WASTE CLEARINGHOUSES AND EXCHANGES: A SUMMARY

NEW WAYS FOR IDENTIFYING AND TRANSFERRING REUSABLE INDUSTRIAL PROCESS WASTES

This report (SW-130c.1) summarizes a final report (SW-130c), which described work performed for the Federal solid waste management program under contract no. 68-01-3241 and which is available from the National Technical Information Service as PB-261 287. The following summary is reproduced as received from the contractor.

U.S. ENVIRONMENTAL PROTECTION AGENCY

1977

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ACKNOWLEDGEMENT

We were assisted in conducting this study by many persons and organizations in Europe and the United States. They include industrial firms, industry and professional associations, and agencies of state and local governments, especially those concerned with the Philadelphia metropolitan area. Only a few could be cited in the text, but we are pleased to acknowledge the contributions of all with thanks.

CONVERSION TO METRIC UNITS

In this report, some units are expressed in U.S. customary units. Conversion to metric units is easily accomplished by using the following formulae:

Multiply *miles* by 1.6092 to get *kilometers*

Multiply *tons* by 0.9072 to get *metric tons* (10^3 kg)

Multiply *pounds* by 0.4536 to get *kilograms*

EXECUTIVE SUMMARY

MAJOR FINDINGS AND NEXT STEPS

The U.S. Environmental Protection Agency (EPA) estimated in 1976 that 344 million metric tons (wet basis) of industrial processing residues are generated annually in the United States. EPA suggests* that plant managers and engineers consider the following sequence of steps as they develop their waste management strategies:

(1) *Minimize* the quantity of waste generated by modifying the industrial process involved.

(2) *Concentrate* the waste at the source (using evaporation, precipitation, etc.) to reduce handling and transport costs.

(3) If possible, *transfer* the waste "as is", without reprocessing, to another facility that can use it as a feedstock.

(4) When a transfer "as is" is not possible, *reprocess* the waste for material recovery.

(5) When material recovery is not possible,

   (a) *Incinerate* the waste for energy recovery and for destruction of hazardous components, or,

   (b) If the waste cannot be incinerated, *detoxify and neutralize* it through chemical treatment.

(6) Use carefully controlled *land disposal* only for what remains.

EPA commissioned this one-year study both to explore the feasibility of the waste transfer concept (step 3 and to some extent step 4) and to outline the requirements for a successful waste transfer organization. The purpose of the transfer approach is to help broaden the potential markets for both new and apparently-marginal industrial residues, and thus to reduce the quantity of potentially harmful wastes which require disposal into the natural environment. Hence, established secondary materials markets were not within the scope of the study.

*_Federal Register_, Vol. 41, No. 161, pp. 35050-1.

This study began by investigating the several existing European "waste exchanges," whose purpose is to transfer *information* about wastes available and wastes sought as feedstock. It was soon discovered, however, that a few chemical reclamation companies also offer to transfer waste *materials*. This led to the distinction between two types of transfer agents, the "information clearinghouse" and the "materials exchange": the former transfers information only, while the latter accepts residues, analyzes them, identifies new uses, treats them as necessary, and then actively seeks buyers. Both types of organizations were studied.

CONCEPT OF WASTE TRANSFER

Waste transfer is both similar to and different from the purchase and re-use of industrial by-products. In both cases, an industrial process generates, in addition to its principal product, some material which is not usable by the generating company, but which can economically be sold for reuse by another company. When the material has a well recognized value which justifies the costs of recovery, handling, and transportation, it is known as a by-product. When the material has a value which has not been recognized, it is a potentially transferrable waste. So long as disposal is easy and inexpensive, disposal is the waste generator's economically preferred course. Transfer to another plant or industry is economically attractive only when disposal presents major problems, as will increasingly be the case as restrictions tighten and costs rise.

While some transfers occur directly through the initiative of either the waste's generator or its potential user, large-scale realization of the concept requires a third party or "transfer agent." This is because the possible uses are not well established, generators and potential users usually do not know about each other, and companies are reluctant to reveal information about their processes and materials. A transfer agent is therefore needed to identify generators and users to each other while at the same time protecting confidential information until a promising match is identified. Still more transfers can be made if the transfer agent is able to offer additional services, such as assistance with negotiations, consultation about uses and reprocessing requirements, or actual handling of the materials.

The term "waste" has two meanings which are related but distinct. First, it can refer to damaged, defective, or residual material resulting from an industrial process, retaining some or much of its original value; this is "scrap waste" or "scrap". Second, in everyday usage "waste" can refer to any kind of refuse, with no value, which can only be thrown away; this is "trash waste" or "trash". In common usage of "waste", confusion often arises because the distinctions between "scrap" and "trash" are not obvious to everyone. What is considered trash by one person is considered useful by another. This difference between two values seen in one waste is central to both the economic and the technical viability of waste transfer, and creates opportunities for transfer agents.

THE TRANSFER AGENT'S FUNCTIONS

Engineers routinely examine their residues to seek further uses as by-products. In recent years, stricter waste disposal regulations and the scarcity and rising prices of raw materials have made it more economically attractive for companies to research further uses for the valuable components of their wastes. Large companies with many processes and skilled chemical engineers are likely to find those recycling opportunities which exist, particularly within their own manufacturing facilities.

However, even engineers in large national companies are not likely to recognize all waste transfer opportunities outside of their own industry. Moreover, technical discoveries of new ways to find value in scrap do not occur in all companies at once. Also, medium-sized or small companies typically lack the time and skills to find reuses for their wastes.

Therefore, needs exist which a formal, institutional transfer agent can satisfy. Indeed, the difficulties which many engineers face in distinguishing between scrap wastes and trash wastes offer the opportunities for waste transfer agents to provide useful technical and economic services. The transfer agent works at the fuzzy and shifting boundary between wastes and by-products. If successful, the transfer agent will gradually identify what can be described as a "scrap chemicals market," a small but distinct market sector containing materials which are more valuable than trash but less valuable than established by-products. The transfer agent may also lift some scrap wastes with uncertain value up into the category of by-products with well recognized value.

The function of the transfer agent, therefore, is to identify and help bring together the generator, who views the waste as trash without further value, and the user, who views it as scrap with re-use value. In this process, the transfer agent identifies scrap materials of interest to both generators and users.

To be economically and technically useful, a transfer service must recognize the realistic limits of its business or functions. On the one hand, it cannot afford to accept trash wastes. On the other, it would serve no unique environmental or public purpose by trying to deal in regular flows of process by-products with recognized value which are commercially established; and the organization would not be a waste transfer service, but instead one of many competing industrial or chemical brokerages. A transfer agent can thus offer useful activities in only a narrow sector of the chemical materials market—the scrap sector.

REQUIREMENTS FOR A TRANSFER

Transfers of scrap can occur only after many conditions have been established for both generator and user. Each, depending upon his own business and perspective of what is

important, must consider the following:

- *Technical feasibility*—the matching between the chemical and physical properties of available waste streams and the specifications of raw materials they might replace.

- *Economic feasibility*—balancing of disposal costs foregone and raw materials costs saved against the administrative and transport costs of implementing a waste transfer.

- *Institutional and marketing feasibility*—values at risk, guarantees of supply, guarantees of anonymity, and mutual confidence among generator, user, and transfer agent.

- *Legal and regulatory*—potential transfer must be handled confidentially, be allowed by law, and be unlikely to lead to liability suits.

POTENTIAL OPPORTUNITIES FOR WASTE TRANSFER

Accurate information about wastes being produced by industrial processes is difficult and expensive to obtain. The first national estimate was compiled by EPA for Congress in 1973. More detailed national estimates by industry were developed in 1974-1976 by a series of 14 EPA-commissioned studies, of which 11 were reviewed for this report.[8-18]

The quantity of manufacturing processing wastes generated in those industries amounts to about 206 million metric tons/year on a wet weight basis. Those wastes having potential value for transfer and reuse total about three percent, or about six million metric tons/year (wet basis). In selected industries, however, the percentage can be much higher: up to 95 percent in pharmaceuticals (SIC 2831), at least 25 percent in organic chemicals (SIC 286), at least 10 percent in petroleum refining (SIC 2911), about 40 percent in paints and allied products (SIC 285), and as much as 20 percent in small industrial machinery (SIC 355).

Wastes generally recognized as having components of potential value include:

- wastes having high concentrations of recoverable metals
- solvents
- alkalis
- concentrated acids
- catalysts
- oils
- combustibles (for fuel)

Available data cover only about one-third of the manufacturing industries which might participate in waste transfers. But they suggest that significant fractions of wastes from other industries may have value which is not now being extracted. The easiest method for testing the hypothesis would be an inexpensive transfer service for an industrial region having many chemical plants, one or more petroleum refineries, and a mixture of other industrial plants.

All industries which manufacture chemicals or use chemicals as raw materials are potential clients of transfer agents. Potential participants in and beneficiaries of waste transfer are concentrated in five industry groups:

- Pharmaceutical (SIC 2831 and 2833)
- Paints and allied products (SIC 285)
- Organic chemicals (SIC 2865 and 2869)
- Petroleum refining (SIC 2911)
- Small industry machinery (SIC 355)

Their wastes with the highest reuse and transfer potential include solvents, still bottoms, and spent catalysts. In general, transfer will take place:

- from larger companies using continuous processes to smaller companies using batch processes;

- from basic chemical manufacturers to formulators; and,

- from industries with high purity requirements (e.g. pharmaceutical) to those with lower purity requirements (e.g. paints).

In addition, almost any industry which needs fuels or cleaning solvents, for example, machine shops and boat builders, is a potential user of scrap wastes. Moreover, reclaimers would naturally become clients of a transfer organization in order to expand their business.

Most potential clients will demand reasonably large amounts of regularly-produced scrap wastes. There is some potential for transfer of smaller amounts of wastes produced occasionally, such as spilled or ruined batches of paint or other chemicals. While many such wastes can be anticipated, their total tonnage, and hence their economic and environmental impact on the area, is not likely to be large.

The economic gains from each potential transfer depend upon the waste generator's savings on disposal costs and the user's savings on raw materials costs. The total gain must

cover such transfer costs as transportation, administration, and possibly reprocessing. Generally, scrap wastes valued at less than one cent per pound cannot be transferred economically over a distance greater than 50 miles.

A transfer organization which serves several industries has a greater chance of identifying new transfer opportunities than does one serving only one industry. Thus, while the chemical industry is expected to be the mainstay of any transfer service, participation by customers of the chemical industries should be expected and encouraged. Such customers or major users of chemicals include the textile, paper, wood products, printing, rubber and plastics, leather, ceramics, machinery, and electronics industries.

No government agency, whether federal or state or local, whether a line agency or a special-purpose authority, should try to operate or sponsor a waste transfer service directly. The potential conflicts between their promotional and regulatory roles would render the service unacceptable to its intended industrial clients, and thus largely ineffective. Nonetheless, governments retain an indirect interest because of their public health and environmental protection responsibilities. They can provide significant general support, notably by encouraging waste inventory and market research studies, offering technical assistance to organizers and sponsors of clearinghouses, encouraging generators to keep wastes separated and to analyze their characteristics, controlling disposal and thereby raising its costs, and clarifying the questions and uncertainties which now surround legal liabilities of generators and handlers of hazardous wastes.

DIFFERENT ROLES OF A CLEARINGHOUSE AND AN EXCHANGE

When generators and users cannot satisfy all requirements for a transfer by themselves, they may seek help elsewhere. Their first recourse is to informal networks of colleagues. The second is to professional societies and advertising columns of technical journals.

The third is to an information clearinghouse, which serves the limited function of linking interested trading partners. A clearinghouse transfers only information. It plays only a *passive* role in the transfer process, because it leaves generators and users to negotiate directly.

The fourth recourse is to a dealer, reclaimer, or materials exchange equipped to handle, treat, and certify the characteristics of chemical materials. Such agents play an *active* role, because they stand as intermediaries between generator and user. Of course, many companies reclaim materials with well-recognized reuse value. Only a few small companies in Europe and the United States now seem to be offering, or interested in offering, the full range of services needed to transfer scrap chemicals.

Most existing transfer organizations are operated by the chemical industry associations or governments of European countries as wholly- or partially-subsidized information clearinghouses. Only a few waste transfer agents operate now in the United States; two follow the European pattern, and two take more active roles in identifying matches and negotiating transfers, although they do not physically handle the materials. Several small materials exchanges were identified, one in Eurcpe and the rest in the United States.

Information Clearinghouses

The functions of an information clearinghouse are very limited: to offer a central point for collecting and displaying information, and to introduce interested potential trading partners to each other. They do not actively seek customers, negotiate transfers, set values, process materials, transport materials, or provide legal advice. Any such functions required to transfer a specific material are performed by generators, users, or middlemen dealers.

The basic clearinghouse service is to receive offers of waste materials and requests for scrap materials, list both anonymously, and publish the lists to members and interested nonmembers of their sponsor association. Interested potential traders then contact the clearinghouse, which refers them to each other, but takes no further active role in negotiations which may lead to transfers. Most clearinghouses try to learn whether transfers in fact were completed, but with only limited returns.

All existing information clearinghouses are subsidized by their sponsors. Some charge nominal listing fees. An information clearinghouse requires little capital investment and can be operated at an annual cost of between $10,000 and $90,000 per year, depending on industry response and the degree of active promotion of its service. Financial self-sufficiency could be achieved once the information transfer service has shown its usefulness to industry, by building a large circulation and by setting realistic listing and subscription fees. A participating company could probably recover such fees with one successful transfer a year.

Experience of the older European clearinghouses suggests that about 10 percent of scrap wastes listed will actually be transferred. Approximately one-half of those wastes transferred went to waste brokers and reprocessing companies (i.e., solvent recovery, etc.). The remainder were transferred to manufacturers.

The best sponsor for a clearinghouse is a local or regional industry association, or an organization equally responsive to industry's needs, for three major reasons. First, to be successful, clearinghouses must obtain the support of industry, especially plant managers and engineers faced with waste disposal problems. Second, it is not likely that clearinghouses

will be self-supporting until industry learns about the assistance which clearinghouses offer. Finally, they must keep identities and waste generation data confidential.

Although information clearinghouses can assist industry, their importance should not be overemphasized. When clearinghouses began in Europe, they received many listings. The initial influx of wastes included many continuous waste streams. In most cases after the first 12-to-18 months of operation, the number of listings declined. Presumably as plant managers either negotiated transfers or decided that their wastes had no value in the current market, they discontinued their listings.

However, in addition to facilitating transfers of specific wastes, clearinghouses provide two useful general services. First, both their existance and listings of available wastes help to educate industrial engineers about the increased opportunities for transferring and using scrap wastes. Second, their series of lists can gradually build an inventory, incomplete but also inexpensive, of industrial processing wastes.

In the next few years, several more clearinghouses may begin in the United States. Even though subsidized clearinghouses can be operated in areas with a low density of industry, they will facilitate a greater number and higher percentage of transfers in heavily-industrialized areas, such as Houston, Chicago, and Philadelphia, having a large number and variety of industries within relatively small geographic regions.

The scope of the typical clearinghouse in Europe is national, and in two cases international. The likely American pattern will be a network of regional clearinghouses, with arrangements to cooperate in cases in which the value of the scrap waste is great enough to cover costs of transporting it between regions.

Materials Exchanges

The services of exchanges are more complex and expensive than those of clearinghouses. Exchanges buy or accept wastes, analyze their properties, identify potential uses, reprocess them as needed, and sell at a profit. They transfer information only as a courtesy to clients or in the course of paid consulting services. Whereas a clearinghouse needs only a part-time staff and office space, an exchange needs highly-competent technical, managerial, and marketing skills, as well as storage and processing facilities.

Financial success depends upon brokering matches to completion. Because of transportation costs, most transfers can occur within about 50 miles only. Exchanges must, for economic reasons, concentrate on those scrap wastes of most value and most likely to find buyers. A materials exchange requires a capital investment of from $200,000 to $350,000,

and annual operating costs are expected to fall in the range of $50,000 to $150,000 per year. Economic analysis indicates that a materials exchange service is not likely to become profitable, unless offered together with a range of other established services to chemical industries, such as handling surplus chemicals.

NEXT STEPS NEEDED TO DEVELOP CLEARINGHOUSES

1. Detailed data are needed from one or more operating clearinghouses in order to guide the creation of clearinghouses elsewhere. Such data should include listing activity, costs, and manpower used, and should not overlook the value of contributed volunteer professional time. These operating data must be collected without impairing the anonymity guaranteed to listers.

2. Although the role of the public sector must be only indirect, it is nonetheless important in providing support services, notably by encouraging studies of operating experience and inventories of available wastes.

3. Emphasis should be given to the needs of potential scrap users. Waste generators quickly recognize the potential usefulness of the information clearinghouse service. Moreover, success of the waste transfer concept depends ultimately upon the demands of users of acceptable scrap wastes. Examples of new recycling technologies and successful new types of transfers should be brought to the attention of potential scrap users through technical journals and professional societies.

4. Information about the waste transfer concept and practice should be disseminated widely, to satisfy the interest which is now so evident. Useful techniques include publications, regional conferences, and technical assistance. Various institutional and legal arrangements for clearinghouses should be examined and perhaps tested.

5. A definitive study of legal liability issues is needed in order to clarify the many questions, and to dispel some of the fears, which now present major barriers to participation in waste transfers by generators and potential users. Topics addressed should include transfer of title to wastes, residual liability, variations in law and practice among states, and developing trends both in legislation and in court decisions.

6. One or more subsidized clearinghouses should be encouraged in order to:

   - demonstrate the effectiveness of the transfer concept,
   - identify the existence of transfer opportunities,
   - generate detailed operating data,
   - educate potential transfer participants in industry, and,
   - identify the potential for financial self-sufficient clearinghouses.

7. A financially self-sufficient clearinghouse should be designed and demonstrated over a period of two-to-three years. Various combinations of related services and various forms of institutional sponsorship should be examined.

8. Materials exchange services should be offered and operated only by the private sector. But the public sector should provide general encouragement through technical and information services.

I. INTRODUCTION

PROBLEM AND THE EPA RESPONSE

The U.S. Environmental Protection Agency (EPA) estimated in 1976 that 344 million metric tons (wet basis) of industrial processing residues are generated annually in the United States. This is almost twice the quantity of municipal wastes and more than thirty times the amount of sewage sludge generated annually.[1]*

As ocean dumping is decreased and water pollution and air pollution controls are tightened, these materials will increasingly be concentrated into solids and sludges for disposal on land. EPA estimates that 25 million tons of hazardous wastes are annually disposed of on land. Furthermore, EPA projects that this quantity will double during the next decade.[2]

Section 212 of the Solid Waste Disposal Act as amended required EPA to investigate the problem of hazardous wastes and study the concept of national disposal sites for storage and disposal of these materials.[3] The EPA did this, but recommended that any action on a national disposal site system be made part of a larger strategy based on improved regulatory controls.[4]

The EPA's report was submitted to the President and the Congress in 1973. It concluded that:

- Current practices of hazardous waste management are inadequate.
- This is because adequate treatment and disposal are expensive and, except in the case of radioactive wastes, are not mandated by law.
- What is lacking is appropriate legislative authority over land disposal of non-radioactive materials. Existing authorities are adequate to protect the air, surface waters, and probably ocean waters from hazardous materials, but not land and groundwaters.
- The technology of hazardous waste management is generally adequate.
- A national disposal site system would be expensive, requiring investments of about $940 million and annual operating costs of about $620 million.

*References are listed at the end of the report.

- The private sector is capable of assuming most or all of the responsibility for hazardous waste management, and a small private-sector hazardous waste management industry has in fact begun to develop.

The strategy recommended in the report is first to establish appropriate regulatory controls, then to monitor the response of the private sector, and only later to take further government action if that is found necessary.[5]

EPA currently proposes the following order of preference and sequence of steps for handling industrial waste streams:[6]

(1) *Minimize* the amount of waste generated, by modifying the industrial process involved.

(2) *Concentrate* the waste (through evaporation, precipitation, etc.) at the source to reduce handling and transport costs.

(3) If possible *transfer* the waste as is to another industry which can use it as a feedstock.

(4) When a transfer "as is" is not possible, *reprocess* the waste for material recovery.

(5) When material recovery is not possible,

   (a) *Incinerate* the waste for energy recovery and for destruction of hazardous materials.

   (b) If the waste cannot be incinerated, *detoxify and neutralize* it through chemical treatment.

(6) Use carefully controlled *land disposal* only for what remains.

The present study is concerned with Step 3 and to some extent Step 4. It explores the feasibility of the concept of "waste exchange" and outlines the requirements for successful waste transfer operations.

The study is intended to further the strategy recommended in the 1973 EPA report by outlining one way in which industry can reduce its waste disposal needs. The study is also responsive to the goals of the National Academy of Science, whose 1966 study of waste management identified recovery and re-use of pollutants as the strategy with highest probable long-term utility in alleviating the nationwide pollution problem.[7]

OBJECTIVES AND FOCUS OF THIS STUDY

This study has two major objectives: (1) to assess the feasibility and potential impact of transferring wastes in the United States, and (2) to provide guidelines for the organization and operation of a waste transfer organization. The conclusions are based on a review of the activities of existing transfer organizations; analysis of the technology, economics, and institutional aspects of waste transfer; and extensive discussion of the concept with industries generating and potentially using wastes.

This report will interest primarily existing and potential operators of waste transfer services. The main questions addressed are:

- How do existing transfer organizations operate, using what procedures, and with what results?
- Where can such an organization operate best?
- Who are the most likely clients? What are their needs? How do they behave?
- How can clients best be identified, contacted, and attracted?
- Will their demand for transfer services grow, or at least remain stable over time?
- What proportion of transferrable wastes are likely to find exact matches–that is, find uses without chemical treatment?
- What skills and resources are required to run a transfer organization successfully?
- What are the economics of transferring wastes?
- What legal problems may arise?
- What competition might a transfer service face?

Other readers of this report will include potential sponsors or subsidizers of transfer organizations, generators of wastes, and potential users of wastes having reuse value.

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