests, which inevitably led to dissatisfied parties. Rather than being a measure of managing the project to conform with expectations, quality became a measure of RMT's ability to produce information needed by the Group to raise funding and settle disagreements, a role that was not envisioned at the outset of the project.

Community Relations

Community relations at the outset of the project were disastrous. Public meetings conducted by US EPA became shouting matches as concerned neighbors demanded action and accountability from the Agencies, and special interest groups threatened organized protests to prevent the transport of wastes from Aqua-Tech to RCRA-approved disposal facilities in their communities.

The site's reputation as an ultrahazardous waste treatment center also led to potentially severe limitations on emergency response capabilities - the local fire department stated that they would not enter the site if called, and the county's emergency response personnel only allowed shipments out of the site along sparsely populated backroads to avoid schools and residential areas.

Residences adjacent to the site lived in fear of toxic releases and explosions. The public panic caused by the

Aqua-Tech site had two severe ramifications for the project: initially, wastes were not approved for shipment to a local, RCRA-permitted incinerator for fear of the public's reaction; and the US EPA and SC DHEC refused to allow shipments of compressed gas cylinders from the site for recycling or disposal elsewhere because of the potential backlash that might have resulted from a release in transit. The requirement to treat all cylinders on-site eventually increased cost to the Group by as much as \$1.5 million.

Responsiveness

Responsiveness, a measure of RMT's ability to address the Group's concerns and to keep the Agencies satisfied with cleanup activities, was also directly related to allocation and data management issues. In order to allocate costs and raise funds, one of the primary needs of the Group at first was an immediate accounting of wastes sent to the site by the 108 organizations singled out by the US EPA for cleanup liability. RMT and Laidlaw were tasked with assigning theoretical transportation and disposal costs for each generator's wastes.

To accomplish such a task in the time allowed, several simplifying assumptions had to be made regarding the costs of disposing of broad classes of similar wastes. For example, flammable liquids were given an average disposal cost based on quotes provided by several disposal facilities.

While some generators expressed dissatisfaction regarding their cost assignments, others became dissatisfied with data quality. Laidlaw was eventually able to provide inventory data for the wastes found on-site, but RMT had difficulty rectifying inventory data with database records compiled by Aqua-Tech's operators. Consequently, the reliability of RMT's database of wastes on-site information initially was poor.

Inquiries from individual organizations flooded in to RMT to determine how costs were assigned and to question waste information compiled in the database. The measure of responsiveness became a matter of RMT's ability to address generator concerns regarding the data used as the basis of cost allocation and fundraising, not our ability to meet the technical and regulatory challenges of the Removal Action.

PROJECT PERFORMANCE

Cost Control

To manage costs, RMT evaluated each defined task of the Removal Action, using such tools as cost forecasting, cost sensitivity, and Pareto charts, to determine where to focus the greatest effort at cost control. RMT found that there were four main cost items, which individually far exceeded the cost of the remaining tasks: cylinder treatment, cyanide waste disposal, waste characterization analyses, and lab pack management.

The greatest cost by far was cylinder treatment, which was approximately one-third of the overall project costs, and one-half of the task-specific costs. RMT applied the greatest scrutiny possible to invoices from the cylinder treatment contractor, Earth Resources Corporation (ERC), and communicated cost issues and concerns to ERC on a regular basis. When the cylinder inventory began to climb, RMT forced ERC to renegotiate unit charges for work in progress by threatening to bid the additional cylinders as a separate project.

An inventory of wastes on-site was critical to cost control. The US EPA eventually allowed the Project Team to conduct an inventory, as long as it was conducted simultaneously with the waste treatment and removal tasks already begun by Laidlaw. To do so, Laidlaw had to bring additional personnel to the site.

Once Laidlaw was able to complete an inventory, RMT discovered that cyanide wastes comprised approximately one-third of the drummed wastes. RMT and Laidlaw began to negotiate with the disposal facilities to obtain the most favorable pricing possible. Given the large volume requiring disposal and the high fees normally charged for cyanide treatment, qualified firms were eager to obtain the waste stream. The Project Team negotiated a turnkey price for cyanide waste that included transportation and disposal, and eliminated all surcharges. This turnkey pricing concept saved as much as \$300,000, since many of the cyanide wastes were shipped in overpacks and contained as much as 50 percent solids (e.g., bricks, boards, discarded PPE, and glass). This turnkey pricing approach was in turn achieved for many of the other large waste streams, such as flammable liquids and oxidizers. The size of the waste streams also allowed the Project Team to negotiate on-site support from several disposal facilities to collect samples, prepare waste profiles, and assist with manifesting and loading shipments.

RMT also used the inventory and database records to control costs for laboratory analyses, since the Project Team was able to satisfy sampling requirements by identifying large groups of similar wastes for composite sampling. Several thousand drums were sufficiently identified from database records and by confirmatory hazard category analyses, leaving only a few hundred drums of wastes that had to be sampled and analyzed individually.

Schedule Control

Once RMT had an inventory of waste streams, the Project Team was able to set realistic schedules and milestones. Since none of the main tasks were contingent on each other, critical path scheduling was not directly applicable for the overall project. The subcontracts negotiated by the Project Team put most contractors in either a lump sum or unit cost situation, so that schedule delays had little impact to the cost of the task.

All tasks were conducted concurrently with removal of the drummed wastes, which turned out to be the only critical path element. Therefore, RMT needed to focus the greatest attention on one area of the project to maintain control of the schedule. To do so, RMT established milestones for each waste stream and maintained daily contact with Laidlaw to ensure that the Project Team was always looking ahead to the next waste stream to avoid delays in sampling, profiling, and negotiating transportation and disposal services. The Project Team also kept the US EPA informed regarding proposed disposal outlets, so that the time required for Agency approval did not add delays.

Two tasks took much longer to complete than originally planned - cylinder treatment (because Laidlaw found over twice as many cylinders as indicated by the early estimates) and lab pack management (because Laidlaw encountered almost 8,000 unidentified containers and almost 700 potentially shock-sensitive wastes in the lab packs). However, neither task delayed the overall project endpoint. The most critical issue for the project schedule was the capacity of the disposal facilities, and the only management tool available to RMT was to make sure that Laidlaw communicated well with each disposal facility to avoid surprises.

Quality

Measured by conformance with expectations, the project was a great success. Each waste stream was successfully treated or removed as planned. RMT prioritized removal activities to deal with the most dangerous wastes first, such as Poison A compressed gasses (e.g., arsine and phosgene), high strength cyanide wastes, water-reactive and air-reactive wastes, and flammable wastes. As hazardous as most of the work was, there were no major releases and only one potentially serious injury. US EPA's On-Scene Coordinator frequently expressed his satisfaction with the progress and scope of the Removal Action.

By aggressive pursuit and use of the inventory, Aqua-Tech electronic database, and Aqua-Tech paper records, the Team was able to maintain the use of hazardous waste codes, as originally assigned by the generators, for many of the wastes found on-site. This helped to minimize the possibilities of sending wastes to disposal facilities which could not properly handle those wastes, due to either technical capabilities or to permit requirements.

The Project Team's conservative approach to managing and treating wastes minimized the Group's liability in terms of potential lawsuits from neighbors impacted by the Removal Action and from future CERCLA involvement, since RMT scrutinized the financial, regulatory, and environmental status of disposal facilities receiving wastes from the site.

RMT also maintained a high level of quality by consulting with industry experts, when appropriate, to review proposals and workplans for ultrahazardous activities, such as on-site treatment of shock-sensitive/explosive wastes and unidentified laboratory wastes. Such reviews added value for the Group and provided the Project Team with a better understanding of quality management and cost management issues for these unusual tasks.

Community Relations

RMT established a community relations plan that addressed the bad publicity problem on several levels. RMT met with neighbors to provide information about cleanup activities and listen to community concerns. RMT also conducted frequent press conferences at the site to report progress and encourage community confidence in the cleanup effort.

Each quarter, the Project Team met with representatives of the local emergency response planning group, which included the local fire department, hospital officials, law enforcement agencies, and paramedic services, to keep them informed regarding the status of the most hazardous waste streams on-site and to coordinate emergency response activities if the need ever arose. RMT also went door-to-door to inform residents when detonations of shock-sensitive wastes were scheduled to occur.

The proactive community relations plan paid off. Although Laidlaw was unable to send drummed wastes to the nearby RCRA-approved incineration facility for disposal, they were able to send almost 200,000 gallons of residuals and rinsate to that facility from the decontamination of over 100 process and storage tanks, at a savings of nearly eighty cents per gallon over the next lowest quote. The protests and negative press promised by organized community groups never occurred. Community tensions were also lowered sufficiently to allow the sale of most of the metal debris and equipment after decontamination to a local recycler rather than landfilling it.

Because the neighbors were kept informed, access was granted to sample residential well water for many of the neighbors, whereas the Agencies had been meeting resistance. The Project Team conducted the Removal Action without a single complaint from neighboring residents and businesses.

Responsiveness

The most difficult task interacting with the PRP Group on this project was to respond in a timely manner to all of the requests regarding, and exceptions to, the database records, while trying to manage the cleanup of an ultrahazardous site. RMT began the Removal Action with

little knowledge of the problems to be encountered on the site and with poor data on the scope of the project. Day by day, the Project Team began to collect and compile waste identity, hazard information, and quantity data into a master database. This database enabled RMT to make informed evaluations, recommendations, and decisions on Removal Action issues, and allowed RMT to respond to the Group's many needs for data to create preliminary and interim allocation formulas. The comprehensive yet flexible database linked Aqua-Tech records, Agency records, inventory data, and disposal information. As the project progressed, RMT was able to review records and rectify discrepancies to the satisfaction of most of the Group's member organizations.

The Project Team responded to all Agency requests in a manner that allowed the Group to establish a clear leadership role on-site, ensuring control over remedial activities. This control allowed RMT to manage the work to provide cost-effective solutions that produced permanent results and minimized or eliminated residual liability.

The Results

RMT on several occasions was required to submit documentation to the PRP Group regarding the performance criteria discussed above. The frequent self-checks and feedback from the clients resulted in positive benefits to the PRP Group, RMT and Laidlaw, the community, and the Agencies. Investment of the whole Project Team with the responsibility for project success led to several innovative and cost-effective solutions to difficult problems, and also resulted in an excellent health and safety record for the project.

THE PRP GROUP

The original PRP Group, consisting of nearly 100 organizations, is growing steadily and will likely reach several hundred. Under the leadership of two dozen PRPs -- large and small -- the Removal Action has been carried out with momentum and efficiency. Charles H. Tisdale, a Partner in the King & Spalding law firm in Atlanta, led the formation of the PRP Group and has served as its Chairman since the US EPA first indicated that it would turn to the generators to pay for the cleanup of this RCRA site. Mr. Tisdale has been supported by attorneys and managers from thirteen other PRPs on the Steering Committee, some of whom serve on the 14-member Technical Committee.

The predominant exposure for many of PRP's to the Removal Action was through allocation issues. The majority of the technical issues of the Removal Action were handled through the Steering and Technical Committees. However, there were several lessons to be reinforced or learned to help to minimize generators' future exposure in other CERCLA sites.

Auditing of TSD Facilities

Generators should have some audit mechanism in place for facilities where they send their hazardous wastes, such that they at least view a facility on a periodic basis, even if they may have little RCRA knowledge. Generators may wish to network or form coalitions to help to defray auditing expenses and pool RCRA knowledge.

Proper Completion of Hazardous Waste Manifests

Attention should be paid to various parts of the manifests, such as the quantity shown for each line item. If containers are not completely full, net container content weights are more accurate than listing the volume of the container, and may ultimately reduce liability should the TSD ever become a CERCLA site. In particular, laboratory packs should show the net contents weight, not the gross weight of the contents, containers, packing materials, and overpack. If a waste is disposed of at a per pound cost, such errors on the manifest can be very costly for the generator if those figures are used as part of an allocation base at a CERCLA site.

Proper Use of Waste Codes

Only waste codes which apply to the waste in question should be used to describe the waste. Indiscriminate use of waste codes to attempt to cover any and all possibilities can affect the cost of disposal, as well as the ability of different TSD's to accept the waste at all.

If necessary, more waste profiles could be completed for narrower ranges of waste characteristics, to avoid grouping wastes that may ultimately incur different disposal costs. While the current TSD may price material based on greater knowledge of the waste, the same waste leaving from a CERCLA site may incur a significantly higher cost of disposal on the basis of the waste codes.

The proper use of waste codes is increasingly complex, with severe consequences for under-representing waste codes for a particular waste. The Aqua-Tech Removal Action also highlighted a consequence of over-use of waste codes.

Compressed Gas Cylinders

Manufacturers of compressed gas cylinders must accept return of their cylinders from a compressed gas cylinder user. However, unless they are permitted as a RCRA facility, they cannot accept those cylinders if the cylinders have been declared a hazardous waste by the generator. Generators should first exhaust all possibilities in returning cylinders to the cylinder manufacturer before declaring cylinders hazardous waste and sending them to a RCRA facility.

If a cylinder manufacturer is no longer in business, it is possible that their operations were purchased by another

compressed gas cylinder company, to whom returns may be made.

Attempts should be made to minimize the extraneous tubing, valves, and other arrangements on lecture bottles. Although the cylinder itself may be very small, the attached material may force the use of a larger enclosure/recovery unit, at a higher cost.

Waste Minimization

It almost goes without saying that minimizing hazardous waste generation will have concurrent long term benefits of reducing ongoing liabilities at RCRA hazardous waste facilities.

While it may be cost-effective in the short term to send hazardous wastes off-site for disposal, the possibility of paying for disposal a second time may shift the outcome of a cost-benefit analysis.

Costs at many CERCLA sites are allocated on the basis of volume of hazardous materials sent to the site. Therefore, a benefit of minimizing hazardous waste generation and disposal is reducing the potential level of participation should a TSD ever become a CERCLA site.

THE FUTURE OF THE SITE

When the last container of waste left the site in fall, 1993, only a handful of structures remained. Most of the 20-acre site was underlain by municipal solid waste landfill. The landfill was placed in a former ravine, with one end of the fill stopping twenty feet short of a creek.

Four phases of groundwater monitoring during the period the site operated under RCRA showed evidence of significant groundwater contamination, but not significant contamination of the creek or sediments. Surrounding drinking water wells have also shown no evidence of contamination from the site. The US EPA is now considering whether to propose the site to the National Priorities List. As part of the final stages of the Removal Action Project, RMT has started a soil sampling program.

EPITAPH

Records show that nearly 45 million pounds of hazardous and ultra-hazardous wastes and hazardous substances were sent to this site from the fall of 1980 through the summer of 1991.

Site operation clearly accomplished the recycling or treatment of tens of millions of pounds of hazardous substances. Most are still being generated on a daily basis and are going to other treatment and recycling facilities.