The Record. July 2, 1969

Staff Engineer, Systems Section, TA&I Branch,
Division of Technical Operations, BSWM

Trip Report -- Waukeshaw County, Wisconsin

A. Where: Waukeshaw County, Wisconsin

B. Date: June 18, 1969

C. Purpose: To meet with the owner of Sanitary Disposal Service, Inc. in Delafield, Wisconsin to make necessary arrangements for a scooter solid waste collection study to be conducted July 7-11, 1969. TSP/42/9

D. Person Contacted:

Mr. Ron Nickel, Owner, Sanitary Disposal Service, Inc., Delafield, Wisconsin

Sanitary Disposal Service, Inc. is a modern, efficient and well-managed collection and disposal firm serving 70 percent of Waukeshaw County with private and contracted collection service. Mr. Nickel inherited the firm from his father when he was 17 years old and has made continuous improvements since.

The company collects from 6000 private residences and also collects from 4 towns on a contract basis. Collection frequency is once per week and the charge is $36.00 per residence per year. Mr. Nickel also operates a disposal site employing a D-8, a small dozer and a scraper. Scales are available but are used only infrequently.

Mr. Nickel owns 22 scooters, but only 12 are presently in use. This is due to the recent loss of a contract by being underbid by a competitor. Two man crews are used, the packer truck driver operating a scooter in addition to the truck. Mr. Nickel buys Cushman scooters for $2962. The scooters are renovated and improved structurally before being placed on the route. At the end of one year of use the scooter is torn down and rebuilt again. The scooters are junked after 2 years usage. The total cost to operate the scooter for 2 years is about $5000.

The employees of Sanitary Disposal company receive $180.00 per week when all fringe benefits are included. The men begin work at 5:30 a.m. and are provided breakfast and lunch by the company at the garage. Mr. Nickel maintains a good relationship with his employees resulting in maximum efficiency from his men.

The latest innovation by Mr. Nickel is the use of plastic bags by his customers at a cost of $0.05 per bag.

The date for the field study was set for July 7 thru 11. Mr. Nickel indicated that he would be able to obtain motorcycles for our use.

Mr. Nickel has an extreme interest in new methods and concepts of solid waste collection. I advised him of the availability of demonstration grants for this purpose and he seemed quite interested.

Altogether, I was very impressed with Mr. Nickel and his operation and the trip was very productive.

Ronald A. Perkins

cc: Mr. William Q. Kehr
Solid Waste Mgt. Representative
Chicago, Illinois

RAPerkins:ads

APPENDIX G

WAUKESHA COUNTY, WISCONSIN

FIELD STUDY, JULY 8-11, 1969

Waukesha County is located in the flat southeastern section of Wisconsin directly west of Milwaukee County. The County has benefited from westward expansion of the City of Milwaukee, producing one of the highest county population growth rates in the United States in the 1960's. The population has increased from 158,249 in 1960 to an estimated 212,000 in 1969. This suburb of Milwaukee is characterized by upper middle class homes in large housing developments built within the last ten years to meet the needs of commuters not wishing to live in the city. These homes are located on small lots and are close to the street.

Sanitary Disposal Service, Inc. provides once weekly waste collection service to approximately 50-60% of the population of Waukesha County on a private or contract basis. The cost to private subscribers is $36 per year. The company began using Cushman scooters in October 1966 in an attempt to increase collection efficiency. Sanitary Disposal Service currently operates 22 Cushman scooters in two man crews with two scooters per crew. The scooters are transported to the routes in pairs on trailers hauled behind the packer trucks (Figure G-1). The packer driver operates a scooter in

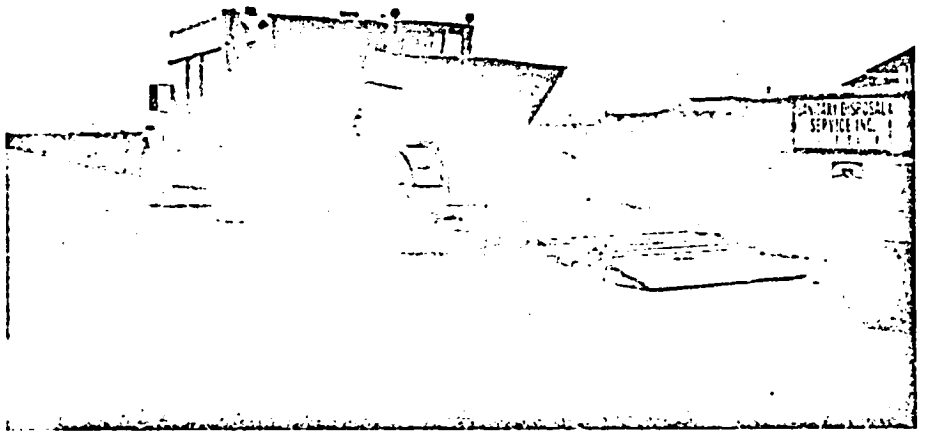

Figure G-1. Satellite vehicles with hauling trailer.

addition to the packer truck during collection by attaching his satellite vehicle to the packer truck when moving it.

The use of plastic bags for waste storage has been recently initiated by Sanitary Disposal to further reduce collection time. The cost of these bags to the customer is $.05 per bag and approximately 15% of the customers were using plastic bags at the time of the study.

FIELD STUDY ANALYSIS

The field investigation was conducted July 8 through 11 in the City of Brookfield and the Village of Elm Grove in Waukesha County. One crew was observed for the four day period. The area in which the crew operated was very flat with modern upper-middle class homes located on small lots with short driveways. The housing density of this area was about 40 houses per mile (Table G-1), but since Sanitary Disposal only has about 75% of the residences as customers, the effective density was reduced to 30 houses per mile. The company requires that the storage area be easily accessible to the scooters in order to reduce walking distance to an average of ten feet at each dwelling unit.

Stepwise regression analyses were made on the data for both collectors individually and combined. The average variable values and the mathematical models for both drivers were

TABLE G-1

COMBINED STATISTICS
CITY OF BROOKFIELD AND VILLATE OF ELM GROVE
WAUKESHA COUNTY, WISCONSIN

Population*	39,800 (est. 1969
Dwelling unit*	9,500 (est. 1969)
Persons per dwelling unit	4.18
Land area*	29 sq miles
Population density	1,370 persons per mile^2
Housing density	330 homes per mile^2
Miles of street*	233 miles
Houses per street mile	40

*From Village Manager of Elm Grove and City of Brookfield Department of Public Works.

very similar (Tables G-2, G-3). From this and the percent of the variation covered it can be concluded that the variables recorded are very significant and therefore reliable in predicting productive time per satellite vehicle load. The regression model which best described productive collection time for the 173 satellite vehicle loads observed in Waukesha County was:

$$Y_p = -0.89 + 0.54\ X_1 + 0.15\ X_2 + 0.011\ X_3 + 0.047\ X_4 + 2.93\ X_5$$

where Y_p = Productive collection time per satellite vehicle load, in minutes

X_1 = Number of dwelling units serviced per load

X_2 = Number of items collected per load

X_3 = Average distance satellite vehicle travels up driveway of each dwelling unit, in feet

X_4 = Average distance from satellite vehicle to storage at each dwelling unit, in feet

X_5 = Route distance of satellite vehicle per load, in miles

This equation was able to explain 83.0 percent of the total variation in the data and the standard deviation of the residuals was 20.0 percent of the response mean, productive time. The F value of 163.5 indicates that these five variables are significant in explaining productive time. The route distance per load of the satellite vehicle was the most highly

TABLE G-2

SATELLITE VEHICLE COLLECTION MODEL COEFFICIENTS
WAUKESHA COUNTY, WISCONSIN - JULY 8-11, 1969

Operator	Variable						
	X_1 Dwelling units serviced per load	X_2 Items collected per load	X_3 Distance vehicle up driveway	X_4 Distance vehicle to storage	X_5 Route distance per load	X_0 Constant term	R^2 Percent variation explained
WCD_1	0.42	0.17	0.007	0.026	*3.05	-0.24	85.3
WCD_2	*0.78	0.10	0.014	0.047	2.59	-1.56	84.0
Combined	0.54	0.15	0.011	0.047	*2.93	-0.89	83.0

*Variable most highly correlated to productive time.

TABLE G-3

AVERAGE VALUES OF SATELLITE VEHICLE COLLECTION VARIABLES, WAUKESHA COUNTY, WISCONSIN - JULY 8-11, 1969

Driver	Satellite vehicle loads observed	Variable X_1 Dwelling units serviced per load	X_2 Items collected per load	X_3 Distance vehicle up driveway (ft)	X_4 Distance vehicle to storage (ft)	X_5 Route distance per load (mile)	D_{ss} Distance street to storage (ft)	Y_p Productive time per load (min)
WCD_1	102	5	22	70	10	0.60	70	8.0
WCD_2	71	5	22	70	0	0.60	70	7.4
Combined	173	5	22	70	10	0.60	70	7.7

correlated variable to productive time in this equation. This means that the variations in productive collection time per satellite collection vehicle load were best accounted for by the corresponding variation in route distance traveled by the vehicle.

To illustrate the utility and accuracy of the regression model developed, it was compared to actual field observation values. Using the average variable values, the productive time required to make one trip with the satellite vehicle was predicted (Table G-3).

Unloading and other time were accounted for by dividing the productive time by the fraction of productive time (Table G-4) to yield total elapsed time required.

X_1 = dwelling units per load	=	5
X_2 = items per load	=	22
X_3 = average distance vehicle goes up driveway	=	70 ft.
X_4 = average distance from vehicle to storage	=	10 ft.
X_5 = route distance of vehicle per load	=	0.60 miles
Percent productive time substituting into the model;	=	77.5%

$$\text{Productive time} = -0.89 + 0.54\,(5) + 0.15(22) + 0.011(70) + 0.047(10) + 2.93(0.60)$$

TABLE G-4

SATELLITE COLLECTION VEHICLE OPERATOR ACTIVITY ANALYSIS
WAUKESHA COUNTY, WISCONSIN, JULY 8-11, 1969

Operator	Total minutes observed	Percent of total time			
		Productive	Unloading	Driving packer	Other
WCD_1	1,117.4	80.7	17.6	0.0	1.7
WCD_2	706.5	72.7	15.2	5.9	6.2
Combined	1,823.9	77.5	16.6	2.2	3.7

Productive time = 8.1 minutes per load

Total elapsed time = $\frac{\text{productive time}}{.775} = \frac{8.1}{.775} = 10.5$ minutes per load

The predicted productive time of 8.1 minutes per load is 5 percent above the average time observed, 7.7 minutes per load, during the field study (Table G-2). Therefore, the regression model is very accurate in describing productive time required per satellite vehicle load.

System Cost Analysis

The costs for the average satellite vehicle collection crew in Waukesha County, Wisconsin were obtained from the owner of Sanitary Disposal Service, Inc. Two man crews were used in Waukesha County, but were equivalent to three man crews in other areas. The cost calculations and comparisons are based on the assumption of crew equivalency.

Daily Crew Costs

The daily cost of a satellite vehicle collection crew consists of labor, satellite vehicle operation and depreciation, packer truck operation and depreciation, and overhead. The costs are given in dollars per day.

Labor.

2 - satellite vehicle operators @ $180/wk = $72.00

Satellite Vehicle Operation and Depreciation.

Operation

2 - satellite vehicles each @$1000/yr	=	$7.70

Depreciation

2 - satellite vehicles, $3000 new, 2 yr. life	=	11.54
Total operation and depreciation	=	$19.24

Packer Truck Operation and Depreciation.

Operation

1 - 25 cu yd Heil @ $2500/yr	=	$9.61

Depreciation

1 - 25 cu yd Heil, $15,000 new, 4 yr. life	=	14.40
Total operation and depreciation	=	$24.01

Overhead.

Overhead cost was unable to be obtained from Sanitary Disposal Service, Inc. and therefore was estimated at 20 percent of all other costs.

Overhead cost = 0.20(72.00 + 19.24 + 24.01)	=	23.05

Total Crew Cost.

The total daily crew cost is	$138.30

Annual Collection Cost per Dwelling Unit

The annual collection cost for the average dwelling unit observed in Waukesha County for once weekly collection was be determined by multiplying the crew efficiency by the crew

cost rate. The crew observed during the field investigation worked approximately 7.0 hours per day in the actual process of collection. The true crew cost rate is then $138.30/day X 1 day/7.0 hrs or approximately $20.00 per collection hour. The crew efficiency was 10 dwelling units per 9.9 minutes or 61 dwelling units per hour. The annual collection cost per dwelling unit for once weekly collection is then:

$20.00/hr X 1 hr/61 d.u. X 52 collections/d.u./yr ≅ $17.00

Collection Cost Per Ton

During the field investigation, 5 truck loads of waste were weighed to determine the residential solid waste generation rate in Waukesha County (Table G-5). The collection cost per ton was calculated using this generation rate. The amount of waste collected per hour by the crew would be:

61 d.w./hr X 4.18 persons/d.w. X 2.6 lbs/capita/day
X 7 days = 4600 lbs/hr.

Multiplying by the crew cost per hour produces the collection cost per ton.

$20.00/hr X 1 hr/4600 lbs X 2000 lbs/ton ≅ $8.50/ton

TABLE G-5

RESIDENTIAL SOLID WASTE GENERATION
WAUKESHA COUNTY, WISCONSIN
JULY 8-10, 1969

Date	Weight (lb)	Dwelling units serviced	lb/capita/day
7/8	12,350	154	2.7
	10,350	164	2.2
7/9	14,250	161	3.0
	6,100	88	2.4
7/10	10,550	143	2.5
Total	53,600	710	2.6

Satellite Vehicle Collection vs. Conventional Collection

Productive time requirements and costs for conventional walking collection were estimated and compared to satellite vehicle collection using a regression model similar to the one developed for satellite vehicles. The regression model for walking collection is:

$$C = 0.18 - 0.12W_1 + 0.12W_2 + 0.24W_3 + 0.005W_4$$

where C = productive time in minutes to service W_1 dwelling units

W_1 = the number of dwelling units to be collected

W_2 = total number of items to be collected from W_1 dwelling units

W_3 = total number of trips to truck while servicing W_1 dwelling units

W_4 = total distance walked by collector while servicing W_1 dwelling units, in feet

The average housing characteristics used in the satellite vehicle calculations were used to calculate the productive time required for one walking collector to service 5 dwelling units. The results were then compared with satellite vehicle collection to determine the most efficient method for Waukesha County. The average values for Waukesha County were:

W_1 = 5 dwelling units

W_2 = 4.4 items/dwelling unit$^+$ x 5 dwelling units = 22 items

W_3 = 1 trip/3 items* x 22 items = 7.33 trips

W_4 = [45 + 2.55 (average street to storage distance)] W_1*

= [45 + 2.55 (70)] 5 $\cong$ 1120 feet

---

*Appendix A

$^+$Table G

Substituting these values into the regression model,

Y_ρ = 0.18 - 0.12(5) + 0.12(22) + 0.24(7.33) + 0.005(1120)

= 9.6 minutes of productive time

Since the average walking collector who also drives the crew truck is productive 80 percent of the time while on the collection route (Appendix A), the total time required to service 5 dwelling units becomes $\frac{9.6}{0.80}$ or 12.0 minutes. The satellite vehicle operator serviced an equivalent number of dwelling units in a total time of 9.9 minutes. Therefore, satellite vehicle waste collection in Waukesha County is theoretically 21 percent more efficient than the alternate method of waste collection by walking collectors.

The cost of a walking collection crew in Waukesha County would be $115.20 per day. Since the crew spends approximately seven hours per day on the collection route the true cost per hour

is approximately $16.50. The two man crew can collect a total of 10 dwelling units per 12 minutes or an equivalent of 50 dwelling units per hour. The annual collection cost per dwelling unit is then:

$16.50/hr x 1 hour/50 dwelling units x 52 collections/yr
= $17.00

The annual cost per dwelling unit for satellite vehicle collection was also $17.00. Thus the two methods are theoretically equal on the basis of economics alone.

Operational Comments

The unique concept used by Sanitary Disposal Service, Inc. of having the packer driver also operate a satellite vehicle is very efficient. Driving the packer truck occupied a maximum of only six percent of one man's time. This leaves 94 percent of the operator's time to be available for productive work instead of waiting at the truck. The time required to attach or detach the satellite vehicle from the packer was only 0.3 minutes. The only disadvantage to leaving the packer truck unmanned and running is the danger of children innocently or intentionally tampering with it.

The operators in the area observed were benefited in their operation by the accessability to the waste storage point. Very short driveways averaging seventy feet in length with

little or no walking distance from the vehicle to the storage point increased crew efficiency significantly.

Customers were very thoughtful in their choice of a storage point and the collectors were seldom required to ring doorbells to ask people to unlock garages, the most common storage area.

The average number of items collected per dwelling unit, 4.6, was extremely high. This value was nearly twice the average value for the other five areas studied, due to garden wastes which constituted approximately 50 percent of the total wastes. The amount of waste collected in the winter would thus be reduced significantly. Approximately 40 percent of the items were not in standard containers. Most of the wastes collected were containerized in paper and plastic bags, increasing transportability by the satellite vehicles. Approximately 15 percent of the items collected were plastic bags. The operators carried a supply of plastic bags in their vehicles and delivered them to customers upon request.

The satellite vehicle operators observed used an excessive amount of time unloading the wastes into the packer truck. The high average unloading time of 1.7 minutes was due to several reasons. The hopper on the 25 cu. yd. Heil

Collectomatic Mark III has only a 1.5 cu. yd. capacity requiring 2 to 3 compaction cycles to accommodate the waste from the satellite vehicles. This problem was enhanced by to the consistent overloading of the satellite vehicles by their operators (Figure G-2). The 1¼ cu. yd. satellite vehicle hoppers were usually heaped up to about 2 cu. yd. before returning to the packer truck. The operators averaged 22 items per load compared to an average of 15 items per load for the six study areas. Operators had to unload the satellite vehicles carefully and slowly to avoid spilling wastes onto the pavement from the overloaded vehicles.

Reducing the number of items per load and use of a packer with a 3 cu. yd. hopper could decrease unloading time significantly. In addition, the installation of a rubber flap on the back of the satellite vehicle hopper could reduce the amount of waste spillage and attendant cleaning up time.

The Company reported very little trouble due to winter snowfall. No adverse effects on normal operations were experienced until there was more than two inches of snow on the ground.

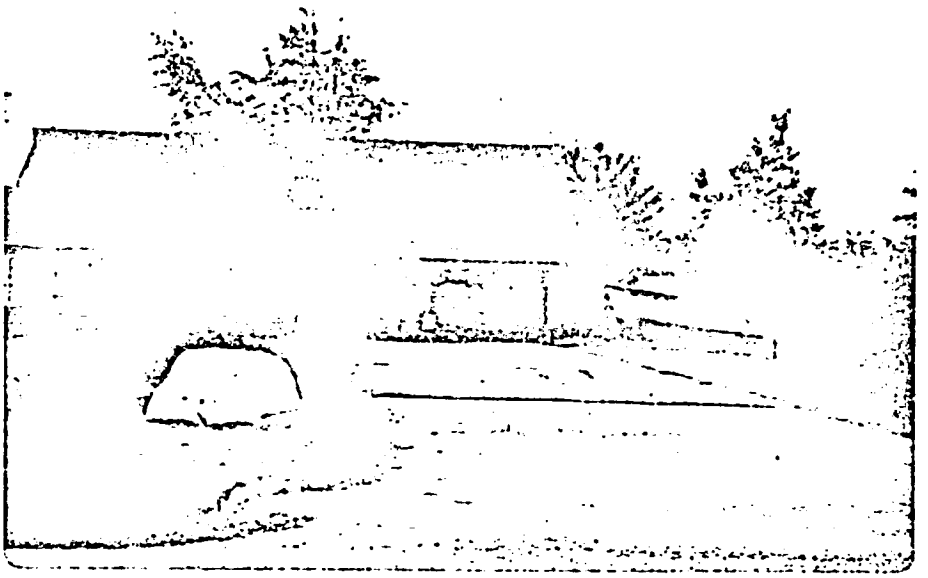

Figure G-2. Overloaded satellite vehicle

HAMPSON AND MCLEAN
ATTORNEYS AT LAW
PUBLIC SERVICE BUILDING
PORTLAND, OREGON 97204
(503) 226-6641

January 31, 1973

The Metropolitan Service District
c/o Lloyd Anderson
City Hall
Portland, Oregon

Gentlemen:

Bottle Systems Inc., an Oregon corporation, has a contract (contingent upon certain factors) with FMC Corp.-Engineered Systems Division providing for the study of the feasibility of a mechanized deposit return system in grocery stores and a central sorting and redistribution system for beer and soft dring bottles.

Each subscribing store would have a machine into which the customer would place the returnable bottles and receive a credit slip showing the number of bottles, the amount of deposit credited and the date. This slip would be redeemable at the checkout stand for cash or groceries.

The bottles would be picked up by truck in large units, taken to a central location where they would be sorted by automatic or semi-automatic methods. They would then be packaged and palatized and returned to or picked up by the bottlers for washing and reuse.

This system would involve a savings to the grocery store, the jobber or wholesaler, and the bottler and an eventual savings to the customer, the preservation of the Oregon Bottle Bill and the reduction of solid waste.

If the system proves to be feasible it could also accept wine bottles for collection and shipment to California or eventually to Oregon's own wineries.

Bottle Systems Inc. seeks a grant of $50,000 to conduct this study. If at anytime during the course of the investigation the research discloses the system would prove to be uneconomic then the study would be terminated.

If the system is installed and is in fact economic then Bottle Systems, Inc. will repay Metropolitan Service District the amount of the grant over a period of time on a schedule to be agreed upon. Likewise Metropolitan Service District would receive an annual license fee of a reasonable amount upon each receiving machine. The amount of such fee and the terms thereof would have to be arrived at jointly.

A resume of F. M. C. Corp.'s qualifications will be supplied as soon as it is received from it.

Sincerely,

Alfred A. Hampson

Alfred A. Hampson

AAH:nm

MSD METROPOLITAN SERVICE DISTRICT
6400 S.W. CANYON COURT PORTLAND, OREGON 97221 (503) 297-3726

file

June 22, 1973

Mr. Alfred A. Hampson
Hampson & McLean Attorneys
Public Service Building
Portland, Oregon

Dear Mr. Hampson:

On June 8, 1973, the Metropolitan Service District Board reviewed the Technical Advisory Committee's recommendation that the Bottle Bank, Inc. proposal be referred to the Oregon State Department of Environmental Quality. Mr. Ernie Schmidt, of the DEQ stated that his organization was not able to directly act on the proposal and for this reason, it was referred to MSD. After some discussion, the MSD Board acted by consensus to file the proposal for consideration at a time when the District is in a position to deal with it.

I personally regret the amount of time and effort you have expended in attempting to develop this concept. However, I think the Board's feeling was that unless some support from private industry was indicated, MSD should not get involved.

If you have any questions regarding this decision, please contact me.

Very truly yours,

Charles C. Kemper
MSD Program Coordinator

CCK/jw
cc: Lloyd Anderson
Ernie Schmidt
A. McKay Rich

Continental Metal

Continental Can Company, Inc.
Metal Operations
10200 North Lombard
Portland OR 97203

April 23, 1974

Mr. Charles Kemper
Program Manager
Metropolitan Service District
6400 S. W. Canyon Street
Portland, Oregon 97201

Dear Mr. Kemper:

We at Continental Can Company are very interested in the problems and opportunities connected with solid waste disposal. We are aware of the fine planning and detailed work which has been carried on by your department in conjunction with COR-MET, the four counties, and the staff of the Department of Environmental Quality.

The purpose of this letter is to express to you and your associates a desire on our part to be given an opportunity to enter into a proposal which would allow Continental Can Company to handle the solid waste of the Metropolitan Service District.

I would appreciate it if you would send me a copy of the engineering study pertaining to this project so that we may study it in detail.

Thank you for your consideration,

David Wilson
General Manager - Northwest

DW:cw

METROPOLITAN SERVICE DISTRICT
6400 S.W. CANYON COURT PORTLAND, OREGON 97221 (503) 297-3726

May 7, 1973

TO: Technical Advisory Committee

FROM: MSD Staff

SUBJECT: CRITERIA FOR EVALUATING PROPOSALS TO THE METROPOLITAN SERVICE DISTRICT

As a result of the Bottle Bank, Inc., proposal for feasibility grant funds, the MSD Board has requested that the Technical Advisory Committee develop procedures that can be used to evaluate proposals of this kind. With the help of Bill Culham, we have developed the attached criteria for TAC discussions. The criteria described herein includes:

I. Requests for Financial Aid or Grants

II. Proposal to Supply Equipment

III. Proposal to Provide Turn-key Operations

IV. Proposal to Provide Total Management Systems from Private Industry and Governments

It should be recognized that the MSD will receive, in the future, many proposals on which the Board must decide. From past experience it appears they will rely on TAC to provide technical analysis and recommendations.

OTHER APPLICATIONS: INDUSTRY AS A MARKET

By

Thomas J. Lamb

Arthur D. Little, Inc.
20 Acorn Park
Cambridge, Massachusetts

Prepared For

Conference on Energy Recovery
From Municipal Solid Waste

October 31 - November 1, 1974

POTENTIAL CUSTOMERS

&

FUEL USES

• Commercial	Space Heating	Opportunities Limited
• Industrial	Space Heating Process	Opportunities Very Good

Representative Customers That Have Expressed Interest

Weyerhaeuser Company	Forest Products
CPC International	Food Products
Federal Government	Varied Uses

Fuel Uses

Present: A Fuel for Steam or Direct Process Use

Future: A Fuel for Steam or Direct Process Use

Pipeline Quality Gas (1000 Btu's/CF)

Hydrogen For Process or Fuel Cells

Synthesis Gas for Methanol or Ammonia

FUEL FORMS

	Transportation	Range	Storage	Environmental Impact On User	Type Boiler
Solid	Truck/Rail	Moderate	Yes	Particulate Control & Ash Disposal	Coal
Gaseous	Pipeline	Limited	No	None	All
Liquid	Truck/Rail/Pipeline	Wide	Yes	Particulate Control ?	Coal and Heavy Oil
Steam	Pipeline	Limited	No	None	Not Required

CONCERNS OF THE USER

- Reliability of Supply
- Quality Control
- Back-Up Fuel
- Impact on Fuel Allocations
- Emissions
- Ash Disposal
- Capital Expenditures for Conversion
- Fuel Storage and Handling
- Corrosion/Erosion in Boilers

PRICING

Negotiated Price With or Without Escalation

Price Based on Alternate Fuel Price With or Without Escalation Tied to Alternate Fuel Price

Price to Make Resource Recovery Competitive to Alternate Disposal Techniques

INCENTIVES TO USE FUEL

1. Savings in Annual Fuel Bill
2. Community Responsibility
3. Assured Fuel Supply

NATIONAL LEAGUE OF CITIES

UNITED STATES CONFERENCE OF MAYORS

PRE-REGISTRATION LIST

CONFERENCE ON ENERGY RECOVERY FROM MUNICIPAL SOLID WASTE

ST. LOUIS, MISSOURI

OCTOBER 31 - NOVEMBER 1, 1974

1620 Eye Street, N.W., Washington D. C. 20006 / 202-293-7300

Carl E. Avers	Nashville Thermal Transfer Corporation	Nashville, Tennessee
John N, Barineau	Browning-Ferris Ind.	Houston, Texas
Jimmie R. Bearden	Dir. of Sanitation	Little Rock, Ark.
Pressly F. Beaver	Ass't. Dir. of Public Works Department	Charlotte, N.C.
Alfred H. Beck	Operations Engineer	Kansas City, Mo.
Matthew J. Beckstedt	City Planning Dept.	St. Charles, Mo.
A. H. Bellac	Combustion Equip. Assoc.	New York, N.Y.
Gordon Benschoter	Aldermen	Fairmont, Minn.
W. E. Black	Mayor	Deer Park, Texas
Joe Bowles	Ass't City Engineer	Rolla, Missouri
Jim Brady	City Hall	Dubuque, Iowa
Barbara Bralich	Oahkosh Industrial Development Committee	Oshkosh, Wis.
Bill Bramblett	Browning-Ferris Ind.	HOuston, Texas
Harry M. Brawley	Councilman-at-Large	Charleston, W. Va.
Jack Becker	Finance Director	Hamilton, Ohio
Robert M. Bruce	City Engineer	East Lansing, Mich.
Franchot Buhler	NLC and USCM	Washington, D. C.
Roger G. Burns	Leonard S. Wegman Company, Inc.	New York, N.Y.
Theodor F. Buss	Sales Manager	St. Louis, Mo.
Harry Butler	Technical Ass't Coord. EPA	Washington, D. C.
Ersel C. Byrd	Mayor	Yuma, Arizona
J. R. Castner	City Manager	Ames, Iowa
Thomas E. Cavanagh,Jr.	Manager, Resources Conservation	Springfield, Ill.

Merl O. Chambers	Supt., Power Plant Construction	Springfield, Ill.
Gil Chaveneelle	City Hall	Dubuque, Iowa
James W. Clevenger	City Administrator	Yuma, Arizona
James J. Cordiano	AMAX Resource Recovery Systems	Dayton, Ohio
Malcomb Cox	Environmental Eng.	Hamilton, Ohio
Russell E. Cummings	Project Development Department	New York, N.Y.
Michael F. DeBonis	Staff Engineer - EPA	Washington, D. C.
Farris A. Deep	Nashville Thermal Transfer Corporation	Nashville, Tenn.
Edward T. DiBerto	Operations Assistant	Norfolk , Va.
Thomas A. Donnegan	Union Carbide Corp.	New York, N.Y.
Patrick L. Dougherty	Commissioner of Public Works	Rockford, Ill.
George I. Engle	Construction Engineer	New Haven, Conn.
John Engle	Public Utilities	Hamilton, Ohio
Joseph Edeskuty		Fairmont, Minn.
Robert Edeskuty		Fairmont, Minn.
Fred Fregerio	The Heil Company	Milwaukee, Wis.
C. Willard Gamble	Incinerator Supt.	New Haven, Conn.
Chris G. Ganotis	MITRE Corporation	Bedford, Mass.
Diane Gardner	Missouri Municipal League	Jefferson City, Mo.
Gordan Gezon		Grand Rapids, Mi.
Ned L. Gines	City Commissioner	Logan, Utah
Donald H. Graham	Black, Crow and Eidsness, Inc.	Gainesville, Florida

Herbert L. Greene	NASA-Langley Res. Center	Hampton, Virginia
Jim A. Haley	Public Works Dept.	Austin, Texas
Ernest L. Hardin, Jr.	Illinois Institute for Environmental Quality	Chicago, Ill.
Donald E. Hathaway	Commissioner-Public Works	Shreveport, La.
Denise F. Hawkins	Urban Planner - EPA	Washington, D.C.
James M. Henneberry	Environmental Coordinator	Springfield, Ill.
Steven J. Hitte	Staff Engineer _ EPA	Washington, D.C.
David H. Hozza	Councilman	St. Paul, Minn.
Nicholas Humber	Director, Resource Recovery Div., EPA	Washington, D.C.
William S. Hutchinson,Jr.	Deputy Director Public Works Dept.	Jacksonville,Fla.
Bob Justmann	City Hall	Dubuque, Iowa
Michael Kanner	Research Scientist	St. Paul, Minn.
William C. Dase	Cullen-Kilby-Carolan	Dubuque, Iowa
Dan Keasling		Fairmont, Minn.
Jack Kirsch	Public Works Director	Hamilton, Ohio
Margaret Krash	Pennsylvania League of Cities	Harrisburg, Pa.
Francis W. Kuchta	Dir. of Public Works	Baltimore, Maryland
Donald D. Kummerfeld	First Boston Corp.	New York, N.Y.
Louisa Legg	Resource Management Policy Council	Boston, Mass.
Steven J. Levy	Staff Engineer - EPA	Washington,D.C.
Stephen G. Lewis	MITRE Corporation	Bedford, Mass.
Richard J. Linzmaier	Senior Planner	St. Louis, Mo.
H. E. Lordley	Director of Utilities	Richard, Va.
Robert A. Lowe	Energy Recovery Branch EPA	Washington,D.C.
Al Lundh	City Hall	Dubuque, Iowa
Richard J. Lutovsky	Economic Development Coordinator	Decatur, Ill.

Dorsey H. Lynch	First Boston Corporation	New York, N.Y.
J. F. Lynch	Technology Agent	Little Rock, Ark.
Les Madsen		Fairmont, Minn.
Krishan Malik	Mechanical Engineer	Austin, Texas
Sam P. Mancuso	Dir. of Public Works	Lake Charles, La.
Bob May	Browning-Ferris Ind., Inc.	Houston, Texas.
J. Keith McCartney	Marketing Specialist	LaVerne, Calif.
Joseph J. Milkovich	Consultant	Huntington Beach, Calif.
Herbert H. Minakami	Div. of Refuse, Collection and Disposal	Honolulu, Hawaii
Wallace Miyahira	Deputy Dir. & Chief Eng.	Honolulu, Hawaii
Park L. Morse	Sen Eng. Economist	Fremont, Calif.
Dr. H. Nugent Myrick	Texas Solid Waste Management News	Houston, Texas
Gailen Narum	City Engineer	Fairmont, Texas
Luther D. Nelson	Hennepin County Dept. of Public Works	Hopkins, Minn.
Ed Nicholson	Sanitary Commision	Richmond, Ind.
Arthur Nielson	Alderman	Rockford, Ill.
Brian W. Opel	State Board of Health	Martinsville, Ind
Osmund Orland	Commissioner	Aurora, Ill.
Jack Owen	Ass't. City Manager	Denton, Texas
Dr. Marion A. Panzarella	Board of Public Utilities	Jamestown, N.Y.
Roy A. Patton	Ass't. City Manager	Farmers Branch, Texas
Bernadette B. Payne	NLC and USCM	Washington, D.C.
William P. Poblete,P.E.	Public Health Eng.	Rochester, Minn.
Dr. George T. Preston	Garrett Research & Development Program	LaVerne, California
Robert Randol	Financial Analyst - EPA	Washington, D.C.
Mike Rempter	DeKalb County Solid Waste Management Committee	Sycamore, Ill.

Theordore Rusen	City Engineer	Norwood, Ohio
Carl J. Saladino	Ass't. Superintendent Power Plant Construction	Springfield, Ill.
James H. Scarbrough	EPA - Region IV	Atlanta, Georgia
Ted Schaffer	American Institute of Planners	Washington, D.C.
Robert M. Schule	NLC and USCM	Washington, D.C.
Jerry Schwartz	Solid Waste Management Magazine	New York ,N.Y
Dr. Larry J. Shannon	Midwest Research Inst.	Kansas City,Mo.
Alan Shilepsley	Physical Scientist - EPA	Washington, D.C.
Kenneth D. Sill	Techology Agent	Sioux City, Iowa
G. Rex Smith	Maintenance Engineer	Lincoln, Neb.
Walter R. Smith	Leonard S. Wegman Co.,Inc.	New York, N.Y.
Robert L. Stockman		Alto, Mi.
G. Wayne Sutterfield	Refuse Commissioner	St. Louis, Mo.
Victor J. Tedesco	Councilman	St. Paul, Minn.
Morris G. Tucker	EPA-Region VII	Kansas City, Mo.
Robert Urell	City Hall	Dubuque, Iowa
Ed Wal	OSZYK	DeKalb, Ill.
A. Mark Westling	Consultant	Eugene, Oregon
John White	City Hall	Dubuque, Iowa
C. F. Wilkinson,Jr.	Dir. of Public Works	Richmond, Va.
Ralph E. Willis	City Engineer	Richmond, Ind.
David A. Witte	City Commissioner	Sioux Falls, S.D.
Tsu-Ten Wu	EPA	Washington, D.C.
Seymour Zenlea	MITRE Corp.	Bedford, Mass
Raymond B. Zielinski	Mayor	Bellefontaine Neighbors, Mo.

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10 E/ 4

M E M O R A N D U M

TO: MSD Board

FROM: Charles C. Kemper

SUBJECT: Trip Report - National Solid Waste Management Association (NSWMA), Houston, Texas, June 23-26, 1974

The following contains a report of my trip to the National Solid Waste Management Association Conference(NSWMA) held in Houston, Texas beween June 23-26, 1974. The NSWMA consists of people in all areas of the solid waste industry including equipment manufacturers, private collection industry and the disposal industry. This national conference included a large equipment show, technical tours and technical seminars. My report will discuss these items and what I found epecially interesting.

EQUIPMENT SHOW

There were over 130 industries represented at the Equipment Show. These included baler, milling, conveying, truck, compactor, weighing, and mechanical equipment manufacturers. Solid waste magazines, periodicals and the federal EPA were also represented. Of special interest to me were:

INDUSTRY	SERVICE
A.I.M. Corporation	Tire-Gon machine
American Can Company	Model Americology resource recycling plant for processing municipal solid wastes.
Atlas Hoist & Body, Inc	Trailer roll-off
Browning-Ferris Industries, Inc.	Collection, processing, disposal systems..systems and equipment for handling solid and liquid wastes.. resource recovery systems.
The Carborundum Co.	Eidal Division, Carborundum solid waste systems; Eidal vertical grinders.
Caterpillar Tractor Co.	Landfill compactor and diesel truck engines.
Dempster Brothers	Refuse handling equipment and systems
Dings Co. Magnetic Group	Solid waste magnetic system
Environmental Protection Agency	Office solid waste management programs
Fairbanks Weighing Division	Colt industries..motor truck/scale axle load scale operation model and electronic indicating and printing equipment.

INDUSTRY	SERVICE
J. W. Greer, Inc.	Gifford wood..Z-bar solid waste conveyors, baling and shredding equipment.
Hammermills, Inc.	Subsidiary, the Pettibone Corp.- Shredders
Hazemag, Inc. U.S.A.	Municipal refuse shredding systems with capibilities extending to second and third stage reduction.
The Heil Co.	Solid waste collection and handling systems.
Hyster Corporation	Construction equipment division Hyster C441a LandSaver Compactor.
Jeffrey Manufacturing Company	Solid waste shredding equipment and systems.
Newell Manufacturing Company	Shredders
Peterbilt Motors Company	Heavy duty diesel trucks.
SCA Services, Inc.	Nationwide solid and liquid waste service, collection, disposal, material processing, and resource recovery systems.
Waste Age Magazine	Publication-The Voice of Resource Management
Waste Management, Inc.	Total waste management systems.. modern storage, collection, transfer, interim processing, and disposal, including all facets of resource recovery.
Williams Patent Crusher and Pulverizer Co.	Solid waste shredders and shredding systems.

The conference participants utilized the Equipment Show effectively.

TECHNICAL TOURS

Houston, Texas is the home office for Browning-Ferris Industries (BFI) and as a result, a technical tour was organized for those people interested. BFI operations in Houston include a resource recovery center, a transportation system, a sanitary landfill and a hazardous waste treatment facility. Our tour included all of these facilities.

Resource Recovery Center(RRC)

This facility operation contained weighing scales, refuse dumping floor, conveyor system, hand picked corrugated and paper, milling operation, magnetic separator, compactor and large truck transfer of residual to the BFI landfill operations. The RRC charges the City of Houston, I think, $6.05 per ton to dump. The facility operates at about 2200 ton per week. About 12 railroad cars a week are filled with separated metals, mostly cans. The paper and corrugated(I don't know how much) appeared clean and looked uncontaminated. From an environmental point of view the noise was hardly noticeable outside the building. Dust was not apparent. Odors were only present in the dumping floor area. Traffic flow was light and not really an example of what could occur here. The system design was poor, however, especially in the dumping floor area. Magnetic separation seemed reasonably efficient, but required one man to separate large chunks of paper, etc. from separated cans. Discharge of separated ferrous looked reasonably uncontaminated. The truck weighing system was simple and efficient and took about 15 seconds(maximum). The most important environmental problem that could effect MSD will be traffic, especially from the public.

Transportation System

This system included the large transfer trucks and trailers I think they used Heil trailers and White trucks. The average wait at the RRC was about 15 minutes and their distance from the landfill was about 15 miles.

Sanitary Landfill

The sanitary landfill was called McCarty Road Reclamation Site. This BFI operation is a separate company from RRC which is separate from the transportation operations. The facility receives both shredded refuse and other materials from collectors outside the city. This landfill was operated from the lower side and to a lift of about 25 feet. They had one dozer and one compactor working. Cover material was borrowed from an adjacent area. Generally, the operation was very clean and well covered with good surface drainage.

Hazardous Waste Treatment Facility

This BFI operated facility was located adjacent to the landfill operations. The facility consisted of two lagoons, about five transfer tanks, a skid mounted pumping system and assorted plumbing. I am not exactly sure how this operation works. It appeared neatly kept with light odors apparent.

TECHNICAL SEMINARS

The technical seminars included a refuse collection forum, a resource recovery forum, and new opportunities in liquid and solid waste processing and disposal. Of particular interest was the forum on resource recovery. The papers presented included:

- Incentives and Expanding Markets for Secondary Materials
- Energy Recovery From Wastes
- Materials Recovery: Technology and Processes
- Is Source Separation Practical

Some of the high points stressed in Resource Recovery(RR) processes were:

1. The important considerations in a Resource Recovery System:
   - Important components should be designed for redundancy.
   - Fire control systems should be installed.
   - Shredding size should be determined.
   - Abrasive action in burner feed tubes is dependent on material
   - Burner air omission particle size must be evaluated.
2. The five RR processes that have been built are:
   - St. Louis(600 ton/day)
   - Blockton, Mass.(600 ton/day)
   - Nashville(700 ton/day)
   - Franklin, Ohio (150 ton/day)
   - Houston(500 ton/day)
3. Estimated costs of operating these kinds of facilities are:

   at 480 tons/day - $12.00 per ton
   at 600 tons/day - $10.00 per ton
   The number of operating hours effect the cost per ton.

4. Air classification systems include:

- horizontal
- vertical
- rotating
- zig zag

5. For the next several years, the first generation equipment will be evaluated and product development will continue to occur. Also, separation of ferrous, light combustible and glass with hand picking of corrugated and paper will probably be the extent of central process separation.

6. New legislation is needed to give the recycled material the same economic break that virgin materials have. The virgin materials ethic must be changed. The availability of virgin materials continues to drop. Recycled materials competition with virgin materials is apparent and the time has come to recognize the value of recycled materials.

7. New data on source separation reveals that the cost and time of separating at the home is small.

8. The air classification components should be designed to:

- drop light materials
- have low ash content
- have 90% of the materials drop
- drop 25% of the input materials
- drop all that can't be burned

Respectfully submitted

Charles C. Kemper, P.E.
Program Manager

TRIP REPORT: G.R.C.D.A. 15th ANNUAL SEMINAR & EQUIPMENT SHOW

PARTICIPANTS FROM OREGON:

Merle Irvine, MSD
Corky Ketterling, MSD
Bob Brown, DEQ
Mike Kennedy, CH_2M-Hill
Ben Masengil, Lane County
Dave Phillips, Clackamas County

SUMMARY OF TECHNICAL SESSIONS:

Resource Recovery Session:

Comments of Ron Schwegler, Moderator:

* Reviewed history of resource recovery development
  * Late 1960's, early 1970's characterized by unjustified optimism
  * 1973-1975: significant problems became apparent
  * 1975-1976: pessimistic outlook
  * 1977: realism; recognition of problems
* Admitted to a personal 180 degree shift in his own attitudes

Comments of Joseph Ferrante:

* At best, resource recovery is a gamble
* Characteristics Saugaus project
  * 500,000 tons solid waste handled annually; 30,000 tons ferrous recovered; ½ x 109 exponent of steam, annually
  * Turnaround truck time is 3-5 minutes
  * Employs 50 people (O&M, Admin)
  * Receives 8:30-5:00 and ½ day on Saturday
  * 16 unloading bays
  * 6,500 ton pit; unloaded one a year
  * 3-4 ton cranes; loading system
  * 825 degree steam @ 650 PSI to G.E. which fulfills ½ of G.E.'s steam needs
  * Steam line is 3,000 feet
  * Two reserve; package boilers are maintained
  * Fuel price based on oil currently @ $12-$14 BBC
    * Steam valved @ $2-$5/1000 pounds
  * Tipping fee about $15/ton
  * Ash Trumel rotary drum magent

    * Ash 10% of incoming

* Saugaus atributes which enabled project to get started
    * The efforts began in the late 1960's
    * Privately owned/operated landfill existed
    * G.E. possessed an enlightened self interest
    * The driving force for the project resulted from the following key items:
        + Area characterized by major industrial complex with lack of landfill capacity
        + Participants were looking for reliability, full service, capability, long term, low cost and private ownership
        + RESCO-GE relationship set by contract with inflation characterized by a maintenance index, replaced fuel index
        + Needs of community consisted of environmental and land use sensitive solution to disposal
* Summarizing Statement: Communities come together only when a crisis is perceived

Comments of Ray Linstrom:

* Americology, an "RDF facility designed, constructed, financed by private industry"
* Dump charge of $8.74 initially; $9.16 now; $10.10/ton
* System characteristics: Contract signed in January, 1975 15 year, processing plant to power plant distance is 14 miles, municipal collection; produces 265,000 tons annually; plant capacity is 400,000 tons, 1,600 tons daily
* Wisconsin Electric buys fuel on an analyzed basis rather than by tonnage only

Comments of Keith McCartney:

* 80% commonality among <u>all</u> resource recovery technology
* Technological obsolescence ridiculous because of significant lead time on its development (demonstration phase is 5 years)
* San Diego is 200 tons/day (Ben Masengil says 100 tons/day)
* Scheduled to start in 1972; site problems (15 different sites evaluated)
* Features include shredded storage in flat building and dolph metering bins, glass retrieval, and their own "Recyc-Al", pyrolysis produces fuel oil for utility

Comments of Jack McWhirter:

* 50% of secondary sewage treatment is sludge treatment; combined disposal garbage/sludge is the answer
* Sludge disposal problems through incineration consist of air pollution, fuel req'mts, heavy metals content
* At Charleston they have:
  * Successfully disposed of municipal waste/secondary sludge in equal portions with no air pollution problems, heavy metal content and no reduction in fuel gas production from waste

My impressions of first session:

* Ron Schwegler's comments were suprising
* Industry representatives unwilling to appear "open" about costs and problems
* McCartney's slides were good to keep in mind in our presentations
  * Slide of thumbprint; indicates trickness of "RR"; each community has their own thumbprint
  * Slide of bowl of cherries; early impression of RR
  * Slide of boy eating chicken soup; RR is young, but give it a little chicken soup and it will be O.K.

Luncheon Speaker: "How Today's Politics Affect Solid Waste Industry"

* Administrative assistant to William Lockyer
* Scavenger; term offended some
* Out of League; displayed inaccurate information and lack of appreciation for complexity of solid waste problems and failure to communicate with all interests in legislative proposals

Productivity Session:

Comments of Phil Richmond:

* Reviewed the mixture of municipal and private collection in Tulsa, Oklahoma. The municipal collection segment was characterized by low manpower levels and antiquated equipment. 150-200 private companies operate, only 24 of which have a business license. Projected losses from the municipal operation are 1.7 million dollars annually.

* Referred to intangibles of productivity, including:
  * Politics, including difficult decisions and proper level of expectations
  * Budget Directors
    * Purchasing Departments, lowest bid
  * People, including personnel and labor unions
* Tangibles of productivity are equipment, routing, employee morale
* Provided a set of generalized solutions to typical intangible problems

Comments of Morris Bishop:

* Talked about the scheduling advantages of a four day work week

Comments of Marshall Williams:

* Talked about the application of electro-chemical and space-age technology to data collection and storage systems of garbage related machinery
* Main component consists of an E cell which records mechanical movements or electrical signals
* Countless applications for productivity measurement of equipment and employees

Comments of Bill McFadden:

* Reviewed implementation of Phoenix's mechanized collection system

My impressions of Productivity Sessions

* Comments of speakers invited a fascinating cross section of collection service applications
* Appears to be a multitude of productivity variables and possibilities for implementation

Federal and State Laws Session:

Comments of Al Marino:

* Reviewed rule of California's Solid Waste Management Board in state-wide waste activities, including proposals for:
  * A state-wide task force on garbage disposed of
  * Retail tax on packaging
    * Taxes would be allocated back to local governments for

litter enforcement program administration and for setting up recycling stations

* Discuss possibility for developing state-wide authority to overrule local zoning and siting of Class 1 hazardous sites. Pessimistic about possibilities

Comments of Lany Hickman:

* Discuss aspects of Resource Recovery and Conservation Act from perspective of federal government
* Optimistic about creation of cabinet level committee to do policy and issue studies and to provide a basis for new legislation in the form of product charge or bottling law

Comments of Steve Burks:

* Reviewed Resource Recovery and Conservation Act from the League of Cities perspective
* Felt local government opposition to sub-state regionalism would prevent meeting act's deadlines
* Optimistic about creation of cabinet level Resource Conservation Committee

Comments of John Barineau:

* Reviewed history of federal legislation affecting solid waste industry, including Solid Waste Act, 1965; Resource Recovery Act of 1970; Clean Air Acts of 1965 and 1970; Ocean Dumping Act; Federal Water Pollution Control Act of 1972; and the Resource Recovery Act of 1977
* Collective effect of these laws was to:
  * Attempt to close open dumps
  * Provide limited demonstration grants
  * Wholesale closure of commercial and industrial incinerators and increased waste
  * Create whole new classes of liquid and hazardous waste; create significantly greater quantities of sewage sludge
  * Bring into uniformity some of state and local laws
  * Create consistent criteria for landfill
* The future of the solid waste industry is toward greater complexity and dependence on government/private industry partnerships

Luncheon Speaker - Leo J. Ryan

* Criticised local government solid waste officials for not being

more visable and vocal

* Addressed successes of energy recovery from solid waste in Europe
* Supportive of applying same concepts in the United States

Financing Resource Recovery Session:

Comments of Bob Aldrich:

* Fundamental alternatives for financing resource recovery systems are public sector or private sector financing
* Public sector financing achieved mainly through GO bonds which have the advantage of a low interest rate and are easily structured. Their disadvantage is that communities won't vote for these bonds and that the community accepts too much risk
* Private sector financing achieved from corporate financial structure. Advantages are that low interest rates may be developed, depending on substantiality of firm. 30-40% of net present value of investment can be deducted as tax credits. Industry is responsible for their own technology. The disadvantages are that the financial burden appears on the firm's balance sheet and therefore, must achieve a relatively high return on investment and this financing alternative does not properly assign risk of delivery of solid waste.
* The best solution is a combination of public and private financing which properly assign risks yet, is guaranteed by project revenue. The term for this method of financing is "solid waste revenue bonds"
* Who develops solid waste revenue bonds? The following are required:
    * Availability of waste and unavailability of alternative disposal
    * Ability to pay
    * Contracts for markets
    * Establish technology
    * Responsible economic evaluation
    * Special security provisions
* If roles are well defined, then the project will be well defined

Comments of Charles Ballard:

* Resource Recovery is definitely not the right answer for everyone
* The financial plan must meet the objectives of the participants
* Ballard provided schematics and flow diagrams for various financial plans to meet differing objectives

Comments of Gary Larson:

* Resource Recovery is a good option when we can afford it; expressed cautious optimism
* Main ideas to keep in mind:
  * Our objective is disposal of solid waste
  * Landfills are still required
  * Resource recovery is capital intensive; mistakes are expensive
  * Resource recovery cannot compete with close-in landfills
  * Community must expect to pay for disposal
  * Resource recovery is here to stay

My Impressions of Financing Resource Recovery Session:

* Because of MSD's personal relationship with Aldridge and Larson, much of information presented was not new
* Session created a strong respect for abilities of financial institutions
* Capabilities of individuals involved has been a tremendous asset the development of the solid waste industry
* Illustrates increasing complexity and development of solid waste industry

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TO: MSD BOARD

FROM: Charles Kemper

SUBJECT: Trip report - St. Louis Conference on Resource Recovery

This is a report of my trip to the National Cities Conference on Energy Recovery from Municipal Solid Waste that was held in St. Louis, Missouri on October 31st and November 1, 1974. Also included are some comments on the tour of three Solid Waste Processing facilities at Great Falls, Montana; St. Louis, Missouri; and San Francisco, California.

The conference offered municipal officials an opportunity to examine several technologies for converting solid wastes into marketable material and energy resources. In addition, it provided officials a unique chance to preview key planning and implementation issues which an agency must consider.

Generally, the program included:

- A status report on major resource recovery systems around the county;
- First hand reports from municipal officials about their city's experience in starting up systems;
- An opportunity to meet and question representatives from leading private companies in the energy recovery field.

Specifically, some of the major areas of discussion included:

- Nashville's solid waste fueled central heating and cooling service;
- Pyrolysis - A summary of major systems;
- St. Louis/Union Electric Company Energy Recovery Project;
- Air emission assessment;
- Wet pulping resource recovery;
- Utility applications;
- Industry as market;
- Planning and implementation considerations;
- Management and operation issues;
- Financing considerations;
- System procurement issues.

The following contains a more detailed discussion of special areas that I found interesting.

A. Conference

I. Nashville Project

A public corporation was created to manage and market the energy conversion from solid waste to steam and air conditioning services in downtown Nashville. A water walled incinerator is used for energy conversion. The facilities cost $16.5 million with the following breakdown:

$6.5 million for 720 ton/day heating plant
$2.0 million for cooling facilities
$4.0 million for transfer system
$4.0 million for financing, etc.

The annual revenue is $1.6 million now with $3.0 million expected in three years. Financing was achieved through revenue bonds at 5.1% interest rate. This service originally served 27 buildings and has 40 buildings signed up at present. A transfer system is utilized with transfer truck and trailers coming to the downtown area. No dumping fee is charged at the facilities. Incineration could utilize in addition to solid wastes, also oil and gas. This program has merit because all new buildings in the area are signing up even when heating/air conditioning systems are already in existance.

The heat/air transfer system consists of 4 lines; two heat and two cooling, all closed systems, at 150 PSIG, 300° F. and 41°F, respectively. Charges for services are $1.50 per 1000 lbs. Approximately 25% of all wastes are used at present. The facilities will be at capacity in 1977. Other incinerators will be added as necessary. A sanitary landfill is used as a shunt or backup to the system. The only design problem encountered was the incineration stack emission equipment that is being modified at present.

It looks like Nashville has a unique system that satifies their need.

II. Pyrolysis

The following three pyrolysis techniques were presented:

- Garrett R & D system
- Monsanto - Landgard system
- Union Carbide - Purox system

The Garrett system is being developed for demonstration at San Diego. The product is a low grade oil resulting by converting solid waste under high temperature with no oxygen. The Monsanto system is being utilized in Baltimore, Maryland. The Union Carbide system will produce 3.3 million BTU/hour.

This discussion did not interest me, as I feel the technology is still in the future.

III. St. Louis - Union Electric Project

This project is very close to the kind of system we are proposing. The city of St. Louis has contracted with Union Electric to develop a system that would convert solid waste to energy by utilizing the present Union Electric Steam generation system. The program is in Phase I with fuel being burned at the Union Electric facility in South St. Louis. Solid waste processing is occurring at the St. Louis demonstration facility. I will cover some comments under the Facility Tour discussion.

Union Electric has committed a large amount of capital and has accepted a large amount of the risk. Their rationale is to develop a competitive system for utilizing the resources or solid wastes. The Union Electric in Phase II will consist of 2 large processing centers that will recover ferrous materials and light combustible fuel. The Labadie plant will contain 4 processing lines at 6,000 tons per day, while the Meramac plant will contain 3 lines at 2,000 tons per day. The system is designed to have two lines (one at each plant) down at one time and still operate at capacity. A sub-transfer system will also be constructed to provide a place for both municipal and private collectors. The dumping fee will be established to remain competitive with other methods of disposal. Union Electric is really in charge and has put $70 million on the line to construct the system. No flow control legislation is proposed because rates will be set to remain competitive. Union Electric has worked extremely hard to provide information to all regulating authorities. Union Electric facilities are presently burning the fuel.

The existing Hammermill maintenance is about $.53 per ton which is down from $.90 per ton. Their engineers expect it to be reduced even more.

An interesting comment on paper recycling was that St. Louis estimates that with %75 public participation approximately 7% loss in heating value (BTU/LB.) will result. They estimate fuel value at $.30 per million BTU today and $.75 per million BTU by 1980 (this could recover $7 to $7.50/ton.

In summary, the Union Electric/St. Louis program is going ahead as evidenced by the committment in September, 1974 by Union Electric of $70 million for Phase II construction. We were impressed.

IV. Financing Aspects

Resource recovery technology has moved ahead at a greater rate than the financing capability. Financing evaluations should be accomplished early in the planning and implementation phase with close watching throughout. Marketing risks should be shared by public and private groups. It was their feeling that to make resource recovery viable, public and private must work together by sharing risks. These kinds of systems are speculative with potential for large gains or large losses. The cooperation between public and private must strive to balance:

1. Low rates to the public vs. private industry profit.
2. Reliability and efficiency for the public vs. efforts by private industry to reduce system costs.
3. Public system flexibility vs. private industry long term capitalization and control.

In addition, the cooperation and agreements must consider:

- Mixing the risk;
- Incentives to both sides;
- Long term committment by both parties;
- Reduction of mistrust.

Regarding the agreements and contracts that must be developed, the following elements were presented and advocated:

- Contract should assist in establishing credit and financing;
- Dividing risk between the public/private;
- Methods of negotiating;
- Long term agreement (15 - 20 years);
- Require all refuse to be processed at the facility;
- Private operation and management;
- Factor of gross revenues to public;
- Public ownership of land and possibly buildings;
- Define the effect of source separation risk on the system;
- Define force majeure risk;
- Mix of public/private will reduce the risk thus reducing rates;
- Risk share by the recovered products purchaser.

This discussion was very informative and provided realistic problems to financing resource recovery facilities. The main thrust of this discussion was that a strong partnership must be developed between all actors where the risk and profits will be shared in an equitable manner.

V. Procurement

This section was very timely because of our thrust to develop an RFP document. I will not go into great detail here, because I have supplementary information that defines suggested contents of these kinds of documents.

This discussion centered around the kinds of procurement and problems encountered. Two basic approaches for procuring resource recovery systems are:

1. Through architect and engineering firms;
2. By RFP through turn-key.

The RFP turn-key method was discussed and seemed to be used more extensively than the A & E approach. The following problems were encountered at Inempstead, N.Y.:

- Legal authority to sign agreements;
- Competitive bid problems (waiver);
- Built-in dump fee escalator - cost increases;
- Devising a contract that would allow financing.

The cost increased from $30 million to $55 million between iterations of the RFP.

The procurement discussion pointed out that regional procurement would reduce costs, assure larger quantities of materials and achieve ather economies of scale. In addition, costs could be reduced through lease purchase of equipment.

Several legal items were discussed. In Baltimore the city requested or had a test case because of a state law requiring competitive bidding for public works projects. In Hylton vs. Maryland, City Council of Baltimore, the courts determined that their resource recovery facility was "truly unique" and "competitive bidding was not required". This test case was required in order for Baltimore to proceed.

The RFP document should consist of the following items:

1. General Information
   - Goals
   - Alternatives
   - Project Funding
   - Background
   - Schedule

2. Proposer Expectations
   - Management Plan
   - Program Network (PERT)
   - Reporting
   - Technical and Financial Audits

3. Program Expectations
   - Redundancy
   - Design
   - Sites
   - Safety
   - Environmental Regulations
   - Landfill

4. Contractual Considerations
   - Facility Ownership
   - Sequential Contract
   - Conditions
   - Process Guarantees
   - Performance
   - Insurance
   - Life
   - Patent Rights
   - Royalties

5. Appendix
   - Project Reports
   - Background
   - Soils
   - Etc.

Another important problem that must be considered is the proposal evaluation technique. Pre-evaluation screening is probably illegal. All proposers should be evaluated on the same criteria. The evaluation procedures must be well defined before proceeding

too far. An open request for proposals should be accomplished by advertisement and open letters to appropriate system developers. A minimum response time is determined to be 30 days. Three to six months should be allowed in some cases.

Some RFP evaluation criteria that could be considered are:

- Qualifications
- Management
- Technical Approach
- Detailed Cost
- Proposed Contract
- Marketing Capabilities

A third party evaluation may also be used.

B. Tours of Solid Waste Processing and Resource Recovery Facilities

I. Great Falls, Montana

The Great Falls, Montana facility is operated by the city of Great Falls. It is operated in conjunction with a sanitary landfill. This processing facility consists of two processing lines of 20 ton/hour and 15 ton/hour, respectively. Cost of the entire facility plus several trailers was $780,000.00. The Heil Company designed and constructed this facility on a turn-key basis. The solid waste is brought to the processing center by primarily municipal trucks and weighed. The material is dumped on the dumping floor and loaded on the

inlet conveyor by one front loader. Milling occurs followed by magnetic separation. Listed below are some comments of my observations.

1. A single scale house was used with the weighing data to be used for planning purposes only. The weighing information is not used for billing.
2. The design capacity is 240 tons per day at peak capacity and 200 tons per day at average operation.
3. The dumping floor was sloped too much away from the inlet conveyors.
4. The new model Dings magnetic separator seemed to be working efficiently. Only large pieces of paper (etc.) were attached to the product. They were receiving $110.00 per ton for this material. Only $7 per ton less than the uncontaminated metals.
5. Heil equipment was used throughout including about 2-3 large transfer trailers.
6. The building size appeared to be about 12,000 ft.^{2}.
7. Noise abatement materials or procedures were not apparent. Outside the building the noise was small.
8. Sewage sumps were pumped instead of by gravity flow thus causing problems.

II. St. Louis Facility

This facility was developed in order to demonstrate the viability of processing and separating metals and fuel from municipal waste. The city of St. Louis and EPA developed the 45 ton per hour facility including transfer station.

Listed below are some observations:

1. Milling operation did not look as efficient as Great Falls. They had four line failures that day.
2. The building is about 200' x 100' primarily dumping floor and inlet conveyor.
3. A Gruendler shredder was coupled with the Radar air separator. All shredders and conveyors were outside. Dust was a problem that could easily be solved by placing inside.
4. A vertical mill nuggetizer was noisy, but provided very clean materials. I think $40.00 a ton is received by the city for the ferrous fraction.
5. All solid waste delivered to the facility is collected by the municipal agency.

III. Union Electric Power Facility

This steam generating facility is burning coal in conjunction with light combustible fuel. Feeding this material to the furnaces is a complex process and some problems have been uncovered. Listed below are some major impressions:

1. The fuel truck is unloaded by mechanical means into a conveyor feed system that transmits the material to a storage bin. Several truck capacities can be stored there. (I believe 3)
2. The four line burner feed is 8 to 10 schedule 40 mild steel pipe. Erosion has caused the pipe sides to wash

out at critical bends, etc.

3. The fuel material has a heat capacity of from 5000 to 7000 BTU's per pound.
4. The solid waste fuel material appeared low in moisture and fluffy. Storage of the material indicated no apparent problems.

IV. San Francisco

The Sunset Scavenging Company (SSC) collects and disposes of about half of the City of San Francisco's solid waste. At the present time the city of Mountain View maintains a landfill on San Francisco Bay that presently accepts these wastes from the city. SSC owns and operates a transfer station near Daly City, California. This facility transfers not only raw waste but milled refuse. One half of the transfer facility mills while the other half transfers directly. A magnetic separator is used to pull out ferrous. We were not able to see the facility in operation, however, the following are some observations.

1. The haul distance after transfer is about 25 to 30 miles.
2. The facility is an excellent example of a private industry operation.
3. The transfer facility equipment was clean and appeared reasonably efficient. External view was hidden by berming,etc.
4. Traffic flow seemed efficient. The site was located in heavy industrial. I don't think the facility would be acceptable in light industrial areas.

C. SUMMARY

1. Solid waste energy recovery facilities are complex, expensive and have potential of great returns both financially and from an energy standpoint.
2. These kinds of facilities can only be developed through close cooperation between public agencies involved and private industry.
3. The financial risks for these kinds of facilities must be reduced to the public agency and to private industry through sharing of risks.
4. Market research should be accomplished on all potential byproducts. The potential purchasers should also accept some of the risk to the system.
5. Private industry operation appears the most effective.
6. The approach MSD is taking is in line with many of the other public agencies accross the U.S.
7. These resource recovery facilities should be allowed to handle the majority of wastes generated within the area. Areawide approaches to this problem are being utilized throughout the U.S. In places where cities are financing resource recovery facilities, agreements have been developed with areas outside the city to allow for their wastes to be handled.
8. Energy recovery of solid wastes <u>will</u> happen. Energy requirements and technology are available, however, complex financing techniques are not progressing as rapidly.

Respectfully Submitted,

Charles C. Kemper

10:45 a.m.— Financing Considerations

Financing traditionally has been categorized as the business of acquiring funds. Modern public financial management goes a step beyond this limited role and performs a function in the planning phases of project development. Discussion in this session will focus on why and when to bring the financial/consultant into the resource recovery planning process. It will also treat the financial risks that may be shared between the public and private sectors.

SPEAKERS

Dorsey H. Lynch, Assistant Vice President, Public Finance Department, First Boston Corporation, New York, N.Y.

Robert E. Randol, Resource Recovery Division, U.S. Environmental Protection Agency, Washington, D.C.

Charles A. Ballard, Vice President, Dillon, Read and Co., Inc., New York, N.Y.

12:15 p.m.—LUNCHEON Lewis and Clark Rooms

ADDRESS
Mayor Nicholas A. Panuzio
Bridgeport, Connecticut

1:30 p.m.— System Procurement Issues

On the road to resource recovery, a city must negotiate many legal and procedural problems. Issues that will be discussed in this session include the constraints imposed by competitive bidding laws, questions about the legality of turnkey construction, and the difficulties involved in developing a suitable request for proposals, evaluating proposals, and selecting a contractor.

SPEAKERS

Alan Shilepsky, Resource Recovery Division, U.S. Environmental Protection Agency, Washington, D.C.

Francis W. Kuchta, Director of Public Works, Baltimore, Maryland

Stephen G. Lewis, Associate Department Head, Management Systems Department, MITRE Corporation, Bedford, Massachusetts

Donald H. Graham, Supervisor of Solid Waste Systems, Black, Crow and Eidsness, Inc., Gainesville, Florida

3:00 p.m.— Optional Tour of the St. Louis
5:30 p.m. Processing Facility and the Union Electric Power Plant.

Transportation provided.

Conference Adjourns

PREVIEW

This conference offers city officials an opportunity to examine several technologies for converting urban waste into marketable material and energy resources. But more importantly, it provides a unique chance for both elected and appointed officials to preview key planning and implementation issues a city must consider.

The program will include:

- a status report on major resource recovery systems around the country
- first hand reports from municipal officials about their city's experience in starting up systems
- a chance to meet and question representatives from leading private companies in the energy recovery field.

PROGRAM

Conference on Energy Recovery from Municipal Solid Waste

Hosted by the City of St. Louis in Cooperation with the Missouri Municipal League.

October 31 — November 1, 1974

Stouffer's Riverfront Inn St. Louis, Missouri

The National League of Cities and the U.S. Conference of Mayors

in conjunction with the Office of Solid Waste Management Programs, U.S. Environmental Protection Agency

Printed on 100% recycled paper

Wednesday, October 30

4:00 p.m.— REGISTRATION
6:00 p.m. Assembly Area West

8:00 p.m.— Wednesday Night at the Resource Recovery Movies Eugene Field Room

Interested companies in the resource recovery field show their movies or slides for viewing by interested city officials. Questions may be raised in a relaxed atmosphere giving municipal representatives an opportunity to see what the private sector has to offer.

Thursday, October 31

8:30 a.m.— REGISTRATION
9:00 a.m. Assembly Area west

9:00 a.m.— Welcome and Conference Overview
Grand Ballroom South

Franchot Buhler, Director, NLC and USCM Solid Waste Project

William Wilson, Director of Streets, St. Louis, Missouri

9:15 a.m.— STATUS REPORT ON ENERGY RECOVERY

This up-to-the-minute report and slide presentation will provide a national summary of what's happening — and where — kicking off the first day's discussion of systems currently in operation and technologies still under development.

J. Nicholas Humber, Director, Resource Recovery Division, U.S. Environmental Protection Agency, Washington, D.C.

9:45 a.m.— NASHVILLE'S SOLID WASTE-FUELED CENTRAL HEATING AND COOLING SERVICE

In operation since early 1974, Nashville's program combines traditional systems — waterwall incineration of unshredded waste plus district heating and cooling for downtown office buildings — with an innovative management and financing arrangement.

Farris A. Deep, President Nashville Thermal Transfer Corporation, Nashville, Tennessee

Carl E. Avers, General Manager and Chief Engineer, Nashville Thermal Transfer Corporation, Nashville, Tennessee

10:45 a.m.— Coffee Break

11:00 a.m.— PYROLYSIS: A SUMMARY OF MAJOR SYSTEMS

In addition to a summary of the major pyrolysis systems planned to date, this session will feature a panel of private representatives who will field questions and discuss the merits of their particular systems.

Steven Levy, Resource Recovery Division, U.S. Environmental Protection Agency, Washington, D.C.

Panel of Private Representatives

J. Keith McCartney, Garrett Research and Development Co., Inc., LaVerne, California

Edsel D. Stewart, Manager, Monsanto Landgard Systems, St. Louis, Missouri

T. A. Donnegan, Marketing Specialist, Union Carbide Corporation, New York, New York

12:15 p.m.— LUNCHEON
Lewis and Clark Rooms

ADDRESS
Mayor John Poelker
St. Louis, Missouri

1:30 p.m.— ST. LOUIS/UNION ELECTRIC COMPANY ENERGY RECOVERY PROJECT Grand Ballroom South

Since early 1972, the City of St. Louis has been providing processed municipal waste as fuel for the direct production of electricity in the Union Electric Company's coal-fired boilers. This session reviews project operations and also includes an independent assessment of extensive air emission tests.

Morris Tucker, Region VII,
U.S. Environmental Protection Agency, Kansas City, Missouri

G. Wayne Sutterfield, Refuse Commissioner, St. Louis, Missouri

D. L. Klumb, Project Engineer, Union Electric Company, St. Louis, Missouri

2:30 p.m.— AIR EMISSION ASSESSMENT

Larry J. Shannon, Head Environmental Systems Section, Midwest Research Institute, Kansas City, Missouri

3:00 p.m.— Coffee Break

3:15 p.m.— OTHER ALTERNATIVES

What about other variations? For starters this session offers three that may be applicable in many metropolitan areas.

Another Processing Method for Resource Recovery (Wet Pulping)

Dean H. Kohlhepp, Chief Engineer, Black Clawson Fibreclaim, Inc., Middletown, Ohio

Other Utility Applications

Joseph F. Mullen, Combustion Engineering, Inc., Windsor, Connecticut

Other Applications: Industry As A Market

Thomas J. Lamb, Senior Consultant, Arthur D. Little, Inc., Cambridge, Massachusetts

5:00 p.m.— RECEPTION
6:00 p.m. The Old Courthouse

Hosted by the City of St. Louis and the Union Electric Company

8:00 p.m.— Thursday Night at the Resource Recovery Movies Eugene Field Room

Friday, November 1

9:00 a.m.— GETTING STARTED: PLANNING AND IMPLEMENTATION CONSIDERATIONS
Grand Ballroom South

MODERATOR
Franchot Buhler, NLC and USCM

9:00 a.m.— Introduction and Overview

Reliable technology isn't enough. Several important non-technical issues must be addressed to get the technology into place and working. These include: waste supply, markets, municipal commitment, public vs. private ownership and operation, obtaining financing, and selecting and procuring a system. Resource recovery is an uncharted course, as many cities are learning. This morning's session draw upon the experience of several cities.

Robert A. Lowe, Resource Recovery Division, U.S. Environmental Protection Agency, Washington, D.C.

9:30 a.m.— Management and Operation Issues

There are several public and private ownership/management options for resource recovery systems. Currently, engineering firms and corporations marketing energy recovery facilities offer a variety of these management packages. This panel will focus on the advantages and disadvantages of various public and private management and operation alternatives.

SPEAKERS

Harry P. Butler, Resource Recovery Division, U.S. Environmental Protection Agency, Washington, D.C.

Kenneth J. Rogers, Director of Market Development, Resource Recovery Division, Combustion Equipment Associates, Inc., New York, N.Y.

J. R. Castner, City Manager, Ames, Iowa

10:30 a.m.— Coffee Break

GEORGE D. WARD & ASSOCIATES

1126 S. W. 13th Avenue, Portland, Oregon 97205
222-4333

ENVIRONMENTAL CONSULTING ENGINEERS

December 14, 1974

FILE NO. 10.D/1

Mr. Charles Kemper
C.R.A.G.
6400 S. W. Canyon Court
Portland, Oregon 97221

Re: Sewage Sludge Disposal

Dear Mr. Kemper:

As you perhaps know, I no longer represent the Columbia Processors Co-op concerning their sludge disposal requirements. However, my interest in the field of sewage sludge disposal and utilization is still running strong and I am presently exploring a few ideas involving agricultural utilization of municipal digestor sludge on a large scale.

In this regard, it would be appreciated if you would bring me up to date on the current CRAG, MSD, COR-MET position on the various forms of organic waste sludges. As I recall, CRAG's original plan was to implement a regional sludge incineration program in which sludge generated throughout the entire metropolitan area was to be incinerated. The mid-1973 COR-MET report appears to also have accepted incineration, especially in regard to septic tank pumpings.

It would be appreciated if you would provide me with the most current "regional" decision on municipal sludge disposal including a list of the various agencies and organizations in support of whatever the presently adopted plan is. Additionally, I would also appreciate knowing if either CRAG or MSD would care to review a large scale land disposal concept capable of serving the entire CRAG area on a long term basis. The concept, as presently invisioned, allows for resource recovery in the event a market for the material can be developed.

Cordially yours,

George D. Ward

George D. Ward

GDW:sw

EXTENSION SERVICE

Oregon State University

Soil Science Department
Ag Hall 100

Corvallis, Oregon 97331

FILE NO. 16.D/1

February 6, 1975

Mr. Douglas Capps
Attorney at Law
Hearings Officer
620 Morgan Bldg.
Portland, OR 97205

Dear Mr. Capps:

I note in the February 2 issue of the Oregonian that Portland Commissioner Connie McCready has announced that the hearings on Portland sewage sludge incineration are reopened until February 14. I wish to add further comments to my statements at the hearing you conducted on September 11, 1974.

I respectfully request that the city of Portland postpone decision on this matter until a fuller study of other alternatives can be completed--to the extent of possibly implementing a thoroughly monitored, carefully chosen alternative. At the present time, several scientists and engineers in Oregon are very interested in sludge (all waste) disposal alternatives which would include energy conservation and resource recycling. A one day conference, featuring Oregon private and agency scientists and engineers is planned for March 19, 1975 at Oregon State University. This conference, sponsored by the Oregon State University Extension Service, will include papers on experience, socio-psychological factors, health factors, legal aspects, economics, technology and agronomic aspects of agricultural utilization of sewage sludge.

Since the public hearing, I note the following items pertinent to this discussion:

1. President Ford and other leaders continue to urge the conservation of energy. We are just beginning to appreciate how ancillary energy has shaped and formed our culture and how dependent on it we really are.

2. The price of fuel continues to increase.

3. The prices of nitrogen and phosphorous fertilizers are increasing faster than most other prices.

At a recent Northwest Fertilizer Dealer's Conference at Pasco it was predicted that the 1975 price of N would be 30 - 35¢ per pound. In 1972, the price of fertilizer N was 8 - 9¢ per pound.

Farm yields and incomes in the Northwest depend on fertilizer availability. I will agree that the very high prices of fertilizers are related in part to misjudgments on plant capacity requirements. On the other hand, the world demand is increasing as the "less developed countries" attempt to buy their share of energy and fertilizer. They find this cheaper than imported food for what little money they have.

In view of these trends, I submit as follows:

1. The world supply of fossil natural gas is limited. We will run out of natural gas before we use up other fossil fuels. Some industrial processes depend almost completely on natural gas. Sludge disposition is related to natural gas supply and price because:

    a. Methane (Natural gas) is a convenient fuel for incineration of sludge. There is an energy cost of incineration.

    b. Fertilizer nitrogen, discarded when sludge is incinerated, is fixed from the atmosphere at the cost of twenty cubic feet of natural gas per pound of nitrogen. The methane equivalent of the Columbia Blvd. plant sludge nitrogen (for fertilizer manufacture only) is 90,000 cubic feet daily. The value of this nitrogen to the farmer would be $1000 per day. The N in sludge is worth about $18 per ton of dry sludge at today's fertilizer prices. The phosphorus, on the basis of Salem sludge analyses, is worth an additional $3.50 per ton of dry sludge, $210 per day from the Columbia Blvd. plant capacity.

    c. Sludge, mixed with grass seed straw, has a biological methane generation potential. This gas could be fed into existing gas line grids after some cleaning.

2. In view of (1.) above, it seems probable that agricultural utilization of sludge, liquid or dry; in Western Oregon or Eastern Oregon; as a fertilizer, soil conditioner, or erosion control device is a very viable alternative worthy of further investigation in view of current energy and resource deficiencies and prices.

This conclusion will be given further scrutiny at the O.S.U. Conference on March 19. I would urge that the matter be given considerable further study before the incinerator construction decision is finalized. In a letter

from Professor V. V. Volk to J. L. Swenson, dated August 21, 1974, we outlined an example of how O.S.U. could cooperate with the city of Portland and others to consumate such a study.

Sincerely yours,

James A. Vomocil

James A. Vomocil
Soil Science Specialist

JAV:jw

cc: J. L. Swenson
C. C. Kemper
C. McCready
G. W. Ward
H. B. Cheney
V. V. Volk

FILE NO. 10 D/1

EXTENSION SERVICE Oregon State University Corvallis, Oregon 97331

March 5, 1975

Dear Sir:

The new surge of interest in agricultural utilization of treated municipal sewage sludge has prompted us to organize a one day educational conference on the subject. As indicated in the enclosed agenda, we have arranged for several professional and agency scientists and engineers, along with one farm representative, to present discussions of the social, health, legal, economic, technical, and agronomic aspects of farm use of sludge. Emphasis will be on the prospects for capturing the fertilizer value.

I hope you will be able to attend for an updating of your knowledge of this matter.

Sincerely yours,

James A. Vomocil

James A. Vomocil
Soil Science Specialist

Enclosure - Agenda

Conference on Agricultural Utilization
of Treated Sewage Sludge

March 19, 1975 8:30 a.m.-4:30 p.m.
Memorial Union 105, O.S.U. Campus

Chairman: J. A. Vomocil

8:30 a.m. Introduction

8:40 a.m. Stan Le Sieur; United Sewerage Agency Experience with Agricultural Utilization of Sludge.

9:25 a.m. Wealth from Waste, a movie on an operation in England.

9:45 a.m. Coffee

10:00 a.m. Don Marske, Gary Clark, Arnold Holden, Larry Krone; Panel on Socio-psychological Factors in Agricultural Utilization of treated Sewage Sludge.

11:10 a.m. Chuck Hagedorn; The Scientific Basis of Concerns about Agricultural utilization of Sewage Sludges.

11:50 a.m. Lunch (on your own)

1:00 p.m. Warren Westgarth; The Letter and Spirit of State and Federal Laws Dealing with Sludge Utilization

1:40 p.m. Gene Nelson and Bruce Weber; Evaluating the Costs and Benefits Associated with Agricultural Utilization of Treated Sewage Sludge

2:25 p.m. Chuck Zickefoose and Ed Lynd; Preparation, Transport and Spreading of Treated Sewage Sludge for Agricultural Utilization.

3:10 p.m. Coffee

3:30 p.m. Van Volk, Agronomic Influence of Sludges on Land and Crops.

Conference sponsored as a public education program by O.S.U. Extension.

Organized and arranged by the following serving as an informal committee: E. R. Lynd, D.E.Q.; D. P. Norris, Brown and Caldwell, Consulting Engineers, Eugene; J. Vlastelecia, E.P.A.; C. L. Smith, O.S.U.; J. M. Witt, O.S.U.; G. D. Ward, George Ward and Associates, Consulting Environmental Engineers, Portland; V. V. Volk, O.S.U.; A. G. Nelson, O.S.U.; M. Northcraft, O.S.U.; T. L. Willrich, O.S.U.; J. W. Huffman, Oregon Department of Human Resources; A. W. Anderson, O.S.U.; and J. A. Vomocil, O.S.U.

MSD METROPOLITAN SERVICE DISTRICT

MEMORANDUM

DATE 5/5/75 TIME _____ AM PM PHONE NO. _____

☒ TO Connie McCready ☒ FROM C. Kemper

FILE NUMBER _____

SUBJECT Sludge Disposal

Someone from your office may wish to attend the conference discussed on the attached page. This has to do with sludge disposal on land.

CK

Return to CCK

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION X
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

April 2, 1975

REPLY TO ATTN OF:
REPLY TO ATTN OF: mail stop 329

Notice of Technology Transfer Seminar
on Land Treatment of
Municipal Wastewater Effluents

I am pleased to announce that the U.S. Environmental Protection Agency Office of Technology Transfer is presenting a two-day seminar on land treatment, May 28 & 29, 1975 at the Thunderbird Hotel (Jantzen Beach) in Portland, Oregon; one of a series of such seminars to be held nationwide.

Several nationally known experts on land treatment are on the program. They include: Dick Thomas of EPA's Research Laboratory in Ada, Oklahoma; Charles Pound of Metcalf & Eddy, Palo Alto, California; Morgan Powell of CH2M/Hill, Denver, Colorado; Bel Seabrook of EPA, Washington D.C.; Frank D'Itri of Michigan State University; and Gordon Culp of Culp, Wesner, Culp-Clean Water Consultants, Eldorado Hills, California. Items of discussion include objectives of land treatment, design factors, cost factors and data, case histories of several projects, as well as a separate one-hour presentation on the Muskegon, Michigan project. The seminar is expected to be of special interest to consulting engineers dealing with municipal wastewater systems.

A tentative agenda and registration blank are attached. For additional information please contact John Osborn, EPA Region X, Seattle, Washington 98101 (206) 442-1296.

Additionally, EPA is conducting a conference on Operation and Maintenance Manual preparation and review in Seattle on May 22, 1975. If you are interested and have not received a notice please contact Tom Johnson at (206) 442-1266.

Clifford V. Smith, Jr., Ph.D., P.E.
Regional Administrator

TENTATIVE AGENDA FOR
TECHNOLOGY TRANSFER DESIGN SEMINAR

ON

LAND TREATMENT OF MUNICIPAL WASTEWATER EFFLUENTS

Portland, Oregon
May 28-29, 1975

May 28

8:00-9:00 a.m.	REGISTRATION	John E. Osborn Regional T.T. Chairman
9:00 a.m.	WELCOME	Dr. Clifford V. Smith Regional Administrator Region X
9:05 a.m.	INTRODUCTION & PURPOSE	Bob Madancy, Office of Technology Transfer
9:15 a.m.	EPA'S APPROACH TO LAND TREATMENT AND COST EFFECTIVENESS	Bill Whittington, EPA OWPO, Washington D.C.
10:15 a.m.	COFFEE BREAK	
10:30 a.m.	EPA-M&E REPORT AND ORD	Dick Thomas, EPA Kerr Envr. Research Lab. Ada, Oklahoma
10:45 a.m.	DESIGN FACTORS Introduction & Pretreatment Overland Flow Irrigation (Nutrient/Water Utilization) Infiltration-Percolation Site Selection Storage (Total Water Balance) Land Availability Distribution Techniques Public Health Considerations Monitoring (Need) Land Use Climate, Topography Surface Runoff Control	Charles Pound Metcalf & Eddy Consulting Engineers Palo Alto, California
12:00	LUNCH	
1:15 p.m.	DESIGN FACTORS (Continued)	Charles Pound Metcalf & Eddy

May 28 (Continued)

1:45 p.m.	DESIGN FACTORS Hydraulic Loading Nutrient Loading Soil Water Rights Crop Selection (Forest Application-Hardwood/ Softwood) Heavy Metals Farming Management Underdrain Systems Groundwater Conditions Monitoring (Location)	Dr. Morgan Powell CH2M/Hill, Consulting Engineers, Denver, CO
3:15 p.m.	COFFEE BREAK	
3:30 p.m.	REVIEW OF SIGNIFICANT LAND TREATMENT PROJECTS Overview & EPA-APWA Report	Bel Seabrook, EPA, OWPO Washington D.C.
3:50 p.m.	MISC. CASE HISTORIES Pennsylvania State Michigan State Melbourne Phoenix Tallahassee Etc.	Dr. Frank D'Itri Michigan State University Lansing, Michigan
5:10 p.m.	ADJOURN	

May 29

8:30 a.m.	MUSKEGON, MICHIGAN PROJECT	Dr. Y. A. Demirjian Dep. Dir. of Public Works Muskegon Co., Michigan
10:00 a.m.	COST OF LAND APPLICATION SYSTEMS (Draft of EPA Technical Bulletin)	Bel Seabrook, EPA, OWPO and Charles Pound, Metcalf & Eddy
10:30 a.m.	COFFEE BREAK	

May 29 (Continued)

10:45 a.m.	EXAMPLE COMPARISON OF LAND TREATMENT AND AWT (Montgomery County, Maryland and Boulder, Colorado)	Gordon Culp, CWC Consulting Engineers Eldorado Hills, California
12:15 p.m.	LUNCH	
1:15 p.m.	Q/A SESSION (Includes questions from Technical Bulletin presentation and Dr. Jim Smith, ORD will be available for Sludge questions. Regional Grants personnel also available)	John E. Osborn Regional T.T. Chairman

---

(please fill out, detach & mail to address on reverse side)

TECHNOLOGY TRANSFER DESIGN SEMINAR
Portland Thunderbird Hotel (Jantzen Beach)
May 28 & 29, 1975

Name of applicant(s)_____

Employer_____

Address_____ Phone_____
street city state zip code

Profession_____

Desire room reservation application yes /__/ no/__/
NOTE: response by May 7 to assure hotel accomodations

Mr. John E. Osborn
Technology Transfer Representative
Environmental Protection Agency
1200-6th Avenue m/s 329
Seattle, WA 98101

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PORTLAND, OR 97221

MSD METROPOLITAN SERVICE DISTRICT
527 S.W. HALL, PORTLAND, OREGON 97201 222-3671

November 3, 1975
File No. MSD10E/4

TO: MSD Board of Directors

FROM: Charles C. Kemper

SUBJECT: TRIP REPORT APWA CONFERENCE AND TOUR OF THE CITY OF AMES, IOWA, SOLID WASTE RESOURCE RECOVERY FACILITY

I attended the American Public Works Association Congress and Equipment Show held in New Orleans, Louisiana, between September 21 - 25, 1975. In addition, the City of Ames solid waste resource recovery system was inspected and toured on September 26, 1975. The following is a brief report of the highlights of this trip.

CCK/jw

INSTITUTE FOR MUNICIPAL ENGINEERING

The following are a list of technical papers presented during the I.M.E. technical sessions:

- Public or Private Streets in New Developments - This paper discussed the advantages and disadvantages of private street developments and the resulting maintenance requirements that eventually must be borne by the public agency. The data and conclusions presented resulted from a nationwide survey on the subject.
- Selecting Sites for Public Works Facilities - This paper discussed the criteria for determining "best" site locations for public facilities. The conclusions determined that total capital costs savings may be achieved by higher land costs and reduced transportation and maintenance costs over the life of the facility.
- The USGS Urban Mapping Pilot Project - The Fort Wayne, Indiana, urban area participated in a new ortho-photo mapping technique tested by the U.S.G.S. The purpose of this project was to determine a mapping technique that could be used at a scale that would be used by multiple departments within the city. Useable map scales for a majority of uses were from 1"/100 feet to 1"/200 feet.
- Other IME Subjects:
  - Productivity measurements for engineering personnel.
  - Making affirmative action work.
  - Reducing bureaucratic red tape.
  - Fast track to beat inflation

INSTITUTE FOR SOLID WASTES

The following are a list of technical papers presented at the ISW technical sessions:

. Regional Solid Waste Plan Implementation - This paper discussed the regional solid waste management plan implementation steps for North Central Texas, Arlington, Texas. The system included several transfer stations and landfills for a multi-county area. Resolving the local jurisdictional concerns were the greatest implementation concerns discussed.

. Resource Recovery Status Report - This report consisted of the status of several EPA funded resource recovery systems in operation throughout the United States. They are:

1. St. Louis
2. City of Baltimore
3. Nashville
4. NCRR - New Orleans & Washington D.C.

- St. Louis

This system was conceived in 1967 between the City of St. Louis and Union Electric Company. The process is similar to that proposed by MSD and includes milling of solid waste and separation of ferrous and burnables. On April 4, 1972, the pilot system became operational. Many system problems were discovered, however. After about two years of pilot operation, Union Electric of St. Louis decided to expend approximately $70 million for facilities to process solid waste and burn refuse fuel with coal to produce electrical energy.

The report indicated that Union Electric is on schedule. Several technical problems such as transporting refuse fuel still are under study. However, major equipment items are under procurement and approximately $32 million have been spent to date.

- City of Baltimore

This Monsanto Pyrolysis system was constructed because the existing landfills in the city limits were filling rapidly. The system was a turnkey facility constructed after receiving several bids. Startup of operations began in Spring 1975. The byproduct, a synthetic oil, is equivalent to Bunker oil and the market price was based on that value. Subsequent to facility startup, the shredder was redesigned to provide a smaller particle size for the pyrolysis process.

- City of Nashville

The City of Nashville in 1971, developed an energy recovery system from solid waste that would generate steam and refrigeration for approximately 25 downtown Nashville buildings. The facility construction was completed in June 1972. Raw refuse is burned in two 360 ton/day boilers that produce steam at 108,000 lbs/hour.

Several problems described during this discussion were:

1) Air pollution control equipment scrubber intially designed had to be replaced;
2) Several instances of boiler tubing failures were reported requiring repair;
3) Customer user costs have increased. The present user charges are:
   $4.65/1,000 lb. steam
   $0.07/ton hour refrigeration
4) Management changes.

- National Center for Resource REcovery (NCRR) New Orleans, Louisiana and Washington D.C.

The National Center for Resource Recovery (NCRR) is participating in two projects, one in New Orleans and one in Washington D.C. In New Orleans, an energy recovery system for the City of New Orleans is under construction. This system is similar to that proposed by the MSD in which a light fuel fraction will be produced for energy recovery. The Washington D.C. project is funded by NCRR and EPA as resource recovery component equipment test facilities. Equipment matching byproduct specifications and performance evaluations will be the primary purpose for this facility. This status report was pretty limited.

INSPECTION OF CITY OF AMES, IOWA, RESOURCE RECOVERY SYSTEM

Probably the highlight of my trip was the tour and inspection of the City of Ames, Iowa, resource recovery system. Basically, the City of Ames owns and operates a coal powered electric generating facility and has contracted with the City's Public Works Department to pay 100% of coal value (on a $/million BTU basis) for refuse fuel that will be burned at a 25/75% basis with coal. The Ames Public Works Department pays for any improvements necessary in the coal powered electric generating facility. At the present time, Ames pays $.95/million BTU for coal and, therefore, for refuse fuel. This is equivalent to $13.50/ton since their average fuel heat content is about 7,000 to 7,500 BTU/lb.

The Ames resource recovery facility is designed to handle 500 tons/day. At the present time, during checkout, they are processing 50 tons/day. The facility is similar to that envisioned by MSD (see Attachment I). Total facility cost is $5.6 million. The major equipment consists of:

Primary shredder 6-8 in. (50T/hr) - American Pulverizer
Magnetic separation, primary - Dings
Secondary shredder 1½ in. - 2 in. (50T/hr.) - American Pulverizer
Vibrating Screen - Link Belt
Air Classifier, 200 HP (40-50T/hr.) - Radar
Refuse Fuel Storage Bin (500 tons) - Atlas
Magnetic separation, secondary - Dings
Trommel Screen (3 sizes)
Aluminum magnetic separator

At the present time, this facility is under checkout. Facility completion was September 1, 1975. Final control wiring was being completed while I was there. I observed approximately 1½ hours of operation.

Ferrous separation appeared very efficient with clean and excellent product. This material is marketed to Vulcan Metals for detinning.

Daily technical tests for moisture, heat content and bulk density of incoming materials and products will be performed. Periodic tests will be accomplished for incoming and product material sieve size, content, and chemical makeup. The test heat content for refuse fuel was 7046, 6650, and 7900 BTU per lbs.

Several problems I observed were:

- Poor traffic flow design
- Single truck weighing scales
- Excessive conveyors and resulting complexities
- Excessive automatic controls
- Sand blasting effects from refuse fuel in transfer lines

The contact person in Ames is Jerry Temple, at 232-6210 extension 236 and 237.

The City of Ames, Iowa, will begin in 1975 to use combustible refuse as supplementary fuel in the existing coal-fired boilers at the municipally-owned electrical power plant.

The supplemental fuel processing plant, where the City's solid waste will be handled, is now under construction, and necessary modifications are being made to the power plant itself.

Ames is, therefore, well on the way to providing at least partial answers to two pressing problems-solid waste disposal and the energy crisis.

The plant results from a study by the engineering firm of Gibbs, Hill, Durham and Richardson, of Omaha, Nebraska. When the study determined that burning domestic refuse in existing power generating equipment would be feasible for Ames, the City Council moved ahead with the project.

An average of 150 tons per day of combustible refuse will be available the first year of plant operation...by 1985 that figure will reach 205 tons per day. In the first year, operating costs and fixed charges will amount to $15.34 a ton. By deducting a fuel value credit at current fuel prices of $10.00 per ton of refuse and a recovered materials credit of at least $3.45 a ton the net cost of $1.89 is competitive with landfill costs. At high market prices, the recovered materials credit could be as high as $6.30 per ton.

By 1980, increased use of the plant will further reduce the net cost, giving the City a distinct saving compared with the cost of landfilling.

In this analysis, no credit is given for an expected reduction in the cost of hauling refuse to the centrally-located plant...nor is any attempt made to estimate the likely extent of future fuel costs.

Resource recovery is practical...it is economical ...it will conserve our natural resources...

Ames is in the forefront of an increasing number of cities where people are genuinely concerned about increasing wastes and dwindling resources. At Ames positive steps are being taken about both concerns.

AMES SOLID WASTE RECOVERY SYSTEM

Operator: City of Ames

Participants: Iowa State University

Story County and the communities of Nevada, Story City, Roland, Gilbert, Kelley, Huxley, Cambridge, Colo, Slater, Maxwell and Zearing.

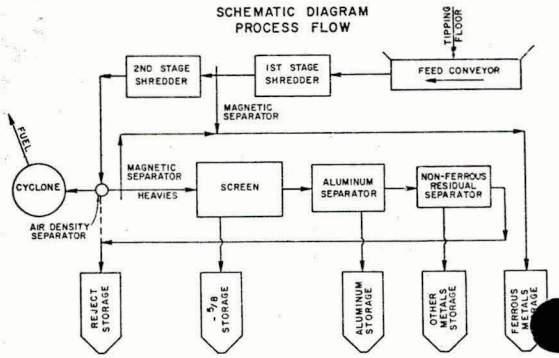
Prepared by

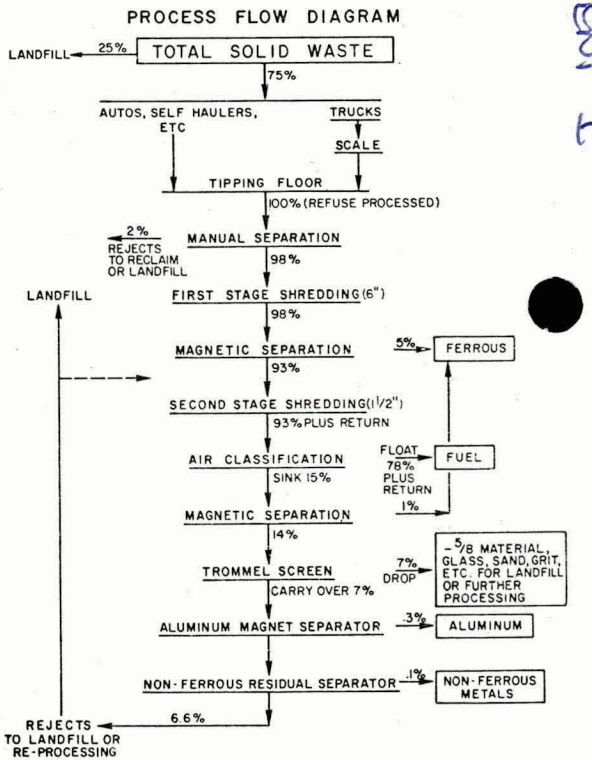
Gibbs, Hill, Durham & Richardson
8404 Indian Hills Drive
Omaha, Nebraska 68114

For further information contact:

Harvey D. Funk (402) 399-1000

Typical Resource/Energy Recovery Flow Diagrams





ATTACHMENT I

THE CITY OF
PORTLAND
OREGON

DEPARTMENT OF
PUBLIC WORKS

CONNIE McCREADY
COMMISSIONER

OFFICE OF
PUBLIC WORKS
ADMINISTRATOR

400 S.W. SIXTH AVE.
PORTLAND, OR. 97204

February 18, 1976

Charles Kemper, Program Manager
Metropolitan Service District
525 SW Hall Street
Portland, Oregon 97201

Dear Mr. Kemper:

The City of Portland is conducting a study of alternative methods of disposal or utilization of treatment plant sludge. This study includes the separate consideration of the problem of disposing of grits, screenings, and possibly skimmings. The time schedule for the study requires a public hearing in April 1976, and selection of the preferred alternative by the City Council in June 1976. New facilities are to be operational by not later than January 1980.

New grit removal facilities are now being installed. With these facilities in service, average production of grits in 1976 is estimated at 5 dry tons per day (30% total solids). Screenings are estimated at 1.5 dry tons per day (22% dry solids). By the year 2000, grits production could average 10 dry tons per day and screenings 2 to 3 dry tons per day. We estimate skimmings at 1 to 2 dry tons per day (20% dry solids).

We are considering the possibility of continuing to landfill grits, screenings, and skimmings. Would the Metropolitan Service District consider entering into an agreement with the City of Portland to accept this material at their future landfill facilities? If such a proposal is tentatively acceptable, we request that Metropolitan Service District provide the City a preliminary letter of intent to enter into such an agreement. In addition, we are interested in a preliminary estimate of cost for the use of the M.S.D. landfill, and a time schedule of when such facilities may become available.

For further discussion or a meeting on this matter, please telephone Dale Nunamaker or Roger Perrin at 248-4213.

Very truly yours,

J. P. NIEHUSER
Chief Civil Engineer

RWP:m
cc: Cowles Mallory
Dale Nunamaker

March 2, 1976

File No. MSD10D/3

COPY

Mr. J. P. Niehuser
Chief Civil Engineer
City of Portland
[illegible] SW Sixth Ave.
Portland, Ore. 97204

Dear Mr. Niehuser:

Regarding your letter of February 18, 1976, the Metropolitan Service District would consider entering into an agreement with the City to dispose of grits and sludges in future MSD facilities. Sanitary landfilling of this material will be accomplished after the sludges are thickened in some manner. In addition, the placement of the sludges in the landfill could be accomplished by City personnel.

For your analysis, the present cost of disposal is approximately $4.00/ton. We expect this cost to increase rather drastically in the next 4 to 6 years. If the MSD Program is implemented, it is expected that between 1978&1980 the MSD will be regulating all solid waste facilities.

If you wish further information, please contact me.

Very truly yours,

Charles C. Kemper
Manager

CCK/jw

cc: Cowles Mallory
John Wight

- WASTEWATER SLUDGE DISPOSAL TECHNIQUES -

A Study of Current Methods

By Charles C. Kemper, P.E.
Metropolitan Service District
March, 1976

I. INTRODUCTION

The ultimate disposition of sewage solids generaged by municipal wastewater treatment plants is a perplexing problem of great concern to many wastewater treatment authorities. In past years, national emphasis has been placed on developing improved solids removal techniques and attaining higher air and water quality standards with little regard for the problems of disposal on land or in utilization of the vast quantities of sludge being generated.

Sewage sludges from municipal wastewater treatment plants vary considerably in their chemical, physical, and biological characteristics. This variability is largely a result of the types of wastewater treatment processes employed and the composition of the wastewaters entering the treatment plants. In many cases, the decision to utilize or dispose of a particular sludge hinges upon its inherent characteristics; a complete and detailed analysis of the sludge is therefore highly recommended.

The Water Pollution Control Act Amendments of 1972 set deadlines for the implementation of secondary and best practicable treatment for municipal wastewater. In effect, these deadlines require the upgrading of a large portion of the wastewater treatment plants throughout the country within the next 10 years.

This upgrading of treatment levels will result in increased volumes of sewage sludges - in many cases, a doubling or tripling of current sludge generation rates.[1] Such dramatic increases could have devastating effects unless they are planned for properly, with careful consideration given to the environmental, legal, economic and social factors involved.

II. SCOPE

The scope of this discussion will be limited to literature and technical reports that have been developed for the three county area. In addition, there are several on-going studies that are just beginning. The findings of which will not be known for 12-18 months.

III. EXISTING WASTEWATER SLUDGE DISPOSAL

The disposal of solids from sewage treatment plants in Western Oregon is compounded by the problems of a seasonal wet environment. Sewage sludge treatment plants have been expanded in recent years to provide needed increased capacity for treatment of runoff and higher levels of treatment. Weather, space, location, odors and plant aesthetics are all key factors in forming and implementing sludge disposal plans. Effluent standards for treatment plants have been the subject of continual review and modification in recent years and are having a considerable impact on disposal needs for sewage solids.

A. City of Portland

The City of Portland program for pollution abatement has involved increased capacity of its two sewage treatment facilities and the addition of secondary treatment at its largest plant, the Columbia Boulevard Treatment Plant. It is designed for 100 million gallons per day with a maximum hydraulic capacity in the primary operation of 300 million gallons per day. While a large percentage of its service area contains combined sewers, overall solids

content remains close to normal levels, probably due to higher than average grit loads and high-strength industrial discharges. This provides an average sludge solids level of 60 tons/day.[4]

The City of Portland's Tryon Creek Wastewater Treatment Plant serves a much smaller area but includes the City of Lake Oswego under a contract arrangement. Its five million gallons per day secondary treatment capacity is due shortly to be expanded to 10 million gallons per day. The plant digests primary sewage solids but has only a minor capacity for solids disposal using drying beds. Over 95 percent of its solids production is hauled to the Columbia Plant for disposal. By 1980, this plant will contribute 4 tons per day of sewage sludge.

At the present time, the City is utilizing several methods of disposing of sludges. These include landfilling grits and sludges, land application and sludge beds. The City disposes of some sludges generated outside the City.

B. Clackamas County

The Clackamas County Service District No. 1 (CCSD#1) Kellog Treatment Plant that was activated in August, 1974, presently transports their sludge to the City of Portland's Columbia Blvd. Treatment Plant. Their facility contains several storage tanks for an anticipated 6 tons per day of sludge. Oak Lodge Sanitary District in Clackamas County is utilizing sludge drying beds for their 1.6 tons of sludge per day.

C. Washington County

The Washington County Unified Sewage Agency (U.S.A.) is presently land disposing most of their sludge solids until the Durham Treatment Plant is on line. At that time, sludges manufactured at Durham will be dewatered and incinerated. The U.S.A. Rock Creek Treatment Plant is in

final design and like the Durham Plant, tertiary treatment will produce by 1980 an estimated 24.6 tons per day of sludges. Primary, secondary sludge and scum will be anaerobically digested and dewatered to 50-60% solids for land application or incineration.

Based on the expected plant capacities in 1980 and 1990, the sewage solids production of treatment facilities in the metropolitan area have been projected. Table 1 summarizes these projections for fifteen plants as of 1990. Several other plants may still be in operation by 1980 but ultimately will probably be consolidated into the ones which are shown. A number of outlying community facilities will continue operation, but have been considered to employ local solids disposal methods without regional impact either due to the amount produced or the proximity to agricultural areas. These plants have been listed in Table 2. Many of the smaller treatment plants will not exceed 500,000 gallons per day. Actual figures are highly variable on a daily basis since solids disposal can be weekly, monthly or even seasonally. Attachment 1 describes the existing sludge handling methods within the area. Figure 1 is a map depicting existing sludge handling techniques.

Sludge solids production is based on 0.2 pound of dry solids per capita for plants employing secondary treatment and 0.35 pounds per day for tertiary facilities. Discharge standards will have a significant impact on solids disposal requirements for plants on the Willamette River by 1990. As such, solids production for Kellogg, Tryon Creek, French Prairie, Durham, Rock Creek and Hillsboro all reflect tertiary standards.[4]

TABLE 1

SUMMARY OF PROJECTED PLANT FLOWS AND DRY SOLIDS PRODUCTION IN THE METROPOLITAN AREA[4]

PLANT	Flow, mgd		Dry Sewage Solids, tpd	
	1980	1990	1980	1990
Columbia Blvd.	90.0	100.0	56.0	62.0
Tryon Creek	6.6	8.4	3.8	8.4
Kellogg	10.4	15.9	5.9	15.9
Durham	16.6	23.7	16.6	23.7
Rock Creek	8.0	12.8	8.0	12.8
Oregon City *	5.7	8.3	3.6	8.3
Gresham	6.0	12.0	3.4	6.8
Vancouver(E)	4.0	8.0	-	-
Vancouver(W)	12.0	16.0	9.1	13.7
Hillsboro(W)	3.5	6.0	2.0	6.0
Oak Lodge	2.8	-	1.6	-
Camas	2.0	4.0	1.1	2.3
Washougal	2.0	2.0	-	-
Inverness	2.0	2.0	-	-
Troutdale	1.0	1.0	0.6	0.6
West Linn(W)*	1.0	-	0.6	-
Wilsonville	1.0	-	0.6	-
Canby	0.5	3.0	0.3	3.0
French Prairie	-	-	-	-
TOTAL	175.1	223.1	113.2	163.5

tpd = tons per day
mgd = million gallons per day
* Tri-City Sewage Treatment Plant

TABLE 2

SUMMARY OF PROJECTED FLOWS AND DRY SOLIDS

PRODUCTION FOR OTHER REGIONAL PLANTS[4]

PLANT	Flow, mgd		Dry Sewage Solids, tpd.	
	1980	1990	1980	1990
Forest Grove	3.0	4.5	1.7	2.6
Salmon Creek	3.0	3.0	1.7	1.7
Molalla	0.5	0.5	0.3	0.3
Sandy	0.5	0.5	0.3	0.3
Estacada	0.5	0.5	0.3	0.3
Battleground	0.5	0.5	0.3	0.3
Ridgefield	0.5	0.5	0.3	0.3
Yacolt	0.5	0.5	0.3	0.3
TOTAL	9.0	10.5	5.2	6.1

tpd = tons per day
mgd = million gallons per day

IV. CURRENT PLANNING FOR SLUDGE DISPOSAL

In July, 1972, the CRAG Board adopted a Sewage Sludge Disposal Plan that essentially would result in sludge incinerators to be constructed at:

City of Portland - Columbia Blvd.
City of Portland - Tryon Creek Plant
City of Gresham Plant
City of Hillsboro Plant
U.S.A. - Durham Plant
City of Vancouver - Vancouver Westside Plant

This Plan was at best premature and accomplished with little study and analysis. In the last several years since the cost of energy has increased extensively, incineration of sewage sludge is viewed as a poor alternative. This is especially true since the heat treatment (dewatering) and incineration facilities require large capital investment. Several newly constructed incineration facilities throughout the United States are standing without use since operating costs are prohibitive.

In the Portland metropolitan area, the City of Portland has placed a hold on the proposed incineration facilities and is reviewing continued use of the dewatering facilities. Gresham is not planning to construct their proposed incinerator. The Unified Sewerage Agency is looking closely at the Durham Plant incinerator and in increasing land application uses for sludge disposal.

The following is a summary of sludge facilities planning.

A. City of Portland

The City of Portland has recently applied for EPA funds to perform a 201 facilities plan for sludge disposal. This is a quasi-regional study that will spend approximately $100,000 to look at various short term alternatives.[5]

B. CRAG

The Columbia Region Association of Governments are presently coordinating a long range study estimated at $75,000. The Corps of Engineers is funding this effort and will perform the tasks. The same consultant that CRAG uses may be used on the 208 Water Quality Management Studies. The City of Portland study is required to input information into the CRAG study.[5]

C. Clackamas County

There is no formalized county planning for sludge disposal.[5]

D. Washington County - Unified Sewerage Agency

The U.S.A. is not formally studying sludge disposal, however, the U.S.A. will continue land application of sludge and improving disposal techniques.[5]

E. Multnomah County

No planning.[5]

F. City of Gresham

No planning.[5]

G. City of Vancouver

No planning; looking at commercial composting process. (Pilot project)[5]

H. Metropolitan Service District

No planning.

V. POSSIBLE WASTEWATER SLUDGE DISPOSAL TECHNIQUES

The following are a series of discussions regarding possible sewage sludge disposal methods.

A. Sanitary Landfill

Sewage sludge can be disposed of in sanitary landfills with or without mixed municipal solid waste.

For disposal with mixed municipal solid waste, dewatered, digested sewage sludge is placed on the working face in a sanitary landfill and promptly covered with earth or municipal refuse. Opinion is divided as to the need for digestion and dewatering of sewage sludge prior to incorporation in a sanitary landfill. While not widely practiced, it is possible to operate a sanitary landfill for sludge disposal alone. In such cases, sewage sludge would at a minimum require dewatering prior to placement in a landfill.

A sanitary landfill, if properly operated, will provide a safe and economically sound means of sludge disposal. Municipal solid waste layered with the sludge will help absorb excess moisture in the sludge. Operational problems such as bogging down of operating equipment and site operator objections may be created as a result of incorporating sewage sludge into a sanitary landfill, however. Critical attention must be devoted to site selection, engineering design, leachate and gas control monitoring systems, and operating plans in the development of any sanitary landfill receiving sewage sludge.

Very few advantages exist for operating a landfill solely for sludge disposal unless its proximity to the sewage treatment plant reduces transportation costs to near zero. The establishment of a landfill only for sludge results in unnecessary duplication of land disposal site, and solves none of the potential problems in a combined sludge/solid waste sanitary landfill. In fact, operational problems may be aggravated by the absence of the absorptive and bearing capacities of mixed municipal refuse.

B. Thermal Processing

While incineration of sewage sludge or solid waste is often considered a disposal alternative, it is in fact merely a volume reduction technique since there remains a residue that requires disposal. Other forms of thermal

processing include heat drying, wet air oxidation, pyrolysis, and use of sludge as supplementary fuel.

Sludge may be heat-dried prior to its utilization on land. This stabilization technique provides a high quality product (90-99% solids) that can be used as fertilizer, either as is or fortified. Some degree of drying is required prior to incineration, pyrolysis, or use of the sludge as supplementary fuel.

When sludge is incinerated or used in a pyrolysis unit or as supplementary boiler fuel, it must be dewatered. Dry sludge solids have a relatively high heat value, but considerable energy is required to drive off the water in the sludge and to bring the sludge to the combustion point. Since thermal processing alternatives require the use of substantial quantities of auxiliary fuels which may be very expensive and of limited availability, an economic analysis should be done and the energy balance calculated.

The potential for air pollution from thermal processing of sewage sludge is another serious disadvantage. Thermal processing facilities are extremely capital-intensive largely because of the pollution control equipment required.

C. Ocean Disposal

Sewage sludge has been deposited in the ocean by coastal cities, using either a pipeline or barges. The continued use of this disposal method is in doubt as a result of more stringent water pollution control laws.

The main advantage of this alternative is the low overall cost to coastal cities, resulting from limited sludge treatment and dewatering requirements and cheap pipeline or barge transportation. The main disadvantage is the

environmental and esthetic degradation of coastal waters which may result from this practice. In addition, the continued use of this disposal method as a viable solution to any city's sludge disposal dilemma is in doubt as a result of EPA regulations on ocean dumping and transportation for dumping purposes.

D. Utilization On Land

There are many ways of using sewage sludge on land as a soil conditioner and/or as a low grade fertilizer. Sludge can be applied to crop and forest land to maintain or restore depleted soil fertility levels and to reclaim abandoned strip-mined and marginal lands. Other potential uses of sewage sludge include erosion control projects and application on golf courses, cemeteries, highway median strips, parkland and airports, and for turfgrass and ornamental shrub production, beautification programs, etc. Sewage solids may be applied in the liquid (2 to 8% solids), dewatered (18 to 30% solids) or dried state (40 to 100% solids). The two most common methods are liquid application and open dumping followed by plowing. Several less common methods are burial in trenches, ridge and furrow irrigation, spray irrigaiton, plow injection and irrigation by flooding.

Of major importance when contemplating the use of sewage solids on food chain crops is the viability of pathogenic organisms and the uptake and accumulation of heavy metals in the edible portion of plants grown for human or animal consumption. Various methods are used to stabilize sludge which render it biologically safe. Several[1] of the more common means of sludge stabilization are:

Anaerobic digestion
Aerobic digestion
Heat treatment
Lime stabilization

Pasteurization
Chlorine oxidation
Composting
Chemical fixation
Long term storage

Although properly stabilized, the possibility still exists for toxic metal accumulation in food chain crops. The metal elements of most importance in sludge are zinc, copper, cadmium, lead, and nickel. These are all potentially toxic to crops, and cadmium and lead may be hazardous if allowed to enter the food chain. The element that is of most concern from a public health viewpoint is cadmium. Good municipal sludge management practices for utilization and disposal of sewage sludge will, if strictly followed, limit the accumulation of cadmium and other toxic metals in plants grown on sludge-amended soils.

A wide range of metals content has been observed in digested sludges taken from various communities; estimates of typical levels have been made (Table 3). In general, sludges with excessively high metals content should not be applied on land used to grow forage or food chain crops.

TABLE 3

RANGE OF METAL CONTENT IN DIGESTED SEWAGE SLUDGES[1]

(Dry Weight)

Analysis	Observed range (ppm)	Typical "domestic" sludge (ppm)
Zinc	500 to 50,000	2,000
Copper	250 to 17,000	1,000
Nickel	25 to 8,000	200
Cadmium	5 to 2,000	15
	(0.1 to 40% of zinc)	(0.1% of zinc)
Boron	15 to 11,000	100
Lead	100 to 10,000	1,000
Mercury	1 to 100	10
Chromium	50 to 30,000	1,000

A primary advantage of land application of sludge is that a relatively inexpensive soil conditioner and low-grade fertilizer is made of what would otherwise be mere waste. A secondary advantage is that requirements for other fertilizers are reduced, thus conserving natural resources used in their production.

The major disadvantage relates to the heavy metals and pathogenic organisms in sewage solids. In large quantities, such contaminants, especially heavy metals, can restrict the types of crops planted and can limit the ultimate use of the land. High concentrations of certain metals can also result in plant toxicity and reduced crop yields. Plant uptake of heavy metals, especially arsenic, cadmium, lead, mercury, and selenium, as well as the presence of pathogenic organisms on the surface of plants, can render the crops unfit for human or animal consumption.

There are two additional disadvantages of land application.

The most obvious is the large amount of land that is generally required to utilize the sludge from a municipal wastewater treatment plant. Application rates of 10 to 25 dry tons of sewage solids per acre per year are typical; however, actual application rates can be determined only on a case-by-case basis depending upon the metals content of the sludge, soil type, climatological conditions, the type of crop or vegetation, application techniques, and whether the sludge is being applied in the liquid, dewatered or dry state.

The other disadvantage is the potential that exists for ground and surface water pollution from infiltration and runoff of sludge contaminants, both biological and chemical. A site-monitoring program should be established to fully assess the degree of environmental degradation, if any, taking place.

E. Sludge Utilization and Disposal Costs

Until recent years, decision-making bodies have been able to aviod identification of the specific cost of sewage sludge handling and disposal by attaching such cost to the sewage treatment facility or sanitary landfill budget. As a result, there is a general lack of reliable comparative cost data of current and past disposal activities, and only approximate figures are currently available (Table 4). Actual cost will vary for each locale, depending upon such factors as volume of sludge to be handled, haul distances, local labor rates, cost of land, equipment cost, soil absorption capacity, etc.

TABLE 4

ESTIMATED TYPICAL COSTS OF SLUDGE

DISPOSAL PROCESSES PER DRY TON, 1974[1]

METHODS	COST PER DRY TON
Dewatering:	
Vaccuum filter	$ 31.00
Centrifuge	26.00
Sand beds	30.00
Land transport (5% solids):	
Tank truck	$ 3.00/mile
Railroad	0.25/mile
Pipeline	1.55/mile
Land transport (30% solids):	
Dump truck	$ 0.65/mile
Railroad	0.25/mile
Ocean transport (5% solids):	
Barge	$ 0.20/mile
Outfall	0.60/mile
Ocean transport (30% solids):	
Barge	$ 0.03/mile
Storage:	
30% (stockpile)	$ 2.30
5% (lagoon)	14.00
Disposal (5% solids):	
Ocean disposal	$ --
Landfill	3.00
Land spreading	20.00
Disposal (30% solids):	
Ocean disposal	$ --
Landfill	3.00
Land spreading	10.00
Miscellaneous disposal methods:	
Incineration (total cost including dewatering)	$50 to 85
Composting (total cost including dewatering)	not accruately known at this time.

F. Composting Solid Waste With Sewage Sludge

It has been estimated that a city can save approximately 30% of the cost of its sewage treatment by pumping the raw sludge to a compost plant for use as a moistening agent and as a source of nitrogen in the compost. The addition of raw sewage sludge to the composting operation certainly enhances the process. The greater use of paper and disposable packaging materials has led to an increase in the amount of paper and paper products in refuse and a corresponding percentage decrease in the amounts of putrescible materials such as garbage. Paper and paper products now consititute 50% of the weight of combined refuse and the content of garbage has decreased to about 10-15%. Consequently, the refuse is much drier and bulkier than formerly and contains smaller proportions of nutrients. The addition of sewage sludge to the refuse speeds up the decomposition process and improves the quality of the finished compost by increasing its nutrient content. Sludge can replace water in adjusting the moisture of the composting mixture and will also improve the color and consistency of the compost. The moisture and nutrient contents of different types of sewage sludge are shown in Table 5.

TABLE 5

MOISTURE AND NUTRIENT CONTENTS OF SEVERAL TYPES OF SEWAGE SLUDGE[7]

Type of Sludge	% moisture	Nutrients, % Day Weight		
		N	P_2O_5	K_2O
Primary				
Raw	95-98	3.0-4.0	1.0-3.0	
Digested	87-95	1.3-3.0	1.5-4.5	0.3-0.50.5
Primary + trickling filter				
Raw	95-98	3.5-5.0		
Digested	90-95	1.5-3.5	2.8-4.5	
Activated				
Raw	98-99.5	4.3-6.4	4.0-7.0	0.3-0.7
Digested	93-97	2.5-4.8	2.5-4.8	0.3-0.6

The most critical nutrient in any aerobic decomposition process is nitrogen. Refuse after separation and grinding as it commonly occurs today may contain only about 1/2 to 9/10 percent of nitrogen. A low nitrogen content requires that the microorganisms acting during the decomposition process recycle this nitrogen through many generations, gradually building up its percentage, as carbonaceous material is decomposed in the aerobic decomposition process to carbon dioxide and water. This process is extremely slow. On the other hand, raw sludges are high in nitrogen content and therefore can greatly speed up the composting process. Unfortunately, these raw sludges are considerably more dilute than digested sludges. Furthermore, any type of sludge may be expected to contain pathogens in greater concentrations than are found in refuse. This means that much care is required in order that plant workers and public users of the compost are protected from disease.

In addition to providing a benefit for the composting process itself, the addition of raw sewage sludge to compost will result in a reduction in the problem of sludge processing and disposal.

The processing of sludge and its disposal presents problems to any sewage treatment operation as mentioned previously. The amount of suspended solids being removed from sewage is constantly increasing with the cost of sewage treatment and increase in disposal of the sludge. Increased use of garbage grinders will cause additional difficulties in that the amount of sludge produced per capita is likely to increase.

Conventional sludge digestion and drying operations could be eliminated, with the raw sludge simply thickened and pumped to the composting plants. The thickening of the sludge to approximately 88% moisture content can be obtained rather inexpensively by gravity filtration through cloth. For a slight increase in the net cost of composting the refuse, a considerable savings in the sewage treatment cost can be realized through the processing of the sludge with the refuse. The composting material will be increased in volume by only 6-10 percent, while at the same time, the addition of the sludge will speed up the composting operation and produce a better final product from the point of view of nutrient contents. Thus, in addition to savings in the sewage treatment plant operation, a greater market value for the end product could result.

At the present time, there is little data on the optimum mix of sludge and garbage for composting. One source indicates that a mix of up to 33% (dry weight) sludge can produce a good soil conditioner. However, the byproduct nitrogen and phosphorous contents would no doubt be affected. Assuming a 1/3 sludge/garbage mix, a composting plant in the range of 300 T/D could be developed. With 2000 T/D of

garbage generated in the Portland metropolitan area, only 10% would need to be diverted to be composted with approximately 100 T/D of sludges. Markets for this by-product may be limited. A 300 T/D output of soil conditioner could over-saturate any potential market.[3]

VI. FINDINGS

The following findings are prepared as a result of this paper:

1. Due to upgrading federal requirements related to wastewater treatment levels, increased volumes of sewage sludges will, in some cases, double or triple current generation rates.

2. Compared to wastewater treatment, very little effort has been given to the problem of sewage sludge disposal.

3. In the Portland metropolitan area, the sludge disposal alternatives have not been thoroughly evaluated to date. There has been virtually no work done on an areawide basis.

4. The Portland metropolitan area by 1990 will produce more than 150 tons per day of raw sewage sludge.

5. The on-going City of Portland sludge disposal study will be closely integrated into the CRAG/Corps study.

6. The Unified Sewerage Agency is presently utilizing land application for sewage sludges. This method will be utilized until the Durham sewage treatment plant is completed. At that time, heat treatment and incineration is planned. Since operating costs for operating these facilities may be high, it is questionable if the incinerator can be used.

7. Future wastewater sludge disposal methods probably will include a combination of methods including landfilling, utilization on land and composting.

8. Composting of solid waste and sewage sludges is a viable solution. Since markets for the compost byproduct are questionable, market research should be analyzed prior to constructing composting facilities.

9. The prices of nitrogen and phosphorous fertilizers are increasing faster than most other prices. The value of nitrogen in sludge is worth $18/ton of dry sludges at today's prices. The phosphorous based on a City of Salem analysis is worth $3.50/ton of dry sludge.[6]

10. Maximum utilization of solid waste with sludge as a compost could divert up to 10% of the metropolitan area solid waste from the waste stream.

REFERENCES

1. "Decision-Makers Guide in Solid Waste Management", EPA, 1976.

2. "Wastewater Engineering; Collection, Treatment and Disposal", Metcalf and Eddy, 1972.

3. Memorandum COR-MET, from Mike Kennedy to Charles Kemper, 14 January, 1976.

4. "Sewage Solids Disposal for the City of Portland", Stevens, Thompson, and Runyan, April, 1974.

5. Interviews with Terry Waldele and Tom Lucas, CRAG, February, 1976.

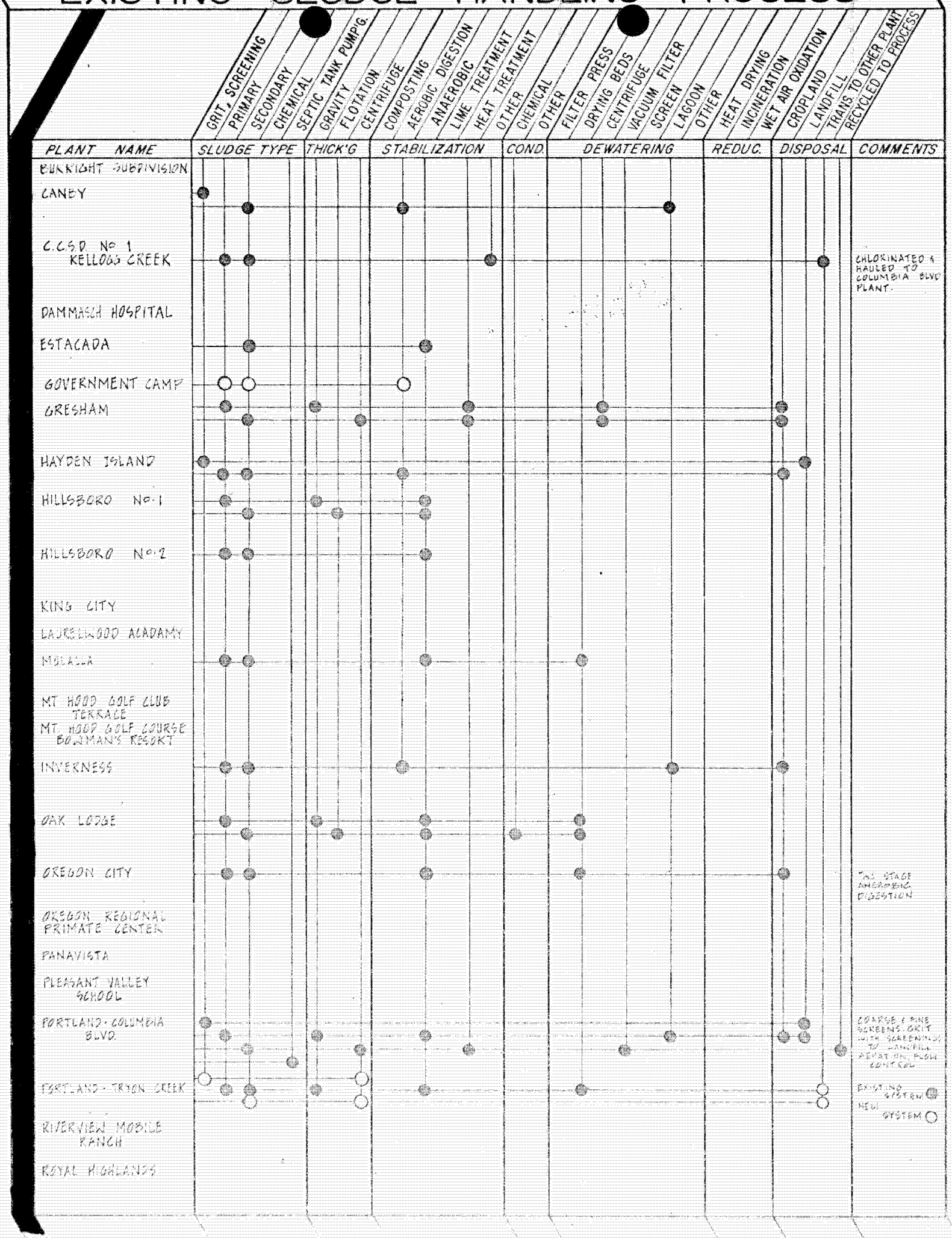
6. Letter from James A. Vomocil, OSU, to Douglas Capps, Attorney, February 6, 1976.

7. "Solid Waste Management", Hagerty, Pavoni and Heer, 1973.

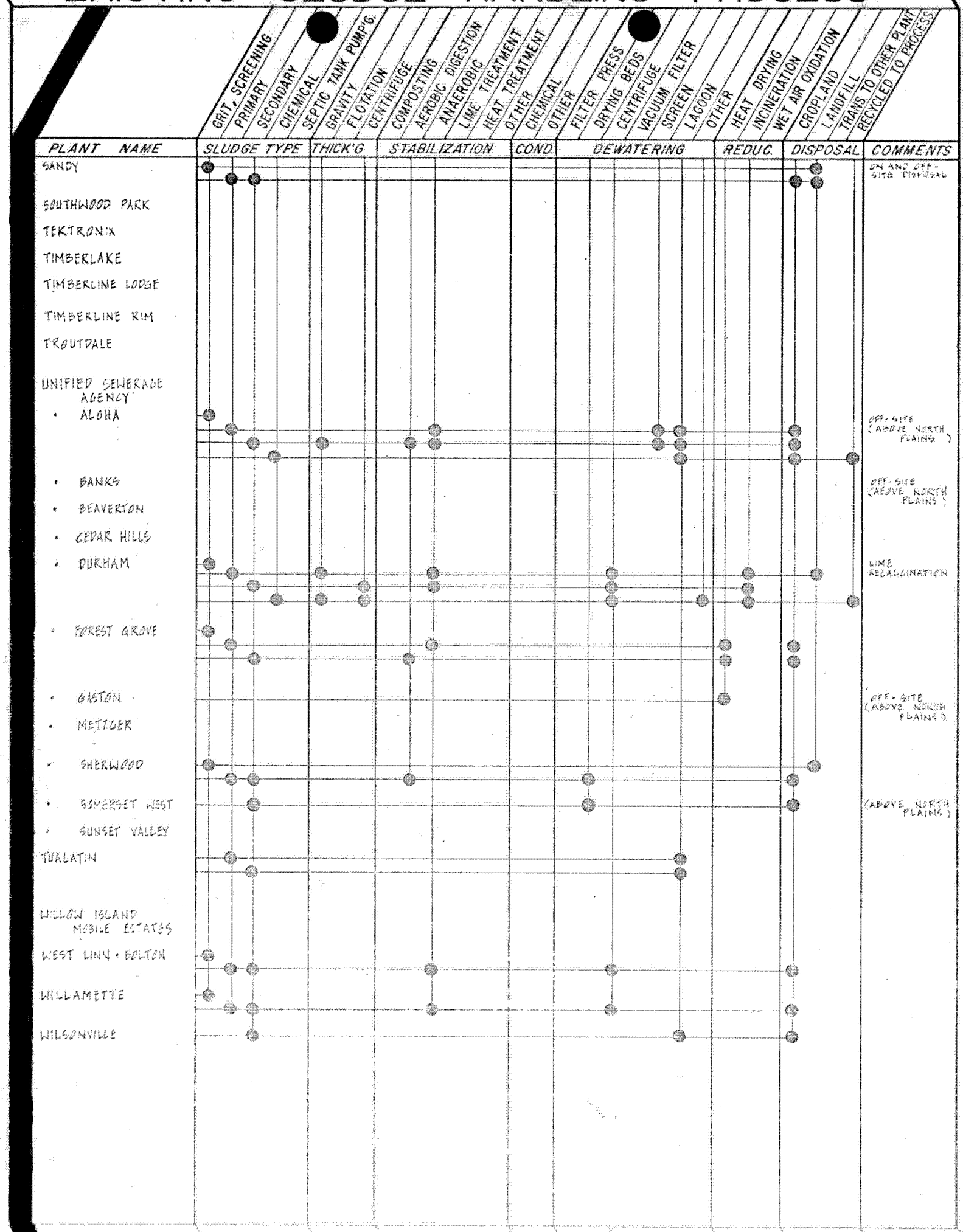
ATTACHMENT 1

EXISTING SLUDGE HANDLING PROCESSES [2,5]

EXISTING SLUDGE HANDLING PROCESS



EXISTING SLUDGE HANDLING PROCESS



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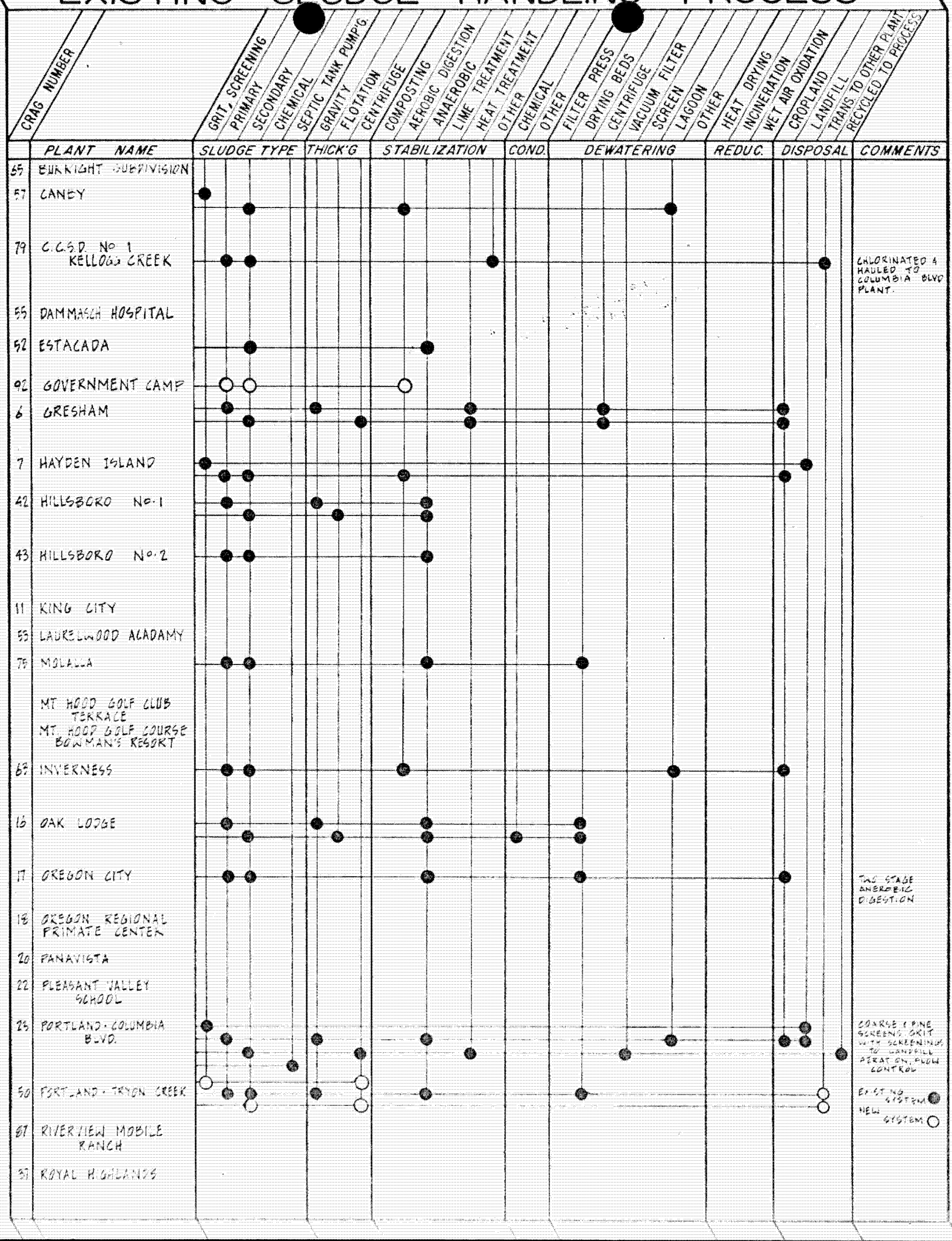

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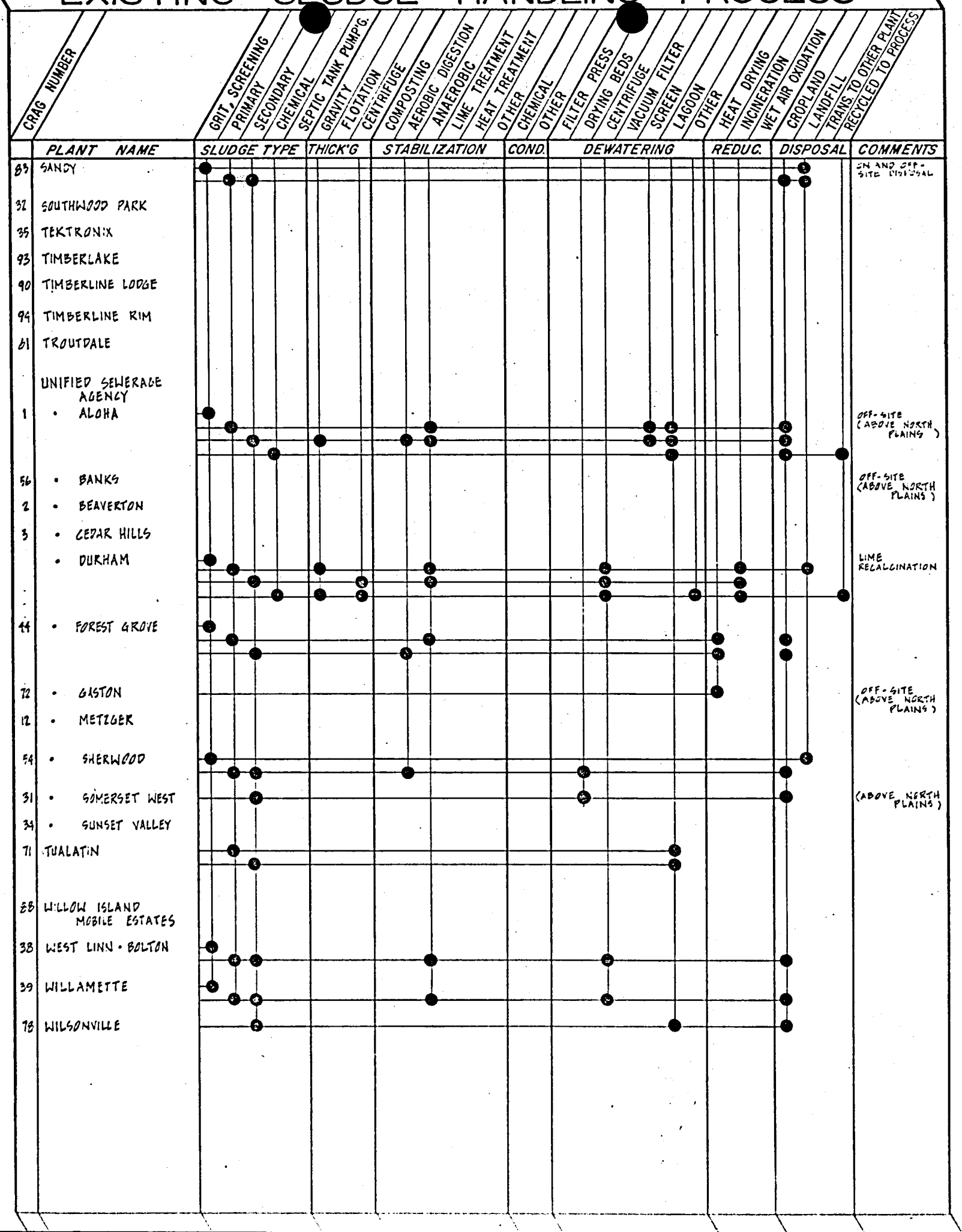
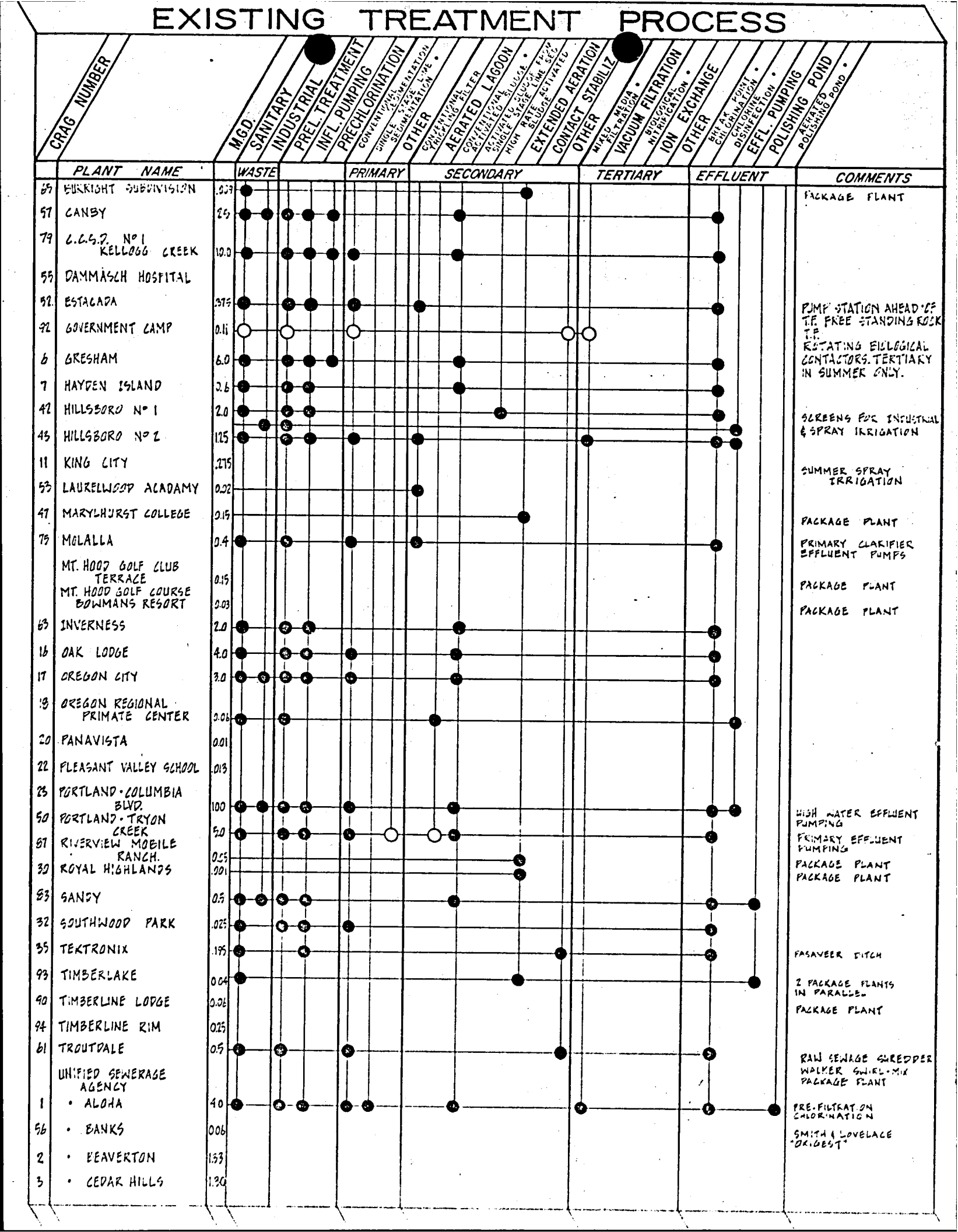
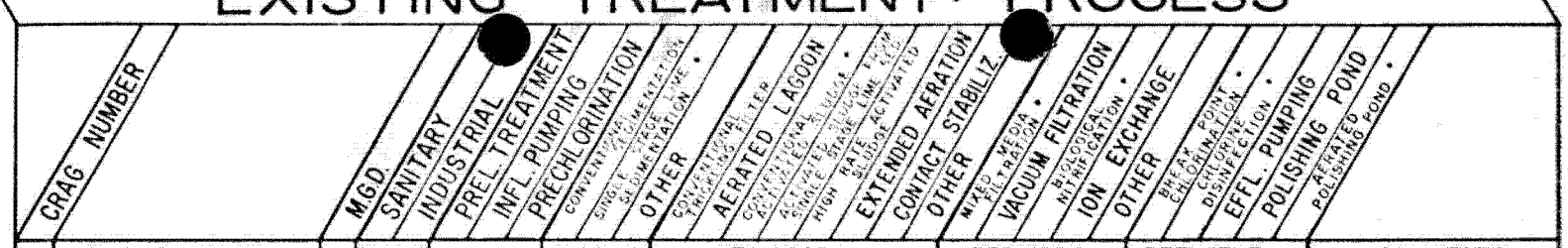


EXISTING TREATMENT PROCESS



CRAG NUMBER	PLANT NAME	M.G.D.	COMMENTS
65	BURRIGHT SUBDIVISION	.009	PACKAGE PLANT
57	CANBY	2.5	
79	C.C.S.D. Nº 1 KELLOGG CREEK	10.0	
55	DAMMASCH HOSPITAL		
58	ESTACADA	.375	PUMP STATION AHEAD OF T.F. FREE STANDING ROCK T.F. ROTATING BIOLOGICAL CONTACTORS. TERTIARY IN SUMMER ONLY.
92	GOVERNMENT CAMP	0.11	
6	GRESHAM	6.0	
7	HAYDEN ISLAND	2.6	
42	HILLSBORO Nº 1	2.0	SCREENS FOR INDUSTRIAL & SPRAY IRRIGATION
45	HILLSBORO Nº 2	1.25	
11	KING CITY	.275	SUMMER SPRAY IRRIGATION
53	LAURELWOOD ACADAMY	0.02	
47	MARYLHURST COLLEGE	0.15	PACKAGE PLANT
75	MOLALLA	0.4	PRIMARY CLARIFIER EFFLUENT PUMPS
	MT. HOOD GOLF CLUB TERRACE	0.15	PACKAGE PLANT
	MT. HOOD GOLF COURSE BOWMANS RESORT	0.03	PACKAGE PLANT
63	INVERNESS	2.0	
16	OAK LODGE	4.0	
17	OREGON CITY	3.0	
18	OREGON REGIONAL PRIMATE CENTER	0.06	
20	PANAVISTA	0.01	
22	PLEASANT VALLEY SCHOOL	.013	
23	PORTLAND - COLUMBIA BLVD.	100	HIGH WATER EFFLUENT PUMPING
50	PORTLAND - TRYON CREEK	5.0	PRIMARY EFFLUENT PUMPING
87	RIVERVIEW MOBILE RANCH.	0.05	PACKAGE PLANT
30	ROYAL HIGHLANDS	.001	PACKAGE PLANT
83	SANDY	0.5	
32	SOUTHWOOD PARK	.025	
35	TEKTRONIX	.195	PASAVEER DITCH
93	TIMBERLAKE	0.04	2 PACKAGE PLANTS IN PARALLEL
90	TIMBERLINE LODGE	0.06	PACKAGE PLANT
94	TIMBERLINE RIM	0.25	
61	TROUTDALE	0.5	RAW SEWAGE SHREDDER WALKER SWIRL-MIX PACKAGE PLANT
	UNIFIED SEWERAGE AGENCY		
1	• ALOHA	4.0	PRE-FILTRATION CHLORINATION
56	• BANKS	0.06	SMITH & LOVELACE "ORIGEST"
2	• BEAVERTON	1.53	
3	• CEDAR HILLS	1.30	

EXISTING TREATMENT · PROCESS



	PLANT NAME	M.G.D.	WASTE	PRIMARY	SECONDARY	TERTIARY	EFFLUENT	COMMENTS
	UNIFIED SEWERAGE AGENCY							
	· DURHAM							TWO STAGE LIME CLARIFICATION & RECARBONATION/ FILTRATION, EFFLUENT SCREW PUMPS, PRE-AERATION INFLUENT PUMPING AHEAD OF TRICKLING SPRAY IRRIGATION
44	· FOREST GROVE	0.6						
72	· GASTON	0.06						DORR OLIVER CLARIGESTER
12	· METZGER	2.5						
54	· SHERWOOD	0.57						TWO STAGE TRICKLING FILTER SUMMER SPRAY IRRIGATION
31	· SOMERSET WEST	0.32						
34	· SUNSET VALLEY	2.5						STAND-BY ONLY
71	TUALATIN							SECONDARY TUBE CLARIFIER; ALUM-, SODA ASH, POLYELECTROLYTE FLOCCULATION & TERTIARY TUBE CLARIFICATION
88	WILLOW ISLAND MOBILE ESTATES							
38	WEST LINN · BOLTON							
39	WILLAMETTE	1.3						
78	WILSONVILLE	0.5						RAW SEWAGE SHREDDER PACKAGE AERATOR & CLARIGESTER
	ZIGZAG CONDOMINIUMS							

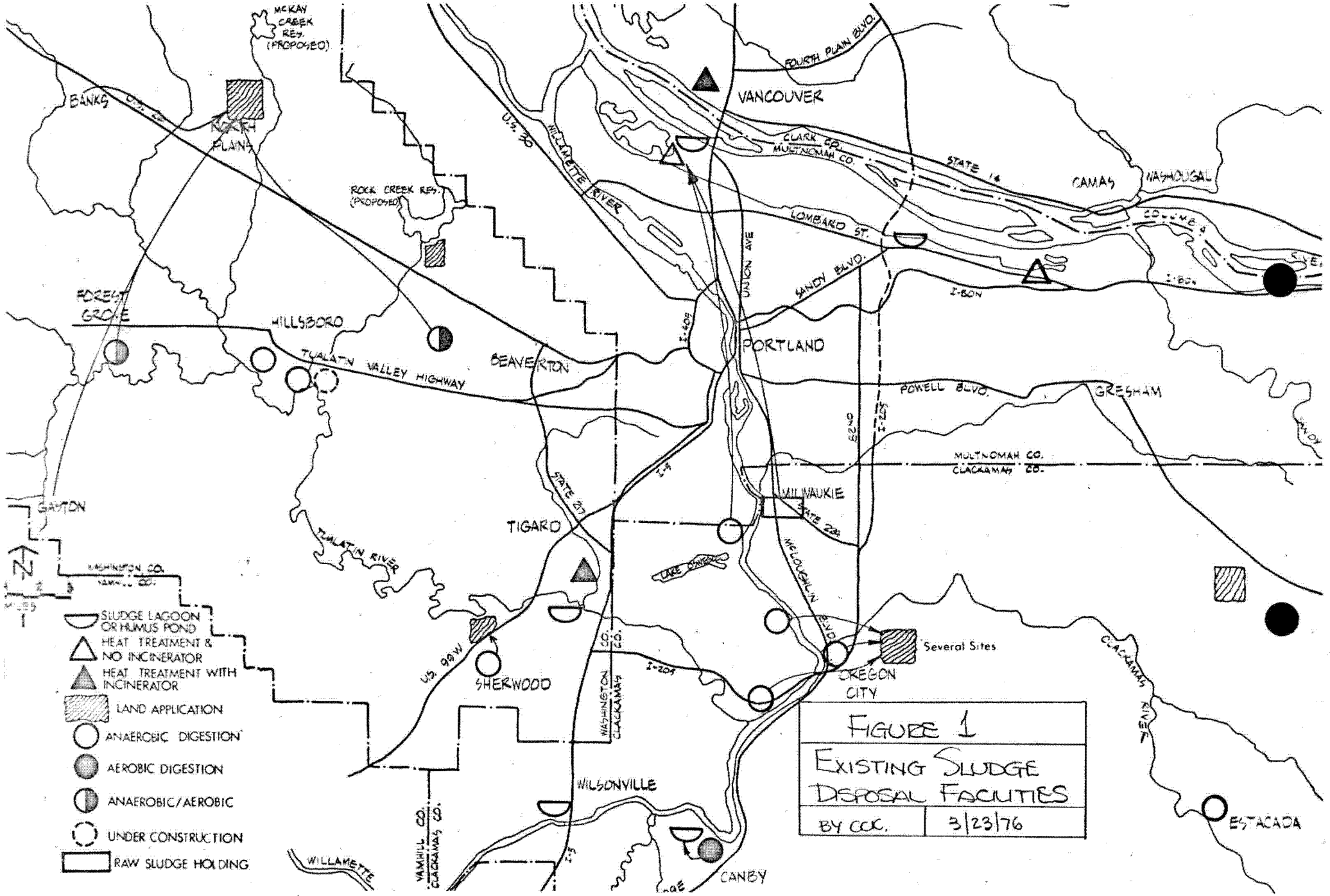


FIGURE 1

EXISTING SLUDGE DISPOSAL FACILITIES

BY CDC. | 3/23/76

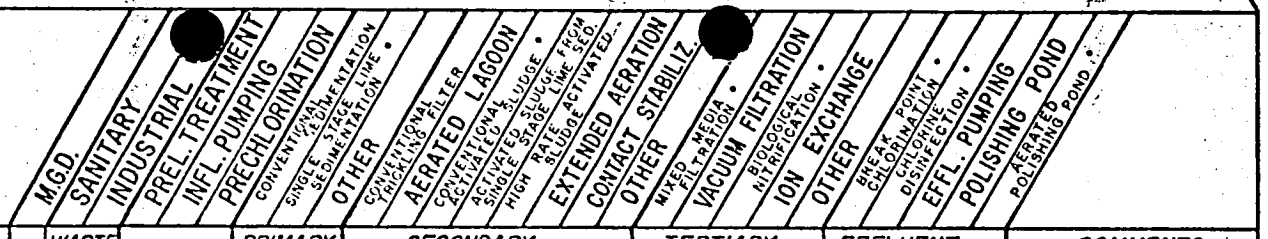
ATTACHMENT 2

EXISTING SEWAGE TREATMENT PROCESS [5]

EXISTING TREATMENT PROCESS

PLANT NAME	M.G.D.	WASTE: SANITARY	WASTE: INDUSTRIAL	WASTE: PREL. TREATMENT	WASTE: INFL. PUMPING	PRIMARY: PRECHLORINATION	PRIMARY: CONVENTIONAL SEDIMENTATION	PRIMARY: SINGLE STAGE LIME SEDIMENTATION	PRIMARY: OTHER	SECONDARY: CONVENTIONAL TRICKLING FILTER	SECONDARY: AERATED LAGOON	SECONDARY: CONVENTIONAL ACTIVATED SLUDGE	SECONDARY: ACTIVATED SLUDGE SINGLE STAGE LIME SED.	SECONDARY: HIGH RATE ACTIVATED SLUDGE FROM SED.	SECONDARY: EXTENDED AERATION	SECONDARY: CONTACT STABILIZ.	SECONDARY: OTHER	TERTIARY: MIXED MEDIA FILTRATION	TERTIARY: VACUUM FILTRATION	TERTIARY: BIOLOGICAL NITRIFICATION	TERTIARY: ION EXCHANGE	TERTIARY: OTHER	EFFLUENT: BREAK POINT CHLORINATION	EFFLUENT: CHLORINE DISINFECTION	EFFLUENT: EFFL. PUMPING	EFFLUENT: POLISHING POND	EFFLUENT: AERATED POND POLISHING POND	COMMENTS
BURRIGHT SUBDIVISION	.003	●													●													PACKAGE PLANT
CANBY	2.5	●	●	●	●	●					●																	
C.C.S.D. Nº 1 KELLOGG CREEK	10.0	●		●	●	●	●				●																	
DAMMASCH HOSPITAL																												
ESTACADA	.375	●		●	●	●			●																			PUMP STATION AHEAD OF T.F. FREE STANDING ROCK T.F. ROTATING BIOLOGICAL CONTACTORS. TERTIARY IN SUMMER ONLY.
GOVERNMENT CAMP	0.11	○	○	○	○										○	○												
GRESHAM	6.0	●		●	●	●					●																	
HAYDEN ISLAND	0.6	●		●	●						●																	
HILLSBORO Nº 1	2.0	●		●	●							●																
HILLSBORO Nº 2	1.25	●	●	●	●	●			●									●										SCREENS FOR INDUSTRIAL & SPRAY IRRIGATION
KING CITY	.275																											SUMMER SPRAY IRRIGATION
LAURELWOOD ACADAMY	0.02	●							●																			
MARYLHURST COLLEGE	0.15	●												●														PACKAGE PLANT
MOLALLA	0.4	●		●		●			●																			PRIMARY CLARIFIER EFFLUENT PUMPS
MT. HOOD GOLF CLUB TERRACE	0.15																											PACKAGE PLANT
MT. HOOD GOLF COURSE BOWMANS RESORT	0.03																											PACKAGE PLANT
INVERNESS	2.0	●		●	●						●																	
OAK LODGE	4.0	●		●	●	●					●																	
OREGON CITY	3.0	●	●	●	●	●					●																	
OREGON REGIONAL PRIMATE CENTER	0.06	●		●						●																		
PANAVISTA	0.01																											
PLEASANT VALLEY SCHOOL	.013																											
PORTLAND · COLUMBIA BLVD.	100	●	●	●	●	●					●																	HIGH WATER EFFLUENT PUMPING
PORTLAND · TRYON CREEK	50	●		●	●	●	○			○	●																	PRIMARY EFFLUENT PUMPING
RIVERVIEW MOBILE RANCH.	0.05													●														PACKAGE PLANT
ROYAL HIGHLANDS	.001													●														PACKAGE PLANT
SANDY	0.5	●	●	●	●						●																	
SOUTHWOOD PARK	.025	●		●	●	●																						
TEKTRONIX	.195	●		●											●													PACAVEER DITCH
TIMBERLAKE	0.04	●												●														2 PACKAGE PLANTS IN PARALLEL
TIMBERLINE LODGE	0.03																											PACKAGE PLANT
TIMBERLINE RIM	0.05																											
TROUTDALE	0.5	●		●		●									●													RAW SEWAGE SHREDDER WALKER SWIRL-MIX PACKAGE PLANT
UNIFIED SEWERAGE AGENCY																												
· ALOHA	4.0	●		●		●	●				●							●										PRE-FILTRATION CHLORINATION
· BANKS	0.06																											SMITH & LOVELACE "ORIDEST"
· BEAVERTON	1.33																											
· CEDAR HILLS	1.30																											

EXISTING TREATMENT PROCESS



PLANT NAME	M.G.D.	COMMENTS
UNIFIED SEWERAGE AGENCY		
• DURHAM		TWO STAGE LIME CLARIFICATION & RECARBONATION/ FILTRATION. EFFLUENT SCREW PUMPS: PRE-AERATION, INFLUENT PUMPING AHEAD OF TRICKLING SPRAY IRR., IND., MP
• FOREST GROVE	5.0	
• GASTON	0.36	
• METZGER	2.5	DORR OLIVER CLARIGESTER
• SHERWOOD	0.57	TWO STAGE TRICKLING FILTER SUMMER SPRAY IRRIGATION
• SOMERSET WEST	0.32	
• SUNSET VALLEY	2.5	STAND-BY ONLY
TUALATIN		SECONDARY TUBE CLARIFIER; ALUM., SODA ASH, POLYELECTROLYTE FLOCCULATION & TERTIARY TUBE CLARIFICATION
WILLOW ISLAND MOBILE ESTATES		
WEST LINN - BOLTON WILLAMETTE	1.3	
WILSONVILLE	0.5	RAW SEWAGE SHREDDER PACKAGE AERATOR & CLARIGESTER
ZIGZAG CONDOMINIUMS		

1.10.03

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUL 23 1976

OFFICE OF
AIR AND WASTE MANAGEMENT

Mr. John Hanke
Metropolitan Service District
527 S.W. Hall
Portland, Oregon 97201

Dear Mr. Hanke:

I appreciate the time and effort required by your participation in the recent OSWMP/208 conference, and I extend my thanks. We believe that coordination between the solid waste and 208 planning communities is one important step towards building more effective, interdisciplinary solid waste management programs. Through your efforts, my office was better able to explore alternative solutions to various residuals management problems and to relate those solutions to the water planning community. Again, thank you for your cooperation.

Sincerely,

Sheldon Meyers

Sheldon Meyers
Deputy Assistant Administrator
for Solid Waste Management Programs
(AW-462)

property SALES CO., Inc.

Telephone 646-1188

12195 S. W. Canyon Road—BEAVERTON, OREGON 97005

TO: Charles Kemper
Metropolitan Service District
6400 S.W. Canyon Court
Portland, Oregon 97221

FROM: Property Sales Co., Inc.
12195 S.W. Canyon Road
Beaverton, Oregon 97005

SUBJECT: Program for acquiring solid waste landfill sites and transfer station sites.

We propose to approach the acquisitions in the following manner:

1. Outline of general area in which the specific sites are desired.

2. Within each of said general areas we propose to get at least two site options at $10.00 each for at least a 30 day period each option being extendable if desired.

3. During the initial option period M.S.D. and or it's engineers will determine what sites they desire to have the option extended and which ones to drop.

4. The selected sites for option extention will then be extended at and for a negotiated price for said extention. Each should be extended for a 6 month period. This will allow for an in depth study of each site.

5. When a given site or sites have been determined to be fully acceptable the option or options will then be exercised with all option monies paid on the site applying on the purchase price.

6. It would be important that all options be taken in our names for an undisclosed client and then we assign said options to the M.S.D.

7. All matters and discussion regarding the property search and option program should be in the strictest of confidence until all options are in hand.

Sincerely,

Robert A. Bailey
Robert A. Bailey, Broker

Ray J. VanderZanden
Ray J. VanderZanden
Property Sales Co., Inc.

METROPOLITAN SERVICE DISTRICT
6400 S.W. CANYON COURT PORTLAND, OREGON 97221 (503) 297-3726

DRAFT

RULES FOR THE CITIZEN ADVISORY COMMITTEE METROPOLITAN SERVICE DISTRICT SOLID WASTE IMPLEMENTATION PLAN

I. PURPOSE

The purpose of the Citizen Advisory Committee shall be:

a. To review and comment on the Solid Waste Implementation Plan of the Metropolitan Service District of the Portland Metropolitan Area; and

b. To provide and enhance citizen input to the plan.

II. OFFICERS

A Chairman and Vice Chairman of the Committee shall be elected by a majority of the committee members present. They shall serve for the duration of the Committee.

III. PROCEDURE

a. Meetings

Meetings shall be held at least once a month for the duration of the Committee's existence. After the end of the agenda, meetings shall be open to the public for comment and input.

b. Quorum

A quorum of the Citizen Advisory Committee shall be a majority of the members of the Committee, or not less than seven, NEEDED FOR VOTING ON RECOMMENDATIONS TO THE BOARD.

c. Voting

Voting in the Committee shall carry by a simple majority of those present.

d. Absences

Three consecutive unexcused absences shall constitute a vacancy for that seat on the committee and the Metropolitan Service District Board shall fill the vacancy at the earliest possible moment.

IV. RELATION WITH METROPOLITAN SERVICE DISTRICT BOARD AND TECHNICAL ADVISORY COMMITTEE

The Citizen Advisory Committee should have an opportunity to comment on solid waste matters and to communicate with the Metropolitan Service District Board and the Technical Advisory Committee prior to action by the Board.

V. AMENDMENTS

These rules may be amended from time to time by a majority of the members of the Committee, provided that all members of the Committee have been sent copies of the proposed amendments prior to the meeting where action on the rules is scheduled.

CONFERENCE

Energy Recovery from Municipal Solid Waste

- SESSION -
System Procurement Issues

THE CONSULTING ENGINEER'S ROLE IN PROVIDING SOLID WASTE MANAGEMENT SERVICES

Black, Crow and Eidsness, Inc.
Consulting Engineers
Gainesville, Florida

D. H. Graham, P.E.

NATIONAL LEAGUE OF CITIES

UNITED STATES CONFERENCE OF MAYORS

U.S. ENVIRONMENTAL PROTECTION AGENCY

Hosted by:

City of St. Louis
Missouri Municipal League
St. Louis, Missouri
October 31 - November 1, 1974

THE CONSULTING ENGINEER'S ROLE IN PROVIDING SOLID WASTE MANAGEMENT SERVICES

BLACK, CROW AND EIDSNESS, INC.
Consulting Engineers
Gainesville, Florida

D. H. Graham, P.E.

Introduction

It is indeed a pleasure to be here and to have this opportunity to share with you our ideas and experiences regarding the role of a private consulting engineering firm in assisting governmental agencies in establishing and implementing a rational solid waste management program.

The old cliche that there is "gold in garbage" continues to gain momentum and impetus during this inflationary economy and awareness for energy conservation. The rationale behind this awareness is motivated by many significant factors; depending upon where the problem is, its magnitude, and legislative driving forces.

Today, I would like to briefly relate for you our approach and rationale in assisting various clients with their solid waste activities. Ultimate solutions will vary, subject to many factors, e.g., refuse quantity and composition, location, costs, availability of land, and local markets for reclaimed products.

Whatever the local situation, some preparatory engineering work is essential for an orderly and rapid program. The purpose of such work is to narrow the range of inquiries so that alternatives that are offered can be effectively evaluated and compared.

We feel the following fundamental steps will result in a sound solid waste program.

1. *Local problem definition*—This phase consists of doing an objective evaluation of existing methods, determining the life expectancy and costs of existing systems, waste quantity, character, and growth projections. These factors will establish the real needs, urgency, and beginning basis for preparing a long-range *comprehensive plan*.

2. *Market analysis survey*—This is an essential step in establishing the potential merits of a resource recovery program as an expedient solution. Such a survey will establish local or regional market outlets, values, penetration volumes, etc., in addition to developing contacts and letters of intent to purchase.

3. *Preliminary engineering screening of applicable process technologies*—This effort can be accomplished only after potential product markets are identified, and preliminary values and specifications are established. The ultimate technology selection will, in all probability, be a custom-tailored process utilizing the various system components necessary to complement available product markets. The ultimate economic analysis must consider the overall savings of raw natural resources, land, and energy.

4. *Project financing mode*—Once a rational concept is established, a suitable mechanism for financing the program becomes essential. Several options are available, e.g., municipal revenue bonds, private capital, state grants and aids, public and private owned facilities. These mechanisms have been discussed at great length in previous sessions of this conference.

5. *Legislative authorization*—The necessary legislative action to support an aggressive solid waste management program is essential to the success of the program. This legislation must have the following minimum features.

   - The governing agency must have legal title to *all* waste sources, and the authority to convey such title.
   - Waste definitions are essential in obtaining control and enforcement.
   - Such laws must be tested and proven valid.
   - Local legislative action must be compatible with state and federal guidelines, goals, and legal restraints.

6. *Implementation planning*—The municipality or agency should establish realistic implementation goals that are compatible with the financing mode, legislative base, and its predetermined needs.

The above six steps essentially become the comprehensive plan. Only when this plan has been established and approved by all involved governmental agencies, can a request for proposal (RFP) be prepared and issued that will produce meaningful responses that can be evaluated and compared.

Several basic steps are essential to preparing an RFP. Time will not permit a discussion of each; however, most are

self-evident and we will highlight what we consider to be the main features.

RFP Objectives Can Be

1. Professional engineering services
2. Design services
3. Management consultant services
4. *Random* or *specified* process turnkey system approaches
5. Competitive priced systems
6. Construction management services
7. Long-term operating services
8. Combination of *any* and *all* of the above

Request for Proposal (RFP) Contents

1. General project information
    a. Project phasing
    b. Program goals and objectives
    c. Alternate proposal considerations
    d. Proposal consideration options
    e. Project funding basis
    f. Background considerations
2. Proponent's performance expectations
    a. Project management methodology and controls
    b. Scheduling goals
    c. Reporting
    d. Technical and financial audit
    e. Overall program network analysis interactions
3. Process expectations
    a. Process restraints
    b. Process redundancy
    c. Product specifications
    d. Facility layout and equipment specifications
    e. Safety considerations
    f. Receiving storage and product/residual disposal methodology
4. Contractual considerations
    a. Facility ownership
    b. Sequential contracting
    c. Negotiable terms and conditions
    d. Process guarantees
    e. Product revenue guarantees
    f. Performance bonding
    g. Insurance
    h. Personnel qualifications
    i. Patent rights
    j. Royalties
    k. Payment schedules
5. Proposal requirements
    a. Proposal bid bonds
    b. Submission deadlines
    c. Proposal outline/format
    d. Proposal evaluation criteria
    e. Evaluation methodology
    f. Issuers legal and financial liability

6. Supplemental information

    a. Project related reports, drawings
    b. Site maps, soils data, utility services
    c. State and local environmental and zoning restraints
    d. Product specifications
    e. Applicable legal documents

RFP Issuance Methodologies

1. Proponent procurement

    a. Prequalifications screening (illegal in certain states)
    b. Public advertisements
    c. Issuance to select proponents only (legal restraints in many states)

2. Advertising media

    a. Solid waste trade journals
    b. Major national newspapers
    c. National Wall Street journals
    d. Commerce Business Daily

3. Response Period(s)

    a. Dependent upon scope of activities, 30-day minimum recommended

Proposal Evaluation/Proponent Selection

This task should be preplanned prior to the RFP issuance. Conducting these evaluations requires considerable time, technical assistance, and finesse. A formal evaluation criteria and scoring outline is often useful to establish a normal working base for evaluators. The following key criteria are suggested for consideration during most proposal evaluations:

1. Proponent background and related experience

2. Management experience and technical qualifications

3. Technical approach to the problem

4. Proposed costs, details, burdens, etc.

5. Contractual restraints

6. Operating management capabilities

7. Marketing capabilities

8. Suggested evaluation sequence

    a. Review written proposals (normalize cost, conduct preliminary scoring)
    b. Interview proponents at their facilities
    c. Proponents' formal public presentations to governing bodies, agencies, and selection committee
    d. Objective evaluation and recommendation by outside party
    e. Final committee or agency

selection (proponent notifications, public selection announcement)

f. Begin contract negotiations (always maintain backup proponent options)

Public System Procurement Considerations

Public procurement policies, laws, practices, and methods vary considerably between state and municipal governments. Many states have competitive bidding laws which impose rather strict limitations on the agency with regard to buying turnkey or packaged systems. Various approaches are being employed to work within these restraints and still obtain the benefits of the turnkey approach.

Such an approach is through a qualified flexible industrial firm that will function for the governmental agency as a management consultant. In this role the management consultant may perform the following basic services on the agency's behalf:

1. Engineering design services

    a. Typical A/E activities
    b. Prepare phased work packages
        - Major long lead process components
        - Site preparation and foundations
        - Primary electrical components
        - Facilities and structures
        - Equipment installation

2. Procurement services

    a. Issuance of work package
    b. Bid review, evaluation, and recommendations
    c. Vendor expediting inspections, etc.

3. Construction management

    a. Bid package construction coordination
    b. Financial monitoring and controls
    c. O&M manual start-up assistance

4. Operating management

Generally these services are obtained on an individual phased sequential contract basis. Certain supplemental features sought in these services that are not *normally* imposed on routine engineering services are:

1. Process design and performance guarantees

2. Schedule delay penalties

3. Performance bonding

4. Product sales/revenue guarantees

5. Operating performance penalties (reciprocal penalities can apply here, e.g., if agency fails to deliver adequate refuse, penalties are levied)

These comments, today, have been presented only in an attempt to highlight

how the consulting engineer may assist public agencies in developing and implementing a solid waste management program commensurate with their needs and within the local legal restraints.

Engineering services are taking on many new titles in today's marketplace, e.g., management consultants, solid waste management services, professional management, etc. Key elements to consider in evaluating a firm or an individual when seeking this type assistance are:

1. Previous agency contracts, studies, or contacts

2. Firm's related experience

3. Available staff size

4. Key personnel and qualifications

5. Previous clients' recommendations

6. Schedule compatibility

7. Supplement services available

8. Firm's location and service base

It has indeed been a pleasure to be here today. I will be happy to supplement any areas of interest during the panel discussion. Copies of these comments will be made available after the panel discussion, should any of you desire a copy.

NATIONAL LEAGUE OF CITIES

UNITED STATES CONFERENCE OF MAYORS

INFORMATION ON

PROGRAM PERSONALITIES

The following profiles provide additional information on speakers appearing at the St. Louis, Missouri solid waste conference. They are arranged alphabetically for handy reference during or after the conference.

1620 Eye Street, N.W., Washington D. C. 20006 / 202-293-7300

CARL E. AVERS

Mr. Avers is presently General Manager and Chief Engineer for the Nashville Thermal Transfer Corporation (NTTC), Nashville, Tennessee. NTTC was established in 1970 for the purpose of constructing and operating centrally-located facilities to furnish heating and cooling for buildings in Nashville. The main fuel is the solid waste provided by the Metropolitan Government of Nashville and Davidson County. Prior to his responsibilities with NTTC, Mr. Avers was General Manager of Applied Energy, Inc. (AEI), a subsidiary of San Diego Gas and Electric Company (SDG&E) from 1968 to 1972. He further was employed by SDG&E from 1962 to 1968. As General Manager, Mr. Avers has been responsible for all operating and management aspects of AEI, including contract negotiations. Additionally, he developed thermal energy rates, conducted feasibility studies, assisted in establishing accounting and billing systems and procedures and helped negotiate financing of AEI. As Plant Engineer in electric steam generating plants, Mr. Avers had complete test, control, operations, maintenance, start-up engineer, construction monitoring, and consulting engineer liaison responsibility at AEI. His educational background is in Mechanical Engineering, as well as a Special Business Administration Program for Engineers from Stanford University. His professional affiliations include: Registered Professional Engineer, State of California; Americar Society of Mechanical Engineers; and American Society of Heating, Refrigeration and Air Conditioning Engineers.

CHARLES A. BALLARD

Since November 1971, Mr. Ballard has been Vice President of Dillon, Read and Company, Inc., New York, N. Y. From 1969 until undertaking his current position, he was Executive Vice President for the INNOVEST Group, Inc., Philadelphia, Pa. In addition, Mr. Ballard has held the following positions: Vice President - Finance, Systems Capital Corporation, Philadelphia, Pa.; Assistant to the President and Member, Aquisition Committee of New England Industries, Inc., New York, N. Y.; and Assistant Vice President - Finance for the Overmyer Co., Inc., New York, N. Y. His educational background is in Banking and Finance and his professional affiliations include membership in: the Union League of Philadelphia; The Pennsylvania Society; Pennsylvania Academy of Fine Arts; and The Wall Street Club.

HARRY P. BUTLER

Mr. Butler is presently Technical Assistance Coordinator, Resource Recovery Division of the Environmental Protection Agency's Office of Solid Waste Management Programs (OSWMP). As Technical Assistance Coordinator he plans and executes a program of resource recovery technical assistance delivery to cities and states. Prior to his involvement with EPA, Mr. Butler served nine years in the Navy as a nuclear submarine navigator after graduating from the U.S. Naval Academy with a B.S. in Engineering. Following service in the Navy, Mr. Butler attended Harvard University's business school where he received a Masters Degree in Business Administration. He subsequently gained business experience in consulting and marketing.

J. R. CASTNER

Mr. Castner has been City Manager of Ames, Iowa since 1964 and has spent over twenty-one years in municipal administration. During his terms, Ames has experienced a period of transition to emphasize social needs as well as the normal demands of municipal government. Municipally subsidized housing, a public transportation system and a city-owned ambulance service have been initiated. Durg abuse and alcoholism, programs for Ames' elder citizens and summer employment for youth are also receiving attention. This is in addition to an aggressive capital improvements program which has been undertaken. Mr. Castner has also held similar positions in Herndon, Virginia, Carney, Ohio, Milton-Freewater, Oregon, and Downers Grove, Illinois. Mr. Castner served two years as Vice President of the International City Management Association (ICMA). He was Chairman of the 1971 ICMA conference program committee and is presently a member of that committee. In addition, Mr. Castner is past President of the Iowa City Manager's Association and of the Oregon City Managers Association. He is presently on the Board of Directors of the League of Iowa Municipalities.

TOM COOPER

Mr. Cooper is an Associate Counsel for the Office of Federal Relations of the National League of Cities and the U. S. Conference of Mayors (NLC and USCM). Presently, he has responsibility for matters relating to energy and the environment. Prior to joining NLC and USCM, Mr. Cooper was a Consultant to the Colorado General Assembly and Staff Assistant to a United States Senator.

FARRIS A. DEEP

Mr. Deep is President, Nashville Thermal Transfer Corporation, Nashville, Tennessee and Executive Director of the Metropolitan Nashville and Davidson County Planning Commission. He joined the Planning Commission in December 1956 and was Director of Planning Service Division before assuming his present position. Prior to his involvement with the Planning Commission, Mr. Deep was associated with the L. and N. Railroad Engineering Department from 1947 until 1956. His educational background is in Civil Engineering and among his professional affiliates are: Member, American Society of Planning Officials; Member, The American Institute of Planners; and Honorary Associate, Middle Tennessee Chapter, American Institute of Architects.

T. A. DONNEGAN

Mr. Donnegan is a Marketing Specialist with the Union Carbide Corporation, New York, N. Y.
(Biographical information was not available at the time of printing.)

DONALD H. GRAHAM

Mr. Graham joined Black, Crow and Eidsness, Inc. in 1973 as Supervisor of Solid Waste Systems to invest his processing experience in the firm's solid waste activities. Twelve years prior to his current assignment, he worked for Hercules Incorporated as a research engineer at the Allegany Ballistics Laboratory doing propellants process development and advanced wastewater magnetic separation treatment process development. Later, Mr. Graham became a group supervisor for solid waste research and development activities in support of the Delaware Reclamation Project. His duties included technology surveys, pyrolysis development, size reduction and separation development, and preliminary solid waste market studies. In addition, he became group supervisor for Trident C4 Process Development at Hercules/Bacchus. A member of numerous professional organizations and a registered engineer in several states, Mr. Graham holds several U.S. patents regarding classified solid propellant processes and numerous foreign and U.S. patents concerning solid waste reclamation processes.

NICHOLAS HUMBER

After serving as a Consultant to the U.S. Environmental Protection Agency (EPA), Mr. Humber joined EPA in 1971. He is presently Director, Resource Recovery Division of EPA's Office of Solid Waste Management Programs (OSWMP). Before moving to his current post, Mr. Humber's previous experience and professional associations have included: Management Consultant (1969-1971), Management Analysis Center, Inc.; Manager of Marketing Research (1967-1969), Boeing Corporation; Assistant

to Manager of Fabrication and Engineer in Long-Distance Xerography Laboratory (1963-65), Xerox Corporation. Mr. Humber received a degree in Mechanical Engineering from Rensselaer Polytechnic Institute and an MBA with a major in marketing and finance from the University of Pennsylvania, Wharton Graduate School of Business.

DAVID L. KLUMB

Mr. Klumb is the Manager of the Solid Waste Utilization System for the Union Electric Company, St. Louis, Missouri, where he has been employed since 1953. In 1969, he was assigned as Project Engineer, responsible for the St. Louis - Union Electric - U.S. Environmental Protection Agency Solid Waste Prototype Program. Mr. Klumb was given responsibility for designing and building the $70 million, 8,000 tons per day Solid Waste Utilization System. Prior to his current position, he was employed by Union Electric in their Engineering and Construction Department where he was involved in engineering design and economic evaluation of electric generating facilities. Mr. Klumb's educational background is in Mechanical Engineering and he is a registered professional engineer in the State of Missouri. Among his numerous professional affiliations, Mr. Klumb is a member of the American Society of Mechanical Engineers and Past Chairman of the St. Louis Section, as well as a member of the St. Louis Engineer's Club.

DEAN H. KOHLHEPP

Mr. Kohlhepp is presently the Chief Engineer for Black Clawson Fiberclaim Inc., Middletown, Ohio. He has spent the last eighteen years with Black Clawson working in the design and application of machinery to process and separate waste materials. Mr. Kohlhepp supervised the design, construction and early operation of the Franklin, Ohio Solid Waste Recycling Plant. He is a Registered Professional Engineer and holds a degree in Mechanical Engineering from Pennsylvania State University.

FRANCIS W. KUCHTA

Mr. Kuchta is the Director of Public Works, Baltimore, Maryland and has served the city since 1947. He joined the Public Works Department in 1969 as Deputy Commissioner and was appointed its Director in January of this year. Prior to his present position, Mr. Kuchta served the city in the capacity of Director of Development with the Baltimore Urban Renewal and Housing Agency and Assistant Director of the Redevelopment Commission. In his urban renewal work, he was responsible for the administration of all the development phases of the program, including acquisition of all real estate, clearance of structures, sale of cleared lands, and construction contracts in urban renewal and housing projects. A native Baltimorean, Mr. Kuchta received his Civil Engineering degree from Johns Hopkins Univer-

sity. He is extremely active in professional organizations, including: Registered Professional Engineer in the State of Maryland; Member, Maryland Society of Professional Engineers (MSPE); Vice President, Baltimore Chapter, MSPE; Fellow, American Society of Engineers, serving as the Society's representative on the Maryland Interprofessional Committee for Environmental Policy; and member, American Public Works Association.

THOMAS J. LAMB

Mr. Lamb joined Arthur D. Little, Inc., Cambridge, Massachusetts, in 1956 and is presently a Senior Consultant. He has gained experience in a number of engineering activity areas, including pilot plant design and operation, process and equipment design and evaluation, project engineering, and technical and economic feasibility analysis. In recent years Mr. Lamb has spent much of his time in several aspects of environmental management. His involvement in the solid waste field has included: participation in the design of a novel, patented municipal incinerator; direction of a project to improve the combustion efficiency of existing municipal incinerators; participation in the design of a process for recovery of a stable solid fuel and other recycled materials from municipal waste; evaluation of existing and developing processes, such as incineration, composting and pyrolysis for the treatment of municipal waste; development of solid waste disposal plans for several municipal and state agencies; and participation in the development of a program to burn prepared municipal waste in industrial and utility boilers. Mr. Lamb's educational background is in chemical engineering, and he is a member of the American Institute of Chemical Engineers as well as a Registered Professional Engineer in the State of Massachusetts.

STEVEN J. LEVY

Since 1966, Mr. Levy has been employed by the Environmental Protection Agency's Office of Solid Waste Management Program (OSWMP), and he is currently a Senior Staff Engineer for the Resource Recovery Branch. Most recently, he has been involved in the development and implementation of a Resource Recovery Demonstration Grant Program. In addition, Mr. Levy has responsibility in the area of energy recovery and pyrolysis of municipal solid waste. Mr. Levy received a degree in Civil Engineering from Georgia Institute of Technology and a Master of Science in Environmental Engineering from Drexel University.

STEPHEN G. LEWIS

Mr. Lewis joined the MITRE Corporation in 1963 and is currently Associate Department Head of the Management Systems Department. His Department is responsible for providing professional planning and development services in a variety of social and urban problem areas. In the past two years, Mr. Lewis has specialized in solid waste management programs and resource recovery systems. He directed a project in support of the U.S. Environmental Protection Agency's Resource Recovery Program in which MITRE evaluated systems proposed by cities and states to select those for full scale demonstration. He also headed a project assisting nine cities and a major firm constructing a steam recovery incinerator. Presently, Mr. Lewis is directing resource recovery implementation programs for the Commonwealth of Massachusetts and is a consultant to a number of states and cities through EPA's program of major technical assistance. In addition, Mr. Lewis is an active participant in local government, having served on the Finance Board of Acton, Massachusetts. Two years ago, he was elected to the Acton Board of Selectmen, of which he is Vice Chairman.

ROBERT A. LOWE

Mr. Lowe is Chief of the Resource Recovery Division's Energy Recovery Branch in EPA's Office of Solid Waste Management Programs. In this capacity, he oversees EPA's energy recovery demonstration program (including the St. Louis/Union Electric Company Project) and the resource recovery technical assistance program. Mr. Lowe has written Energy Recovery from Waste, a booklet describing the use of solid waste as a supplementary fuel in power plant boilers. Prior to joining EPA in 1972, Mr. Lowe spent three years as a member of the accounting firm of Peat, Marwick, Mitchell and Co. He received his B.A. Degree from the Johns Hopkins University and his MBA from the Wharton School of the University of Pennsylvania in 1970. Mr. Lowe is a Certified Public Accountant.

DORSEY H. LYNCH

Mr. Lynch became associated with The First Boston Corporation, New York, N. Y. in July, 1971 and, since that time, has specialized in tax-exempt pollution control and solid waste financing. He is presently an Assistant Vice-President Public Finance Department and Coordinator of First Boston's program for helping industry and government finance solid waste disposal and resource recovery facilities. Mr. Lynch has also contributed to the development of leveraged tax-shelter leasing for pollution control and solid waste facilities in connection with financings for the Anaconda Company and Jones & Laughlin Steel Corporation, the first leveraged tax-shelter lease financings ever done in connection with the tax-exempt bonds. He has worked in the pollution control financing programs for many of this nation's largest corporations. In solid waste, Mr. Lynch is presently working on the financing program of the Connecticut Resources Recovery Authority, Hackensack Meadowlands Development Commission, Southern Essex Solid Waste Council, among others. Prior to joining The First Boston Corporation, Mr. Lynch worked for Peat, Mariwick, Mitchell and Company and The First National Bank in New York City.

J. KEITH MCCARTNEY

Mr. McCartney is presently employed by the Garrett Research and Development Company, Inc., La Verne, California. He has extensive knowledge of combustion equipment, pollution control equipment and total energy systems. In addition, Mr. McCartney possesses internal and international corporate liaison capability with other areas of concentration including advertising, literature preparation and technical assessment. Prior to assuming his current position, he was Technical Manager for Flaregas Corporation, Nanuet, New York, where he was responsible for all technical aspects of the design and construction of the company's line of waste gas flares. From 1969 to 1973 Mr. McCartney was Supervisor for Commercial and Industrial Sales, The Southern Connecticut Gas Company, Bridgeport, Connecticut. He was with Peabody Engineering and its subsidiaries in England, Canada and the United States for seven years. Mr. McCartney was involved in the early stages of the Connecticut Solid Waste Disposal Plant and the formation of the Bridgeport Region. Raised and educated in England, Mr. McCartney has spent his professional career exclusively in the energy and pollution control field.

JOSEPH MULLEN

Mr. Mullen is Manager, Marketing Programs, Combustion Engineering, Inc., Windsor, Connecticut.
(Biographical information was not available at the time of printing.)

NICHOLAS A. PANUZIO

Elected Mayor in 1971, Mr. Panuzio became the first Republican to govern Bridgeport, Connecticut in forty-four years. He was re-elected in 1973. Mayor Panuzio presently serves on the Board of Directors for the Connecticut Resource Recovery Authority and CRRA's first major state resource recovery project will be located in Bridgeport with cooperation from several surrounding communities. Mayor Panuzio is a member of numerous regional, state and national organizations, including the Governor's Clean Air Task Force, the Governor;s Drug Advisory Council and the President's Commission on Continuing Education. He was appointed by the Governor as an Executive Board member of the Connecticut Planning Commission on Criminal Administration and is a member of the advisory board of the state's Department of Community Affairs. In 1970, Mayor Panuzio was elected as a State Representative from Bridgeport to the General Assembly. Shortly after taking office, he was named to the prestigious position of Assistant House Republican Leader, a rare tribute to a freshman legislator. A life-long resident of Bridgeport, Mayor Panuzio was a member of the administrative staff of the University of Bridgeport for thirteen years, rising from Assistant Director of Admissions to Development Administrator for the university. Mayor Panuzio was also included in a recent special issue of Time Magazine highlighting 200 of the nation's most promising young leaders.

JOHN H. POELKER

In April, 1973 Mr. Poelker was elected Mayor of the City of St. Louis, Missouri. He brought to the Office of Mayor a public service record which has spanned thirty-two years. Mayor Poelker served as a Special Agent for the FBI from 1942 to 1953, specializing in accounting case investigations. In 1953 he was named Assessor for the city and served in that capacity for four years. As Assessor, he was responsible for the levying of assessments on real and personal property in St. Louis. Mayor Poelker became City Comptroller in 1957, the chief fiscal office in city government. As Comptroller he served on the Board of Estimate and Appointment whose members approve all appropriations of public funds. During his sixteen years on the Board, Mayor Poelker was involved in civic as well as governmental affairs. Among his numerous professional and civic affiliations are included: Member, National League of Cities' Taxation and Finance Committee; President (1971-72), Municipal Finance Officers Association of the United States and Canada; President (1963-64), Health and Welfare Council of Metropolitan St. Louis; President (1969), Hospital Planning Commission; President (1970), Alliance for Regional Community Health (ARCH); Member, Governor's Advisory Council on Local Government; Member, Missouri-Illinois Governors' Task Force on Regional Planning Reorganization; and Solicitations Chairman, City Division of the United Fund. Mayor Poelker is also very active in the Catholic Church and the Boy Scouts of America.

ROBERT E. RANDOL

Mr. Randol is a Financial Analyst, Resource Recovery Division, with the Environmental Protection Agency's Office of Solid Waste Management Programs (OSWMP). He has responsibility for focusing upon market and economic analysis to encourage implementation of resource recovery systems. This analysis has included: 1) the development of strategies including guidelines, incentives, or regulations and an evaluation of their economic impact; 2) the identification of regional markets for recovery systems; and 3) the examination of fiscal programs and model contracts to share financial risks between the public and the private sector. Prior to joining EPA, Mr. Randol served as a consultant for the First National City Bank, Milan, Italy and for the San Francisco Chamber of Commerce. He received a degree in Sociology and Eco omics from Harvard University and a MBA from the Stanford Graduate School of Business in Finance and Marketing.

KENNETH J. ROGERS

Mr. Rogers is the Director of Market Development, Resource Recovery Division at Combustion Equipment Associates, Inc. in New York, N. Y.
(Biographical information was not available at the time of printing.)

LARRY J. SHANNON

Presently, Dr.Shannon is the Head, Environmental Systems Section, Midwest Research Institute (MRI), Kansas City,Missouri. Dr. Shannon has extensive experience in various areas of environmental sciences with particular expertise in air pollution control technology and solid waste management. He has managerial responsibility for programs dealing with the systematic study of processes, plants, and industries and their interaction with the environment. He had directed and participated in programs involving assessment of particulate pollution from stationary sources, definition of the chemical and physical properties of particulate pollutants, analysis of the state of the art of technology for control of small (submicron sized) particles emitted from stationary sources, assessment of feasibility of emission standards based on particle size, assessment of resource recovery technology suitable for use with minicipal refuse, and formulation of a statewide solid waste management program. Dr. Shannon is also a member of MRI's Energy Task Force which is involved in programs relating to energy use and conservation. Before joining the MRI staff in 1969, Dr. Shannon spent six years as a Senior Chemical Engineer with United Technology Center, a Division of United Aircraft. He received a PhD. in Chemical Engineering from the University of California at Berkeley and among his professional affiliations are membership in the Air Pollution Control Association and the American Institue of Aeronautics and Astronautics.

ALAN SHILEPSKY

Mr. Shilepsky is a policy analyst in the Resource Recovery Division of the Office of Solid Waste Management Programs, where he studies institutional barriers to resource recovery. Before coming to EPA, he was on the staff of the National Commission of Materials Policy, and concentrated on the Recovery Chapter of the Commission's final report. Mr. Shilepsky's academic background is interdisciplinary,with a M.S. in Physics from the University of Wisconsin and a soon-to-be-completed M.A. in Public Affairs from the University of Minnesota.

EDSEL D. STEWART

Mr. Stewart is currently the Manager of Monsanto Landgard Systems, St. Louis, Missouri. He has been with Monsanto Company for almost fifteen years and with the Landgard development virtually since its conception in the late 1960's. As Manager of Landgard Systems, Mr. Stewart has worldwide responsibility for marketing, engineering, and licensing.

G. WAYNE SUTTERFIELD

For the past seventeen years, Mr. Sutterfield has been with the city of St.Louis, Missouri, and he has operated as Refuse Commissioner since 1967. In this capacity, he is in charge of the collection and disposal of all residential refuse for the city. In addition, Mr. Sutterfield holds responsibility for city operations concerning the St.Louis/ Union Electric Company Energy Recovery Project. Prior to his work as Refuse Commissioner, he served the city as Deputy Traffic Commissioner for ten years. Mr. Sutterfield's educational background is in Mechanical Engineering, and he is a Registered Professional Engineer and a member of numerous Engineering and Professional Organizations.

MORRIS G. TUCKER

Mr. Tucker is currently Engineer and Chief of the solid waste Management Branch, Environmental Protection Agency (EPA) Region VII, Office Kansas City, Missouri. Before undertaking his present duties, he was Chief, Technical Assistance and Investigations Branch, Division of Technical Operations,Office of Solid Waste Management Programs, EPA, Cincinnati,Ohio. Mr. Tucker was also active with the Department of Health, Education and Welfare's U.S. Public Health Service. Working out of the Dallas,Texas Regional Office, he was an Engineer for Federal facility activities, Water Supply and Pollution Control, and the Arkansas-Red River Basins Water Quality Study. Mr. Tucker's educational background is in Geological Engineering and Sanitary Engineering,and he is a member of the American Public Works Association.

WILLIAM WILSON

Mr. Wilson is Director of Streets, St. Louis, Missouri. (Biographical information was not available at the time of printing).

SOLID WASTE PROJECT STAFF:

FRANCHOT BUHLER

Mr. Buhler is Senior Staff Associate in the Office of Urban Services of the National League of Cities and the U.S. Conference of Mayors. Since 1973, Mr. Buhler has directed the solid waste project, serving as staff director for a national municipal task force on solid waste management. In this capacity, he has been responsible for regional conferences and workshops sponsored by NLC and USCM in conjunction with the U.S. Environmental Protection Agency; and he has written the report of the NLC and USCM Solid Waste Task Force, entitled "Cities and the Nation's Disposal Crisis."

Mr. Buhler's background combines experience in both urban affaris and rural development. He has managed a variety of projects for local government, private firms and public interest groups. His articles have appeared in national magazines, professional journals and newspapers.

ROBERT M. SCHULE

Mr. Schule is a Senior Staff Assistant in the Office of Urban Services of the National League of Cities and the U.S. Conference of Mayors, assigned to the solid waste project. Previosuly, he was a Project Assistant on NLC and USCM's Manpower Staff with primary responsibility in the area of youth programs. In the course of his duties, Mr. Schule made on-site visits to 75 cities across the country and co-authored a number of publications.

BERNADETTE B. PAYNE

Ms. Payne is Senior Office Assistant in the Office of Urban Services of the National League of Cities and the U.S. Conference of Mayors, assigned to the solid waste project. She has been with the organization since 1972. Her previous professional experience included four years as legal secretary for a Washington, D. C. law firm and two years as a clerk-typist in the Patent Office of the U.S. Department of Commerce. Ms. Payne attended Central State University in Wilberforce, Ohio.