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Project Summary

Centralized Treatment of Metal Finishing Wastes at a Cleveland Resource Recovery Park: Part I: Design and Costs Part II: Financing Part III: Site Investigation

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This report, in three parts, describes the characteristics of the Cleveland, OH, area electroplating operations and an approach and design for a centralized facility to treat cyanide and heavy metal wastes generated by this industry. This facility is termed the Resource Recovery Park (RRP).

Part I examines the technical feasibility of the concept, assessing the wastes of a number of platers in considerable detail and designing the treatment and recovery processes to be applied to those wastes. Part II presents the results of a marketing study intended to determine the incentives for individual plating shops to participate in the system. Part II also details the proposed management and financing plan projecting an attractive rate of return to investors. Part III describes an investigation of a particular site and the accompanying design and costs.

This Project Summary was developed by EPA's Water Engineering Research Laboratory, Cincinnati, OH, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

In 1982, when this study was made, the metal finishing industry in greater Cleveland was composed of approximately 100 plants (76 within city limits), the vast majority of which were small electroplating job shops. These shops discharged an average of 18,500 gal/day of rinsewater that contained dilute concentrations of cyanide and various heavy metals used in the electroplating process. EPA's pretreatment standards require that the discharge of these pollutants were to have been reduced by April 27, 1984. In addition to the rinsewater, electroplating shops generate spent process solutions. Although the volumes of these solutions are relatively small (typically 300 gal/wk), the concentration of heavy metals is quite significant, often exceeding 1,000 mg/L. EPA has listed spent solutions from electroplating operations as RCRA hazardous wastes.

The typical solution for compliance with electroplating pretreatment regulations is to install conventional physical/chemical treatment consisting of cyanide oxidation, hexavalent chromium reduction, metals precipitation, and

sludge dewatering. The conventional system produces a sludge that is classified by EPA as hazardous and that requires disposal in an approved landfill.

The EPA estimated capital and annual operating waste treatment costs for an average job shop complying with EPA regulations in 1984 are $87,400 and $22,400, respectively. This exceeds the monetary capabilities of many electroplating shops; in fact, EPA estimates that 20 percent of job shops will be forced to close. Industry estimates on job shop closures will be much higher.

With compliance, the disposal of treatment sludges is also a financial burden for many platers because of the high cost of disposal and a lack of approved landfills. Sludges often must be transported more than 100 miles to landfills where the charge for disposal may exceed $0.50 per gallon.

In 1977, EPA's Office of Research and Development (ORD), anticipating the potential impact to industry resulting from compliance with wastewater and solid waste regulations, began investigating alternatives to on-site waste treatment. The most promising alternative discovered to date is centralized treatment. The primary assets of this approach are economy of scale and improved waste management. When resource recovery is included in the central treatment system, not only are operating costs reduced by the value of the recovered materials, but the volume of waste treatment residuals is decreased, thereby reducing the need for hazardous waste disposal capacity. No other alternatives were considered attractive at this time.

Earlier studies have established the economic feasibility of the Centralized Waste Treatment (CWT) concept, its successful application in the Ruhr Valley in Germany, and its potential use in five, widely differing municipalities.

The focus of this three-part report is on defining the components of the planned RRP. The results of the analysis and design are presented, and a discussion of the benefits of the proposed RRP for the Cleveland metropolitan area and the participating electroplaters is developed.

Design and Costs

In January 1981, the present CWT project was initiated to develop a central treatment facility design. To gather data for the design, engineering visits were made to 30 of the major electroplating shops in the area. Estimates were then made of the waste volumes and characteristics each shop would contribute to the RRP, after application of in-plant concentrating techniques.

A study to characterize the Cleveland electroplating industry and to determine the local impact of environmental regulations determined that all of the shops would be required to meet the federal pretreatment standards and that the local publicly owned treatment works plans to enforce its own pretreatment standards. It was found that for shops discharging 10,000 gpd or more, the federal standards are the controlling limits. For shops discharging less than 10,000 gpd, however, the federal limits regulate the discharge of only cyanide, lead, and cadmium. For these shops, the local standards will be used for other metal parameters such as nickel, chromium, copper, and zinc.

The RRP treatment process design is a conventional system with ion exchange regeneration capabilities. Metal and cyanide recovery were not included in the initial design because of technical and economic considerations. A schematic of the RRP operations as they may eventually develop is given in Figure 1.

The capital and operating costs for the 76-plant design were determined. The total RRP investment cost is $1,560,000. An additional $1,240,000 would be required to purchase ion exchange modules. It was assumed that these modules would be owned by the RRP system and leased to the plating shops. Therefore, the total capital required by the 87-plant-capacity RRP is $2,800,000. The operating costs for this capacity design were calculated to be $705,000. The resulting waste treatment fee for the RRP is $0.085 per gallon of waste received or per gallon of ion exchange regeneration solution—the amount needed to regenerate receiving modules.

Financing

Part II presents the results of marketing, financial, and economic analyses of the proposed RRP. The incentives for participation, the proposed management structure, the planned sources of financing, and pro forma operating results are described.

The great majority of electroplating shops in Cleveland would find it economical to participate. All but the four to six largest shops can pretreat their wastes cheaper by joining the RRP than they could by installing in-plant treatment. Financing by a combination of private equity capital and commercial debentures is proposed, with ownership in the hands of a private corporation. The return on investment to the providers of the equity is shown to be very attractive. Proposed fees are calculated based on a criteria of complete capital recovery in 10 years at a cost of funds of 20 percent in addition to a profit of 10 percent of total annual costs (including capital recovery). On this basis, operating results are projected for 10 years showing that revenues are sufficient to achieve investment goals. Although the proposed facility would have the potential of providing additional economic benefit through recovery of resources and cogeneration of electricity and process heat, that benefit is not included in the analysis presented.

Site Location

Part III of this report presents the results of an analysis of a specific site as a potential location for the RRP. The analysis covers engineering and cost aspects as well as ownership, management, marketing, and financing concerns.

The potential site has a number of significant advantages that would increase the likelihood of a successful RRP operation. The location and size of the site and the availability of existing structures are primary assets.

The market evaluation for the specific site indicates that for 54 of the 76 Cleveland electroplating shops the facility could provide a savings when compared with on-site treatment. The proposed facility will have the potential of providing additional economic benefit through recovery of resources and cogeneration of electricity and process heat.

A combination of a loan secured from the program established by Ohio's Senate Bill 313 and the private placement of stock appears to be the preferred method of obtaining capital. The return on investment to the providers of the equity is shown to be approximately 13.1 percent.

Conclusions

For most industrial cities, major savings in total pollution control costs could be obtained if a centralized facility is established to treat the concentrated wastes of a number of manufacturers. This concept has been in practice in the

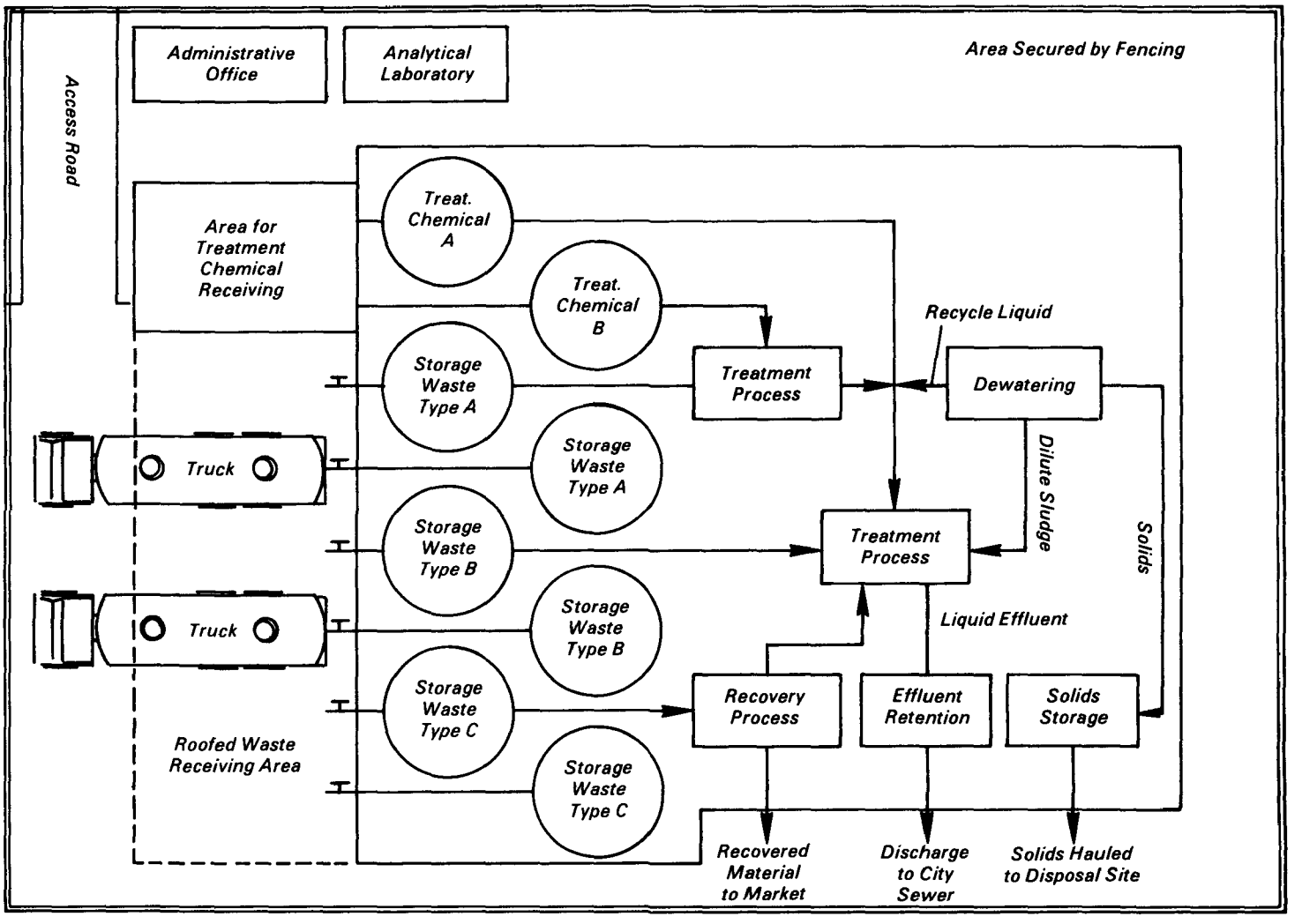

Figure 1. Central processing facility.

Ruhr Valley of Germany for over 10 years, with almost complete success. The facilities have been funded both privately and by municipalities (using their credit and capital). In all cases, they are fully supported by fees charged to those sending wastes to the facility; yet fees represent major savings to the participating industries over building individual facilities.

The concept of centralized waste treatment offers relief for only one of the problems facing most platers. The problems of replacing outdated equipment, obtaining cheaper energy, and incorporating cost-saving automation remain. The Cleveland RRP would not only provide waste treatment for all local users and those within a practical shipping range, but would offer the following additional features:

- Facilities for recovering components of wastes, where economically feasible
- Sites for relocating and modernizing facilities where the current location is limited
- Low cost steam and electricity through a central boiler-cogeneration facility
- Centralized laboratory facilities
- Distributed computing services
- A pool of credit for qualifying participants
- Centralized shipping services

Private financing of the proposed RRP is shown to be a viable and attractive venture. The steps being taken in Cleveland to achieve this goal should serve as a model for other U.S. industrial communities.

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The complete report, entitled "Centralized Treatment of Metal Finishing Wastes at a Cleveland Resource Recovery Park: Part I. Design and Costs, Part II. Financing, Part III. Site Investigation," (Order No. PB 85-217 651/AS; Cost: $23.50, subject to change) will be available only from:
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