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An Evaluation of Tin Can Recycling in Kalamazoo, Michigan

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AN EVALUATION
OF TIN CAN RECYCLING
IN KALAMAZOO, MICHIGAN

by

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Recycling Rationale

The economic system of the United States is based on taking natural resources, converting them into consumer products by industrial processes, and selling these products to consumers. It is assumed that consumers will use up all of these products. But this is not the case. The consumer uses only parts of these goods and discards the unwanted remains.

The ubiquitous tin can is an example of this production-consumer-waste process. According to the National Canners Association[1] the tin can is used for 90 percent of all canned foods and beverages. Yet, after its contents are consumed the can is thrown away creating a solid waste problem.

It has been estimated that metal cans comprise four percent of all household waste by weight.[2] The actual number of cans purchased and concomitantly discarded has been reported by Darnay and Franklin[3] who

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[1] "Disposal Of Canned Food Containers". A Fact Sheet Prepared By The National Canners Association, Public Relations Division, 1133 20th Street, N.W., Washington D.C. 20036, January, 1973.

[2] "The Recycled Material". A Pamphlet Prepared By The Committee Of Tin Mill Products Producers, American Iron And Steel Institute, 150 East 42 Street, New York, New York 10017, p. 5.

[3] A.J. Darnay, Jr. and W.E. Franklin, The Role Of Packaging In Solid Waste Management, 1966 To 1976. Public Health Service Publication No. 1855. (Washington: U.S. Government Printing Office, 1969), p. 47.

state that:

> "-Americans purchase and consume the contents of more than 131 million cans in an average day;
>
> -The average American family uses about 850 metal cans in a year; and
>
> -The average American empties about 252 cans in a year or almost five per week."

A discarded tin can has two ultimate fates. It may either become a pollutant or a resource. A resource is a useful material, or a supply of something that can take care of a need. Pollutants can be said to be resources out of place.[1] Hence, solid wastes in the form of pollutants are really resources out of place. If tin cans are discarded randomly without care or thought to the nation's future needs, they become pollutants. If, however, these unwanted cans can be returned economically to the production-consumer-waste process (recycled) it would be possible to lower the cost of industrial goods, and waste treatment operations. At the same time it would conserve natural resources.

At present a common disposal method for tin cans is by landfill. After a few years under these conditions the cans rust away and a resource is wasted. Approximately 12 million tons of steel, mostly in the form of tin cans, are being lost every year in landfills as a

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[1]Richard P. Lonergan and Eugene M. Herson, "Solid Waste-A Natural Resource?", In Man And The Quality Of His Environment; Western Resources Conference Book, 1967. J.E. Flack and M.C. Shipley (Eds.). (Boulder: University of Colorado Press, 1968), p. 108.

result of current waste disposal practices.[1]

The best way to make used tin cans a resource instead of a pollutant is to recycle them. According to Wagner[2], "the key to the whole problem of solid, liquid, or gaseous waste disposal is not disposal at all, but recycling."

Solid waste experts generally agree that recycling aids in the following:

1. Litter Control-it encourages people to hold items for intelligent disposal rather than discarding them on the spot.

2. Solid Waste Management-it reduces the volume of materials requiring end-disposal facilities.

3. Conservation-it helps conserve valuable, scarce, and generally nonrenewable resources.

Hale, Hill, and Hickman[3] point out some additional social and environmental benefits of recycling:

"-Advoidance of adverse public health and environmental impacts associated with waste disposal;

-Reduced environmental impact in the production of goods (since use of secondary materials in production generates less air and water pollution and less mining and process solid wastes than does use of virgin materials);

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[1] N.L. Drobny, H.E. Hull, and R.E. Testin, Recovery And Utilization Of Municipal Solid Waste; A Summary Of Available Cost And Performance Characteristics Of Unit Processes And Systems. Public Health Service Publication No. 1908. (Washington: U.S. Government Printing Office, 1971), p. 3.

[2] Richard H. Wagner, Environment And Man. (New York: W.W. Norton and Company, Inc., 1971), p. 423.

[3] Samuel Hale, Jr., John A. Hill, and H. Lanier Hickman, The Federal Role In Solid Waste Management--Present And Future. (Cincinnati: U.S. Environmental Protection Agency, 1972), p. 5.

-Slower energy and water withdrawal rates, if secondary materials displace virgin materials as production inputs;

-Lower dependence on imports of foreign raw materials, with consequent favorable balance-of-trade and national security impacts."

Tin Can Recycling Methods

There are four basic ways a salvaged tin can may be recycled:

1. As a precipitation agent in a leaching process for the beneficiation of copper ore;
2. As a source of tin for chemical detinning operations;
3. As a source of scrap iron in steelmaking processes, and
4. To produce ferroalloys.

Reuse in copper mining

The largest use of salvaged tin cans from municipal waste is in the refining of copper ore. For ores rich in oxides, a leaching process based on a copper-iron exchange process is used with detinned cans as a source of iron. Ore is dumped on large piles of tin and a 5 to 10 percent solution of sulfuric acid is percolated through the pile.

The ore reacts with the sulfuric acid, and copper sulfate is formed. When the copper sulfate reaches the tin cans, ferrous sulfate is formed and copper metal precipitates on the cans. The precipitated copper is washed off, decanted, and sent to the smelting operation. Theoretically only 0.878 pound of iron is required to precipitate one pound of copper, but in actual practice this often reaches two pounds of iron per one pound of copper.[1]

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[1]Drobny, Hull, and Testin, op. cit., p. 86.

Although the copper industry is the largest consumer of scrap tin cans, it does not constitute an infinite market, since less than four percent of the copper ore in the United States is refined by the leaching/cementation process.[1] In 1966, approximately 250,000 tons of tin cans were employed for this purpose. This constituted only about 2.5 percent of all cans available in municipal refuse. Furthermore, it has been estimated that the maximal potential consumption is only about 5 percent of the cans available.[2]

Detinning

The United States has no deposits of tin. Each year over 50,000 tons of this metal are imported for domestic use.[3] It has been estimated that 90 percent of the tin plate produced in this country is lost through the disposal of tin cans.[4] Hence, a potential way to recycle used tin cans is the detinning industry where seven and one half pounds of tin could be recovered from every ton of scrap cans.[5]

Detinning is an industrial process for recovering tin from cans rejected in the manufacturing process, cans salvaged from municipal waste, and other sources. The detinning industry currently uses primarily

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[1] ibid.

[2] ibid.

[3] "Progress Report On Recycling." A Pamphlet Prepared By The Committee Of Tin Mill Products Producers, American Iron And Steel Institute, 150 East 42 Street, New York, New York 10017, p. 7.

[4] Drobny, Hull, and Testin, op. cit., p. 86.

[5] "Progress Report On Recycling", op. cit.

industrial tin plate scrap for recovering tin. The most common technique employed is an alkaline chemical process in which tin plate is treated with a hot solution of caustic soda and sodium nitrite, causing the tin to be dissolved into sodium stannate. The tin recovered from the sodium stannate through either crystallization, electrolysis, or neutralization, is purer than the metal produced from ore.

Fats, waxes, greases and lacquer coatings on the tin cans interfere with the detinning process. Thus, the potential use of salvaged tin cans depends on the ability to get the cans clean. Once this is accomplished, there should be no reason why used tin cans cannot be an excellent source of tin plate scrap.

Only about 3,000 tons of tin a year are being reclaimed, but there are eleven detinning plants throughout the country and the companies that operate them have stated they will buy all the clean, non-incinerated can scrap they can get.[1]

The detinning plants, as of mid-1972, were located in Baltimore, Maryland; East Chicago, Indiana; Elizabeth, New Jersey; Gary, Indiana; Los Angeles, California; Milwaukee, Wisconsin; Newark, New Jersey; Pittsburg, Pennsylvania; San Francisco, California; Seattle, Washington; and Tampa, Florida.[2]

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[1] "Progress Report On Recycling", op. cit.

[2] ibid.

Remelting in steel mills

Steelmaking, especially in conjunction with tin recovery, is another potential way to recycle tin cans. Since the detinning process does not affect the steel, detinned steel scrap is often used in steelmaking. The steel-scrap industry, however, is faced with many difficulties. Drobny, Hull, and Testin[1] explain the problems involved:

> "Steel has been manufactured conventionally by processing iron ore in a blast furnace to produce pig iron. Pig iron is then further refined in the open hearth furnace to produce steel. Retention time in the open hearth is on the order of 6 to 8 hours. Recently the basic oxygen furnace, with processing times on the order of 15 minutes, has begun to replace the open hearth. Because of the short processing times, only a very limited amount of scrap can be tolerated in the basic oxygen furnace. Consequently, the market for scrap has decreased in recent years. This may be offset, however, by the advent of the electric furnace which can produce steel from a charge of 100 percent scrap. This change will not occur overnight since a steelmaker is not likely to switch to electric furnaces until the supply of ore becomes short. In addition, the price of scrap is volatile compared to that of ore which is predictable, if not stable."

There are even more limitations in recovering steel from tin cans. The non-ferrous contaminants in reclaimed cans foul the refractory linings in steel furnaces and adversely affect the quality of the steel produced. To avoid such metallurgical complications it has been recommended that tin cans be limited to five percent of the total scrap charge in basic oxygen furnaces.[2] Similar limits have been established for open hearth and electric furnaces. If the maximal weight of tin cans were added to the scrap charges of basic oxygen

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[1] Drobny, Hull, and Testin, op. cit., p.86.

[2] "Progress Report On Recycling", op. cit., p.6.

furnaces that produce 65 percent of the nation's steel, an estimated 20 billion cans could be recycled annually.[1]

Reuse in the production of ferroalloys

Another way to recycle steel can scrap is in the production of ferroalloys, where the iron is combined with carefully controlled amounts of elements such as silicon and manganese. The material is then used as a part of the "melts" for alloy steel or castings in foundries.[2]

Existing Recycling Programs in the United States

There are two ways to collect tin cans for recycling. One is the collection of cans by private citizens and the other is the separation of cans from municipal waste.

Environmentally concerned citizens in some 350 cities throughout the country are separating their cans from their household garbage and bringing them to can collection centers established by can manufacturers and the aluminum and steel industries.[3] These centers accept all types of cans (steel, aluminum, and bimetallic). The only requirements are that labels should be removed from food cans and, whenever possible, the cans should be rinsed out and flattened. There are five such industry sponsored can collection centers in the State of Michigan (Table I).

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[1] "Progress Report On Recycling", op. cit. p.7

[2] ibid

[3] "Progress Report On Recycling", op. cit. p. 2.

TABLE I

INDUSTRY SPONSORED METAL CAN RECYCLING CENTERS IN MICHIGAN[1]

Location	Sponsoring Company	Hours	Payment/Ton
Livonia	National Can Corporation	9:00-4:30 M and Th	No payment
Detroit	American Can Company	Open at all times	No payment
Ecorse	Great Lakes Steel-Division Of National Steel	Not available	No payment
River Rouge	Great Lakes Steel-Division Of National Steel	Not available	Not available
St. Joseph	Continental Can Company	Open Monday through Friday	$20/ton to civic groups and organizations

[1] Data supplied by the individual collection centers.

In 1971 an estimated 800 million cans were recovered from these collection centers nationally. But solid waste experts consider citizen collection centers a stopgap effort at best. When measured by the 70 billion cans that were used in 1971, citizen collection campaigns produced comparatively insignificant results.[1]

Tin cans are removed from municipal solid waste for salvage purposes at several localities throughout the United States. They are removed from city incinerators, and at nearly all compost plants, to upgrade the quality of the final product. Until 1961, Los Angeles had separate collection and salvage of tin cans, which resulted in an income to the city of $500,000 per year.[2]

Municipalities do not sell salvaged cans directly, but rather deal through a scrap broker. Two brokers handle almost all the salvage in the United States: Proler Steel Company, Houston, Texas, and Los Angeles By-Products Company, Los Angeles, California. Most incinerators sell their cans to Proler Steel Company at a price varying from $10 to $20 per ton. Indications are that most of the cans end up at copper mines in the West.[3]

A recent study[4] done on resource recovery from city waste reports:

> "As of 1968, the most widely employed means of separating solid waste is handpicking and sorting from conveyors.... Handsorting is

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[1] "Progress Report On Recycling", op. cit., p. 2.

[2] Drobny, Hull, and Testin, op. cit., p. 86.

[3] Drobny, Hull, and Testin, op. cit., p. 87.

[4] Drobny, Hull, and Testin, op. cit., p. 23.

unsatisfactory for large recovery and utilization for several reasons including: (1) low salvage prices that limit the economic attractiveness of such operations; (2) limited degree of separation that can be effected since a nominal size work force can be concerned only with removing more bulky pieces; and (3) human fallibility."

Fortunately, since tin cans are really made of steel, with only a thin coating of tin to provide a solder bond, they can be magnetically removed from other household waste for recycling. Magnetic separation of cans from municipal refuse is working now in cities throughout the United States (Tables II and III).

Information supplied by the American Iron and Steel Institute[1] states:

"-In Chicago, the city sanitation department is retrieving more than 700 million steel cans annually and realizing revenues in excess of $100,000.

-Atlanta, which has been employing magnetic separation for more than 35 years, salvages 100 million cans a year.

-The small town of Franklin, Ohio (population: 15,000)- site of a demonstration recovery system for steel, paper, glass and cellulose fibers-is reclaiming 30 million steel cans a year. Although the cans constitute less than four per cent of the trash processed about 10 per cent of the plant's revenue comes from the sale of can scrap to a nearby steel producer.

-Smaller cities using or installing magnetic separation are Milford, Conn. (population: 50,000); Pompano Beach, Fla. (38,000); Vancouver, Wash. (40,000); Harrisburg, Pa. (85,000; Madison, Wis. (172,000)."

It is estimated that municipalities equipped with magnetic separators recovered 1.1 billion cans in 1971.[2]

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[1] "Progress Report On Recycling", op. cit., p.2.

[2] "Excerpts From Ferrous Metal Recovery", National Center For Resource Recovery Bulletin, Fall, 1972. (unpaged.)

TABLE II

CITIES OPERATING STEEL CAN RECOVERY SYSTEMS AS OF JULY, 1972[1]

Location	Estimated Annual Can Recovery	Markets
Amarillo, Texas	50 million	copper mines
Atlanta, Georgia	100 million	ferroalloys
Chicago, Illinois	730 million	copper mines
Franklin, Ohio	30 million	steel making
Houston, Texas	104-130 million	copper mines
Los Gatos, California	120 million	copper mines
Madison, Wisconsin	38-41 million	steel making/ copper mines
Martinez, California	80 million	copper mines
Melrose Park, Illinois	83 million	copper mines
New Castle County, Delaware	312-500 million	detinners/ steel making
Oakland, California	182 million	copper mines
Pompano Beach, Florida	60 million	to be established
Sacramento, California	74 million	copper mines
St. Louis, Missouri	260 million	pilot program
St. Petersburg, Florida	3 million	detinners
Stickney, Illinois	84 million	steel making/ copper mines
Tampa, Florida	104 million	steel making/ copper mines

[1] "Progress Report On Recycling", op. cit., p. 4.

TABLE III

CITIES PLANNING STEEL CAN RECOVERY SYSTEMS FOR 1972-73 AS OF JULY, 1972[1]

Location	Estimated Annual Can Recovery	Scheduled Opening
Brevard County, Fla.	108 million	Fall 1973
Ft. Lauderdale, Fla.	124 million	Spring 1973
Framingham, Mass.	42 million	mid-1973
Harrisburg, Pa.	66 million	mid-1972
Hempstead, N.Y.	618-728 million	late 1973
Milford, Conn.	41 million	Fall 1972
Newington, Conn.	83 million	mid-1973
San Diego, Cal.	52 million	late 1973
San Francisco, Cal.	275 million	late 1972
Scottsdale, Ariz.	52 million	Spring 1973
Vancouver, Wash.	41 million	Fall 1972

[1] "Progress Report On Recycling", op. cit., p. 5.

Markets and Recycling

Developing the technology of tin can salvaging and recycling is not considered to be an insurmountable problem. However, developing markets for reclaimed cans is a very real problem. Despite the high degree of public interest in recycling that has been expressed in the last few years, the amount of materials actually being recycled is declining. According to Hale, Hill, and Hickman[1]:

> "For virtually every important materials category (e.g. steel, paper, rubber, glass), the share of secondary materials used as inputs to production processes has undergone a long-term decline since World War II."

As previously mentioned, tin cans are salable to only four specific markets and each of these markets has its difficulties and limitations. Unless there is a market for used tin cans, collection of tin cans will be useless. If scrap dealers cannot sell their own accumulations of tin cans they, in turn, will not want to buy cans from people who collect them.

The situation is explained by Fred Berman[2], President of the Institute of Scrap Iron and Steel:

> "The recycling center, as it is referred to, does not recycle. It merely increases the supply of waste available for recycling. But to make an increased supply a viable solution there must be an increased demand. The expansion of recycling within this country must be parallel to and in conjunction with the development of markets which can absorb the recovered materials. Al-

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[1] Hale, Hill, and Hickman, op. cit., p. 5.

[2] "Reclamation, Conservation, Beautification", A Pamphlet Prepared By The Institute Of Scrap Iron And Steel, Inc., 1729 H Street, Northwest, Washington, D.C. 20006. (unpaged.)

though the technology exists, the economic incentives do not at this point in time.

"If our objective is to insure that recycable materials are reclaimed, and the scrap cycle is closed so that materials move in an orderly manner from manufacturer, to user, to discard, to reclamation, to manufacturer again, there simply must be markets. To direct our energies and concern at creating more supply, when the need is clearly more demand for what is now available is an exercise in futility."

This view is further substantiated by Hale, Hill, and Hickman[1]:

"It is clear that the primary obstacle to increased resource recovery is not technology (supply) but lack of adequate markets (demand) to raise significantly the quantity of recovery waste material utilized above present levels."

Somehow, market outlets for recycled materials must be developed. One way to accomplish this would be by insisting that all products contain maximal quantities of recycled materials.

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[1] Hale, Hill, and Hickman, op. cit., p. 6.

TIN CAN RECYCLING IN KALAMAZOO

The Problem and Its Background

Discarded tin cans in Kalamazoo are a wasted resource. All, except for a minute portion, are disposed of by landfill. The City of Kalamazoo has no municipally-owned refuse collection service and the community is served instead by nearly a dozen privately owned garbage collection companies. According to Donald Swets[1], Director of Public Works for the City of Kalamazoo, about 80% of the refuse collected in the city is picked up by members of the Kalamazoo Disposal Association. This association is composed of five firms who own and operate their own landfill in Barry County. The rest of the city's solid waste is collected by smaller companies and probably ends up in the Kalamazoo County Landfill in Oshtemo Township. No attempt is made by the refuse collection companies to salvage tin cans.

Individual citizens who do not subscribe to a collection service may also haul their solid waste to the Oshtemo Landfill.

In late 1971 the Kalamazoo Nature Center established a recycling center for glass, paper, and metal at its Human Environment House, 6634 North Westnedge Avenue. They first took the tin cans to the Continental Can Collection Center in St. Joseph, Michigan, but they discontinued this practice due to high labor and transportation costs.

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[1]Statement by Donald Swets, personal interview on June 20, 1973.

Later they sold their cans to Coldwater Iron and Metal Company in Kalamazoo for four dollars per ton. After a few months, the Nature Center stopped its recycling efforts entirely.[1]

Due to the citizen support of the Nature Center's program and those of several other groups in the community the City decided there was sufficient interest in recycling to merit a more extensive program utilizing the City's resources and personnel. On August 4, 1971 at the request of City Manager James Caplinger a recommended solid waste recycling program for the City of Kalamazoo was submitted by William Cosman, administrative assistant in the Public Works Department, Assistant Fire Chief Jack Bastianse, and Donald Flegal of the City's personnel department.

Since Kalamazoo does not have a municipally-owned refuse service, a door-to-door pick-up of home owner separated recyclable materials could not be considered. Therefore, the recycling committee[2] suggested the following:

"1. Four collection sites be established within the City, one to service each of four quadrants.

2. Each site be used once every fourth Saturday unless a holiday interferes.

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[1]Arnold Leder, "Evaluation: Recycling Efforts--Kalamazoo Nature Center--City Of Kalamazoo". A Report Submitted To The City Of Kalamazoo On February 19, 1972 By The Coordinator Of The Human Environment House, p. 7. (mimeographed.)

[2]William F. Cosman, Donald B. Flegal, and Jack G. Bastianse, "Recommended Solid Waste Recycling Program For The City Of Kalamazoo". A Report Submitted To The Kalamazoo City Manager On August 4, 1971, p. 2-3. (mimeographed.)

3. Sufficient containers to handle the recyclable materials be placed on each site during the morning of the collection day for that site and removed in the evening.

4. Each site be manned during the entire time it is open with sufficient personnel to handle the work load.

5. An intensive advertising program be designed and implemented to alert the public about this recycling program, teach them how to separate their solid waste materials and enjoin their active support."

This proposed recycling program was given a ten-week trial run in late 1971. The four collection sites established were:

First Saturday-Oakwood Junior High School (parking lot south of school off Oakland Drive)

Second Saturday-Woodward Elementary School (parking lot east of school off North Avenue)

Third Saturday-Milwood Junior High School (parking lot at north end of Konkle Street, southwest of school)

Fourth Saturday-Mr. Olivet Water Tower (parking area south of Mt. Olivet near Virginia Avenue)

Each site was open from 9:00 a.m. until 4:00 p.m. where paper, glass, and metal cans could be deposited.

During the trial period of operation, 81 tons of paper, 29 tons of glass, and 4.2 tons of metal were collected.[1] The City estimated 1600 families participated in the program. The trial project had an income of $1,095 and expenses of $1,656.[2] However, since the break-even point was being neared in the latter stages of the project it was decided to make it a year-round program.

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[1] Kalamazoo Gazette, December 7, 1971.

[2] ibid

The City of Kalamazoo's official recycling program began on Saturday, January 8, 1972, and was manned by three city employees hired under the Emergency Employment Act of 1971. In announcing the new program City Manager James Caplinger said, "The major thrust of our recycling program is toward the smaller, individual contributor who doesn't have the means to dispose of his materials."[1]

As of October, 1972 the amount of cans collected per week ranged from 700 to 1200 pounds and were sold to Superior Salvage and Auto Parts for eight dollars per ton. The most productive collection site was Oakwood and the least productive was Mt. Olivet. The Mt. Olivet location has since been closed.[2]

After one full year of operation the City's recycling program had an income of $3,312.39. Its expenses amounted to $7,112.02, and the City had a net loss of $3,799.63 (Table IV). This was despite the fact that the Federal Government paid the employees salaries. Paper brought in the most revenue and metal the least ($119.21).

A personal interview with Caplinger and Swets on June 20, 1973 indicates that the recycling program is still losing money. Caplinger stated, "Our conclusion is that recycling doesn't pay and is a loss operation for the City....Metal itself is a total loss.... We collect a pretty insignificant amount compared to paper and glass."

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[1] Kalamazoo Gazette, January 4, 1972.

[2] Statement by Donald Swets, personal interview, June 20, 1973.

TABLE IV

CITY OF KALAMAZOO RECYCLING PROGRAM'S COST EXPERIENCE FOR CALENDAR YEAR 1972[1]

Income:		
Paper sold		$2,120.08
Paper receivable		125.00
Glass sold		548.10
Glass on hand (estimated)		400.00
Metal sold		92.01
Metal on hand (estimated)		27.20
	TOTAL	$3,312.39
Expense:		
Labor (EEA not included)		$3,409.36
Contractual		17.60
Equipment		2,540.94
Supplies		428.15
Fringe Benefits		715.97
	TOTAL	$7,112.02
	NET LOSS	$3,799.63

[1] Data supplied by Donald Swets, Director of Public Works, City of Kalamazoo.

When asked about the future of the recycling program Caplinger said that he anticipated that it would be a continuing program even though the City has to subsidize it. He feels that it is a symbol to the community of the City's concern for conserving the environment.

Evaluation and Recommendations for Change

It is commendable that the City of Kalamazoo has a recycling program, but, as can be readily seen from the foregoing information the metal recycling program is not without problems. Simply stated, the tin can recycling program is too limited in scope and as a result too few cans are collected to be economically feasible or environmentally helpful.

The City should attempt to collect steel cans from the whole community not just from individuals who have no other means of solid waste disposal or who are environmentally concerned.

At present the amount of cans salvaged by the City is so small that it is negligible compared to what could be collected. According to the 1970 United States Census, Kalamazoo has a population of 85,555 people not counting the student population at various institutions of higher education located in the city. If the average American empties 252 cans in a year, this means that Kalamazoo could generate over 21,559,860 cans annually. Since 95% of all cans are steel[1] this means that Kalamazoo has the potential of recycling

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[1]Personal communication from J.W. Klingseisen, Plant Manager, American Can Company, 8651 East Seven Mile Road, Detroit, Michigan, on April 16, 1973.

20,481,867 cans per year. Admittedly these are very rough approximations, but they do give some idea of what could be done.

Furthermore, tin can recycling can only be economically feasible if it is done in large quantities. For this reason the City might want to work out some sort of mutual agreement with nearby municipalities (Portage and Parchment) whereby Kalamazoo would accept their steel cans for recycling and all parties concerned would then be benefitted.

If the City of Kalamazoo is truly committed to recycling it might want to make more sweeping changes in its program that would improve its efficiency. These changes are:

1. The City should switch to a municipally-owned and operated refuse collection service, or at least have all private collection companies dump their solid waste at a common municipal reclamation center.
2. The City should instigate a systems approach to refuse reclamation, utilizing magnetic separation of steel cans from all municipal refuse thereby eliminating the need for the City's present recycling effort.

It is recognized that the implementation of these reforms would not be easy. First the private solid waste disposal companies would object to losing their business to a city owned waste collection service and rightly so. Given the present American attitudes and values and with no pressing environmental crisis or shortage of iron ore, this change would probably be impossible to instigate at this time. However, it might be possible to have more municipal control of refuse collection and these companies could take their refuse to a city owned reclamation center to be processed rather than to a sanitary landfill.

A second difficulty would be the cost of machinery, personnel, et cetera. Drobny, Hull, and Testin[1] report the following about the cost of magnetic separation:

> "Operating costs for magnetic separators are minimal and result primarily from power consumption. Small magnetic separators, more than adequate for use in solid waste recovery, require at most about 1 hp, and so power costs for magnetic separation are expected to be an insignificant fraction of total power consumption in a solid waste recovery plant. Consequently, the major cost of magnetic separation is the cost of equipment, especially the auxiliary equipment for handling influent and effluent streams. Cost data for tin can recovery facilities...indicate that the major cost item is not the magnetic separator, but, rather the auxiliary facilities. The total cost of a can recovery system facility at an 800-ton/day incinerator was estimated at $400,000 with the major fraction of the capital cost being attributable to site preparation, structures, and auxiliary equipment such as a shredder, conveyors, and railroad siding. Similarly only a fraction of the estimated operating costs are attributable to the magnetic separation process. In fact, less than 25 percent of the total cost for all equipment was attributable to power and maintenance. The remaining 75 percent resulted from labor (system operators and inspectors). Total cost of can recovery including amortization and operating cost was estimated to be $13.60 per ton recovered."

If it is possible to extrapolate from these data, any steel recovered from a magnetic separation process would have to be sold for more than $13.60/ton in order for the operation to be profitable. This leads to the third problem associated with tin can recycling, which is the scarcity of viable markets and the low value of scrap steel even when markets are found.

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[1]Drobny, Hull, and Testin, op. cit., p. 27.

Indications are that markets for salvaged tin cans would be difficult to find in the Kalamazoo area. A telephone survey conducted in June, 1973 of the 13 scrap metal dealers listed in the Yellow Pages of the Kalamazoo Telephone Directory revealed that only three would buy tin cans. Two companies would buy if the seller had large quantities of cans and one company said it would purchase small amounts from individual citizens. Prices paid per ton ranged from $12 to $15. Scrap metal dealers are reluctant to buy tin cans because of the high freight rates. One scrap dealer reported that it cost him $8/ton to ship tin cans to the Chicago-Gary area where he sells them to steelmakers. In most areas of the country it costs more to ship scrap steel than iron ore.

The overall conclusion is that while tin can recycling may be environmentally sound it is not economically viable and that a tin can recycling operation for the City of Kalamazoo would be impractical at the present time.

BIBLIOGRAPHY

Berman, Fred, "Conserving The Future-America's Scrap Processing Industry." Phoenix Quarterly, IV(4):1973, 1-8.

Berman, Fred, "Paying The Freight For Recycling." Phoenix Quarterly, IV(2):1972, 7-8.

Boyd, James, "Economics Major Recycling Problem." Phoenix Quarterly, IV(2):1972, 5-6.

Cosman, William F., Donald B. Flegal, and Jack Bastianse, "Recommended Solid Waste Recycling Program For The City Of Kalamazoo." A Report Submitted To The City Manager On August 4, 1971. Pp. 5. (mimeographed.)

Darnay, Arsen, Recycling Assessment And Prospects For Success. Washington: U.S. Government Printing Office, 1972. Pp. 14.

Darnay, A.J., Jr., and W.E. Franklin, The Role Of Packaging In Solid Waste Management, 1966 To 1976. Public Health Service Publication No. 1855. Washington: U.S. Government Printing Office, 1969. Pp. xix + 205.

Dean, K.C., C.J. Chindgren, and Leroy Peterson, Preliminary Separation Of Metals And Nonmetals From Urban Refuse. U.S. Department Of The Interior: Bureau Of Mines Solid Waste Research Program Technical Report-34, June, 1971. Pp. 10.

Drobny, N.L., H.E. Hull, and R.F. Testin, Recovery And Utilization Of Municipal Solid Waste; A Summary Of Available Cost And Performance Characteristics Of Unit Processes And Systems. Public Health Service Publication No. 1908. Washington: U.S. Government Printing Office, 1971. Pp. vi + 118.

Hale, Samuel, Jr., "Resource Recovery Losing Ground." Phoenix Quarterly, IV(2):1972, 3-4.

Hale, Samuel, Jr., John A. Hill, and H. Lanier Hickman, The Federal Role In Solid Waste Management Present And Future. Cincinnati: U.S. Environmental Protection Agency, 1972. Pp. 30.

Leder, Arnold, "Evaluation: Recycling Efforts--Kalamazoo Nature Center--City Of Kalamazoo." A Report Submitted To The City Of Kalamazoo On February 19, 1972 By The Coordinator Of The Human Environment House. (mimeographed.)

Lonergran, Richard P., and Eugene M. Herson, "Solid Waste-A Natural Resource?" In Man And The Quality Of His Environment; Western Resources Conference Book, 1967. J.E. Flack and M.C. Shipley, (Eds.) Boulder: University Of Colorado Press, 1968, 107-120.

Sullivan, P.M., and H.M. Stanczyk, Economics Of Recycling Metals And Minerals From Urban Refuse. U.S. Department Of The Interior: Bureau Of Mines Solid Waste Research Program Technical Progress Report-33, April, 1971. Pp. 19.

Train, Russel E., "Trends In Recycling Not Encouraging." Phoenix Quarterly, IV(2):1972, 1-2.

Wagner, Richard H., Environment And Man, New York: W.W. Norton And Company, Inc., 1971. Pp. xiii + 491.

__________, "Disposal Of Canned Food Containers." A Fact Sheet Prepared By The National Canners Association, Public Relations Department, 1133 20th Street, N.W., Washington, D.C. 20036.

__________, "Excerpts From: Ferrous Metal Recovery." National Center For Resource Recovery Bulletin, Fall, 1972. (unpaged.)

__________, Kalamazoo Gazette, December 7, 1971.

__________, Kalamazoo Gazette, January 4, 1972.

__________, "Progress Report On Recycling." A Pamphlet Prepared By The Committee Of Tin Mill Products Producers, American Iron And Steel Institute, 150 East 42 Street, New York, New York 10017. Pp. 10.

__________, "Reclamation, Conservation, Beautification." A Pamphlet Prepared By The Institute Of Scrap Iron And Steel, Inc., 1729 H Street, Northwest, Washington, D.C. 20036. (unpaged.)

__________, "The Recycled Material." A Pamphlet Prepared By The Committee Of Tin Mill Products Producers, American Iron And Steel Institute, 150 East 42 Street, New York, New York 10017. Pp. 8.

Letter From R.B. Choate, National Can Corporation, 1300 Levan Road, Livonia, Michigan 48150, Dated April 9, 1973.

Letter From J.W. Klingeisen, American Can Company, 8651 East Seven Mile Road, Detroit, Michigan 48234, Dated April 16, 1973.

Letter From C.M. Krohn, Continental Can Company, 3545 Lake Shore Drive, St. Joseph, Michigan, Dated May 1, 1973.

Letter From Arthur H. Warmuskerken, Great Lakes Steel, Ecorse, Michigan 48229, Dated April 17, 1973.

Personal Interview With James Caplinger, Kalamazoo City Manager, and Donald Swets, Director Of Public Works, On June 20, 1973.