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NATIONAL SURVEY OF CART-BASED
AUTOMATED AND SEMI-AUTOMATED
RESIDENTIAL REFUSE COLLECTION SYSTEMS

BY

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Method

In the fall of 1981, in conjunction with American City and County, the author undertook a detailed survey to determine the extent to which cart-based automated or semi-automated refuse collection operations are in use in the United States. An eighteen page questionnaire listing all suspected sites using cart-based systems in residential collection was sent to the known manufacturers and vendors of these systems for verification and completion. The vendors included:

American Refuse Systems

EMCO

David A. Garofalo and Associates

Heil Rotomold, Inc.

PPI Industries

Reuter, Inc.

Rubbermaid Applied Products Inc.

Turn-Key Container Systems, Inc.

Zarn, Inc.

Questionnaires were completed and returned by eight of the nine vendors. Heil Rotomold advised that it had acquired "Fiberglass Specialists" but was unable to include data from

this company's customer list. David P. Garofalo wrote that his firm had formally replaced Maxon and Hollowform in the mechanized container business. Reuter, Inc., noted that it was marketing automated collection systems for itself and for Government Innovators. The only vendor that did not complete the questionnaire or provide information about its containerized installations was EMCO.

Purpose

The survey and the data reported here are solely concerned with the use of standardized, 80 to 90 gallon, wheel-type or roll-out containers used in automated or semi-automated residential refuse collection operations. Unlike a survey reported recently in Waste Age magazine, these data do not include installations using 150 to 300 gallon or larger containers used either in side loading or front-loading operations. Such systems typically are used for multiple residential and commercial collection and have little value in a survey strictly limited to residential collection operations.

The data reported here are also unique in that they are based on information provided by the known vendors of cart-based residential refuse collection systems. It was initially felt that these vendors would be in the best position to provide complete and accurate data on sites using cart systems in automated and semi-automated residential collection. This view has subsequently been validated. For example, all but one vendor responded with detailed information about installations using their systems.

In addition, it is clear that the WasteAge survey overstated the number of wheel-type cart installations as well as the number of fully automated systems. It also incorrectly identified some installations as either automated or semi-automated.

The survey reported here asked system vendors to verify the sites listed on the questionnaire and also to add any additional cart based systems of which they were aware. They were also asked to supply the following information: type of site (city, county, military base); year installed; full, partial or demonstration installation; number of carts by size and vendor; collection method (automated versus several categories of semi-automated collection); and whether governmental or private collection. Data from the completed survey are found in Table I which lists all sites using cart based systems in alphabetical order by state. Table II aggregates these data and provides summaries by state and region. In a few cases, vendor provided information was supplemented by the author and in compiling totals vendor provided information was reconciled in those sites supplied by more than one vendor.

Findings

The survey produced some interesting and surprising results. To begin with, cart systems have been commercially available in the United States for about ten years. Nevertheless, only 261 local governments out of a total of over 9300 cities and counties in the U.S. with over 2500 people have implemented cart based collection. This represents a scant 2.8% of the local governments in which such systems appear applicable. In addition to the 261 local governments, 41 military bases and other entities have implemented cart-based residential collection systems. Anything but a ground-swell.

Moreover, the trend toward adopting cart systems--while stable--does not seem especially strong. Table III shows the date by year of all reported installations.

Except for 1979, in which 59 installations were begun, the years between 1977 and 1981 showed a range of from 32 to 44 new installations per year nationwide. This is a truly exceptional statistic when the cost of refuse collection (especially when expressed as a percentage of municipal budget) and the financial shoals on which many municipal governments have so recently foundered are contrasted with the relative cost-effectiveness of cart systems. That considerably more cart systems have not been implemented must be a tribute, in part at least, to the conservatism and resistance to change often found in local government.

The second finding which stands out is the regional distribution of cart-based systems. As shown in Table III, over 61% of all systems (185 sites in 13 states) are in the southern and border states. Further, of the 186 sites in this area, 109 (58.3%) accounting for 800,900 containers (57.3%) are found in the four states of North Carolina, South Carolina, Georgia, and Florida. Not only, then, are cart systems more prevalent in one region, but receptivity to innovation as well as other factors supporting the implementation of automated or semi-automated cart systems appear unevenly distributed within that region.

Following the southern and border states, in order of number of installations are: the midwest and great plains states (51 sites in 11 states or 16.9% of all sites); the western and

mountain states (48 sites in 11 states or 15.9%); and the New England and mid-Atlantic states (18 sites in 6 states and the District of Columbia or 5.9%). These data should also be viewed from the perspective of a few very large installations within each of the regions. Single installations such as Phoenix, AZ (105 k carts), Ft. Lauderdale, FL (81 k carts), Atlanta, GA (115 k carts), Memphis, TN (180 k carts), Detroit, MI (30 k carts) and Washington, D.C. (62 k carts) -- no matter what the regional data indicate -- are considerably larger than the total of the installations in several states and in the cases of Memphis and Atlanta are larger than totals of an entire region. It is also clear from the geographic distribution data that neither geography, topography, nor climate appear to be factors hindering cart installation. Cart systems are found throughout the country.

The third interesting, if not also surprising finding of this survey, is that of 302 reported sites, only 69 or 22.8% are fully automated. See Table V. Further analysis reveals that only one vendor, Reuter, Inc., is a substantial presence in the fully automated market, supporting in whole or in part 59 of the 69 fully automated installations identified in this survey. Thirty of these are in the western and mountain states area and 15 are in the south.

The survey also found that the vast majority (242 or 80.1%) of all cart based automated and semi-automated systems are in cities. Thirty-two (10.6%) are found on military bases, 17 (5.6%) in counties, and two (0.7%) are in city and county

installations.

Nearly two-thirds of these systems, including all of the systems in the largest cart-based installations, rely on municipal crews for refuse collection (203 sites, 67.2%). Private haulers collect refuse using cart-based automated or semi-automated systems in 88 locations (29.4%).

Two hundred and four (67.5%) of the sites were reported to have full, permanent cart-based installations. Partial installations accounted for 85 locations (28.2%) and there were 4 demonstration sites (1.3%).

The total number of carts reported (remember these are the 80 to 90 gallon, wheel-type carts, used by a single residence-- the data do not include the larger standardized containers used for multiple family and commercial purposes) was 1,894,200. Of these, 402,500 (21.3%) were reported in fully automated systems.

Finally, in all but 32 sites carts were supplied by a single vendor. Twenty-nine sites had purchased carts from two different vendors and three reported carts from three different vendors.

Conclusion

The use of standardized, wheel-type, 80 to 90 gallon refuse containers in automated and semi-automated residential refuse collection operations is thought by many observers to provide substantial improvements over traditional refuse collection methods. Unit costs are generally lower and collection productivity considerably higher. It is not unusual for sites installing such systems to cover the total cost of the installation out of actual savings. For example, Memphis, TN, the site of what is

currently the largest cart-based system in the nation estimated the payback period for implementation of its system to be less than one year and expects thereafter to achieve a \$9 million annual savings.

Other factors are also important. On-the-job injuries are reduced substantially, and with this reduction comes reduced medical and workers' compensation payments and insurance costs, fewer injury related productivity losses and reductions in human suffering and misery associated with such injuries.

Data reported in this survey indicate a stable but by no means headlong rush by local governments in the United States to adopt this innovative and cost-effective technology. The fact is that only 261 cities and counties --out of over 9300 local governments in excess of 2500 persons -- have adopted automated or semi-automated cart collection technology.

Perhaps as more experience is gained by more local governments with cart-based collection and as cart systems are more widely implemented, some of the concerns that local decision-makers have about these systems will be eased. Perhaps, too, the greater need today to reduce the costs of providing public services will impel more adoptions of cart-based systems.

The data in this survey may also be found valuable by local decision-makers when they are confronted with the harsh reality of determining the most cost-effective method of collecting refuse in their communities. Among other things, this survey has identified cart systems across the nation, in all climes and geographic and topographic settings and in 40 of the 50 states. Local governments reviewing their refuse collection operations

have only to look around to find one or more cart-based system nearby--often in a neighboring city or state.

TABLE 1

AUTOMATED AND SEMI-AUTOMATED
CART-BASED RESIDENTIAL
REFUSE COLLECTION SYSTEMS
Installation and State*

Location	Type of Installation	Date Installed	Full or Partial Installation	Demonstration or Permanent Installation	Container Manufacturer	Number of Containers	Container Size	Method of Collection	Who Collects Refuse
ALABAMA									
Alexander City	M	73	F	P	PPI	5.0k	84	R2	G
Andalusala	M	75	F	P	PPI	4.0k	84	R2	G
Clanton	M	81	F	P	RUB	2.3k	85	R3	G
Demopolis	M	80	F	P	RUB	2.8k	85	R3	G
Haleyville	M	79	F	P	PPI	460	84	R2	G
Jacksonville	M	78	F	P	RUB	3.5k	85	R3	G
Montgomery	M	80	F	P	ZRN	5.0k	82	S	G
	M	81	F	P	RUB	52.0k	85	R3	G
Muscle Shoals	M	80	F	P	RUB	3.5k	85	R3	G
Opelika	M	81	F	P	GAR	9.0k	90	A	G
Reform	M	81	F	P	ZRN	1.2k	90	S	G
Russellville	M	81	F	P	RUB	3.0K	85	R3	G
Tallassee	M	81	F	P	RUB	2.0k	85	R3	G
Tuscaloosa	M	78	F	P	PPI	21.0k	84	R3	G
Union Springs	M	80	F	P	RUB	1.6k	85	R3	G
ALASKA									
Ft. Richardson	B	79	F	P	RUB	200	85	R2	P

*NOTES: Data presented here include only installations using standardized, wheel-type, 80-90 gallon containers in automated or semi-automated residential refuse collection. All data were provided by cart system vendors.

Type of installation: M—municipal; C—county; B—military base; R—other.

Full installation—F; partial—P; demonstration—D.

Manufacturer: ARS—American Refuse Systems, Inc.; GAR—David P. Garofalo and Associates; HRM—Heil Rotomold, Inc.; PPI—P.P.I. Industries, Inc.; RGI—Reuter, Inc.; RUB—Rubbermaid Applied Products, Inc.; TKY—Turn-key Container Systems, Inc.; ZRN—ZARN, Inc.

Number of containers: above 1,000 noted as 1.0k or greater; below 1,000 noted as 325 or similar.

Cart size: 82, 84, 85, 90 gallon sizes.

Method of collection: A—fully automated; S—semi-automated/no other information; R1, R2, R3—rear-loading, semi-automated, 1, 2, or 3 crew; S1, S2—side-loading, semi-automated, 1 or 2 crew.

Who collects refuse: G—governmental collection; P—private collector; GP—combination.

ARIZONA

Casa Grande	M	74	F	P	RGI	150	90	A	G
Coolidge	M	74	F	P	RGI	650	90	A	G
El Mirage	M	81	F	P	HRM	1.0k	90	R3	P
Fort Huachuca	B	79	P	P	ZRN	3.0k	82	S	P
Huachuca City	M	75	F	P	RGI	50	90	A	G
Kearney	M	74	F	P	RGI	925	90	A	G
Luke Air Force Base	B	79	F	P	RUB	1.1k	85	R2	P
Parker	M	79	P	P	RGI	25	90	A	G
Phoenix	M	79	P	P	GAR	40.0k	90	A	G/P
	M	75	P	P	HRM	55.0k	90	A	G
Safford	M	78	F	P	RGI	1.5k	90	A	G
Scottsdale	M	79-81	F	P	HRM	5.0k	90	A	P
	M	70	F	P	RGI	8.0k	80	A	G
Tempe	M	81	P	P	GAR	1.6k	90	A	G
Tucson	M	79	P		PPI	900	84	S1	G

ARKANSAS

Forrest City	M	81	F	P	ZRN	4.0k	90	S	G
Greeves Ferry	M	79	P	P	PPI	50	84		P
Mountain Home	M	78	P	P	PPI	500	84	S1	P
Rosers	M				PPI	600	84	R3	P

CALIFORNIA

Beverly Hills	M	78	P	P	RGI	500	90	A	G
	M	81	P	P	GAR	5.0k	90	A	G
Camp Pendelton	B	78	F	P	RGI	3.2k	90		G
Delano	M	76		P	RGI	150	90	A	G
Fort Ord	B	79	P	P	ZRN	5.0k	82	S	P
Fresno	M	76	P	P	RGI	1.0k	90	A	G
Marysville	M	81	P	P	RUB	3.1k	85	S1	P
Monterey	M	77	P	P	RUB	1.9k	85	S1	P
Sacramento City	M	81	P	P	HRM	4.5k	90	A	G
Shafter	M	76	F	P	RGI	200	90	A	G
Taft	M	75	F	P	RGI	200	90	A	G
Travis Air Force Base	B	77	F	P	RUB	1.8k	85	R2	P
Wasco	M	77	F	P	RGI	500	90	A	G

COLORADO

Fort Carson	B	75	F	P	ZRN	3.0k	82	S	P
	B	81	P	P	RUB	250	85	S2	P
Longmont	M	76	F	P	PPI	15.0k	84	S1	G

CONNECTICUT

Kent		77	P	P	PPI	1.0k	84		P
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DELAWARE

Dover Air Force Base	B	75	F	P	ZRN	3.0k	82	S	P
Wilmington	M	76	P	P	RUB	900	85	R3	P
	C	73	P	P	ZRN	11.0k	82	S	P

FLORIDA

Blountstown	M	78	P	P	ZRN	500	82	S	G
Clearwater	M	78	P	P	RGI	1.4k	90	A	G
	M	81	F	P	GAR	20.0k	90	A	G
Dade County	M	70	P	P	ZRN	10.0k	82	S	G
Daytona Beach	M	80	F	P	RUB	17.0k	85	R3	GP
Fernandina Beach	M	78/81	F	P	RUB	1.0k	85	R3	G
	M	71	F	P	ZRN	8.0k	82	S	G
Fort Lauderdale	M	73	F	P	RUB	52.0k	85	R3	GP
	M	79	F	P	ZRN	10.0k	82/90	S	G
	M	81	P	P	RGI	19.0k	90	A	G
Fort Pierce	M	80	F	P	RGI	12.3k	90	A	G
Fort Walton Beach	M	81	P	P	RUB	900	85	S2	G
	M	80	P	D	TKY	400	90	A	G
Leesburg	M	77	F	P	ZRN	4.0k	82	S	G
Maitland	M	75	F	P	PPI	2.3k	84	R2	G
Miami Springs	M	77	F	P	RGI	3.6k	90	A	G
N. Miami Beach	M	77	F	P	RGI	6.1k	90	A	G
Pahokee	M	76	F	P	RGI	1.0k	90	A	G
Palatka	M	77	P	P	RUB	600	85	R3	G
	M	77	F	P	ZRN	6.0k	82	S	G
Pensacola	M	81	P	D	TKY	400	90	A	G
Rockledge	M	73	F		PPI	4.0k	84	R2	G
St. Petersburg	M	82	F	P	RGI	43.3k	90	A	G
Stuart	M	76	F	P	PPI	3.0k	84	R2	G
Tallahassee	M	79	F	P	RGI	21.6k	90	A	G
Winter Garden	M	74	F		PPI		84		G
Winter Haven	M	80	F	P	ZRN	1.0k	82	S	
	M	72	F	P	PPI	7.9k	84	S2	G

GEORGIA

Americus	M	72	F	P	PPI	4.0k	84	R2	G
Atlanta	M	73	F	P	ZRN	115.0k	82	S	G
Bainbridge	M	78	F	P	RGI	3.5k	90	A	G
Bibb County	C	77	P	P	RUB	2.0k	85	R3	G
Blakely	M	79	F	P	PPI	2.0k	84	S2 R2	G
Camilla	M	78	F	P	ZRN	6.0k	82	S	G
Carrollton	M	74	F	P	PPI	5.0k	84	R2	G
Cochran	M	79	F	P	RUB	2.1k	85	R3	G
Commerce	M	73	F	P	PPI	1.5k	84	R2	G
Conyers	C	79	F	P	ZRN	4.0k	82		P
	M	77	P	P	RUB	1.0k	85	R3	P
Douglasville	C	77	F	P	ZRN	4.0k	82	S	P
Dublin	C	78	F	P	ZRN	2.0k	82	S	P
Eden	C	79	F	P	ZRN	3.0k	82	S	P
Evans	M	81	P	P	RGI	800	90	A	G
Fairburn	C	78	F	P	ZRN	5.0k	82	S	P
Fort Gordon	B	77	F	P	ZRN	3.0k	82	S	P
Fort McPherson	B	77	F	P	ZRN	3.0k	82	S	P
Fort Steward	B	79	F	P	RUB	2.7k	85	R2	P
Garden City	M		F	P	RUB	800	85	R3	G
Leslie	M	74	F	P	PPI	150	84	R1	G
Macon	M	77	F	P	RUB	34k	85	R3	G
Marietta	C	79	P	P	ZRN	1.0k	82	S	P
Milledgeville	M	81	F	P	ZRN	4.0k	90	S	G
Monroe	C	78	F	P	ZRN	1.0k	82	S	P
Nashville	M	74	F	P	PPI	1.8k	84	R2	G
Ocilla	M		F	P	RUB	1.5k	85	R3	G
Oxford	C	79	F	P	ZRN	2.0k	82	S	P
Perry	M	79	F	P	RUB	3.3k	85	R3	G
Plains	M	76	F	P	PPI	400	84	R2	G
Snellville	M	79	F	P	ZRN	8.0k	82	S	P
Toccoa	M	76	F	P	RUB	4.3k	85	R3	G
Wentworth	M	80	F	P	ZRN	2.0k	82	S	G

IDAHO

American Falls	M	76	F	P	RGI	800	90	A	G
Burley	M	79	F	P	RGI	1.1k	90	A	G
Soda Springs	M	81	F	P	RGI	1.1k	90	A	G
Weiser	M	79	F	P	RGI	1.1k	90	A	G

ILLINOIS

Blue Island	M	80	P	P	RUB	1.8k	85	S1	P
Glen Allen	C	79	P	P	ZRN	3.0k	82	S	P
Kankakee	M	80	P	P	RUB	1.0k	85	R2	P
Madison	M	80	F	P	ZRN	2.0k	82	S	G
	M	81	P	P	RUB	300	85	R3	G
Markham	M	78	F	P	RGI	4.0k	90	A	G
Park Forest	R	80	P	P	RGI	300	90	A	P
Scott Air Force Base	B	76	F	P	ZRN	4.0k	82	S	P
Silver Lake	M	80	P	P	RUB	1.5k	85	R2	P

INDIANA

Fort Wayne	M	79		P	RGI	800	90	A	P
Indianapolis	M	80	P	P	RGI	1.3k	90	A	G
Kokomo	M	78	P	P	RUB	600	85	R3	P
Ligonier	M	79	P	P	RUB	300	85	R2	G

IOWA

Davenport	M	78	P	P	RGI	1.9k	90	A	G
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KANSAS

Coffeyville	M	78	P	P	PPI	700	84	S1 R1	P
Derby	M	78	P	P	RUB	600	85	R3	P
Dodge City	M	77	P	P	PPI	1.1k	84	S1	G
	M	78	P	P	RUB	600	85	R3	G
Fontana	M	78	P	P	RUB	300	85	R3	P
Fort Riley	B	81	P	P	ZRN	500	90	S	P
Fort Scott	M	78	P	P	PPI	200	84	S1	P
Hutchinson	M	79	P	P	PPI	10.0k	84	R2	G
Liberal	M	77	F	P	PPI	6.0k	84	S1	G
Rose Hill	M	76	P	P	PPI	350	84	R1	P

KANSAS (Continued)

Salina	M	81	F	P	PPI	10.0k	90	R2	G
Wichita	M	78	P	P	RUB	3.5k	85	R2	P

KENTUCKY

Fort Knox	B	78	F	P	RUB	3.6k	85	R3	P
Goose Creek	M	75	F	P	ZRN	3.0k	82	S	G
Lexington	M	81	P	D	ZRN	1.2k	90	S	G
	M	81	P	D	RUB	925	85	R3	G

LOUISIANA

Bastrop	M	76	F	P	ZRN	8.0k	82	S	G
Broussard	M	81	F	P	ZRN	2.0k	82	S	G
England Air Force Base	B	75	F	P	ZRN	5.0k	82	S	
Farmerville	M	76	F	P	ZRN	2.0k	82	S	G
Ferriday	M	79	F	P	ZRN	5.0k	82	S	G
Fort Polk	B	77	F	P	ZRN	5.0k	82	S	P
Franklin	M	76	F	P	RUB	4.5k	85	R3	G
Haynesville	M	81	F	P	ZRN	1.4k	82	S	G
Houma	M	78	F	P	ZRN	15.0k	82	S	G
Independence	M	79	F	P	ZRN	1.0k	82	S	G
Jonesboro	M	79	F	P	ZRN	4.0k	82	S	G
Kentwood	M	79	F	P	ZRN	2.0k	82	S	G
Lake Providence	M	81	F	P	ZRN	3.0k	82	S	G
Monroe	M	78	F	P	ZRN	25.0k	82	S	G
New Orleans	M	78	P	P	ZRN	1.0k	82	S	G
Pope Air Force Base	B	77	P	P	ZRN	2.0k	82	S	
Rayville	M	74	F	P	ZRN	7.0k	82	S	G
St. Joseph	M	79	F	P	ZRN	3.0k	82	S	G
Sulphur	M	79	F	P	ZRN	6.0k	82	S	G
W. Monroe	M	79	F	P	ZRN	8.0k	82	S	G

MARYLAND

College Park	M	81	F	P	RUB	4.0k	85	R3	G
Hampstead	M	80	P	P	RUB	400	85	R2	P
Landover Hills	M	79	P	P	RUB	600	85	R2	P
Westminster	M	80	P	P	RUB	1.1k	85	R2	P
Williamsport	M	80	P	P	RUB	3.0k	85	S1	P

MICHIGAN

Detroit	M	81	P	P	GAR	30.0k	90	A	G
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MINNESOTA

Ely	M	77	F	P	RGI	200	90	A	G
Hopkins	M	81	F	P	RGI	14.5k	90	A	P
Minneapolis	M	80	P	P	ZRN	4.0k	82	S	P
Mt. Iron	M	79	F	P	RGI	1.3k	90	A	G
Virginia	M	79	F	P	RGI	500	90	A	G

MISSISSIPPI

Clarksdale	M	78	F	P	RGI	6.5k	90	A	G
DeSoto County	M	78	F	P	RUB	7.5k	85	R3	G
Greenville	M	81	F	P	RGI	15.5k	90	A	G
Grenada	M	81	F	P	ZRN		90	S	G
	M	77	F	P	RUB	5.0k	85	R3	G
Indianola	M	78	F	P	ZRN	2.0k	82	S	G
Moss Point	M	74	F	P	PPI	5.5k	84	R2	G
Tupelo	M	78	F	P	RUB	11.0k	85	R3	G
Winona	M	78	F	P	RUB	3.5k	85	R3	G
Yazoo City	M	80	F	P	ZRN	8.0k	82	S	G

MISSOURI

St. Ann	M	80	P	P	ZRN	6.0k	90	S	G
St. Louis	M	77	P	P	RUB	7.0k	85	R2	P
	M	81	P	P	PPI	600	90	S1	G
University City	M	78	P		PPI	150	84	S1	G

MONTANA

Havre	M	76	F	P	RGI	100	90	A	G
Laurel	M	78	F	P	RGI	1.8k	90	A	G

NEBRASKA

Alliance	M	78	F	P	RGI	2.7k	90	A	G
Kearney	M	74	F	P	RGI	200	90	A	G
McCook	M	76	F	P	RGI	900	90	A	G
Sidney	M	76	F	P	RGI	1.1k	90	A	G

NEVADA

Nellis Air Force Base	B	79	F	P	RUB	1.7k	85	R2	P
Reno	M	77	F	P	RUB	14.5k	85	R2	P

NEW JERSEY

Atlantic City	M	81	P	P	RUB	6.0k	85	R3	G
Fort Dix	B	75	F	P	ZRN	3.0k	82	S	P
Glassboro	M	81	P	P	RUB	1.5k	85	R3	G

NEW MEXICO

Grants	M	75	F	P	RGI	2.8k	90	A	G
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NEW YORK

Fort Hamilton	B	75	F	P	ZRN	3.0k	82	S	P
Schenectady	C	75	P	P	ZRN	3.0k	82	S	P
Webster	M	78	P	P	RUB	1.2k	85	R2	P

NORTH CAROLINA

Albemarle	M	76	F	P	RUB	6.0k	85	R3	G
	M	81	F	P	ZRN	2.0k	90/82	S	G
Apex	C	80	F	P	ZRN	1.0k	82	S	P
Ashville	M	79	P	P	RUB	600	85	R3	G
Carrboro	M	80	F	P	RUB	1.8k	85	R3	G
Cherryville	M	74	F	P	PPI	1.9k	84	R2	G
Clayton	M	80	F	P	RGI	1.5k	90	A	G
Duke Univ.	R	80	P	P	ZRN	500	90	S	P
Fayetteville	M	78	P	P	RUB	2.0k	85	R3	G
	M	79	F	P	ZRN	23.0k	82	S	G
Fort Bragg	B	75	F	P	ZRN	6.0k	82	S	P
Garner	C	75	F		PPI	2.5k	84	S2	G
	C	76	F	P	ZRN	6.0k	82	S	P
Gibsonville	M	77	P		PPI	400	84	S2	G
Havelock	M	76	F	P	RUB	1.5k	85	R3	G
Hendersonville	M	80	F	P	ZRN	6.0k	82	S	G
High Point	M		F	P	RUB	25.0k	85	R3	G
	M	80	F	P	ZRN	1.0k	82	S	G
Madison	M	80	P	P	ZRN	1.0k	82	S	G
Monroe	M	80	P	P	ZRN	1.0k	82	S	G
	M	75	F	P	RUB	7.8k	85	R3	G
Morehead City	M	79	F	P	ZRN	3.0k	82	S	G
Nags Head	M	74	P	P	ZRN	2.0k	82	S	P
Norwood	M	77	F		PPI	900	84	R2	G
Reidsville	M	81	P	P	ZRN	1.0k	82	S	G

NORTH CAROLINA (Continued)

Rocky Mount	M	76	P		PPI	520	84	R2	G
Rolesville	M	78	F		PPI	160	84	S1 R2	P
Rural Hall	M	80	F		ARS	1.2k			G
Sanford	M	79	F	P	ARS	5.0k			P
Smithfield		77	F	P	ZRN	5.0k	82	S	P
Southport	M	79	F	P	RGI	1.0k	90	A	G
Toast	M	77	P	P	RUB	500	85	R2	P
Wendell	M	80	F	P	ZRN	3.0k	82	S	G
Wilmington		79	F	P	ZRN	5.0k	82	S	G
	M	79	P	P	RUB	400	85	R3	P
Wilson	M	81	F	P	ZRN	14.0k	82	S	G
Zebulon		77	F	P	ZRN	4.0k	82	S	P

NORTH DAKOTA

Dickinson	M	81	P	P	TKY	3.0k	90	A	G
Williston	M	78	F	P	RGI	350	90	A	G

OHIO

Columbus	M	79	P	P	ZRN	3.0k	82	S	G
Dayton	M	81	P	P	GAR	3.5k	90	A	G
Marietta	M	74	F	P	ZRN	2.0k	82	S	G

OKLAHOMA

Clinton	M	76	P		PPI	1.2k	84	S1	G
Duncan	M	79	F	P	PPI	9.0k	84	S1	G
El Reno	M	78	F	P	PPI	4.0k	84	S1	G
Fort Sill	B	78	F	P	ZRN	4.0k	82	S	P
Owasso	M	79	F	P	PPI	2.4k	84	S1	G
Seminole	M	80	P		PPI	900	84	S1	G
Sulphur	M	81	F	P	PPI	2.0k	90	R3	G
Tinker Air Force Base	B	77	F	P	ZRN	3.0k	82	S	P
Tulsa	M	81	P	D	RUB	2.0k	85	R3	G

PENNSYLVANIA

Carlisle Barracks	B	78	F	P	RUB	300	85	R2	P
Pleasant Hall		77	P	P	PPI	3.0k		R3	P

SOUTH CAROLINA

Bishopville	M	80	F	P	ZRN	4.0k	82	S	
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SOUTH CAROLINA (Continued)

Camden	M	79	F	P	ZRN	2.0k	82	S	P
Cheraw	M	79	F	P	RUB	2.7k	85	R3	G
Chester	M	79	F	P	RUB	2.8k	85	R3	G
Clinton	M	79	F	P	RUB	3.0k	85	R3	G
Columbia	M	80	F	P	RUB	27.5k	85	R3	G
Conway	M	82	F	P	RUB	3.7k	85	R3	G
Florence	M	81	F	P	ZRN	10.0k	90	S	G
Fountain Inn	M	79	F	P	ZRN	3.0k	82	S	G
Greenville	M	77	F	P	ZRN	30.0k	82	S	G
Greenwood	M	80	F	P	RUB	8.8k	85	R3	G
Greer		79	P	P	RUB	2.4k	85	R2	P
	M	79	F	P	ZRN	5.0k	82	S	G
Lake City	M	80	F	P	ZRN	3.0k	82	S	G
Lake View	M	80	F	P	ZRN	4.0k	82	S	G
Lancaster	M	79	F	P	ZRN	6.0k	82	S	G
Laurens	M	78	F	P	ZRN	4.0k	82	S	G
Mauldin	M	78	F	P	ZRN	4.0k	82	S	G
McColl	M	73	F	P	ZRN	3.0k	82	S	G
Myrtle Beach	M	79	F		ARS	5.0k			G
Rock Hill	M	80	F		ARS	13.0k			G
Shaw Air Force Base	B	79	F	P	RUB	800	85	R2	P
Simpsonville	M	78	F	P	ZRN	4.0k	82	S	G
Travelers Rest	M	79	F	P	ZRN	3.0k	82	S	G
Union	M	79	F	P	ZRN	8.0k	82	S	G
Walterboro	M	76	F	P	RGI	1.8k	90	A	G

TENNESSEE

Johnson City	M	80	P	P	ZRN	2.0k	82	S	G
	M	79	P	P	RUB	800	85	R3	G
Kingsport	C	79	P	P	ZRN	2.0k	82	S	P
Manchester	M	81	P	P	HRM	1.0k	90	A	G
Maryville	M	80	F	P	ZRN	6.0k	82	A	G
Memphis	M	80/81	F	P	RUB } PPI } ZRN }	180.0k	85	R3 R3 R3	G G G

Table 1 - Continued

TEXAS

Cedar Park	M	80	P	P	RUB	500	85	R3	P
Fort Bliss	B	79	F	P	ZRN	6.0k	82	S	P
Fort Sam Houston	B	78	F	P	RUB	1.5k	85	R2	P
Kilgore	C	78	P	P	ZRN	3.0k	82	S	P
Marlin	M	79	F	P	RUB	3.3k	85	R3	G
Silsbee	M	81	F	P	ZRN	3.0k	90	S	G
Texas City	C	79	P	P	ZRN	2.0k	82	S	P

UTAH

Cedar City	M	81	F	P	RGI	3.0k	90	A	G
Payson	M	80	F	P	RGI	2.5k	90	A	G

VIRGINIA

Arlington	C	77	P	P	ZRN	2.0k	82	S	P
Fort Belvoir	B	78	F	P	RUB	1.4k	85	R2	P
Fort Eustis	B	76	F	P	RUB	1.6k	85	R2	P
Fort Lee	B	79	F	P	RUB	1.7k	85	R2	P
Fort Monroe	B	76	F	P	RUB	300	85	R2	P
Hampton	M	79	F	P	ZRN	2.0k	90/82	S	G
	M	76	F	P	RUB	34.0k	85	R3	G
Hopewell	M	78	P	P	ZRN	500	82	S	P
	M	80	F	P	RUB	8.0k	85	R3	G
Langley Air Force Base	B	75	F	P	RUB	2.1k	85	R2	P
Newport News	M	81	P	P	ZRN	1.0k	90	S	G
	M	79	P	P	RUB	500	85	R3	G
Richmond	M	81	P	P	RUB	3.3k	85	R3	G
Salem	M	81	F	P	RUB	8.0k	85	R3	G

WASHINGTON

Grandview	M	80	F	P	RGI	1.2k	90	A	G
Pasco	C	74	P	P	ZRN	1.0k	82	S	P
Sequim	M	77	F	P	RGI	300	90	A	G
Shelton	M	78	F	P	RGI	1.2k	90	A	G
Tacoma	M	78	P	P	RGI	100	90	A	G
Toppenish	M	79	F	P	RGI	700	90	A	G
Walla Walla	M	76	F	P	RGI			A	G

WASHINGTON, D. C.

Andrews Air Force Base	B	78	F	P	RUB	2.5k	85	R2	P
City of Washington	M	81	P	P	RUB	62.0k	85	R3	G

WISCONSIN

Kenosha	M	77	P		PPI	150	84	R2	G
Milwaukee	M	81	P	D	ZRN	4.0k	90	S	G
	M	81	P	D	RUB	2.6k	85	R3	G
Shorewood	M	75	F		PPI	6.0k	84	S1	G

WYOMING

Casper	M	80	P	P	GAR	2.0k	90	A	G
	M	81	P	P	HRM	4.5k	90	A	G
Sheridan	M	81	P	P	HRM	1.0k	90	A	G

Installations on original list for which no information was provided.

CALIFORNIA

Sacramento County

GEORGIA

Rockledge PPI

MISSOURI

Springfield PPI

NORTH CAROLINA

Douglasville ZRN

NORTH DAKOTA

Kokomo RUB

OKLAHOMA

Oklahoma City Fairgrounds PPI
Okmulgee

TEXAS

Brownwood PPI
Graham PPI
Seymour PPI

VIRGINIA

Waynesboro ARS

TABLE II
 AUTOMATED AND SEMI-AUTOMATED CARD BASED
 RESIDENTIAL REFUSE COLLECTION SYSTEMS
 STATE AND REGIONAL SUMMARY

	Total Sites	Type of Site	Type of Collection	Full or Partial Installation	Semi- or Fully Automated Systems	No. Carts in Automated Sites	No. Carts in All Sites	Sites with Multiple Vendors
<u>South & Border</u>								
Alabama	14	14 M	14 G	14 F	13 S 1 A	9.0	116.4	1
Arkansas	4	1 M 3 dk	1 G 3 P	1 F 2 P 1 dk	3 S 1 dk		5.2	
Florida ^a	21	21 M	19 G 2 GP	11 F 2 P 2 D 6 dk	11 S 9 A 1 dk	129.1	257.3	6
Georgia	32	20 M 1 MC 8 C 3 B	19 G 13 P	28 F 4 P	30 S 2 A	4.3	233.9	1
Kentucky	3	2 M 1 B	2 G 1 P	2 F 1 D	3 S		8.7	1
Louisiana	20	17 M 3 B	17 G 1 P 2 dk	18 F 2 P	20 S		109.9	
Mississippi	9	9 M	9 G	9 F	7 S 2 A	22.0	64.5	1
Missouri ^a	3	3 M	2 G 1 P	3 P	3 S		13.8	1
North Carolina	31	25 M 2 C 1 B 1 R 2 dk	20 G 2 GP 9 P	22 F 9 P	27 S 2 A 2 dk	2.5	145.2	6

Table II continued

South & Border States (continued)	Total Sites	Type of Site	Type of Collection	Full or Partial Installation	Semi- or Fully Automated Systems	No. Carts in Automated Sites	No. Carts in All Sites	Sites with Multiple Vendors
South Carolina	25	24 M 1 B	21 G 1 GP 2 P 1 dk	25 F	22 S 1 A 2 dk	1.8	164.5	1
Tennessee	5	4 M 1 C	4 G 1 P	2 F 3 P	3 S 2 A	7.0	191.8	2
Texas	7	3 M 2 B 2 C	2 G 5 P	4 F 3 P	7 S		19.3	
Virginia	11	5 M 1 C 5 B	4 G 1 GP 6 P	8 F 3 P	11 S		66.4	4
Regional Total (13 states)	185	148 M 1 MC 14 C 16 B 1 R 5 dk	134 G 6 GP 42 P 3 dk	144 F 31 P 3 D 7 dk	160 S 19 A 6 dk 160 S 19 A 6 dk	175.7	1396.9	24

Table II continued

Midwest & Plains	Total Sites	Type of Site	Type of Collection	Full or Partial Installation	Semi- or Fully Automated Systems	No. Carts in Automated Sites	No. Carts in All Sites	Sites with Multiple Vendors
Illinois	8	5 M 1 C 1 B 1 R	2 G 6 P	3 F 5 P	6 S 2 A	4.3	17.9	1
Indiana	4	4 M	2 G 2 P	3 P 1 dk	2 S 2 A	2.1	3.0	
Iowa	1	1 M	1 G	1 P	1 A	1.9	1.9	
Kansas	11	10 M 1 B	4 G 7 P	2 F 9 P	11 S		33.9	1
Michigan	1	1 M	1 G	1 P	1 A	30.0	30.0	
Minnesota	5	5 M	3 G 2 P	4 F 1 P	1 S 4 A	16.5	20.5	
Nebraska	4	4 M	4 G	4 F	4 A	4.9	4.9	
North Dakota	2	2 M	2 G	1 F 1 P	2 A	3.4	3.4	
Ohio	3	3 M	3 G	1 F 2 P	2 S 1 A	3.5	8.5	
Oklahoma	9	7 M 2 B	7 G 2 P	6 F 2 P 1 D	9 S		28.5	

Table II continued

Midwest & Plains (continued)	Total Sites	Type of Site	Type of Collection	Full or Partial Installation	Semi- or Fully Automated Systems	No. Carts in Automated Sites	No. Carts in All Sites	Sites with Multiple Vendors
Wisconsin	3	3 M	3 G	1 F 2 P	3 S		12.8	1
Regional Total (11 states)	51	45 M 1 C 4 B 1 R	32 G 19 P	22 F 27 P 1 D 1 dk	34 S 17 A	66.6	165.3	3

Table II continued

West-Southwest-Mountain	Total Sites	Type of Site	Type of Collection	Full or Partial Installation	Semi- or Fully Automated Systems	No. Carts in Automated Sites	No. Carts in All Sites	Sites with Multiple Vendors
Alaska	1	1 B	1 P	1 F	1 S		.2	
Arizona ^a	13	11 M 2 B	8 G 2 GP 3 P	8 F 5 P	4 S 9 A	122.9	128.9	2
California	12	10 M 2 B	8 G 4 P	5 F 6 P 1 dk	4 S 7 A 1 dk	12.1	27.1	1
Colorado	2	1 M 1 B	1 G 1 P	2 F	2 S		18.0	1
Idaho	4	4 M	4 G	4 F	4 A	4.1	4.1	
Montana	2	2 M	2 G	2 F	2 A	1.9	1.9	
Nevada	2	1 M 1 B	2 P	2 F	2 S		16.2	
New Mexico	1	1 M	1 P	1 F	1 A	2.8	2.8	
Utah	2	2 M	2 G	2 F	2 A	5.5	5.5	
Washington	7	6 M 1 C	6 G 1 P	5 F 2 P	1 S 6 A	3.5	4.5	
Wyoming	2	2 M	2 G	2 P	2 A	7.5	7.5	
Regional Total (11 states)	48	40 M 1 C 7 B	33 G 2 GP 13 P	32 F 15 P 1 dk	14 S 33 A 1 dk	160.2	216.6	3

Table II continued

New England & Mid-Atlantic	Total Sites	Type of Site	Type of Collection	Full or Partial Installation	Semi- or Fully Automated Systems	No. Carts in Automated Sites	No. Carts in All Sites	Sites with Multiple Vendors
Connecticut	1	1 dk	1 P	1 P	1 dk		1.0	
Delaware	2	1 MC 1 B	2 P	1 F 1 P	2 S		14.9	1
District of Columbia	2	1 M 1 B	1 G 1 P	1 F 1 P	2 S		64.5	
Maryland	5	5 M	1 G 4 P	1 F 4 P	5 S		9.1	
New Jersey	3	2 M 1 B	2 G 1 P	1 F 2 P	3 S		10.5	
New York	3	1 M 1 C 1 B	3 P	1 F 2 P	3 S		7.2	
Pennsylvania	2	1 B 1 dk	2 P	1 F 1 P	2 S		7.2	
Regional Total (6 states 1 D.C.)	18	9 M 1 MC 1 C 5 B 2 dk	4 G 14 P	6 F 12 P	17 S 1 dk		114.4	1

Table II continued

Summary of Grand Total	Total Sites	Type of Site	Type of Collection	Full or Partial Installation	Semi- or Fully Automated Systems	No. Carts in Automated Sites	No. Carts in All Sites	Sites with Multiple Vendors
Grand Total (40 states 1 D.C.)	312	242 M 2 MC 17 C 32 B 7 dk 22 R	203 G 8 GP 88 P 3 dk	204 F 85 P 4 D 9 dk	225 S 69 A 8 dk	402,500 21.3 %	1,893,200	32 10.6%

Notes: Data presented here include only installations using standardized wheel-type, 80-90 gallon containers in automated or semi-automated residential refuse collection.

Note a means that carts were supplied to one site by three vendors.

Type of Site: M = municipal; C = county; B = military base;
R = other; dk = no information provided;

Type of Collection: G = governmental; P = private collection;
GP = combination; dk = no information provided.

Full installation = F; partial = P; demonstration = D; no information provided = dk.

Semi-automated collection = S; automated = A; no information provided = dk.

Vendor data were reconciled for sites with multiple vendors for regional and grand totals.

TABLE III
Installation Start-up Dates

<u>Year</u>	<u>Number</u>	<u>%</u>
pre-1975	23	7.6
1975	16	5.3
1976	23	7.6
1977	32	10.6
1978	46	15.2
1979	59	19.5
1980	44	14.6
1981	39	12.9
1982	2	0.7
dk	18	5.9
Total	302	99.9

TABLE IV
Regional Distribution

<u>Region</u>	<u># States</u>	<u># Sites</u>	<u>%</u>
South-Border	13	185	61.3
Midwest-Plains	11	51	16.9
West-Southwest-Mountain	11	48	15.9
New England-Mid-Atlantic	6 & D.C.	18	5.9
Total	41 & D.C.	302	100.0

Note: See Table II for states by Region.

TABLE V
Semi-Automated or Automated Collection

<u>Type of Collection</u>	<u># Sites</u>	<u>%</u>
Semi-automated	225	74.5
Automated	69	22.8
No Information	8	2.6
Total	302	99.9

TABLE VI

Types of Sites

<u>Type</u>	<u>Number</u>	<u>%</u>
Municipalities	242	80.1
Military Base	32	10.6
County	17	5.6
Other & No Information	<u>11</u>	<u>3.6</u>
Total	302	99.9

TABLE VII

Collection By

<u>Collecting Entity</u>	<u>Number</u>	<u>%</u>
Municipal	203	67.2
Private	88	29.1
Other/No Information	19	2.9
Municipal/County	<u>2</u>	<u>0.7</u>
Total	302	99.9

TABLE VIII

Full or Partial Installation

<u>Type</u>	<u>Number</u>	<u>%</u>
Full	204	67.5
Partial	85	28.2
Demonstration	4	1.3
No Information	<u>9</u>	<u>2.9</u>
Total	302	99.9

TABLE IX

Number of Carts

Total Carts: 1,893,200

Carts in fully automated sites: 402,500 (21.3%)

Note: Numbers were rounded to the nearest 100 to facilitate computation.

TABLE X

Sites Supplied by Multiple Vendors

Total Sites: 302

Sites Supplied by Two Vendors: 29 (9.6%)

Sites Supplied by Three Vendors: 3 (1.0%)

Total Sites Supplied by Multiple Vendors: 32 (10.6%)

Total Sites Supplied by Single Vendor: 270