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USER ACCEPTANCE OF WASTEWATER SLUDGE COMPOST

Municipal Environmental Research Laboratory
Office of Research and Development
U.S. Environmental Protection Agency
Cincinnati, Ohio 45268

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USER ACCEPTANCE OF WASTEWATER SLUDGE COMPOST

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FOREWORD

The Environmental Protection Agency was created because of increasing public and government concern about the dangers of pollution to the health and welfare of the American people. Noxious air, foul water, and spoiled land are tragic testimony to the deterioration of our natural environment. The complexity of that environment and the interplay between its components require a concentrated and integrated attack on the problem.

Research and development is that necessary first step in problem solution and it involves defining the problem, measuring its impact, and searching for solutions. The Municipal Environmental Research Laboratory develops new and improved technology and systems for the prevention, treatment, and management of wastewater and solid and hazardous waste pollutant discharges from municipal and community sources, for the preservation and treatment of public drinking water supplies, and to minimize the adverse economic, social, health, and aesthetic effects of pollution. This publication is one of the products of that research; a most vital communications link between the researcher and the user community.

Wastewater sludge can be converted by composting into a soil conditioner and is one method of recycling resources. The recycling will be effective if the compost is accepted by potential users.

The user acceptance of wastewater sludge based compost or compost-like products was investigated in this study by conducting interviews with actual and potential users in various metropolitan areas. In addition, a literature review was conducted to obtain information on past compost operations. The results of this work are presented in this report.

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ABSTRACT

This study was initiated with the overall objective of determining user acceptance of wastewater sludge based compost. The work included visits to several composting and compost distribution operations, an extensive literature review, and interviews with users in several metropolitan areas.

Existing and past compost and sludge product distribution operations were analyzed to determine the characteristics of the successful operations and the factors that may have led to the lack of success or failure of others.

Interviews were conducted with a broad sampling of users to determine the factors which are pertinent to user acceptance of wastewater sludge compost, specific product characteristics required by certain users or classes of users, and other factors related to user acceptance.

Results of the study indicate that demand already exists for wastewater sludge compost in certain metropolitan areas and that this demand was developed by implementing a planned program. Similar wastewater sludge product distribution operations have failed in the past because of high pricing or poorly planned programs. Factors are developed in this study which should help to assure development of successful distribution operations. A broad characterization of the user requirements and desires was developed based on the user interviews.

This report was submitted in partial fulfillment of Contract No. 68-03-2186 by Culp/Wesner/Culp - Clean Water Consultants under the sponsorship of the U.S. Environmental Protection Agency. This report covers the period September 1, 1975 to May 1, 1976 and work was completed as of March 1, 1977.

CONTENTS

Foreword iii
Abstract iv
Figures vi
Tables vii

1. Introduction 1
   Study objectives. 1
   Definitions 2
2. Conclusions and Recommendations 3
3. Study Method 5
4. Literature and Telephone Review 7
   Method. 7
   Results 7
   Summary 7
5. Area Interviews. 14
   Designated metropolitan areas 14
   Selected metropolitan areas 14
   Interview method. 14
   Results 15
   Summary 15
6. Transport 23

Bibliography 25
List of Metric Conversions 26
Appendices

A. User interviews, Placerville, California 27
B. User interviews, Colorado Springs, Colorado. 31
C. User interviews, Ft. Worth, Texas 34
D. User interviews, Washington, D. C. 38
E. User interviews, Los Angeles, California 42
F. User interviews, Chicago, Illinois 45

FIGURES

Number		Page
1	Historical sludge product sales prices, 1960-1975	12
2	Truck transport of wastewater sludge compost	24

TABLES

Number		Page
1	Literature Review	8-10
2	Telephone Review	11
3	Interviews Conducted by Area	16-17
4	Existing Sewage Sludge Composting Operations	18
5	Compost Transport Cost - Metropolitan Sanitary District of Greater Chicago	20
6	Potential Compost Demand by Area	22

SECTION 1

INTRODUCTION

STUDY OBJECTIVES

Numerous past attempts have been made to market solid waste compost. Most of these attempts were made on a commerical basis and most were not successful if evaluated on that basis. Some of the solid waste compost operations included wastewater sludge, but solid waste was the major portion of the compost product.

It is not possible to extrapolate the results documented from solid waste experience and apply them to wastewater sludge because of differences in composition of the raw material, volume, and the differing economic considerations for each. Generally, for a given population area, the volume of solid waste compost will be several times the volume of wastewater sludge compost. This volume difference alone has a major effect on marketing or distribution technique and strategy.

The purpose of this study was to determine the acceptability of composted sewage sludge to the general public. The determinations in this study were based on information obtained from a literature review and from personal interviews made in various cities representing varied population densities. The following points were considered in conducting the interviews and developing the conclusions:

- Would the user accept a compost product?
- Comments on the like and dislike of product.
- Would the user accept the product at no cost?
- Would the user pay for the product? How much?
- Would the user pick up the product at the source and how far would the user travel for the product?
- For each area, estimate the proportion of the total wastewater compost production that will be picked up at the plant site by the user.
- For each area estimate the amount of wastewater compost that can be distributed by the community based on the acceptability

of the product.

- Estimate the acceptability and distribution potential of wastewater sludge compost in the Washington, D.C., Chicago, and Los Angeles metropolitan areas.

- Estimate the cost for transport of sludge compost to the user.

DEFINITIONS

For purposes of this study the following definitions apply.

Composting

Composting is a biological process for converting organic constituents of wastes into a stable humus-like product. As presently applied to sewage sludge, the processes used are aerobic and are carried out at thermophilic temperatures (113°F[1] to 149°F or higher). Aerobic conditions are maintained because higher temperatures are achieved and odors are minimized as compared to anaerobic composting. Composting can be carried out in the open or in mechanical enclosed systems (digesters). The major sewage sludge composting applications are open type and the process is controlled either by windrow turning or forced aeration.

Compost

Compost is the humus-like product produced by the composting process and, in some cases, additional processing such as air curing and screening. Typical wastewater sludge compost may have an average nitrogen content of approximately 1.0 percent, but this can vary depending on the sludge and the processing. Unless otherwise noted in this study the term compost refers to wastewater sludge based compost.

Distribution

Distribution indicates the movement of product from the producer to the user or to an end disposal such as landfill. This distribution may or may not result in income to the producer and the producer may even have to pay to have the product distributed.

Marketing

The selling of a product or service.

(1) English units are used uniformly in this report because many of the English measures are common in the sanitary field. Conversion factors are contained in the List of Metric Conversions.

SECTION 2

CONCLUSIONS AND RECOMMENDATIONS

There are only three agencies that have long term experience in distributing wastewater sludge compost or compost-like material on a large scale; County Sanitation Districts of Los Angeles (Carson, California), Metropolitan Sanitary District of Greater Chicago (Nu-Earth), and the joint Maryland Environmental Service - USDA project at Beltsville, Maryland.

Based on the contacts made during this study it is concluded that no significant surveys have been published in the past on the acceptability of wastewater sludge compost to users.

This work indicates that there is a demand for composted wastewater sludge. Most successful compost distribution operations are relatively new. It is unclear whether this success is temporary resulting from rapid inflationary commercial fertilizer price increases, is more permanent due to a growing awareness of the value of organic materials to soils, or is perhaps a combination of both.

Where past wastewater sludge product distribution has failed it appears the product was offered at too high a price in comparison with other commercial products or the distribution was poorly handled with little advertising or educational publicity.

It is estimated that the upper price limit for bulk wastewater sludge compost would be $4-$10 per ton and for packaged sewage sludge compost about $60 per ton at the point of sale based on west coast price levels. In general, these price levels will not completely offset the cost of producing the compost.

The successful operations generally apply the following principles and one or more are lacking in the unsuccessful operations.

- Favorable local publicity is developed.
- The product is available for pick-up (or is delivered)
- Guidelines or suggestions are provided for use.
- The product is offered at no cost or extremely inexpensively (except for refined products such as marketed by Kellogg

Supply Company and Milwaukee Milorganite).

The product is given a trade name.

Testing of the sewage sludge compost would likely be required by potential users. As noted in Appendices A through F, many interviewees were interested in the compost, but would reserve any final commitment until the product was tested for their use. These potential users felt that a ton or two of product would be required to perform a meaningful test. For some uses several tests would be required spanning a year or a growing season. Many of the operations interviewed are commercial and must be exact about the products they use. A golf course is a good example because high quality fairways and greens are an important part of their marketing program.

It is recommended that provisions for demonstration testing should be included in any large scale distribution plan. A demonstration program should include research for the intended use prior to test; the actual field test including planning, test, and data compilation; data analysis; and market analysis and promotion based on the results. Well planned demonstrations should:

- Demonstrate the useability to the particular user or class of user.
- Aid in creating or developing a potential market.
- Provide valuable information to the program as to what additives or treatment are necessary to make the product marketable to those unable to use it in its present form.

SECTION 3

STUDY METHOD

This study was carried out in three phases. First, a literature review was made to identify all known air dried and composted wastewater sludge operations in the United States. The literature review covered the period of 1960 to the present.

Second, telephone calls were made to those operations, identified from the literature review, which might provide applicable input to this study of the distribution and user acceptance of wastewater sludge compost. Information relating to use guidelines and transport costs were also obtained from the literature and telephone review.

Third, interviews with actual and potential users were conducted in six metropolitan areas. The following three areas were designated for the interview program because wastewater sludge compost or compost-like products are presently being produced and distributed:

Los Angeles
Chicago, Illinois
Washington, D.C.

Three additional areas were selected for the interview program in order to cover a broad population and geographical range:

Placerville, California (5,000 - 50,000)
Colorado Springs, Colorado (50,000 - 400,000)
Ft. Worth, Texas (400, 000 - 1,000,000)

The interviews were conducted in each of the six metropolitan areas for the following purposes:

1. Visit any active wastewater sludge compost distribution operations.

2. Obtain information on any user acceptance surveys which might have been conducted in the area.

3. Determine user acceptance and distribution considerations at each existing operation.

4. Randomly select and interview 5 to 10 actual and/or potential

users in each area from the following general classifications:

a. State and local highway departments.

b. Municipal parks and golf courses.

c. Private golf courses.

d. Stadiums.

e. Wholesale nurseries.

f. Retail nurseries.

g. State and Federal forestry departments.

h. Major garden clubs or organizations.

i. Lawn and garden service organizations.

5. Obtain copies of sludge compost user guidelines distributed in the area and methods used to disseminate the information to users.

6. Obtain cost information for transport of wastewater sludge compost or dewatered sludge in the area.

Each interview was conducted without notes, however, the purpose of the interview was explained initially. Each interviewee was asked general questions to determine the present knowledge of sludge compost and prior experience with it. A sample of wastewater sludge compost from Beltsville, Maryland[2] was taken to each interview. The interview was conducted and at the conclusion the interviewee was asked if product testing would be desirable or necessary.

(2) Epstein, E., Willson, G. B., Burge, W. E., Mullen, D. C., and Enkiri, N. K., "A Forced Aeration System for Composting Sewage Sludge". Journ. WPCF. 48:4:689. April, 1976.

SECTION 4

LITERATURE AND TELEPHONE REVIEW

METHOD

The literature review covered the period from 1960 to the present. During this review, references were compiled relating to distribution of wastewater sludge compost, air dried wastewater sludge products, and heat dried wastewater sludge products. In addition, letter requests for information were sent to known wastewater sludge product distribution operations. The most promising references were contacted by telephone to develop current information.

RESULTS

The results of the literature and telephone review are shown in Tables 1 and 2 respectively. A graphical historical range of wastewater sludge product prices for the period 1960 to 1975 is shown in Figure 1. This price information is general and variable, but provides a relative comparison. The prices are as reported in the literature without adjustment.

SUMMARY

From the period covered by the literature review (1960 to 1975) only the following active wastewater sludge compost operations were identified:

1. Joint Maryland Environmental Service - USDA, Beltsville, Maryland.

2. Metropolitan Sanitary District of Greater Chicago, Illinois (Distribution Only).

3. County Sanitation Districts of Los Angeles, California.

4. Tillo, South San Francisco, California.

All of the above locations were still composting at the end of 1975. In addition, fixed pile composting (raw sludge) commenced in 1975 at Durham, New Hampshire and Bangor, Maine.

The Upper Occoquan Sewage Authority, Manassas Park, Virginia, is

TABLE 1. LITERATURE REVIEW

Location	Reference[a]	Output[b]	Treatment	Nutrients[c]	Distribution	Price	Remarks
Amarillo, Texas	2-2;25,26('61)	na[d]	air dried,pulverized unbagged	na	user hauls	$3/cu yd	Annual revenue = $3000.00 Word of mouth advertising Demand exceeds supply
Baltimore, Maryland	1-4; 8 ('61)	na	heat treated, granulated	N=3% P=2%	sold to jobber for delivery	$5.00-$7.50 per ton	
Battlecreek, Michigan	1-1:20 ('60)	200 tons[e]	na	N=2.8% P=2.6%	100 lb bags	$2.00/bag	Battlecreek Plant Food[f]
Beltsville, Maryland	14-5;30-32('73)	50tons/day[g]	mixed with wood chips, windrowed	N=0.9% H_3PO_4=2.7% K=0.2%	municipal use only, user hauls	no charge	demand exceeds supply
Birmingham, Alabama	1-1;20 (60)	48,000 cu yd	na	N=2.25% P=3.0%	1) ground 2) unground	1)$3.50/cu yd 2)$1.50/cu yd	still operating in 1970
Boise, Idaho	1-1;20 ('60)	200-350 tons[e]	na	N=3.59%	retail outlets	$3.15/80 lb	BI Organic[f] Farmers are largest users
Bristol, Connecticut	1-1;20 ('60)	600 cu yd	1)air dried 2)pulverized	N=2.69% P=2.52%	na	1)$1.60/cu yd 2)$.25/bushel	Sludge Soil Conditioner[f]
Centralia, Washington	2-1;45 ('61)	na	open air dried some ground & bagged	na	user haul	no charge	Municipality takes loss but improves public relations
Chicago, Illinois	1975 compost conference	25,500 tons	Imhoff treatment sand & gravel drying beds stockpiled	N=4% P=6% K=0.1%	24 cu yds or more delivered user load & haul	no charge	Nu-Earth[f]
Duluth, Minnesota	1-1;20 ('60)	44 tons[e]	na	N=1% P=1.5%	100 lb bags	$1.00/bag	Soil conditioner-sewage sludge fertilizer[f]
Enumclaw, Washington	2-1;44-46 ('61)	na	na	na	100 lb bags	$1.50/bag	Population = 3000 Income pays for chemicals
Fargo, North Dakota	1-1;20 ('60)	12,000 tons[e]	na	na	na	$.50/1000 lb	
Fond Du Lac, Wisconsin	1-1;20('60)	2,000 tons[e]	na	N=2% P=2%	1)80 lb bags 2)bulk	1)$2.00/bag 2)$18.75/ton	Fond Du Green[f]
Fort Wayne, Indiana	1-1;20 ('60)	3,000 tons[e]	na	N=2.5% P=2.5%	na	na	

a. Compost Science Magazine unless otherwise noted
b. Dry tons or cu yd per year unless otherwise noted
c. Expressed as percentage by weight
d. Not available
e. Wet or dry basis can not be determined from reference
f. Product name
g. Wet sludge (22% solids)

(continued)

TABLE 1. (continued)

Location	Reference [a]	Output[b]	Treatment	Nutrients[c]	Distribution	Price	Remarks
Houston, Texas	Public Works Dec. 1972		heat dried	N=5% H_3PO_4=4%	competitive bid, bagged for resale by contractor	$21.00/ton	Hou-Actinite[f]
Indianapolis, Indiana	1-1;20('60)	50 tons	na	N=5.0% P=2.7%	na	na	Indus[f]
Jasper, Indiana	1-1;20 ('60)	50 tons[e]	na	N=5.89 P=3.49	na	na	
Kirkland, Washington	2-1;44-46('61)	na	Filter Dried	na		$3-5/cu yd $6-22/cu yd	Population 5,500 Price depends on quality
Lewistown, Pennsylvania	1-3;46-47('60)	na	drying beds in glass buildings	na	user hauls	nominal fee	
Los Angeles, California	14-4;16-17('73)	36,000 tons	windrow composting	N=1.0 P=1.7 K=0.01	bought/bagged for resale by Kellogg Co.	Retail price $1.59/50 lb bag	Nitrohumus[f]
Milwaukee, Wisconsin	9-2;17 ('68)	80,000 tons	heat dried	N=2.66 P=2.18	Distributors Deal 50 lb bags	retail price $4.50/bag	Milorganite[f] Demand exceeds supply
Mobile, Alabama	9-2;17 ('68)	na	na		25-50 lb bags	no charge	MOBILEAID[f]
New Brunswick, N.J.	1-1;20 ('60)	21,000 tons[e]	na	N=1.77 P=2.18	na	na	downward trend reported in 1960.
Oklahoma City, Oklahoma	1:3;26('60)	na	na	na	sell at beds for $1/ton	na	still operating in 1970
Omaha, Nebraska	1:1;20 ('60)	500-600 tons[e]	na	N=2.5 P=1.5	1) bulk 2) bag	1)$15/ton 2)$1/100 lb	still operating in 1964 distribution through contractor
Oshkosh, Wisconsin	1:3;26-30('60)	600 tons[e]	na	N=2.09 P=2.65	sold locally from plant	$0.25/cu yd $2/cu yd ground	Oshkonite[f]

(continued)

TABLE 1. (continued)

Location	Reference[a]	Output[b]	Treatment	Nutrients[c]	Distribution	Price	Remarks
Pennsauken, N.J.	1-1;20('60)	200 tons	na	na	na	na	
Roanoke, Virginia	1-1;20('60)	1,688 tons[e]	ground & unground	N=2.5 P=1.5	1) 80 lb bags 2) bulk	1)$2/bag 2)$18.75/ton	
San Diego, California	1-3;47('70)	na	mixed with seaweed and leaves, air dried	na	Park Dept.	not for sale	All is used for Mission Ray Development
Santa Fe, New Mexico	1-1;20('60)	500 tons	bagged & ground	na	100 lb bags	$2.50/bag	
Schenectady, New York	1-3;28('60)	250 tons	flash dried	N=2 P=2 K=0.5	65 lb bags user hauls	$1/65 lb bag	ORGRO[f] still composting in 1970
Seattle, Washington	2-1;44('61)	na	air dried	na	city use only	no charge	
Sheboygan, Wisconsin	1-1;20('60)	1000 tons[e]	na	N=1.96 P=1.65	bar or bulk	$.50/80 lb $5.75/ton	
Springfield, Illinois	1-2;48('60)	na	air dried	na	user haul	no charge	main users-farmers, park board, golf courses
Vancouver, Washington	2-1;45('61)	na	glass covered drying beds	na	80 lb bags	$2.50/bag	
Wichita, Kansas	1:1;20('61)	5000 cu yd	na	N=2.1 P=0.2	1)user haul 2) delivered	1)$2/cu yd 2)$3-4/cu yd	Wichita Soil Conditioner
Winston-Salem, N.C.	86,48('71) Am. City	na	Digested, air dried then flash dried in rotary unit	na	bulk or in 50 lb bags	$30/ton bulk $1.05-1.95 bagged	Operating since 1958

TABLE 2. TELEPHONE REVIEW

Location	Contact	Output[a]	Treatment	Distribution	Price	Nutrient	Dates of Operation	Remarks
Amarillo, Texas	Mr. Scherer 806-383-2253	2,000	air dried on land and sand beds; heat dried by Relco	Kentucky & Tennessee	na[b]	N = 2-3% P = 2% K = 0	1960-now	air dired sludge sold to Relco Inc. for $1/ton
Birmingham, Alabama	Mr. Chandler 205-798-6489	na	1) flash dried 2) air dried	user hauls 1) bagged 2) bulk	1) $1/50 lb 2) $1.50/ cu yd	N = 1.7% P = 0 K = 0	1953-now	Grow-Go[c] private company failed so City takes loss
Corpus Christi, Texas	Mr. Matthews 512-884-3011	na	vacuum filtered rotary kiln	user hauls; bagged & sold at plant	$2/80 lb bag $10/cu yd	N = 2.5%	1936-55 air dried 1955-now vac filtered	high costs may cause shift to land application of wet sludge
Ft. Lauderdale, Florida	Mr. Bramble 305-971-6220	2,500	heat treat to 40% solid cake	dispose in landfill	free for asking	N = 0 P = 0 K = 0	not really compost	may go to compost when solids increase to 50 tons/day
Houston, Texas	Dr. Garrett 713-222-3587	25,000	heat drying of activated sludge	by contract with broker	$21/ton	na	1950-now	Hou-Actinite[c]
Milwaukee, Wisconsin	Jim Latham Mr. Wilson 414-271-2403	70,000	kiln dried activated sludge	distributor hauls	$65/ton	N = 6% P = 2% K = 0%	1926-now	
Mobile, Alabama	A. B. Dueitt 205-433-7482	45 - 30,000	air dried	user haul	free	na	1948-now	market 100%
Oklahoma City, Oklahoma	Willard Keith 409-239-6217	na	air dried	90% landfill 10% user haul	free	N = 0.5% P = 0 K = 0	1950-now	
Oshkosh, Wisconsin	Tom Konrad 414-424-0466	na	air dried what could be distri-buted; trucked the rest to landfill	user haul	$.25/bushel $3.00/cu yd	na	1960-1972	could not distribute the dried sludge
San Diego, California	Leo Groggins 714-225-9362	10,000	air dried stacked	park department uses to develop Mission Bay	not for sale	na	1960-now	private company tried to bag & sell but failed
Schenectady, New York	Mr. Brown 518-382-5021	130	furnace dried, digested primary	user haul	$1/65 lb bag	N = 2% P = 2% K = 0	1960-1973	ORGRO[c], not much demand, losing money so not drying now
So. San Francisco, California	Larry Houghton 408-984-2010	na	wet sludge mixed with rice hulls & coffee grounds	sold in bulk to distributor	$3/cu yd fob $.69-.99/bag	N = 2% P = 0.5% K = 0.25%	1950-now	Tillo[c] Company.
The Dalles, Oregon	Joe Hasbrook 503-296-5401	10 cu yd per day	air dried ground	user hauls	free	na	?-1965	now apply wet sludge on airport

a. dry tons per year
b. data not available
c. brand name of product

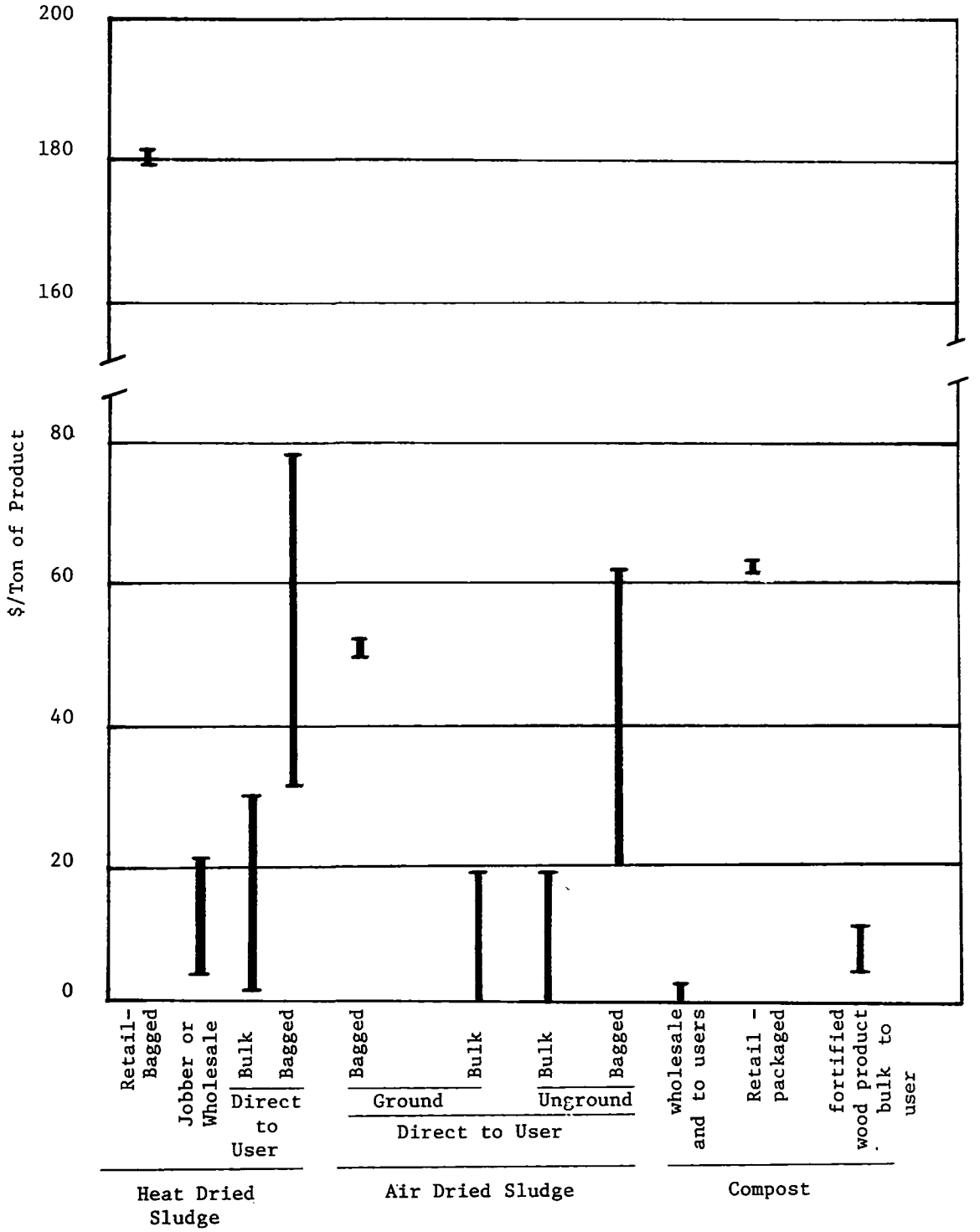
committed to composting beginning in January, 1978. Initial production is expected to be 4,000 tons of composted sludge a year. Kellogg Supply Company, Carson, California signed a contract with the City of Phoenix, Arizona, for sludge and land to commence composting operations in 1976, however, no composting was carried out in 1976.

Figure 1 shows the asking prices for various products, but in most cases the degree of success at the price could not be determined. During the period 1960-1975 many utilities were not able to find users for all of their sludge. All of the present wastewater sludge composting operations are able to distribute all of their product and all but Los Angeles give the product away free; Chicago even delivers at no charge. Figure 1 shows a range of prices asked for air dried sludge from zero to $20 per ton unbagged and $20 to $60 per ton bagged. The price range for air dried sludge seems high even considering the present increased interest in sewage sludge products. The heat dried sludges are quite a different product and are difficult to compare to air dried sludge and compost. For comparative purposes, the retail bulk price for fortified wood product compost in the west coast area is shown. This comparison further implies the pricing for air dried sludge to be out of line because the price of competitive, similar products will normally determine the ceiling price for sewage sludge products. This was confirmed later in the personal interviews as many users said they would not pay more for wastewater sludge compost than they pay for their present product.

Bagged products command much higher prices; however, it is estimated that bagging may cost $10 to $30 a ton additional depending on volume. Most of the higher market price for bagged material is due to the cost of bagging and additional transportation cost.

The price which Kellogg Supply Company receives on the retail market for "Nitrohumus" is shown as "Retail Packaged Compost" and represents a retail sales price for a heavily promoted, well packaged, competitive product in Southern California. The price level for "Nitrohumus" is quite high when compared with all other forms of wastewater sludge products except Milwaukee Milorganite which is a heat dried product. Kellogg Supply Company products are priced near the upper limit of the retail market for packaged compost products and sell at these price levels because of high product quality, good packaging, and heavy point-of-sale promotion.

From this literature review it is estimated that the current upper price limit for bulk wastewater sludge compost is approximately $4-$10 per ton and for packaged sludge compost about $60 per ton at the point of sale based on west coast price levels.



- Price levels are as reported in the literature or from a 1975 market review and are not adjusted.
- Generally the prices do not include delivery.

FIGURE 1. HISTORICAL SLUDGE PRODUCT SALES PRICES, 1960-1975.

SECTION 5

AREA INTERVIEWS

DESIGNATED METROPOLITAN AREAS

Three areas where wastewater sludge compost is presently being distributed were designated for user interviews:

Washington, D.C.; USDA and Maryland Environmental Service at Beltsville, Maryland.

Chicago, Illinois; Metropolitan Sanitary District of Greater Chicago (Nu-Earth).

Los Angeles, California; L. A. County Joint Water Pollution Control Plant at Carson, California, and Kellogg Supply Company at Carson, California.

It was anticipated that wastewater sludge compost market surveys might have been made in these areas previously because of the present distribution.

SELECTED METROPOLITAN AREAS

Three areas were selected for user interviews to cover a broad population and geographical range:

Placerville, California (5,000 - 50,000).
Colorado Springs, Colorado (50,000 - 400,000).
Ft. Worth, Texas (400,000 - 1,000,000).

INTERVIEW METHOD

These interviews were conducted according to the method outlined in Section 3. The interview with each selected respondent was conducted as an informal conversation without notes rather than using a form. Most of the questions were subjective and it was felt that an informal conversation might convey a better understanding of the respondent's feelings.

Each composting or compost distribution operation in the three designated metropolitan areas was visited.

RESULTS

A detailed transcript of each interview by area is contained in Appendices A through F. A listing of the organizations interviewed in each area is shown in Table 3.

The trip reports for the compost site visits are contained in Appendices D, E, and F. The characteristics of these operations are summarized in Table 4.

An effort was made to obtain results of any marketing surveys relating to user acceptance of sludge compost from any available source. As far as could be determined, no such user surveys have been published in the United States.

SUMMARY

Most people interviewed apparently had some knowledge of wastewater sludge compost and were able to discuss the subject.

Comments and user reactions can be generalized as follows:

1. A majority of persons interviewed indicated a willingness to use wastewater sludge compost provided:

   a. It cost no more than the present product.

   b. The user could test it prior to making a commitment.

   Most potential users indicated an interest and, in many cases, a real desire to test the compost. Most people wanted a large sample for the test (a ton or more). Any meaningful testing would have to be on this scale or greater, especially for private commercial operations.

   Some potential users would consider compost as an alternative to fertilizer, but this would depend on the particular application. A test program may be necessary in some of these cases to determine the results that can be expected.

2. In those areas where wastewater sludge compost is now being distributed the users apparently accept the product:

   a. There are few complaints.

   b. Repeat customers are common.

   c. Demand remains high.

TABLE 3. INTERVIEWS CONDUCTED BY AREA

Area	Appendix	Organizations
Placerville, CA	A	Nielsen-Ferrari Lumber Company El Dorado Public Works Dept. El Dorado County Recreation Dept. El Dorado Hills Golf Course El Dorado County Agriculture Commissioner El Dorado Fairgrounds Sierra Golf Course
Colorado Springs, Colorado	B	Broadmoor Hotel Golf Course Valley High Public Golf Course Colorado Springs Parks & Recreation Dept. Colorado College, Supt. of Grounds Gorby-Horning Wholesalers U.S. Air Force Academy, Superintendent of Falcon Stadium U.S. Air Force Academy, Director of Athletic Fields Big Valley Sod Farm
Ft. Worth, Texas	C	Ft. Worth Park Dept. Organic Compost Corporation Corps of Engineers Texas Highway Dept. Consulting Landscape Architect Tarrant County Water Control & Improvement Dist. No. 1 Goldthwaite (wholesaler) K-Mart Store Dickeys Nursery & Landscaping Wolfe's Nursery
Washington, D.C.	D	Dwight D. Eisenhower Golf Course Fairwood Turf Farm Starlite Golf Course Director of Road Operations, Dept. of Public Works, Annapolis

TABLE 3. (continued)

Area	Appendix	Organizations
Washington, D.C. (Continued)		Reston Golf Course National Capital Region of the National Park Service University of Maryland, Physical Plant Department Fairfax County Virginia Parks & Recreation Department
Los Angeles, California	E	Park Newport Apartments The Irvine Company Orange County Fairgrounds Newporter Inn & Golf Club Newport Beach Parks & Recreation Department State Department of Highways, Dist. 07
Chicago, Illinois	F	Metropolitan area cities (5) Warren's Nursery Bruno Galapte Nursery Crescent Landscape & Nursery

TABLE 4. EXISTING SEWAGE SLUDGE COMPOSTING OPERATIONS

Location	Volume[a], dry tons/year	Potential Area or Plant Sludge Volume, dry tons/year	Sales Price, $/cu yd	Estimated Costs For Sludge Compost Production $/dry ton	Point of Sale		Major Compost Users		
					Plant	Delivered	Private Citizens	Govt. Agencies	Private Company
Beltsville	3,650	43,800[b]	$0	40-60[c]	X	-	No	Yes	No
Los Angeles	44,700 present 109,500 future	44,700 present[d] 109,500 future	$2.00[e] ±	11	X	-	No	No	Yes[f]
Chicago	100,000[g]	205,500	$0	14-15[h]	---	X[i]	Yes	No	No

a. Approximate 1975 volume of digested wastewater sludge processed as compost.
b. Blue Plains Plant only.
c. Includes amortization of capital and land costs, but no research work.
d. L.A. County JWPCP, Carson, California.
e. This is approximate price, actual income is based on a royalty on Kellogg sales.
f. Entire compost output under contract to Kellogg Supply Company who pick it up, process the compost, and sell it to retail outlets and other distributors.
g. Estimated based on projected 1975 deliveries of 100,000 dry tons of compost.
h. Costs are primarily loading and hauling.
i. Delivered to users in 28 cu yd lots free of charge and to approximately 60 neighborhood distribution points in the Chicago area.

3. All potential users were shown a sample of the Beltsville, Maryland compost as part of the interview. The only significant comment, generally, was that the user might need a finer material. This comment was especially true of golf courses who would use the product for top dressing of greens. Finer product can be made by finer final screening or by grinding.

   Other concerns were the salt content (for L. A. basin material), and, to a very limited extent, the heavy metals and pathogen content. These last two concerns were mentioned infrequently.

4. Compost is not generally attractive to commercial agriculture at this present time, for the following reasons:

   a. Compost is too low in nutrients.

   b. The volume of compost required is very high compared to fertilizer because of the low nutrient content.

   c. Compost is difficult to handle in commercial agriculture equipment because it is not as uniform as commercial fertilizer.

5. Many potential users indicated they would travel "reasonable" distances to pick up the compost provided the cost plus travel were no greater than their present experiences with other products. Under these conditions the price of bulk compost would probably have to be in the zero to $4 per ton range.

An analysis of the existing wastewater sludge compost operations in each of the three designated areas does provide some very useful information. Each operation has developed a unique distribution approach.

Compost from Beltsville is distributed primarily to public agencies who must pick up the compost at the site. The compost is provided free of charge on this basis. Beltsville will provide compost to private users under special agreement. Demand exceeds supply, but only a portion of the sludge production of the Blue Plains Plant is composted at Beltsville. The Beltsville compost has not been promoted to any great extent.

Chicago is distributing a compost-like product from an old sludge landfill. This product to date has been given to private citizens. The product was named Nu-Earth in 1974 and simultaneously written up favorably in a Chicago newspaper and orders began to exceed the delivery capability. Other classes of users have not been promoted because the present demand cannot be supplied. Chicago has a large back-log of unfilled requests and reports only a couple of user complaints relating to odors out of the many served. The compost is delivered in 28 cu yd truckloads and, in addition, approximately 60 neighborhood pickup points have been established and are kept stocked. Transport costs are shown in Table 5. There is no charge for the compost even when delivered. Chicago feels that if they

TABLE 5. COMPOST TRANSPORT COST - METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

One Way Distance Miles	Chicago[a,d] Contract Cost, $/cu yd	Costs From Figure 2[b,d] $/cu yd
28	2.50	2.60[c]
8	1.30	1.00[c]

a. Based on 225,000 cu yd per year

b. Projected

c. Does not include any contractor profit

d. Costs do not include truck loading

charge for the product the users may feel there is an implied warranty.

Los Angeles County sells all of their compost to Kellogg Supply Company under a long term contract. This company processes the compost into various products which it sells on a wholesale basis to retail outlets such as K-Mart, nurseries, stadiums, golf courses, and similar outlets and users. The Company has been successful in this business for 50 years. Their products are among the most popular in Southern California. They are able to market within a radius of 300 miles limited by transportation costs. Kellogg pays Los Angeles County a royalty based on sales for the compost and picks it up at the plant site.

An analysis of these three examples provides a basis for the following observations:

1. All three operations indicate practically no user complaints. Chicago had 2 odor complaints in the first half of 1975 (150,000 cu yd delivered).

2. It would appear that in each case the particular class of user has accepted the product. The users apparently like the product because there are many repeat customers.

3. Users will accept the bulk product at no cost and, in the case of Chicago and Beltsville, will travel to pick it up. In Chicago it is estimated that the average user travels approximately 2 to 5 miles to pick up compost at the local pick up points. In Beltsville the average user probably travels 20 to 50 miles to pick up the compost.

4. Wastewater sludge compost, properly packaged and promoted on the retail market, can command a price competitive with similar retail products.

The above observations apply to the three active examples and certainly illustrate that success is possible with several differing approaches to the market. Table 6 shows an estimate for potential future demand in the areas surveyed. This future demand was estimated based on interviews and general observations in each area, but a comprehensive demand survey was not made.

TABLE 6. POTENTIAL COMPOST DEMAND BY AREA

Area	Equivalent Sludge Volume Distributed, Dry Tons/Year Present	Potential[a]	Volume User(s) Will Pick Up At Plant %
Colorado Springs	50	1,090	75-100[a]
Placerville	29	178	100[b]
Ft. Worth	1,500	2,500	100[b]
Washington D.C.	3,650	80,000	100[b]
Los Angeles	44,700	109,500	100[b]
Chicago	100,000	205,500	80-100[a]

a. Estimated

b. Present actual experience

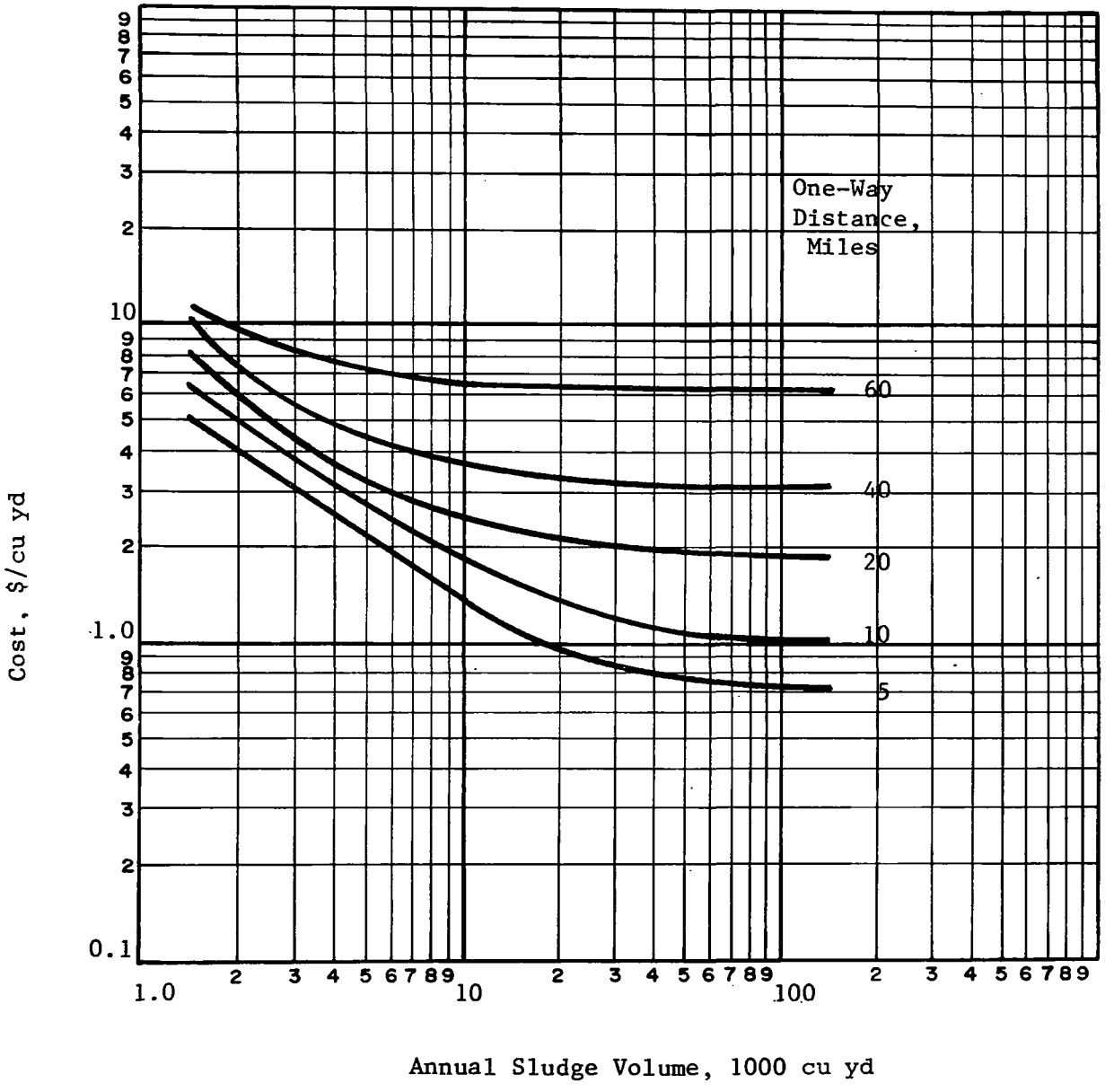
SECTION 6

TRANSPORT

The cost of transporting wastewater sludge compost to the user was estimated based on the experience of Chicago and from information developed in the sludge transport task of this contract. The costs are a function of the size of truck used, distance hauled, and volume handled. The costs are expressed in dollars per cu yd of compost hauled. The costs include all truck operation and maintenance including fuel, operator and amortization of truck capital cost over 6 years at 7 percent. The costs do not include any truck loading facilities.

The costs are applicable over the range of volumes shown. At small volumes the unit costs increases substantially. The cost for truck transport of compost is shown in Figure 2. A comparison of these costs to the costs experienced by Chicago are shown in Table 5. The Chicago compost is hauled by a private company under contract.

The costs of handling and loading the compost could range from $.50 to over $2.00 per cu yd. The cost of loading for Chicago presently is $0.50 per cu yd.



- 8 hour operation per day
- No loading and unloading facilities
- Most economical size truck from choice of 10, 15, and 30 cu yd sizes

FIGURE 2. TRUCK TRANSPORT OF WASTEWATER SLUDGE COMPOST

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LIST OF METRIC CONVERSIONS

English Unit	Multiplier	Metric Unit
acre	0.405	ha
bushels	0.035	cu m
cu ft	28.32	l
cu yd	0.765	cu m
^{o}F	$0.555(^{o}F-32)$	^{o}C
ft	0.3048	m
in.	2.54	cm
lb	0.454	kg
mile	1.61	km
sq ft	0.0929	sq m
ton (short)	0.907	ton (metric)

APPENDIX A

USER INTERVIEWS, PLACERVILLE, CALIFORNIA

A reasonable cross section of users, potential users, and suppliers of soil conditioners were interviewed in Placerville and the surrounding area on November 11-19, 1975. The Placerville wastewater treatment plant does make their sewage sludge available to the public as an air dried sludge and demand far exceeds supply. Two large suppliers of wood product compost are located in the area; one supplies bulk materials FOB the plant to anyone and the other packages their products for distribution to the retail markets outside the area.

The soil in the entire area has a high clay content and requires soil conditioners for best results. Demand seems to be high among citizens. The area has a high proportion of retired people who do a great deal of gardening. The demand from governmental agencies is not very high. County and state highway departments maintain minimal roadside and interchange landscaping. There are a number of golf courses in the area and the compost product has direct application in new plantings and as a twice annually applied top dressing for greens and fairways. With proper promotion, the demand for a low cost product by golf courses alone could be 150 to 400 cu yd per year which is greater than the present total production of sewage sludge in the area.

There seems to be little problem with user acceptance in the area. The maximum price which could be asked for sewage sludge compost is set by the bulk price of wood product compost and manure products. This ceiling price is approximately $4 per cu yd at the plant or about $7 per cu yd delivered. There was a definite indication that wood product compost (which has nitrogen added) would be favored over sewage sludge compost if price were equal. If the sewage sludge compost were free the golf courses would probably use it because they are extremely price conscious.

The area summary of supply and demand for sewage sludge compost is estimated as follows:

Supply	cu yd per year
Placerville WTP (Air Dried Sludge)	82
Actual & Potential Demand	
Private Citizens - actual	82
Golf Courses - potential	100-400
Fairgrounds - potential	30-100

Actual & Potential Demand (Con't.)	cu yd per year
Miscellaneous - worm growers, schools, parks, etc. - potential	30-100

Individual Interviews Follow:

Mr. Elmer Lamb, Jr., Plant Superintendent
Wastewater Treatment Plant
City of Placerville, California

November 11, 1975
(916) 622-0372

The City of Placerville operates a trickling filter secondary treatment plant. The primary and secondary sludge is anaerobically digested and dried on sand beds. This is not a compost operation, however, the fact that all of their sludge production is removed from the plant by users is significant to the compost study relating to Placerville. Certainly these same users would take the composted material also.

The plant produces approximately 80 cu yd of air dried sludge per year. Users load and remove all of this production from the plant site. There is no charge to the user. Demand is much greater than the available product. This demand has developed in the last two years and before that the City could not get rid of the sludge. The City does no advertising or promotion and the demand results from repeat customers and word-of-mouth. The only complaints are with the tomato seeds.

For the most part, the users are older retired citizens who use the product in flower and home gardens. Other users include:

1. One school
2. Placerville City Park Department uses the product occasionally
3. Ranchers, for orchard mulch
4. Worm growers
5. One golf course

Mr. Lamb felt that people would not be willing to load and remove the product from the site if he charged, say, $5 per pickup load. He felt they might be willing to pay if the City loaded the product, but this is an inconvenience to the City. Competitive wood product compost with 0.5% nitrogen is available in the area for $3 to $5 per cy yd loaded depending on size of load. Mr. Lamb was also concerned about additional product complaints if people were asked to pay for the product. Users probably travel an average of 5 miles to obtain the product and some travel as far as 20 miles.

Mrs. Neilsen
Neilsen-Ferrari Lumber Company

November 11, 1975
(916) 622-9211

These people have a blended wood product compost available in

quantity at the mill for pickup. They do not deliver. The price is $3-$5 per cu yd loaded depending on size of truck. The material looks excellent, is of uniform fine particle size, has a slight wood odor, and contains 0.5% of a slow acting nitrogen. The demand is high both from private citizens and a company who packages it for the retail market. The company can produce approximately 800 cu yd in 8 hours. This product is not a sewage sludge product, but does establish a market price ceiling for the sewage sludge product.

Mr. Arthur Cort, November 12, 1975
El Dorado Public Works Department (916) 626-2347
Placerville, California

The county and state do very little in this area of California in the way of new plantings or maintenance of plantings. Any new plantings are installed under contract. In general, they spray along roadways to kill growth and do not encourage plantings along highways and roads. Most regular maintenance consists of runoff control where coarser materials are required.

Mr. Bruce Robinson November 12, 1975
El Dorado County Recreation Department (916) 626-2438
Placerville, California

He would not hesitate to use the sewage sludge compost and thinks it has wide application as soil conditioner. The Recreation Department does not have any parks to maintain, but may be constructing some in the future. Their demand at this time is nil. Bulk (no packaging) would be no problem and manure products are now $7 per cu yd delivered, so cost to the department would have to be comparable.

Mr. Bob Platt, Manager November 12, 1975
El Dorado Hills Golf Course
El Dorado Hills, California

They are very interested in the sewage sludge compost and would have three uses for it.

1. New plantings. It could be used as organic soil conditioner, however, they are established and have little new plantings now.

2. Top dressing for greens. The greens are top dressed twice a year with a sand and compost mixture to a depth of about 3/16 in. They would need fine, screened material but would use 40-50 cu yd per year for this. He sees no problem is using and spreading.

3. Top dressing for fairways. They don't normally dress fairways, but they are badly in need of it because there is no top soil

base. If the material were free, they would consider it. This would require 100-200 cu yd per year.

Expense is a major consideration and they would pay up to what they now pay for commercial soil conditioners provided equal or better results were obtained. They will test it on a green for use next spring.

Most golf courses would have similar requirements for top dressing unless they had an excellent base.

The product appeared satisfactory except it would have to be finer than standard Beltsville material for green top dressing. They would use the product up to cost of comparable products provided results were equal. No special packaging would be required.

For fertilizer, they use Scotts-Pro-Turf. They have used Milorganite, but it tended to burn the turf and required watering in.

Me. Ed Delfino — November 18, 1975
El Dorado County Agriculture Commissioner — (916) 626-2305

Mr. Delfino indicated that there would be little demand for sewage sludge compost within the commercial agriculture industry within El Dorado County. The primary need of commercial agriculture is phosphorus and nitrogen and the handling of large volumes of compost to obtain these needs is not attractive compared to commercial products.

Mr. Cyril Hill — November 24, 1975
El Dorado Fairgrounds — (916) 626-2307
Placerville, California

The fairgrounds uses only commercial fertilizers at this time. Personnel were only slightly familiar with compost materials and their use. They do install new plantings each year and the soil is not very good, but the personnel are not in a position at this time to make a judgement on sewage sludge compost. This is a potential use, but some education would be required and probably a reasonably large test plot during one season would be beneficial in demonstrating the merits of soil amendment. It is quite likely that a steady use could be developed over a period of 2 years, however, this is the opinion of the surveyor. Mr. Hill did not feel that a small sample would be beneficial to him in demonstrating results.

Sierra Golf Course — November 11, 1975
(Private) — (916) 622-0760
Placerville, California

The owner declined to participate in the survey.

APPENDIX B

USER INTERVIEWS, COLORADO SPRINGS, COLORADO

A survey of users, potential users, and suppliers of soil conditioners was made in the Colorado Springs surrounding area on January 27-29, 1976. The Colorado Springs wastewater treatment plant usually does not make its heat treated sludge available to the public; an exception being the City Parks and Recreation Department as discussed later in this report. The Air Force Academy Base has its own sewage treatment plant on the grounds and all of its sludge is composted and used.

The soil in the area ranges from sandy loam to clayey. There is a high need for soil conditioners. There is an extensive park system in the city including several municipal golf courses. Private golf courses are numerous in the area. Those interviewed were accepting the value of composted sludge and therefore a strong emphasis was placed on sample tests to determine useability. There was a unanimous willingness, even anxiousness, to test results. All of those surveyed use Milorganite and would expect local sludge to be less expensive.

Individual interviews follow:

Broadmoor Hotel — January 27, 1976
Chuck Clarke - Director of Golf Courses — (303) 634-7711

Mr. Clarke was familiar with composted sewage sludge as he is presently using Milorganite as a soil conditioner and top dressing. He would need a very fine grained sludge for the greens, more finely ground than the Beltsville sample. The Broadmoor has three golf courses. There are 600 acres, 450 of which are fertilized with a special mix by "Agra-Chem" of Denver. Presently they buy Milorganite in bulk by the train car load and use it once a year in the summer. About 50 tons are applied. They would expect to pay less for local composted sludge and would travel a half hour round trip to pick it up in bulk. They would be grateful for a sample and very willing to test it and give results. They would definitely want an analysis of the product before using it.

Valley High Golf Course — January 27, 1976
Mike Hair - Grounds Superintendent — (303) 635-2741

This is a municipal golf course involving some 225 acres. They presently use Milorganite as a top dressing for the greens plus 10 tons of

"Agra-Chem" 17-5-10 fertilizer spread 8 times a year. Mr. Hair said they would be interested in trying the product but would require a more prilled consistency and questioned the possibility of potential drag in application due to the moistness of the product. They would expect the product to be free or quite low cost and could only determine the feasibility of picking it up in bulk after trying the product and determining its value for their purposes.

Colorado Springs Parks and Recreation Department — January 28, 1976
Bill Stookey - Superintendent of Parks — (303) 471-6630

Mr. Stookey indicated that there would be product acceptance and that Parks and Recreation is presently using heat treated sludge from the local treatment plant as a soil conditioner in undeveloped parks. It is used as a base layer for sodding to increase water holding capacity of some of their soils. Parks and Recreation has 70 flower beds and starts all their own plants (40-50,000 plants per year). They would expect composted sludge to cost less than the $3 per cu yd they are paying for local top dressing, top soil and peat mix of which they use 500-600 cu yd per year. Fertilizer (15-5-5 and 10-6-4) is also used for plantings. They would be glad to have a sample of composted sludge and would record test results.

Colorado College — January 28, 1976
Claude Coward - Superintendent of Grounds — (303) 473-2233

The college has several athletic fields and a total of 55 acres of landscaping. They presently use about 8 tons a year of "Jirdon" fertilizer, 12-12-4 for turf grass. They apply it 3 times a year. They would be interested in composted sludge and would like a sample with the understanding that they would do a study. Mr. Coward would expect the cost to be less than what they are presently paying for fertilizer and would be willing to travel 30 miles round trip to pick up the product.

Gorby-Horning Wholesalers — January 28, 1976
Mike Martinez, Warehouse Supervisor — (303) 598-1539

Gorby-Horning has been in business for about 5 years. All products are sold packaged. They have a high demand for Milorganite, mostly from golf courses. The company also sells fertilizer for trees and turfs. They would consider marketing composted sludge if it were packaged and only if the demand carried the product. They would expect to pay a small amount for the product.

U.S. Air Force Academy — January 29, 1976
Tony Guerrero, Superintendent, Falcon Stadium — (303) 472-1151

Mr. Guerrero is in charge of 225 acres, the grounds of Falcon Stadium,

the official football field for the Academy. He is presently using Milorganite as a soil conditioner and a 20-0-10 fertilizer plus iron and sulfur. He uses 5-6 lb per 100 sq ft 4 to 5 times per year. He would be interested in the product if its nitrogen content were sufficient to make it valuable. He would be able to pick up the product and could travel 20 miles round trip to do so. He would expect to pay less than for Milorganite. Mr. Guerrero would be pleased to run a study with a sample and record results.

U.S. Air Force Academy — January 29, 1976
Mr. Joe Moore, Director, Athletic Fields — (303) 472-1818

Mr. Moore is in charge of all athletic fields other than Falcon Stadium involving some 135 acres. He presently uses all of the sludge from the Air Force Academy Base Sewage Treatment Plant. Mr. Moore hauls it and pits it for composting. He periodically adds nitrogen, phosphorus and potash. He uses the product as a top dressing and for patching breaks in the turf. He finds he no longer has to re-sod where breaks occur making it highly suitable for his purposes. He is very enthusiastic about the value and potential of composted sludge and was happy to know that the E.P.A. is studying its marketability.

Big Valley Sod Farm — January 29, 1976
Wayne and Frances Booker, Owners — (303) 683-2599

Mr. and Mrs. Booker have 2500 acres, 900 of which are used for growing sod. They presently fertilize with "Scotts" Turf Builder and ammonium nitrate. They use 700 to 900 tons per year and apply it every 30 days from March through October. They were interested in the potentials of composted sludge for their needs but definitely would want to test it before they would know if it would be beneficial to them and how much would be necessary for their purposes. They would require a very large sample for testing. They would expect to pay less than what they now pay for commercial fertilizer. If the product were of value to them they would be willing to travel within the city limits for the product.

APPENDIX C

USER INTERVIEWS, FT. WORTH, TEXAS

A cross section of users and sellers of compost, peat and other soil amendments were interviewed in the Ft. Worth area on September 22-25, 1975. The Ft. Worth wastewater plant sludge usage as a soil amendment served as a background marketing system. Fort Worth has two treatment plants, the Village Creek plant and the Riverside plant. The Riverside plant is the older of the two and is to be abandoned in the near future. The Village Creek plant is under expansion now and an additional future expansion to upgrade quality is planned. The Riverside plant utilizes anaerobic digesters and stores the digested sludge in deep lagoons until full and lets the sludge dry over a period of years.

The Village Creek plant uses anaerobic digestion and shallow drying beds and fills an area to 6 inches, lets it dry for a week, then removes the sludge with a front loader into trucks. During 1974, the average sludge (dry solids basis) production at the Village Creek plant was 80,000 lb/day ± and at the Riverside plant was 40,000 lb/day. The City of Fort Worth has no marketing program; however, individuals may go to the plant and obtain sludge. The primary method of getting rid of sludge is via the City Park Department, the Tarrant County Water Control and Irrigation District and the Texas State Highway Department. During the past 3 years demand has been greater than supply. Tarrant County was unable to obtain all that they needed. Other governmental agencies use sludge, but on a truckload basis. They report they are not only pleased with the product, but are enthusiastic. It is anticipated that a composted sludge would be similarly accepted.

It appears that all of the sludge in the Ft. Worth area could be disposed of in composted form for a nominal price. It appears that the primary market would be governmental agencies.

Soils in the area are clay, sand, or rock and therefore, soil conditioners are necessary.

Individual interviews follow:

David Niven — September 22, 1975
Fort Worth Park Department

Mr. Niven has priority on all sludge from the City of Fort Worth waste treatment plants and uses about 20,000 cu yd per year. The parks

in the City of Fort Worth have an area of about 9,000-10,000 acres, and including parkways, golf courses and other miscellaneous areas some 15,000 acres are involved. He is satisfied with the dried sludge and would be glad to have composted sludge. Mr. Niven's present plan is to spread one inch on all parks and road easements. He picks up the sludge and carts it the 18 mile round trip. He stated that the sludge provides a base whereby less fertilizer and water are required since the humus holds the nitrogen and water better than natural soils. He plans on mixing wood chips with the sludge to produce a compost-like material for shrub and plant areas. He also plans on mixing sawdust to provide a potting soil. Mr. Niven doesn't see a decrease in demand for the material on a long-term basis, and he plans on continuing his present usage of about 120 cu yd per day, or 20,000 cu yd per year.

Mr. Maurice Wolff, September 22, 1975
Organic Compost Corporation
Fort Worth, Texas

Mr. Wolff said he would use the product if it were free and would pick it up. The present operation at Organic Compost consists of trucking both sheep and cow manure to huge compost piles. His furthest distance is 140 miles round trip. He markets the compost as "cow manure" and "sheep manure" to retailers such as K-Mart, Sears, Wolfe's nurseries, and others. Organic Compost also has plants in Pennsylvania, Minnesota, and Atlanta. They are the number one suppliers of compost in the country.

Perry Robinson September 23, 1975
Corps of Engineers

The Corps of Engineers maintains recreational areas around lakes that they are associated with. They had just experienced a budget cut when interviewed, which influenced some of their position. Mr. Robinson was interested in the product; but temporarily unable to commit to picking it up or thinking it possible to purchase the product. Aside from these influences, he thought it would be something they could use and was cooperative.

Mr. Jack Unger September 23, 1975
Texas Highway Department
Fort Worth, Texas

Mr. Unger is a landscape architect in the highway department maintenance section. He is very satisfied with the material, but would prefer something which is seedless and a more accessible loading system at pick up site. Mr. Unger uses the material as a fertilizer by applying 1" over road easements. The Fort Worth section maintains a 9 county area. The purchase of a 16-20-0 fertilizer is nearly $200 per ton which takes a substantial portion of the highway department maintenance budget. The more sludge available to him, the less fertilizer he must purchase. Mr. Unger will

accept a compost sample and will comment on its value.

Mr. Alan Divergi
Consulting Landscape Architect
Nyrick, Newman, Dalberg
Fort Worth area

September 23, 1975

Mr. Divergi was interested in the product. He said he couldn't use it as a substitute for fertilizer since so much would be required. They prepare beds for all but turf with 8 in of material consisting of 4 parts sandy loam, 2 parts peat, 1 part sharp's sand, and 1 part "barn manure". He said they would be willing to test it to see if the product was useable to them.

Mr. Gene Fruhwirth
Tarrant County Water Control & Improvement
District No. 1
Fort Worth, Texas 76102

September 24, 1975

Mr. Fruhwirth is of the opinion that the sludge is better than fertilizer and he would use it in preference to fertilizers. Mr. Fruhwirth maintains 54 miles of levees along the Trinity River plus two or three reservoirs. He cannot obtain as much of the sludge as he would like because other agencies have priority and he does not have enough trucks to haul as much as he can use. He says it establishes a beautiful turf, and controls erosion. Where he might apply 10 sacks of fertilizer, he spreads 12 cu yd of sludge. He says the material he presently uses has a pungent odor which disappears in a day or so. He uses a farm-type auger manure spreader and has no problem with distribution. He says he would pay a nominal fee for the material and would contract for a specified amount. He says he uses it at his home and most of his employees use it by taking a pickup truck load from his stockpile at the TCWC and ID yards.

Mr. Charles Gregory
Goldthwaite
Fort Worth, Texas

September 24, 1975

Goldthwaite is a wholesaler and is the local distributor for Milogranite. Mr. Gregory is not interested in peat or composted materials particularly because it is a low profit item requiring a lot of continued sales effort. He said he would be willing to make his customers aware of its availability.

Assistant Manager
K-Mart Store
Fort Worth, Texas

September 25, 1975

K-Mart administrative offices are in Troy, Michigan where Mr. Wall and Mr. Shroeder (Buyers) determine what products are acceptable for purchase by the local K-Mart stores. There are 4 stores in Fort Worth and 3 to 4 trucks of compost are sold per month at all stores. It is estimated that this represents about 100,000 lb per month (approximately 100 cu yd). The store sells the material in 50 lb plastic bags for $1.77 for cow manure and $1.97 for sheep manure.

Dickeys Nursery and Landscape September 25, 1975
Nameless Proprietor

The owner of this nursery/landscape business does not use sewage sludge and would not use sewage sludge compost on turf areas or bedding areas because he believes it causes too many grub worms.

Mr. Chambers September 25, 1975
Assistant Buyer
Wolfe's Nursery

There are 40 Wolfe Nurseries in the Dallas-Fort Worth area. They currently use Organic Compost Corporation's material and sell an undisclosed large quantity. Mr. Chambers indicated that the material would have to be packaged, and then it would be a matter of whether the public would buy it. When asked if it was offered for free or for a nominal price, Mr. Chambers indicated that the convenience factor would dictate usage. Mr. Chambers felt that to market the product successfully through nurseries it would have to be priced well below current products and packaged.

APPENDIX D

USER INTERVIEWS, WASHINGTON, D.C.

Presently in the Washington D.C. area there is one composting operation co-sponsored by the Maryland Environmental Service and the U.S. Department of Agriculture (USDA) Biological Waste Management Group. This project is funded in part by U.S. Environmental Protection Agency. The site for composting is the USDA Research Station in Beltsville, Maryland where 70 wet tons a day, 5 days a week of raw vacuum filtered sewage sludge from the Blue Plains Sewage Treatment Plant of Anacostia are composted on a steady flow basis. The Washington Suburban Sanitary Commission has plans to begin composting 50 tons per week of its sewage sludge in July of this year. The Upper Occoquan Sewage Authority of Virginia, is constructing an advanced wastewater treatment plant with plans to produce approximately 4,000 tons per year of compost at that site beginning January 1978.

The soils in the area range from sandy to clay (both heavy and light). There is a need for soil conditioning, and locally marketed topsoil is reported to be of poor quality. Parks and recreation departments are using composted sewage sludge from the Beltsville operation providing their own transportation for pick up and delivery. Because the surrounding area is the nation's capital, Maryland's capital, and historic northern Virginia, there is a large tourist industry, resulting in many well kept grounds around historic sites, many monument grounds and of course, the usual number of public parks for local community residents. The bicentennial attractions include parks and gardens built and landscaped especially for the occasion. The National Capital Parks Department is using composted sewage sludge for plantings and construction. Park departments in Maryland and Virginia are satisfied users with high potential demand. Some golf courses in the surrounding metropolitan area are already using composted sludge, are satisfied with the product, and indicate that they would welcome the opportunity to have an unlimited supply.

User acceptance is enthusiastic in the Virginia metropolitan area and the City of Washington, D.C. Private business concerns surveyed in the Maryland area were quite pleased with the prospect of using the product, one mentioning the health issue as a possible deterrent due to past experiences he has had with the citizens of nearby housing tracts monitoring everything put on the ground at his turf farm operation with regard to its environmental impact. The Maryland officials within the departments using wastewater sludge compost were hesitant to commit themselves, being quick to indicate that use and/or continued use of composted sewage sludge would depend on public acceptance. They were concerned with the question of

health, particularly Maryland Health Department regulations which consider acceptable uses as follows: (1) Turf farms, (2) Nurseries, (3) Golf Courses, (4) Establishing new lawns, with the exception of use by the individual homeowner, (5) Public works projects, (6) Park lands, with the exception of playground areas, (7) Reclamation projects (marginal land). In contrast, the Fairfax County Virginia Public Health Department ruled that the composted sludge hauled into the county from Beltsville could be used anywhere.

The interviews conducted on March 22-24, 1976, indicate a healthy potential market for the Washington metropolitan area. There is construction commitment now to make available by January 1978 a total of 41,000 tons per year of composted sewage sludge. User demand from this very small sampling ranges from 1500-2000 tons per year.

Individual interviews follow:

Dwight D. Eisenhower Golf Course — March 22, 1976
Les Belcher, Manager and — (301) 849-8341
Boe Marshall, Greens Keeper

Mr. Belcher and Mr. Marshall are presently using composted sludge from the Beltsville operation. They are picking it up with a leased truck and have so far acquired about 750 cu yd. They are using the composted sludge for construction purposes applying 25 tons per acre of seeding to an area 12 to 16 acres. They are also using composted sludge on the fairways and roughs. Normally they use a chemical soil loosener on the greens and top soil on the fairways. Mr. Belcher stated that the local top soil is very poor and he definitely prefers the composted sludge. He indicated that they would be willing to travel up to 30 miles round trip for free composted sludge. Mr. Belcher indicated that he could use a great deal more of the product. There are 216 acres involved at the golf course.

Fairwood Turf Farm — March 23, 1976
Walter Livingston, Manager
Glendale, Maryland

Mr. Livingston would be glad to have a large supply of the composted sludge as a soil conditioner. He is presently using 150-200 tons, 3 times a year of 10-10-10 or 10-6-4 by Agrico, plus lime, as fertilizer for the 500 acres. Mr. Livingston has many trucks at the farm and would be willing to pick up the sludge travelling as far as he could go and still come out ahead of what he is presently paying for commercial fertilizers. This was all contingent upon a sample for use and study to determine if the product would work for his purposes. He pointed out that there might be a problem using composted sludge as his neighbors (a housing tract) closely monitor what kinds of fertilizers and how much he uses on his farm.

Director of Road Operations
Department of Public Works, Charles T. Mewshaw
Anne Arundel County

March 23, 1976
(301) 224-1831

Mr. Mewshaw has been using the compost product recently. His trucks have picked up about 800 cubic yards to date at a cost to the Road Operations, Department of Public Works about $1.50 per cu yd. The product has been applied to an area 250 ft by 4 ft as a mulch and soil conditioner for landscaping use. The public golf course in the county has picked up 750 cu yd for use on their fairways. The greens keeper at the golf course presently uses a 10-6-4 mixture or 10-10-10 for weekly application on greens for their golf course in the summer. Mr. Mewshaw was reluctant to commit to the continued use of sludge. He said it was good for some purposes but stated that, "...you wouldn't want to use it around the capital building or someplace like that." He seemed tentative about the product, but willing to use it and see what it would do.

Reston Golf Course
Mr. Brock, Owner
Reston, Virginia

March 24, 1976

Mr. Brock was very interested in the potential availability of composted sewage sludge in his area. He is involved with 250 acres and three golf courses, one in Fairfax, Virginia, the other two in Reston, Virginia. He presently uses ammonium sulfate - as a winter fertilizer on the fairways. Milorganite is applied 3 times a year. His only qualm about local sludge would be the phosphorus level. He would need a low phosphorus level for his purposes. They would be willing to pick up the product and travel as far as feasible to still keep costs less than he is presently spending on commercial fertilizers. He talked for some time expressing his feelings about the potential he saw in composted sewage sludge emphasizing how poor the local soil is and how healthy it could be with the use of organic products such as composted sludge.

National Capital Region of the
National Park Service
James C. Patterson, Research Agronomist
Washington, D.C.

March 24, 1976

Twenty three percent of the city of Washington is park area and the National Park Service is interested and aggressive about composted sewage sludge. Mr. Patterson indicated that they have picked up about 9,000 cu yd of the product from the Beltsville operation and are using it on all the Constitution Gardens Parks, in Rock Creek Park for renovating soils, and in construction of the Folk-Life Park grounds. The National Capital Region of the National Parks Service is interested in obtaining all of the composted sludge available. They are quite positive of its assets, so much so that they plan to begin composting all sludge from portable toilets at the parks along the C & O Canal which runs between Georgetown

in the City and Cumberland, Maryland. Mr. Brown stated that the parks service has been buying top soil, the quality of which leaves something to be desired. His feeling was that the compost product was far superior to local top soil. For fertilizer they have been using 10-6-4 or 10-10-10 with lime.

University of Maryland — March 23, 1976
Mr. Kehoe, Superintendent of Grounds — (202) 454-2822
Physical Plant Department, Operations Division

Mr. Kehoe would recommend using the product at the univeristy, but stated that there is a health question with the use of composted sewage sludge, and specified that he did not have final authority on purchasing. There are 1500 acres for landscaping and 800 acres for plantings at the university. They use 40 tons of fertilizer a year, using 10-10-10 and 5-10-5 and ammonium nitrate frequently during the summer and watering in with Milorganite and "Turface". There is a golf course at the university. The golf course grounds keeper has been applying digested sludge for years to condition the greens and fairways. Mr. Kehoe indicated that they could pick up and would travel 10 miles round trip to do so.

Fairfax County Virginia Parks & Recreation Department — March 24, 1976
Jim Brown, Superintendent of Construction — (703) 941-5000
Annandale, Virginia

Mr. Brown indicated that so far the county has used 200 cu yd of composted sewage sludge in void areas as a soil conditioner. The county has finished a 27 acre landfill, I-66, using digested sludge from local treatment plants, then seeding, and is now using it as a ballpark. There are plans to use digested sludge and composted sewage sludge at a 70 acre site next to the I-66 landfill. This area will be used for a nursery and tree spade area for the park authority. There are in excess of 10,000 acres of park land in the county, one half of which is forested. There are 70 baseball fields and 40 football fields. Mr. Brown was quite enthusiastic about composted sewage sludge, indicating that the park authority was anxious to have all they could have. The Fairfax County Health Department has ruled that the product can be used anywhere. County trucks are used on rainy days to go to Beltsville for pick up and delivery. The county has been using 10-10-10 fertilizer on plantings.

APPENDIX E

USER INTERVIEWS, LOS ANGELES, CALIFORNIA

A survey of users and potential users of soil conditioners was made in the Los Angeles Area on December 4, 8, 9, and 17, 1975. Kellogg Supply Company has been buying composted sludge from the Los Angeles County Sanitation District for some years and has been most successful marketing the product as "Nitrohumus".

The soil in the area is in need of constant conditioning and the demand seems high among private citizens as well as commercial potential users for some sort of conditioner. County and state highway departments have little need for the product as they contract all of their landscaping out to commercial firms for the initial design. Because Orange County is such a resort area and the climate lends itself to year-round planting, there is much landscaping around commerical as well as private dwellings. The area has a high growth rate and is one of the fastest developing parts of the country. Apartment complexes, townhouses and condominiums are a large portion of the new development taking place. These include large greenbelt areas where composted sludge could be quite useable.

Locally there seems to be high user acceptance, and beyond that, a surprising amount of knowledge about composted sludge. Acceptance was qualified by the cost question, and in one instance, the high salt concentration of the product. Users would be willing to pay no more than the fair market value of other conditioners they are presently using, and would be willing, in most instances, to pick up the product if free or inexpensive enough to justify the trip.

Individual interviews follow:

Park Newport Apartments — December 4, 1975
Mr. Gene Jambon, Yards Maintenance — (714) 644-2622

Mr. Jambon was familiar with composted sludge as a soil conditioner and would not hesitate to use it at Park Newport. There are about 20 acres of landscaping with new plantings each year. They would accept the product free, delivered or not. He would not be able to use it unpackaged for lack of sufficient storage space. He would travel as far as 25 miles round trip to pick up the product. He is now paying $2.85 per 4 cu ft for Redwood compost. Mr. Jambon is interested in a sample of the product.

The Irvine Company December 8, 1975
Mr. Jim Peglau
Landscape Operations Administration

Mr. Peglau is very much in favor of using any high organic matter as a soil conditioner. The soils are poor and he feels they cannot get enough conditioning. Mr. Peglau would be happy to use all he could get free, or at a reasonable price. He could use it in bulk or packaged. The company has used Kellogg's Nitrohumus and City of Milwaukee Milorganite in the past but is not presently using either. The landscaping involved includes several large shopping centers, several small ones, several large apartment complexes and several industrial complexes. All together they estimate about 5 million sq ft of landscaping with 450,000 sq ft more by the end of 1976. All would have annual plantings and extensive lawn coverage. Mr. Peglau indicated that they would pick up free sludge anywhere in Orange County. He is very interested in a sample and would willingly do a pilot study.

Orange County Fairgrounds December 8, 1975
Mr. Jim Porterfield (714) 545-1131

Mr. Porterfield indicated presently they have no use for composted sludge because they use horse manure from the stables on the grounds. He did say that there would be no reason for them not to use it should their manure source be discontinued. There are 80 acres for landscaping on the grounds including trees, grass and shrubs. In the past they have used "Turf Grass Care" a commercial lawn booster. They apply a conditioner 2 times a year and would be interested in a sample and would plot results for the study. He would require a fine screened product.

Newporter Inn & Golf Course December 9, 1975
Bob Slater (714) 644-1700

Mr. Slater was quite familiar with composted sludge, and would be happy to use it on the 17 acres of golf course and motel landscaping. He would be able to use bulk or packaged and would be willing to pick it up with a rental truck at a distance no further than that which would commence decreasing returns. He would expect to pay less for the composted sludge than for commercial products. They are now using Turf 'N Tee and Power Gro. They use about 1 ton of soil conditioner 4 times a year and are continuously dressing the greens. Mr. Slater would welcome a sample to test, but was rather positive about not using a local sample due to the high salt concentration.

City of Newport Beach Parks & Recreation Department December 9, 1975

Mr. Brooks was vaguely familiar with composted sludge, and excited

about recycling in general. He therefore, would be very willing to use the product. Parks and Recreation is presently using sawdust and redwood compost as soil conditioners. They would be willing to pay what they are now paying for the soil conditioners they are presently using. If it were offered free, or extremely inexpensive, they would be willing to pick it up and go 20 or 30 miles with their own truck. They use about 100 cu yd per year of conditioner.

State Department of Highways, District 07 December 17, 1975
Mr. James Miller (714) 620-3964

The Department of Highways contracts all of its landscaping out of the Department to private concerns. For this reason they would have very little use for the product. Mr. Miller was somewhat familiar with composted sludge, and would not object to using it as a conditioner were they in the market for such a product. In the Orange County area for landscaping maintenance the Department uses ammonium sulfate.

APPENDIX F

USER INTERVIEWS, CHICAGO, ILLINOIS

A survey of users and potential users of composted sewage sludge was made in the Chicago area on April 5-7, 1976. The Metropolitan Sanitary District of Greater Chicago (MSD) encompasses 120 communities, including Chicago; serves an area of 860 square miles and 5.5 million people. Each day its waste treatment plants produce 563 tons of solids. Approximately 3.5 million tons of air dried sludge have been accumulating in a landfill in the City for about 40 years. In 1974 the Chicago Tribune newspaper ran a story on the value of air dried sludge and its availability. The product was named Nu-Earth. Local municipalities were notified that MSD would deliver a truckload (28 cu yd) free of charge or people could then pick up what they needed from local distribution sites. During the last six months of 1974 some 97,000 cu yd were distributed and in 1975, 213,000 cu yd were distributed.

The soils in the area range from sandy to clayey. Soil conditioners are essential. There are few parks in the immediate villages or in the City of Chicago. User acceptance is high on an individual basis. MSD accepts requests for public use only. They have established distribution sites in 61 metropolitan area communities. The local municipality contacts MSD, requests the sludge and MSD delivers to a local distribution point. The residents pick up what they want from the local distribution site and take it home for use. Individuals can call MSD directly and have a truck load delivered to their home. The MSD provides application information on request. They do not recommend the product for established lawns. Most of the residents use Nu-Earth on their flower beds and in vegetable gardens.

Although the various local municipalities request Nu-Earth for the distribution points, they generally do not use a significant amount of the product on public property. This apparently does not indicate any objection to the product, but rather that either there is no local park, or there is no regularly planned park maintenance. A program run by the Department of Human Resources known as the "Mayor's Farm Program" used 1,600-1,800 tons of Nu-Earth in 1975. The area summary of supply and demand for sewage sludge compost follows:

Supply	Tons
Accumulated to date	3,500,000

	Demand	Tons
1974	private citizens	34,600
1975	private citizens	76,000
1975	public use	1,600-1,800

Individual interviews follow:

Oak Lawn Park District
Mr. Rich Bondreau
Oak Lawn, Illinois

April 6, 1976
(312) 599-7474

The Village of Oak Lawn Park orders a truckload (28 cu yd) about every 3 days for its distribution site. Citizens come regularly to the drop off point with garbage cans, plastic containers, baggies, etc. to take away a supply for their private use. The village does not use it for the parks. They use commercial fertilizer about once a year. However, there is no on going park maintenance. Mr. Bondreau said there was no reason for them not to use the product on park ground, and maybe at some point they would.

Warren's Nursery
Mr. Maurice Rosener
Payloss Park, Illinois

April 6, 1976
(312) 974-3000

Mr. Rosener has no objection to the product, although they have no need for the product in his operation. They have investigated it thoroughly and it is low in nitrogen for their purposes and too difficult to spread. This is a nationwide sod growing company with 4,000-4,500 acres involved in six states. The soils are 60% muck and clay loam at the Chicago area operation. They use 250-300 lb of nitrogen per acre per year on the 900 acres locally. Fertilizers include 10-8-4, 12-12-12 and ammonium nitrate.

Bruno Galapte Nursery
Oaklawn, Illinois

April 7, 1976
(312) 422-6247

Mr. Galapte declined participating in the survey through his secretary.

Crescent Landscape and Nursery
Mr. Gaelerm
Chicago, Illinois

April 7, 1976
(312) 233-4848

This is a retail operation selling houseplants, potting plants, and other gardening equipment. They sell milorganite and potting soil bought locally. Plantings come from local nurseries. Mrs. Gaelerm said they had looked into the possibility of marketing Nu-Earth but found it undesirable for their purposes. It was not bagged, and not the right consistency.

Mr. Vito Ditanio
Superintendent of Parks
Evanston, Illinois

April 7, 1976
(312) 869-5340

Mr. Ditanio confirmed that Evanston had used three truckloads of Nu-Earth at a distribution point in the city for residents to come and take what they wanted. There are 270 acres of landscaping in the city. Composted sludge has been used to fill in a 17 acre site which was seeded for grass and is now a park. Otherwise the city spreads manure in the spring and tills garden plots. They use no commercial products.

Mr. Frank Mazzulla
Streets Department, Franklin Park
Franklin Park, Illinois

April 7, 1976
(312) 671-4800

Mr. Mazzulla said that to date the village has used 3 truckloads of Nu-Earth at their distribution point. The local citizens take it home in assorted containers for their lawns and gardens. The village has four small parks. They are not presently using Nu-Earth at the park but he would have no objection to doing so.

Mr. Wayne Resek
City of North Riverside
Riverside, Illinois

April 7, 1976
(312) 447-4211

Riverside has ordered two truck loads of Nu-Earth for its distribution point. The product is taken away rapidly by local residents for use in their yards. The city has not used the product before but is now developing a park which could generate a need and Mr. Resek indicated there would be no objection to using it in the park.

Mr. Petrie
Supervisor Worth Township
Worth, Illinois

April 7, 1976
(312) 758-3330

Mr. Petrie indicated that Worth has had two truckloads delivered for resident pick up. At this data not all of it has been used. He explained that this was probably due to two things: (1) On the one hand, they are located near Oak Park where publicity is high and probably most Worth residents pick up what they want there; and, (2) On the other hand, he felt he should do a little more advertising about their site. The town parks are shared by churches and schools who do the maintenance. Mr. Petrie did not think Nu-Earth was being used on any of them.

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

This study has the overall objective of determining user acceptance of wastewater sludge compost. The work scope involved visits to several composting and composting distribution operations, extensive literature review and interviews with users in several metropolitan areas. Existing and past compost and sludge product distribution operations were analyzed to determine the characteristics of the successful operations and the factors that may have led to lack of success or failure of others.

Results of the study indicate that demand already exists for wastewater sludge compost in certain metropolitan areas and that this demand was developed by implementing a planned program. Similar wastewater sludge product distribution operations have failed in the past because of high pricing or poorly planned programs. Factors are developed in this study which should help to assure development of successful distribution operations. A broad characterization of user requirements and desires was developed based on user interviews.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
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