OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

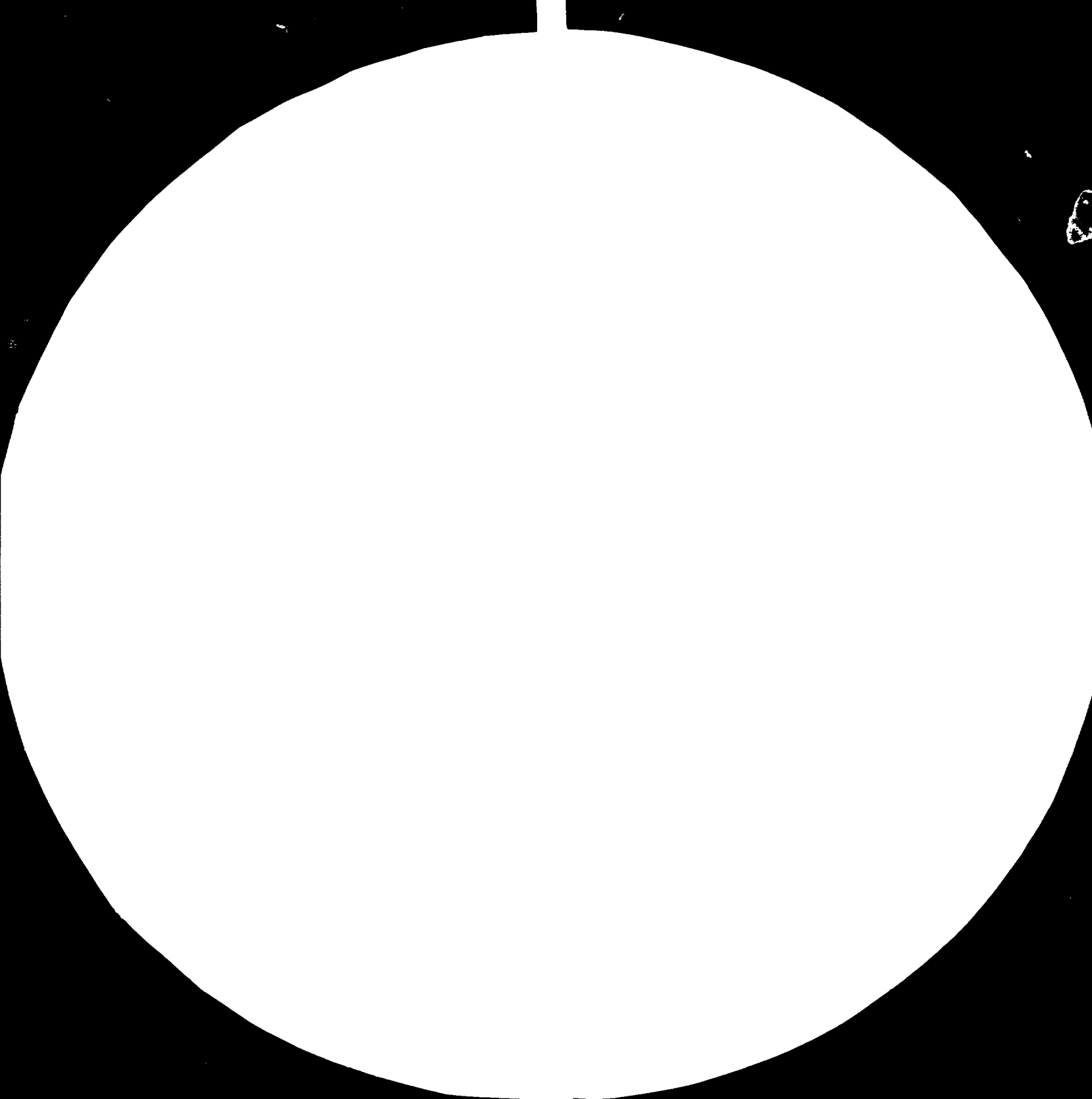
FAIR USE POLICY

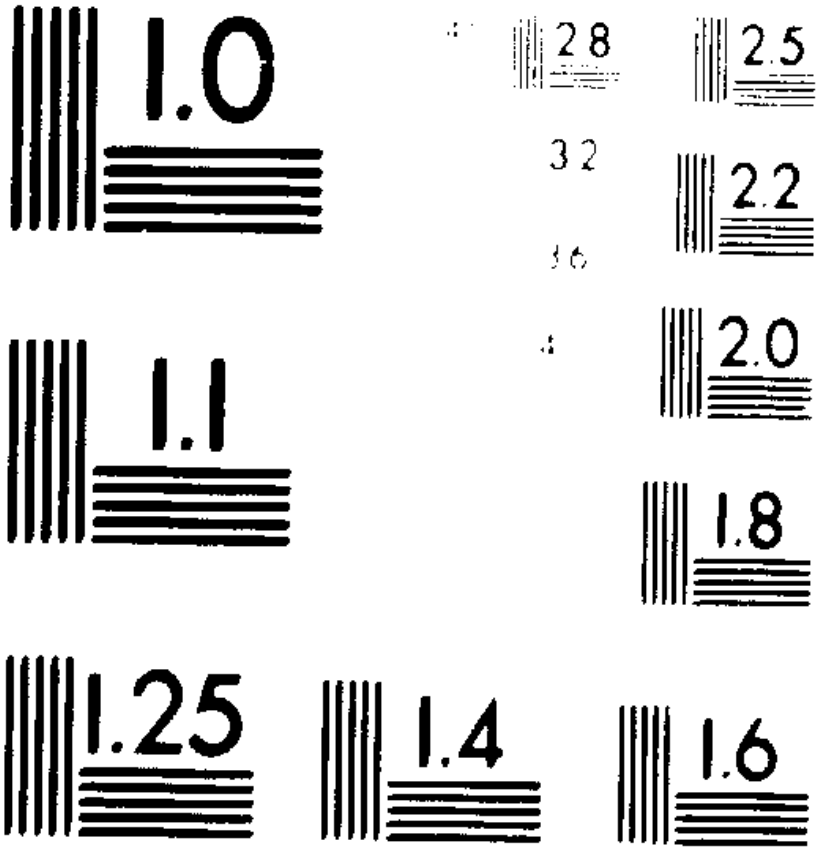
CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org





13395

RESTRICTED

31 August 1983
revised 21 December 1983
revised 6 January 1984
ENGLISH

Syria.

ASSISTANCE TO THE MUNICIPALITY OF DAMASCUS IN THE CONSTRUCTION OF A COMPOST PLANT

SI/SYR/79/802

SYRIA

Technical Report*

Return missions in May and July 1983

Prepared for the Government of Syria
by the United Nations Industrial Development Organization

Based on the work of David J. Miles
expert in waste managemert

* This document has been reproduced without formal editing

Table of contents

	Page
Summary and Recommendations	3
Introduction	3
Technical Exchanges	4
Siting of Plant	4
Consulting Engineers	4
PRE-Qualifications	5

Appendix

I	Site location	6
II	Consulting Engineers	8
III	Pre-Qualification Documents	9
IV	Brief Introduction to Recycling of Plastics from Urban Waste	15

Summary and Recommendations

A consulting/engineering company - GENERAL COMPANY FOR ENGINEERING AND CONSULTING -, a Government owned company has been selected for the management of the compost project. They will be supported by an external compost expert in the preparation and supervision work required for the construction of the compost plant in Damascus.

Pre-qualification documents from 44 compost equipment manufacturers had been received by the Municipality of Damascus and evaluated without assistance of the UNIDO consultant.

In order to assure timely and effective implementation of the project more support will be required from UNIDO.

As requested by the municipality of Damascus, a brief introduction into recycling of plastics from urban wastes has been prepared.

Introduction

The City of Damascus generates approximately 600 tons of domestic and trade waste per day.

At present waste is collected by various methods and transported to Jahroneah for landfilling. Local farmers purchase the partly decomposed waste for soil enrichment.

In 1981 the Syrian Government obtained loans from the Islamic Development Bank, OPEC Fund and the Arab Fund to construct a suitable waste treatment plant. One of the conditions of the loan was that the project should be completed within four years.

Following recommendations made by UNIDO a Consulting Engineering Company was selected to manage the project.

The objective of this ten days' mission in June 1983 was to assist the Municipality of Damascus with progressing the project and discuss technical matters with the Consulting Engineering Company.

Mission June 1983

1. On arrival I had discussions with the Municipality of Damascus on the progress of the work and activities to be carried out for the establishment of the compost plant.

It was understood that the following tasks be completed soon by the GENERAL COMPANY FOR ENGINEERING AND CONSULTING:

- Prequalification documents should be sent out for return by 30 June 1983;
- Any communications with contractors should be via the Municipality of Damascus;
- The Municipality should appoint engineers to collaborate with the consulting/engineering company.

2. The Municipality requested that

- I inspect the sites available and advise them on the most suitable one;
- hold a meeting with the Consulting Engineers;
- offer any comments on the pre-qualification document.

3. Siting of Plant

My recommendations on site location are given in Appendix I of this report.

I must again stress the urgency of this item because it will, of course, effect the whole programme.

Once the site has been acquired, surveys, oil tests, preparation of access roads, negotiation for civil engineering works, etc., will be required, for which a certain period of time is necessary.

There is the danger that in view of time constraints a less favourable site may be selected.

4. Meeting with the GENERAL COMPANY FOR ENGINEERING AND CONSULTING

My meeting with the consulting engineers was attended also by Mr. Nader-Haj-Oghli and notes of the meeting are in Appendix II of this report.

As a result of these discussions it became apparent that expert guidance may be useful during the selection of companies from the list of applicants submitting pre-qualification documents.

5. Pre-Qualification Document

A copy of the above mentioned document is given in Appendix III of this report.

The questionnaire emphasizes too much on the financial aspect and not enough on the actual processing skills of the manufacturers. The questionnaire should have included questions concerning staff training, facilities to analyze wastes and more information on the company itself. Enquiries on the costs for running a waste treatment plant will be sent out at a later stage.

6. Mission July 1983

The object of this mission was to evaluate and give assistance in selection of pre-qualification documents.

The Municipality explained to me that they had tried unsuccessfully to reschedule the mission owing to vacation period following Ramadan (6 days).

Mr. Nader-Haj-Oghli showed me the list of companies who had submitted documents for pre-qualification (44). He explained they would not be opened until after the holiday.

On looking through the list I noticed several companies were being represented two or three times. This was pointed out to Mr. Nader-Haj-Oghli. Mr. Nader-Haj-Oghli stated that all of the companies would be invited to apply for main tender documents. I would then be required to assist the Mayor of Damascus with the Municipality in selecting the company to which the contract will be awarded.

APPENDIX I

Municipality of Damascus
Composting Project

SITING OF PLANT

As requested by Mr. Khalil Aiash and Mr. Nader-Naj-Oghli at our meeting on Tuesday, 17 May, I visited the three sites available for compost plant.

My observations are as follows:

Air Terma

This area has been designated for the new Sewage Treatment Works. The land available is 5 km South East of Damascus. The whole area is very fertile, owned by the local people, and used for agricultural purposes.

Construction of the proposed Sewerage Treatment is scheduled to commence in 1999 and will take four years to complete.

The site is divided by one main water course and there are others faning through the area. Access is via small unmade track for 1.5 km crossing small rivers.

I was informed that there were problems in acquiring this site from the owners.

In my opinion the problems that would be encountered in road construction and land purchase would be prohibitive.

Time is now very important for this project.

Sbeneh

The area of land available in this area has been used as a shallow dumping ground. Situated approximately 8 km to the South West of Damascus City and comprising, I was informed, 50,000 m^2. Since my last report, new dwellings have been constructed. The area available could accommodate some systems for processing the waste but not the open type windrow systems. There would also be complaints from neighbours when prevailing winds were towards their residence.

As stated in my report of November 1981 because its location access and services, this was the most suitable site. However, since that report the area of land available, I was informed, has decreased.

Jahroneah

This area is where, at present, all wastes generated in and around Damascus are delivered. Land available is adjacent to the dumping ground which is 35 km from Damascus.

Advantages of Jahroneah is refuse vehicles already use the area, thus no need for re-routing, no residences to offend with odours, noise, etc., land available and almost to meet any situation.

Advantages of Jahroneah is refuse vehicles already use the area, thus no need for re-routing, no residences to offend with odours, noise, etc., land available and almost to meet any situation.

Conclusion

Considering the time factor and the possiblities of land availability, Jahroneah is the obvious choice if power can be provided. If this site is used then transfer station should be built so that the small carts transfer their waste into larger vehicles, the larger vehicle could be used for bringing compost back to within easy reach of the City for potential customers. This would also allow better vehicle utilization for the smaller collection vehicles.

APPENDIX II

Meeting with Mr Zohair Wafa.

Saturday 21st May in Municipality Offices

Mr Zohair introduced himself as a Consultant engaged by the General Company for Consulting and Engineering to manage the Composting Project.

Mr Zohair stated he had written to some 60 companies inviting them to complete the preliminary questionnaire and enquiry form.

The questionnaire will be returned by the end of June.

Mr Zohair stated that his Company would need two weeks only for appraisal. In order to keep to the schedule final tender documents would be by the end of October 1983.

Mr Zohair said his Company had also been asked to investigate the three areas of land available for constructing the plant.

I suggested that there should be weekly meetings between Municipality and Consulting Engineers to keep information flowing. Also the Consulting Engineer should talk to the Ministry of Agriculture to establish the type of compost that would be most suitable for general areas and what enrichment, if any, was required for certain crops. It was agreed that I should be present at the opening of the pre-qualification documents to advise on the technical aspects.

APPENDIX III - Prequalification Documents

Mr Zohair said to save expense he may send the documents to England for his retained Consultant to advise upon.

I stated most emphatically that this must NOT be done.

Mr Zohair requested a meeting with me to discuss various methods of waste handling and processing techniques. He was informed that I would assist wherever possible with the Municipality's consent.

The pre-qualification document is copied on pages 10 to 14.

Preliminary enquiry and questionnaire for
700 ton/day refuse composting plant

1. The Governorate of Damascus, having obtained loans from the Arab Fund, the OPEC Fund and the Islamic Development Bank, has appointed consultants to call for tenders and supervise the erection and the putting to work of the above proposed plant.
   At this stage we would be grateful if interested companies would reply to this enquiry by correspondence only and that representatives do not make calls, at a later stage they will be invited to do so. We ask that the request is strictly respected.

2. This questionnaire is in two parts:
   Part 1 :
   Is to find the adresses of the plants you have installed in the past and information on them by your answers to the questionnaire.
   Part 2 :
   Is to discover the type of plant or plants which you would propose for a plant to suit Damascus in the light of your experiences with your earlier plants.
   No drawing work is required for part I, only photgraph and a copy of a drawing describing the plants. A descriptive layout drawing of each type is required for part 2 or copies of very similar darwings.

3. In answering the questionnaire please keep to the numbers. Even if you have already given answer to the later question in an earlier one please also answer the later question by saying "Answer to this has been given in earlier no.....". In deseribing the type of plant or plants you would be offering in part 2 also answer according to the questionnaire numbering .

4. We are interested in having information on every type of composting plant - Windrow or enclosed accelerated type of plant. As yet the site is not definitely fixed and it is conceivable that it might be most economic to have the pre-treatment section near the city and the windrow fermentation area in the country near the user area.

5. You will find an analysis of the refuse and other pertinent information attached .

../..

Part I. Questionnaire

1. Please send your brochure and a finacial balance sheet for the last 2 years. reference list of plants erected with location, date of commissioning, daily capacity, type, and name & address and telephone number of your client's engineer from whom we can obtain independent references. Also enclose any technical articles written describing your plants.
2. Describe one or two of the largest plants you have erected both windrow and enclosed accelerated in more detail.
3. State the cost of the above at the time of commissioning :(A) machinery (B) Civil works & buildings, (C) spares, (D) other machinery ,(E) Add extra estimated cost for CIF to Damascus - Syria.
4. State if your price included (A) Incinerator, (B) Mechanical, Handling equipments (shovels etc .....), (C) Weighbridge .
5. State cost of running per ton of refuse handled (A) Salaries, labour (state number and qualifications),(B) Electricity (State consumption per ton), (C) other fuels, (D) Spares.
6. State the frequency at which the "Wear parts" as opposed to the "spare parts" have to be changed or hard faced and describe your preferred method. Tell us if we can probably have these "Wear parts" made locally- there is a steel works in Syria.
7. State the percentage availability of the plant from experience.
8. What means have you adopted (A) to avoid odour, (B) to prevent slivers of glass coming through with the compost.
9. State the secondray disposal problem involved with your system : what precentage of potentially compostable refuse (such as paper) cannot be utilized in your system .
10. State what means you use for collecting or recycling such items as plastic, non-biodegradable materials removed at the final screening.
11. What percentage of compost would you estimate
    A) Would be produced from the raw refuse input with an analysis as that attached (B) has been produced by your plants.
12. What analysis of compost would you (A) expect form the analysis of refuse attached (B) has been actually produced by your plants.
13. What method would you adopt to mix mechanically thickened sewage sludge with prepared refuse .
    A) What extra weight would the sludge produce and .
    B) What would the analysis be:. from experience & estimated.

../..

14. In what way would you in future modify your methods in the light of your experience .(See also Part 2).
15. Do you use the following equipment (A) Magnetic seperators, (B) Ballistic separators, (C) Air classifiers .
16. Are you interested in only supplying a part of the plant i.e. Feeder section, pulveriser or drum section ?. Fermentation section ?. Incinerator section etc... .
17. What areas do you require .
    A) For the treatment section
    B) For the windrowing section (if needed)
    C) For stockpiling 3 Months production.
18. What is the installed horsepower of the electric motors and the maximun demand.
19. Provide us with any further information which you consider would be informative and helpful to us.

Part 2 .

Please describe the plant or plants you might offer to suit Damascus in the light of your experiences and to suit the Damascus conditions and quantities 700 tons of refuse with 100 tons of sewage sludge (dry matter) at 70% H_2O .

Refuse average characteristics

Refuse characteristics have been accurately assessed upon series of of manual sorting and weighing operations carried out with appropriate number of samples methodically selected. These determinations took place from may to August 1978 .

Although the given percentages are more or less variable during seasons of the year, garbage average characteristics are estimated as follows:

	% Weight (Tecneco appraisal)
- Raw refuse moisture	54
- Raw refuse dry elements.....	46
Total	100
- Iron and metals	2.6
- Paper, cardboard, wood, rags.....	30.7
- Plastic, rubber	5.1
- Organic materials	38.5
- Inert(glass, stones, dust ,etc.).....	3.6
- Fine (under riddle Ø 20 mm).....	19.5
Total	100.0

Assuming 35% of ffines is inert material an 65% is organic matter, and adding them to the respective analysis findings, garbage qualitative composition is given by the following table :

Qualitative refuse composition:	% weight
- Iron and metals	2.6
- Plastics, rubber	5.1
- Irent materials ..... (Glass, earthware, rubble, sand,etc)	10.2
- Paper, cardboard, rags,etc.....	30.6
- All animal and vegetal organic matter	51.5
Total	100.0

In terms of compostable matter, Damascus garbage characteristics is given by the following figures :

- Organic substances	51.5
- 60% of cellulosic substances as paper , cardboard and rags	18.36
Total	69.86

In short, one must consider that a 70% of garbage, in weights, is good for compost production .

Density of garbage - Average weight of one cubic meter = 350 kg

ANNEX IV

RECYCLING OF PLASTICS

Prepared for the Municipality of Damascus

Introduction

Considering the shortage of raw materials and the environmental problem which urban waste can cause, recycling of plastic from waste becomes very important.

Pilot plants in Switzerland, Japan, FRG and the USA have demonstrated the possibility of reclaiming plastics from refuse.

The pyrolysis of plastics yields gaseous and liquid products, and the exploration or this cracking reaction has been demonstrated in the UK, Japan and FRG.

Continuous fluidized beds and in molten salts, polyethylene, polypropylene, polyvinychloride and polystryrene are pyrolyzed and better than 98% conversion is obtained. Up to 40% of the feed can be obtained as aromatic compounds.

As a first step PVC-containing material can be almost quantitatively dehydrochlorinated.

1. Following the observations reported to the Municipality of Damascus that the plastics in trade and domestic wastes had increased considerably during the past 12 months, I was requested, by the Municipality to provide information and recommendations on:

   (a) Types of plastics

   (b) Feasibility of separation

   (c) Methods available for separation

   (d) Use of reclaimed materials

2. Thisrequest from the Municipality was reported to U.N.I.D.O. and it was agreed that the information should be provided.

   (a) Visits were made to

   Urzuil Switzerland

   Warren Sprugs Laboratory

   Plastics Association

   Eastbourne Waste Derwed Fuel Plant

TYPES OF PLASTICS

3. There are two main types of plastics. The first thermoplastics, accounting for the major proportion of consumption, can be softened and remoulded in a recycling process. The second, thermosetting plastics, is irreversibly hardened and this limits its recycling potential to use as fillers or as a source of energy through incineration.

   The potential for recovery of plastics lies largely in the treatment of used products. There are already indications of the growth in use of mixed plastics wastes for the manufacture of low specification products.

FEASIBILITY OF SEPARATION

4 There are four accepted methods of separation for plastic materials:

(a) Collection at source ie from dwellings

(b) Hand picking at the garbage treatment plant

(c) Air classification

(d) Electrodynamics

(a) With the appropriate propoganda and education consumers can be urged to separate plastic wastes from their garbage. The most successful of these operations is in Funabashi, Japan, where waste plastics are collected by a special type vehicle. The plastics are collected in polythene sacks, easy to handle even for children. The advantage of this method is the lack of contamination by other wastes.

(b) Hand picking is a method more commonly used where labour is not expensive. It is common practice to slow down a conveying belt transporting wastes into the primary treatment area for this purpose. Another advantage of this method is that other materials can be collected and any rogue items that could cause damage to the treatment plant can also be identified, i.e., explosive canisters, gas containers and large aerosols.

(c) Air classification is obtained after shredding. The main refuse stream will, after shredding pass to a primary air classifier or elutriator that separates material in a horizontal or vertical stream of air. In the former type shredded refuse is discharged from a variable-speed belt feeder into a sloping chute entering the top at one end of the classifier. It falls into a horizontal air stream entering the chamber from the same side as the refuse. Air rates can be varied from 1000 - 5000 ft^3 min. At rates > 141 m^3/min turbulance reduces efficiency.

Heavy objects fall vertically through the air stream and lighter materials are blown laterally past a divider where carefully controlled stream of air, created by a suction fan at the end of the processing system and rising from an opening at the base, carries off the lightest material. These are carried by a conveyor to a rotating frommel screen with, say 5.7 cm holes which allow small pieces of glass or vegetable matter to drop free. Plastics which will have adhered to the drum are then collected

This method claims a plastic recovery of up to 99.4%.

(d) Electrodynamics covers the separation by electromagnetic and electrostatic methods. These rely on the response of materials to electical stimuli where the selection parameter is electrical conductivity. If the voltage impressed on a conductor is induced, by varying the magnetic field, electrical currents flow within the conductor. Each current is accompanied by its own magnetic field which opposes the source field and the particle is repelled from the source field region. The ability of the conductor to sustain the flow of these eddy currents is the selection criterion for identification and recovery of products.

These methods can be used to separate any materials having different electrical conductivities.

5. EXISTING RE-USE PROCESSORS

(a) Plastics are separated from raw garbage by means of air classification. After grinding the plastics and magnetic separation the particles are washed. Particles are then dried in a hydroextractor, pulverised, extruded and granulated. These granules are processed as usual by an extrusion press or by injection moulding machines.

This method is acceptable for re-use only when there is a market for products with a poor shock-and-tear-resistance.

(b) Plastics are heated by microwave to melting point. The elimination of HCI from a PVC-containing feed is also achieved by microwave heating, which in turn is favoured by the carbon-rich residues, of PVC. The The molten material then passes through a modified screw mixer, externally heated. Here, the degradation into gas and into light and heavy fuels takes place at a residence time of 10-20 minutes and at a temperature of 850^{o} C. The oil fractions are collected and sold; the gas is used for heating the mixer or is flared.

(c) Use of crude unsorted plastics in furnaces or fluidized bed. Plastics are fed into the furnace by a screw conveyor, where they decompose and the hot vapours passed to an electrostatic precipitator where paraffin vapours are condensed to form rather pure paraffin waxes. In an intensive cooler a liquid fraction is separated from the hydrocarbon gas.

6. OBSERVATIONS

Considering the operational parameters envisaged for the proposed Damascus Compost Plant I would recommend the following

(a) Waste plastics will be hand-picked from a slow "sorting" conveyor.

(b) Plastics will then be baled for transportation to a treatment (ease of transportion).

(c) Plastics then treated as described in 5a.

(d) Granules then be re-used for producing sacks, baskets etc.