

AUROVILLE SOLID WASTE MANAGEMENT STRATEGY



2001 - 2005

***FOR ECO-SERVICE AND CENTRE FOR SCIENTIFIC
RESEARCH, AUROVILLE.***

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EXECUTIVE SUMMARY

The Auroville Solid Waste Management Strategy was commissioned in October 2000 by Eco-Service and the Centre for Scientific Research (CSR). The project was conducted by *Willis Chirgwin*, waste management consultants from Australia. The research phase of the project commenced on February 24th and it is expected that the Auroville Solid Waste Management Strategy will be adopted and finalised prior to the end of June 2001.

While the primary scope of the project focused clearly on solid waste management in the city of Auroville, research also overlapped and included waste management in the village environment. To fully utilise the research from all sources two other papers have been compiled. The findings of the entire research project are summarised in the following documents:

- The Auroville Solid Waste Management Strategy - May 2001
- The Village Waste Management Strategy (Auroville Area) - May 2001
- The Auroville Solid Waste Management Research Document – May 2001

The Village Waste Management Strategy and the Auroville Solid Waste Research Document will be utilised by Eco-Service, NGOs and community based organisations as these groups begin to initiate waste management projects within Auroville and the village environment. The work will also be of benefit to the master planning process and the Asia-Urbs project, both of which will be addressing waste management.

The purpose of the Auroville SWM Strategy is to provide Aurovilians with a practical framework for improving, developing and implementing a sustainable waste management system over the next 4 years, although many of the initiatives within the Strategy will extend well beyond the current decade.

The Strategy documents existing waste management practices in Auroville. While there are many strengths within the current system, such as the Eco-Service collection model, there are other areas that require significant improvement. If Auroville is to achieve the status of a “zero waste” city, a number of fundamental changes must be pursued. These include changes to the management of medical and hazardous wastes, construction and demolition materials, and residual waste treatment, storage and disposal. In addition to this, Aurovilians and their guests must act intelligently to avoid the production of waste and to keep materials in circulation for the maximum amount of time possible.

The key findings of the project were:

- The need for Eco-Service to be expanded, employing a full time waste management co-ordinator. This person will be central to co-ordinating and delivering the various components of the strategy.
- A Task Force consisting of Aurovilians with direct involvement in various aspects of waste management will be established to assist the co-ordinator and to work directly on particular projects within the Strategy.
- There is a need for further research and development projects in two areas:

1. Residual waste management, which will include:
 - Waste stabilisation using EM (Effective Micro-organism) technology
 - Compressed waste technology for building and construction
 - Waste to energy
2. Research and establishment of appropriate micro-enterprises for plastics recovery, providing a long term value added market for recycling this material.

The Strategy identifies a range of recommended actions to directly improve all aspects of the current system. These include:

- Upgrades and modifications to current sorting, storage and incineration facilities.
- Increase in management effort to provide greater supervision of these facilities.
- Improvements in solid waste data collection
- Creating a formal agreement between Eco-Service management and Eco-Service collectors, outlining roles and responsibilities of each party.
- Introduction of improved occupational health and safety for Eco-Service collectors and Health Centre staff.
- Changes to the current system of *mixed* versus *separated* waste to *recyclable* and *residual* (Rubbish) and an accompanying education program.

The Strategy also recommends that Eco-Service will facilitate the move towards a “zero waste” city through a range of measures such as:

- Introducing an active program focussed entirely on waste avoidance at the micro level of business unit and individual communities.
- Developing future reuse initiatives based on a waste exchange data base accessible to all members of Auroville.
- Improving the management of hazardous waste handling and storage in Auroville.
- Understanding and documenting the “recycling chain” in order to provide higher quality end products to attain better prices and create employment in the local area.
- Introducing a compost advisory service run by Eco-Service to assist communities and businesses better utilise valuable nutrients from this waste stream.
- Developing a construction site demonstration model where building sites practice improved source separation and do not create ongoing visual pollution.
- As a part of the planned hydrological study, GIS survey, and micro planning processes; identify the most suitable location for an inert landfill to serve Auroville and its environs.
- Co-ordinating and delivering a comprehensive and effective community “Zero Waste” education program, which will infiltrate all areas where solid waste is produced, processed, purchased, consumed, recycled and discarded.

It is proposed that Auroville should fund the position of the Waste Management Co-ordinator internally, as waste management is one of the essential services carried out by modern municipalities. The expanded Eco-Service will work towards economic sustainability through further developing profit sharing

arrangements with micro enterprises, and user pays collection and disposal services. Capital improvements to existing facilities and the establishment of an adequately equipped office for the waste management co-ordinator will be funded out of short term loans secured locally.

The challenge for Auroville is to build on the solid foundations of its current waste management system. However, this can only occur when widespread social awareness and the appropriate level of human resources have been adequately developed. The primary recommendation arising out of this Strategy is to secure those human resources.

We are confident that through the measures described in this Strategy, Auroville's Eco-Service and its Task Force will provide leadership in the field of solid waste management in India. The innovations and systems that are developed here will be exportable to other less economically developed countries for their immediate benefit.

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1. INTRODUCTION

1.1 PURPOSE OF PLAN

The Auroville Waste Management Strategy has been compiled to provide Auroville with a comprehensive plan for the management of solid waste over the next four year period. To achieve this an examination of two key areas has been concluded. The first provides an objective analysis of current waste management practices in Auroville, while the second identifies a clear pathway for ongoing development and co-ordination of waste management services in the short, medium and longer terms.

While there have been a number of successful waste management initiatives undertaken in Auroville to date, there are a number of management and operational issues which must be resolved and further developed in order to provide for the long term planning of Auroville's solid wastes.

It is envisaged that this Strategy, which has been developed in close and detailed consultation with Aurovilians, will begin a new phase in the professional delivery of solid waste services in Auroville.

1.2 METHODOLOGY

The outcomes of the waste management research and planning process undertaken by *Willis Chirgwin* are presented in three documents:

- The Auroville Solid Waste Management Strategy - May 2001
- The Village Waste Management Strategy (Auroville Area) - May 2001
- The Auroville Solid Waste Management Research Document – May 2001

The two Strategies are presented for community discussion, and focus on proposed actions rather than broader philosophical or theoretical approaches. The Research Document is provided as a primary information resource to assist Auroville's waste managers to implement the Strategies. The research document will also be useful for planning Auroville's future long term waste management systems.

The following methodologies formed the basis for compiling the Auroville Waste Management Action Plan:

- Interviews with community members involved in managing waste or producing solid waste.
- Interviews with Tamil Nadu Pollution Control Board, NGOs involved in waste management, and various people within Pondicherry Municipal Authority.
- Waste characterisation study to define the quantity and composition of Auroville's residual waste.

- Survey to business and service units to determine quantity and composition of waste, including any potentially hazardous wastes.
- Analysis of Eco-Service weekly data records.
- Site visits to waste facilities and participation in waste collections with Eco-Service collectors.
- Literature reviews.

From the outset, a high level of community consultation was determined to be appropriate for the development of the Strategy. To ensure that all Aurovilians were aware of the Strategy development, articles were published in the Auroville News, explaining the scope of the project and inviting input from all interested persons.

Following the completion of the Draft Strategy, feedback and further input was invited. All persons interviewed were sent a copy of the Draft. An Auroville News article advertised the release of the draft, and invited people to participate in the feedback process, either on a face to face basis or within a public forum.

2. WASTE MANAGEMENT IN AUROVILLE

2.1 CURRENT PRACTICES AND INFRASTRUCTURE

Eco Service – Auroville’s waste and recyclable collection service.

Auroville’s Eco-Service operates a primary waste collection and recycling operation that services all of Auroville’s communities, business and service units. Eco-Service is managed and supervised on a weekly basis by Stefano (Aurodam) who has carried out this task since 1992. For a 12 month period in 1999, Stefano was relieved of this duty by Mukul (Arya) who managed and upgraded the service to its current operating standard. The service operates 6 days per week and is carried out by two local Tamil men, Arumugam (Kottakarai) and Narayanan (Kuilapalayam).

No legal agreement exists between Stefano who comprises the management of the service on behalf of Auroville, and the collectors who perform the actual collections.

Each week the collectors pick up non-organic residual waste and recyclable material from approximately 800 tenements in the Auroville area. Collection vehicles comprise a pedal rickshaw (Arumugam) and a bullock cart (Narayanan). Arumugam is in the process of purchasing a motorised auto with a fully enclosed tray in the near future. Approximately 40% of the residual waste is landfilled adjacent to the Kuilapalayam sorting facility and the remainder is stored at the waste storage building in the Industrial Zone.

At each community or tenement there is a designated area where mixed and separated material is stored in 75 or 200 litre plastic or steel containers. Aurovillians are charged on a user pays basis where a bag of unseparated material is charged at Rs 20 and a separated bag of material is charged at Rs. 10 per bag for collection. Selected materials such as glass, paper and metal are purchased directly by the Eco-Service collectors at set prices.

One of the difficulties is that there is a low level of awareness of what materials are recyclable. Many of the bags which are deemed to be “separated” require re-sorting, as the materials are mixed with waste, particularly non-recyclable plastics. This results in substantial double handling, and difficulty in determining a fair charging system. The current categories of ‘separated’ and ‘non-separated’ do not provide the desired level of efficiency and quality. Those wastes, which are in fact unrecyclable, are often perceived to be fully recoverable. This does not assist Aurovillians to understand what packaging materials should be avoided.

At the end of each week the books are reconciled. The Collectors retain half of the revenue for the week as well as the proceeds from selling recyclable material.

Eco-Service generates a small surplus of funds each year, which are utilised for upgrading services and facilities. The surplus projected over the 12 month period, beginning April 1, 2001 is estimated to be Rs 41,000¹. Eco-Service management retains half of the collection fees, with the remaining 50% of the surplus retained by the Eco-Service collectors in a profit sharing arrangement.

The collectors who carry out the essential waste management service for Aurovillians are exposed to all the hazards associated with municipal waste collection. They do not use the standard safety equipment for their particular industry nor are they vaccinated against tetanus and Hepatitis. Current manual handling practices also pose a risk to the collectors, particularly in respect to back injuries.

Waste Avoidance

Generally in Auroville, there is a sound level of awareness about the need to avoid generating unnecessary waste. This awareness does not always convert to waste reduction, as there are often limited choices of recyclable packaging at local retail and wholesale outlets.² Sometimes the actual operation of the business or service unit creates unnecessary waste due to the way the production process actually occurs.³ Often this is symptomatic of failing to incorporate waste avoidance principles into production planning processes through a lack of in-house expertise or a commitment to waste avoidance principles.

¹ Based on 2000-2001 financial year data (7.5 months July 2000 – mid February 2001).

² Eg, water is only sold in PET bottles at all retail outlets

³ In particular those commercial units which produce reasonable quantities of co-mingled textiles.

As an example of practical waste avoidance Njal (Centre Field) has developed a cloth bag deposit service in order to eliminate plastic carry bags from Auroville. The bags can be purchased for 5 Rs or 15Rs (for small or large respectively), but this payment is essentially a deposit. At any time the bags can be returned for a full refund, ensuring a service of maximum convenience to users. Five shops are now involved in this scheme, and it is hoped that there will be increased uptake over time.

Reuse

Auroville has a number of formal and informal reuse initiatives, which keep a large variety of materials in circulation. The Auroville community demonstrates a genuine commitment to gaining the maximum life from all materials through an active system of barter, exchange and sale.

In respect to the formal reuse sector, the best known facilities are the Free Stores at Bharat Nivas and Kuilapalayam (Mahasaraswati's Free Store).

The Mahasaraswati's Free Store uses a truck that collects items from different communities once a week. Donors are asked to have materials ready for collection on a particular day that is advertised in the Auroville News. Stock includes household durables, automotive accessories, and electrical items. Many items are value added through being repaired and presented for sale in a clean and tidy manner. The outlets are very well managed and well presented.

Olivier (La Ferme) has commenced an initiative to improve the quality of stock in Mahasaraswati's Free Store. He is inviting Aurovilians to place their unwanted items in the Free Store for sale on consignment. This is an excellent means to provide a convenient service whilst ensuring users get a return on items of higher value, and expand the range of stock in the Free Store. This will generate further interest over time, increasing patronage and turnover.

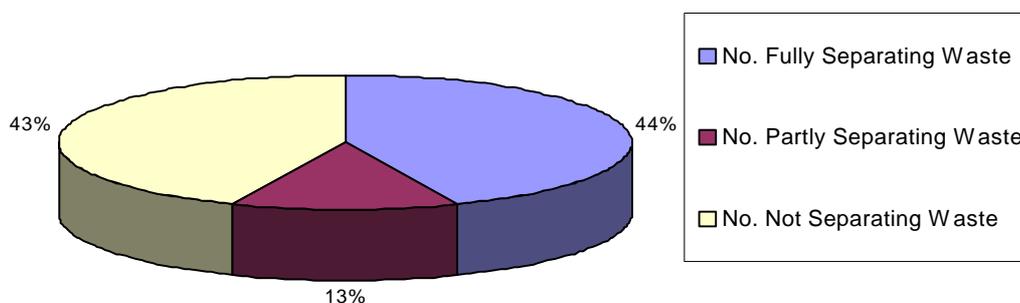
There are also plans to commence a system where children can exchange toys and books. In addition, a monthly market at Pour Tous is also being investigated as a means to increase trade, and ultimately increase reuse.

Naturellement and other food processing businesses provide further examples of reuse. A major issue at Naturellement is that under the present glass jar reuse system, people drop off various quantities of jars and receive payment under the terms of the deposit system. This activity has become problematic as a result of disruption to the general work flow. However Naturellement is committed to making this system work more efficiently.

Recycling

There is a moderate degree of participation in source separation by Aurovilians although this could be significantly improved over the medium term.⁴

Waste Separation by Collection Point - July 2000 - February 2001



% Aurovilians Separating Waste July 2000 – Feb 2001 ⁵		
Waste Unseparated	Waste Partially Separated ⁶	Waste Fully Separated
43%	13%	44%

Recyclable materials are sorted and processed at two facilities in Auroville. Narayanan utilises a sorting facility at Kuilapalayam, and Arumugam sorts and until recently processed material at his house in Kottakarai. Arumugam is now using the storage facility in the Industrial Zone.

The Kuilapalayam facility is located on the edge of a canyon which borders the Auroville community of Aspiration, and is close to the Pour Tous shopping area. The land area of the site is 300 square metres, with the building used to store processed recyclables being approximately 70 square metres.

The current management and physical characteristics of the Eco-Service depot has become problematic. The main issues are:

- High visual impact to neighbours. The sources of this impact occurs when materials are not contained during sorting operations, when litter becomes windblown and spreads waste in the vicinity of depot, and from the slippage of partially buried waste into the canyon system.

⁴ Many successful kerbside collection programmes in USA, Europe and Australia achieve recycling rates in the order of 75 to 90% participation.

⁵ As collected by Eco-Service weekly collections.

⁶ Refers to people selling some recyclable materials of value, but also having bags of unseparated waste for collection.

- Potential for the generation of contaminants such as heavy metals leaching from the landfilled rubbish and from the sorting area inside the yard.
- Potential for the landfilled waste to be washed into the canyon through high rainfall events. This represents a substantial risk of large quantities of waste being eventually washed into the sea.
- Poor fencing and security, with people sometimes congregating in the area creating noise nuisance for neighbours.

The original sorting depot in Kottakarai was moved to Arumugam's house in order to provide a more secure storage area. The sorting area is well screened from neighbours through adequate fencing. As mentioned above Arumugam has begun using the Waste Storage Facility in the Industrial Zone as a primary sorting area. This practice is sound from a transport efficiency and materials handling perspective. However if primary sorting it is to continue at this site, then sorting and storage areas will need to be clearly defined to ensure the facility is managed properly.

There are reasonably stable markets for paper, glass, metals, and some plastics. Plastics such as laminates and plastic films are not presently being purchased by plastic recyclers. These materials can be clearly viewed in the litter stream and dumping grounds around the villages of Auroville and most other places in Tamil Nadu. Currently the plastic market is suffering a downturn due to local market fluctuations, which has resulted in Eco-Service collectors being unable to sell stockpiles of baled plastics.

Eco-Service collectors have reported the breakdown of recyclables collected by volume as being:⁷

Paper	45%
Plastic	25%
Glass	10%
Textiles	15%
Metal	5%

It is estimated that Eco-Service will pay Aurovilians approximately Rs 48,000 for the materials listed above during the 2001-2001 financial year.⁸

Organic Wastes

It is difficult to ascertain the exact amount of organic wastes produced in Auroville as no detailed studies have been undertaken to date. However local data is available through a recent detailed waste management report written for the Union Territory of Pondicherry.

In Pondicherry, it is estimated that each person generates approximately 434 grams of solid waste per day⁹. This compares with estimates in Chennai of

⁷ Source – Eco-Service Collector (Arumugam) An estimate based on year trading to mid Feb 2001.

⁸ Source: based on 2000-2001 Eco-Service data – extrapolated for a 12 month period.

approximately 657 grams generated per person per day¹⁰. In determining the organic fraction of this waste, as characterised by pure organic materials not mixed with soil, it is estimated that 39.03% of waste produced in Pondicherry is organic¹¹ (169 grams per person per day).

Using the same assumptions for Auroville, based on a population of 2000 people¹², it is estimated that 338 kgs are produced on a daily basis. Annually, production is estimated at 123,370 kilograms per year. This figure is offered as an estimate only, as there are significant demographic differences between Pondicherry and Auroville. In addition, agricultural and horticultural activities in Auroville would add significantly to the organic materials generated in Auroville.

Looking at other available waste data, the figures in the Auroville Master Plan estimate that 2000 kilograms of organic waste is produced per week¹³. On an annual basis, this equates to approximately 104,000 kilograms per year.

The majority of this organic material is managed in a decentralised fashion through use in the production of compost, animal feed and bio-gas. The vast majority of organic waste produced in Auroville is composted close to the site of production using a variety of composting techniques. These techniques vary from simple anaerobic compost pits to fully aerobic processes where high quality compost is produced for growing vegetables, fruits and nuts. The climatic conditions ensure that rapid decomposition will take place even if organic wastes are not actively composted.

Good quality compost can be sold for up to Rs 75 per cubic metre and there is currently a real shortage of quality material for use in small scale organic farming.¹⁴ Much of the high nutrient value of organic waste is being under utilised through passive pit type composting techniques where the aim is waste disposal rather than recycling of nutrients.

In 1997 and 1998 Lucas (Grace) managed a significant compost making venture in Kuilapalayam where he began manufacturing compost for local farmers. Excellent quality compost was being produced at a cost of approximately Rs 165 per cubic meter.¹⁵ The maximum production achieved was in the order of 729 cubic meters using organic wastes from all readily available sources. The local farmers however require some 4000 cubic meters to satisfy their fertiliser requirements.¹⁶ The venture was concluded in October 1998. At that time, farmers would rather bring in raw uncomposted material from the Pondicherry dumping grounds, which they could collect for no cost except the transport charges. This project demonstrates the problems associated with the current

⁹ Development of Scientific Solid Waste Management Yard at Mettupalayan Nov 2000.

¹⁰ The Hindu: *All corporations asked to curtail use of plastic items*. March 8th, 2001

¹¹ Development of Scientific Solid Waste Management Yard at Mettupalayan Nov 2000.

¹² This includes an allowance of approximately 25% in addition to permanent residents to allow for guests, staff and tourists. (Based on data from AV Master Plan)

¹³ Auroville Master Plan

¹⁴ Source: Verite community will pay this amount for good quality compost if it is available

¹⁵ Based on 1 vandi load carrying 4 cubic meters @ Rs 660 per vandi.

¹⁶ GTZ Small Projects Fund September 1998 report by Lucas Dengel p.2

situation in respect to larger scale organic composting within the Auroville region. The situation remains unchanged today in Auroville and will require significant changes in the Pondicherry waste management system and the consciousness of local farmers as to the hazards of this practice before it ceases.

Sewage Sludge Management

Auroville has multiple de-centralised systems for treating domestic and commercial waste water and sewage. The sewage sludge from industries is also “domestic” in nature. That is, it is unlikely to contain any heavy metals beyond the usual levels in domestic sewage.

Auroville Water Service operates a 10,000 litre sludge pump truck for servicing septic tank systems, which was purchased by the Auroville Health Centre in 1997. The cost of this service is Rs 1200 per empty. The Auroville Water Service has reported that the sludge is disposed of through depositing in a trench and covering with soil. The sludge is not utilised as a source of nutrient, and has not been tested for heavy metals or other hazardous chemicals.

The Water Service is willing to continue the management of sludges as a part of waste water services. However, in recognition of the linkages between sludge management and solid waste management, it is important that this work is undertaken in consultation with Eco-Service. Currently there are plans to review and upgrade final disposal practices for sewage sludge in Auroville. An external consultant from a Switzerland firm, SANDEC, will be reviewing sewage sludge management by August of 2001.

Construction and Demolition Waste Management

Construction and demolition waste is generally reused, particularly for road construction. However, there is no formal co-ordinated reuse system in place, resulting in piles of rubble being placed in inappropriate areas for long periods of time. As Auroville has many construction sites, and will have for the foreseeable future, current building site waste management practices have a significant impact on visual amenity. Stockpiles of rubble tend to accumulate until a convenient use is found, but the interim storage period may be significant. The main components of this waste stream are bricks (approximately 80%)¹⁷, cement and sand.

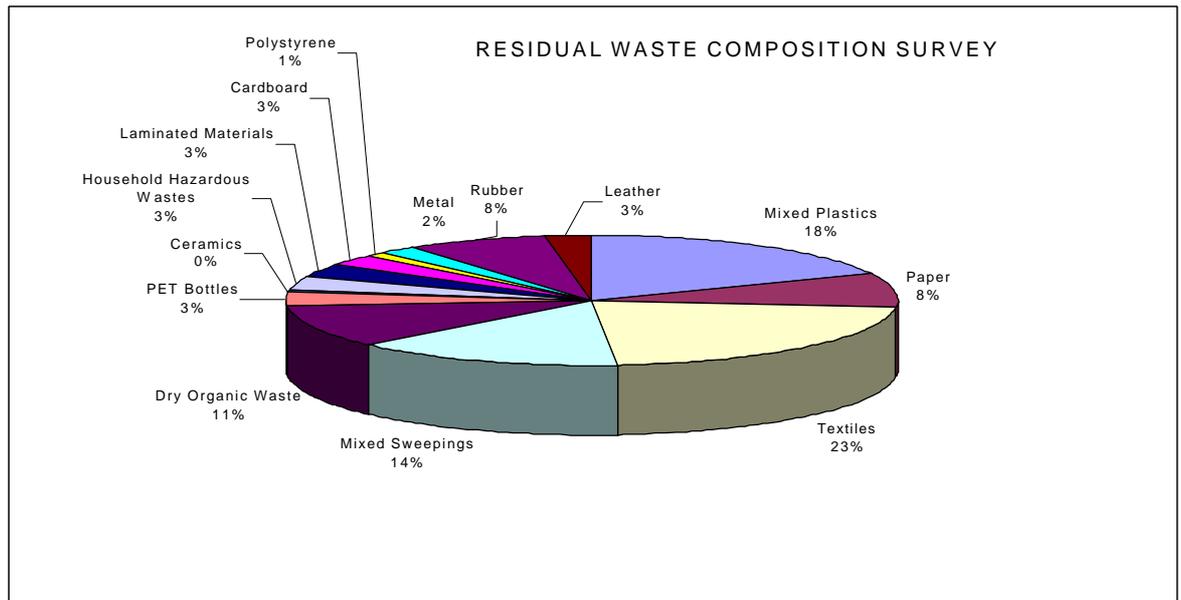
While some construction and demolition wastes have been utilised for road building, there are problems with the material being poorly segregated, resulting in materials which may compromise the integrity of the roads (eg glass tiles cannot be used as they may puncture tyres). Wastes often contain plastics and paper, which add to the visual impact of this waste stream. A major problem is asbestos sheeting waste included in rubble stockpiles. Asbestos fibres pose a significant threat to human health, and must be contained rather than dispersed. Asbestos fibre in roading material is an unacceptable hazard.

¹⁷ Sukrit, Auroville Road Service

Residual Waste Disposal

The total volume of residual waste collected by Eco-Service in the 12 month period up to April 30th 2001, is estimated to be 102 cubic metres.¹⁸ This volume does not include waste that is being burnt or buried at various communities throughout Auroville, the extent and quantity which is unknown at this time.

Residual waste sampled from the Waste Storage Facility in the Industrial Zone consists of the following fractions¹⁹



A significant proportion of this residual waste could be reduced. Using the composition analysis, it was determined that up to 50% of this waste stream could be avoided, as it is fully recoverable. The findings of this survey demonstrates the need for more diligent source separation.

When Eco-Service was started, disposal of residual waste was left to the collectors, resulting in unacceptable and indiscriminate dumping practices. The Environmental Monitoring Group arrived at the decision to burn municipal waste at the Health Centre's medical waste incinerator as a less than ideal, but interim solution. The incinerator designer, Manfred (Petite Ferme) stipulated that PVC plastics should not be burnt, as this is the main source of polluting gases. After approximately two years, the practice was abandoned for the following reasons:

- The small size of the incinerator chamber meant that incineration of municipal waste was highly inefficient.

¹⁸ Based on volumetric survey of waste stored at central store room and Kuilapalayam gully fill.

¹⁹ Based on waste characterisation study of waste from storage facility, April 2001.

- The incinerator began developing cracks on the external structure due to the prolonged high temperatures.
- The practice caused some concern within the community, with the potential creation of toxic gases such as dioxins and furans a primary issue for some community members. Advice from external groups such as Toxic Links confirmed these concerns.
- The Health Centre was finding it difficult to supply the resources to continue the practice.
- The burning of PVC plastics could not be prevented, with inadequate segregation causing this product to be incinerated.²⁰

The waste storage facility was constructed in 1998 for the purpose of safely storing hazardous wastes, and those materials that need to be stockpiled until adequate quantities are collected for viable transportation to distant markets. Hazardous wastes such as dry cell batteries are stored, minimising pollution risks, until appropriate final storage methods are determined.

With the cessation of waste incineration, Arumugam transported residual wastes to the Storage Facility. Narayanan commenced landfilling, burying the waste on the land adjacent to the sorting and processing facility at Kuilapalayam.

Currently, the Waste Storage Facility in the Industrial Zone contains approximately 55 cubic metres of mixed residual waste. This includes approximately 1 cubic metre of dry cell batteries that are beginning to show signs of corrosion and leakage. These batteries are covered by residual waste due to the lack of proper segregation and storage. There is also a small quantity of fluorescent tubes, some of which have become damaged due to improper storage. There is also a stockpile of tyres that has been buried underneath the residual waste.

The front gate is always unlocked, and at various times the building itself has been left unlocked. There is also a risk of fire in the facility. While it is a relatively low risk that the waste would be ignited, the resulting air pollution would have a high environmental impact.

At least 50% of the usable space of the building is now occupied with residual waste. This residual waste has accumulated over the past 11 months, but only includes the waste collected by Arumugam (approximately 60% of the waste of Auroville)²¹.

The landfilling at Kuilapalayam is generally unsupervised, and is not planned. The waste has been buried in an adjacent lateral gully leading directly to the canyon. It is likely that water flow will dislodge the waste, and it will be deposited and spread throughout the canyon system, and eventually discharged to sea.

²⁰ A difficulty in this situation is that PVC plastics are difficult to identify and segregate. However, PVC items used in the health industry are normally confined to a particular range of products, and as a part of the segregation training, this issue could be resolved.

²¹ Based on analysis of Eco-Service data sheets

In terms of developing final solutions for the safe disposal of residual waste, there is a clear need for further research and development in this area. In research conducted to date and as a part of the Strategy development, we were unable to locate commercially available incinerator technologies that are environmentally benign and economically feasible. There is a need for further research in this field, as well as in waste stabilisation prior to landfilling using micro-biological technologies, and in the use of waste in building and construction technologies.

Even if environmentally and economically sustainable incinerator technology is developed in Auroville, a secure landfill facility will be a necessary component of the Auroville waste management system. There are some wastes that cannot be incinerated, such as asbestos, and incinerator ash from the Health Centre. In the event that incinerator technology is not employed, other materials such as co-mingled plastics, textiles and other non-recoverable materials, will also need to be landfilled. Following the identification of an appropriate site and a full Environmental Impact Assessment, a landfill should be established and operated by Eco-Service.

Medical Waste Management

The medical waste incinerator is located at the Health Centre in Kuilapalayam. The incinerator is gas fired, and is used to burn medical wastes produced by the Centre. The average quantity incinerated is 1.5 to 2 kilograms per day.

There are a number of problems associated with the operation of the Health Centre incinerator.

- The medical waste, which consists of soiled bandages and dressings, used syringes (destroyed), and drip bags, is currently loaded into the incineration chamber by a small shovel or by hand. No gloves are used, despite various attempts to introduce this practice by the Health Centre management. This practice is unacceptable.
- The design of the combustion chamber calls for the removal of ash on a regular basis. This happens irregularly, and the build up of ash means that the incinerator burns at reduced efficiency.
- Once ash has been removed from the incinerator chamber, it is not disposed of safely or by any procedure that reduces the leaching of potentially hazardous chemicals. Ash is piled up next to the incinerator for months at a time, and then it is disposed of by dumping on nearby wasteland.
- Burning of chlorinated plastics in medical waste incinerators is banned under the Bio-Medical Waste (Management and Handling) Rules.²²
- Flue gas and ash testing has not been carried out due to the inability of laboratories to test for dioxins in the past.
- The area directly adjacent to the incinerator is poorly laid out and lacks space for a clear waste segregation and storage system.
- The Health Centre autoclave could be utilised for management of potentially infectious waste. However, this is an older machine, and is used sparingly as

²² Mumbai Medwaste Action Group (1998): *Medical Waste Fact-Sheet*

it is believed that it has limited life left. To increase its use through waste management is not viable.

Medical waste should be thoroughly segregated to ensure appropriate and cost-effective treatment for the various components. Currently segregation is not being carried out effectively within the Health Centre, resulting in many materials being unnecessarily incinerated.

The future of the incinerator cannot be determined until objective flue testing is undertaken to determine legislative compliance and environmental impacts. Under the Bio-Medical Waste (Management and Handling) Rules, there are clear performance standards the incinerator must comply with by 31st December 2002. One stipulation is a stack height minimum of 30 metres²³. However, if all test results demonstrate that performance standards are being met, it is recommended that the Health Centre should seek an exemption from the TNPCB to operate the incinerator with its existing 6m high stack. Given the low quantity of waste being incinerated each day, it is not unreasonable to assume that this exemption will be permitted.

If the testing demonstrates the incinerator is not complying with emission standards, it is recommended the use of the incinerator be phased out by Dec 31st 2002. Alternative waste treatment facilities are to be investigated and installed (eg autoclave/microwave system combined with deep burial at a secure landfill which will be established prior to this time). As a part of establishing alternative systems, links need to be developed with JIPMER hospital, to share information and to explore the options of utilising their medical waste management infrastructure.

The Bio-Medical Waste (Management and Handling) Rules do not stipulate emission standards for dioxin and furans. However, it is recommended that if the incinerator meets the legislative requirements, that the ash and flue gases are also tested for these emissions at some time in the future.

Household medical waste is also an issue for consideration. While working with the Eco-Service collectors, a used syringe was found amongst the waste. The collector, stated that the needle was resaleable for 'scrap metal', and took no precautions when handling the syringe. Bloodied bandages and sanitary products were also evident amongst the domestic waste stream. A system is required where household medical waste is segregated from ordinary household waste. A way of achieving this is through the use of a small bag (biodegradable if possible) which is colour coded, clearly labelled and sealed. This sealed bag would be then placed in the residual or mixed waste bin at each community or business unit. The Eco-Service collector would simply add this sealed bag to the rest of the residual waste that is destined for landfill. This ensures that the waste will remain sealed and not be handled by collectors.

²³ Bio-Medical Waste (Management and Handling) Rules: Schedule V, B: Emission Standards

Hazardous Waste Management

The quantity of hazardous wastes are generally quite low given the benign nature of many of the businesses operating in Auroville. However, these wastes require particular management procedures to ensure that pollution is avoided. At a household level, the most common hazardous waste is dry cell batteries. Currently, batteries are stored at the Store Room in the Industrial Zone. In the past, they have been mixed with concrete and set into concrete rings to contain the heavy metals and prevent leaching. Asbestos sheeting is another material that requires strict handling, storage and disposal procedures.

Some business and service units are also producing hazardous wastes. In some cases, there is insufficient knowledge as to acceptable disposal options, and the wastes are being stockpiled on site²⁴. In other cases, relatively low quantities of hazardous wastes produced in business and service units are simply mixed with residual wastes for Eco-Service collection.

The Tamil Nadu Pollution Control Board is planning for the construction of a hazardous waste facility in Chennai within the short to medium term. Sound interim storage is necessary as a first step at Auroville, with the expectation that within five years a commercial facility will be available to treat and safely dispose of these wastes. Location of this facility is important, as it needs to be sited in a position that has controlled public access. The Matrimandir workshop area provides space and security for an interim storage compound/building, and the majority of Auroville's hazardous waste is produced at this site.

2.2 HUMAN RESOURCES

The greatest barrier to developing sustainable waste management systems and services in Auroville is the lack of specific human resources. Until the capacity is created to deliver and implement the initiatives outlined in this Strategy, it is unlikely that the speed of progress which is now required will eventuate.

Under the current capacity, Eco-Service would continue to provide primary collection services, and on-sell recyclable materials for which there is a current market. As well as this, there would be ongoing development of composting technologies on a de-centralised scale. Improvements would continue to occur over time in waste education, as a small number of individuals utilise new curriculum resources and raise awareness of waste management issues through their individual commitment to sustainable waste management.

Despite these efforts the quantity and character of the waste stream will begin to exert pressure on the current infrastructure and service mechanisms. This process has already commenced. For example, the Waste Storage Facility will be at full capacity within the next 12 to 18 months. Without the development of

²⁴ For example, wastes produced by the MatriMandir workshop are currently stockpiled on site.

an alternative strategy for residual waste disposal, Auroville will reach a crisis point in terms of residual waste disposal. It is vital that the next 18 months be utilised to resolve this situation.

Auroville will need to increase its solid waste management capacity if it is to manifest its ideals of environmental sustainability. Through developing skills and resources, Auroville could serve as an example for other rural communities in India. This will not occur under the current scenario.

3. ORGANISATIONAL STRUCTURE

3.1 PROPOSED ORGANISATIONAL STRUCTURE

Solid waste management is an essential service, in the same way that the provision of clean water is an essential component of a community's infrastructure. Eco-Service is an existing entity that has stood the test of time and built a solid reputation for reliability. It is logical then to expand its management and capability to deliver this essential service. In order for this to occur, it is recommended that Eco-Service initially employs a full time co-ordinator. In addition to this position, within 6 months an extension officer should be employed to assist in the implementation of the AV Solid Waste Management Strategy and the Village Waste Management Strategy.

A well managed and fully integrated waste management service is one which actively engages all segments of the community. This approach will avoid the development of a top down management model, which risks operating in isolation from the people whose participation will be the key to its success.

We are recommending an organisational structure that incorporates a mechanism for ongoing participation from those people who have a genuine interest in waste management. To facilitate this, we recommend that a Waste Management Task Force be created to assist the co-ordinator in the ongoing delivery of the Solid Waste Strategy.

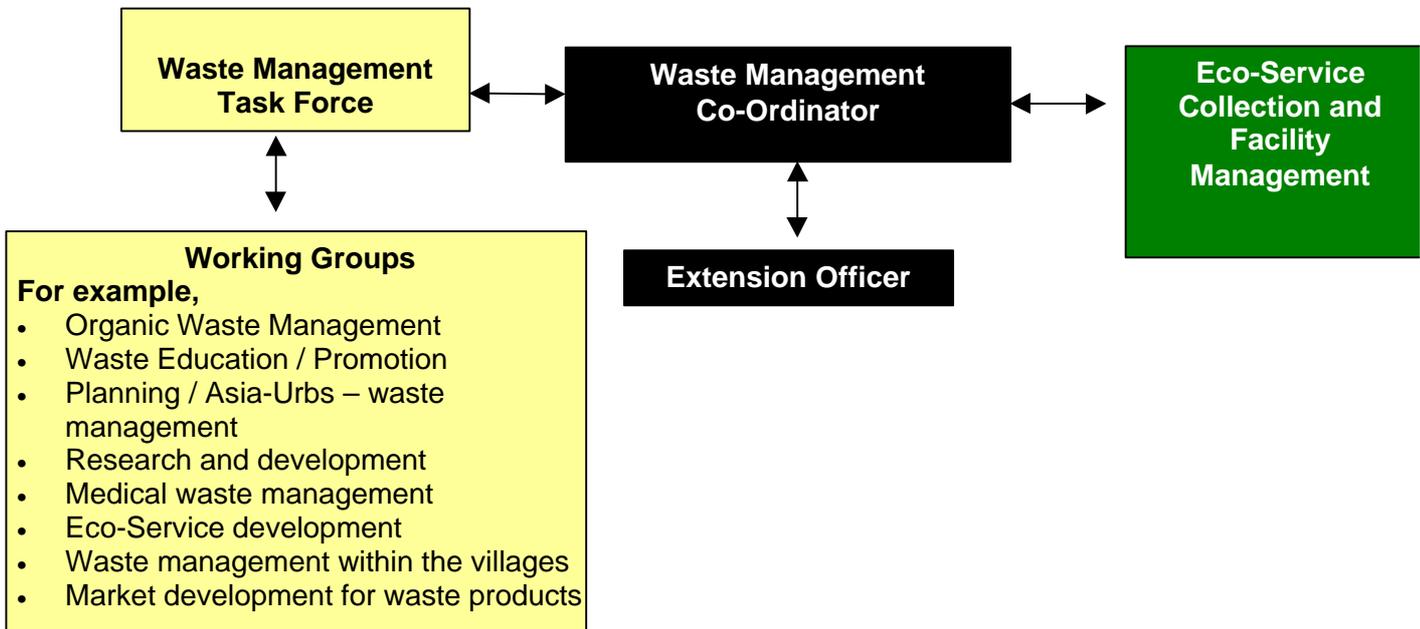
The Waste Management Task Force will consist of people with a commitment to improving waste management infrastructure and services. It is highly recommended that people working with waste management issues, such as composting or research and development, participate in this group. It is also important that the Task Force has clear objectives, and that people are participating in a forum that is actively involved in making positive change and achieving practical outcomes.

One option for the structure of the Task Force is a composite of working groups or individuals working on specific issues. These groups may only comprise of 2-3 individuals, working on issues such as:

- Organic waste management

- Waste education
- Industrial development and waste management planning
- Research and development (eg waste to energy)
- Medical waste management
- Waste management within the villages
- Market development for waste products

Under this model, people would be contributing within the areas of their expertise or interest. However, they would not be working in isolation, as on a regular basis, the Task Force would come together and report on progress (eg on a quarterly basis). The meetings would be outcome driven, with an emphasis on implementing components of the Waste Management Strategy.



3.2 ROLES AND RESPONSIBILITIES

Eco-Service

Purpose: *To further develop the capacity of the city of Auroville to minimise the production of waste and to manage the residual waste in an environmentally sustainable manner. This would be achieved through the implementation of the AV Solid Waste Management Strategy.*

For the initial start up period, it is recommended that Eco-Service operates with two staff – a full time co-ordinator and within six months, a part time extension officer.

The following is an outline of their roles and responsibilities.

Eco-Service Co-ordinator (See Appendix A for full job description)

- Operates autonomously and over sees the practical implementation of the Waste Management Strategy.
- Budgeting and financial management of Eco-Service.
- Accessing funding opportunities for implementation of the Strategy, and developing sustainable economic management models for its long term operations.
- Key contact person for other waste managers in India and for various authorities such as the Tamil Nadu Pollution Control Board or the Pondicherry Municipality.
- Management and business development of Eco-Service waste and recycling collection services.
- Exploration of opportunities for new micro enterprises in resource recovery.
- Liaison with educators in Auroville and village schools, developing waste management education materials and programs
- Co-ordination of the Auroville Waste Management Task Force, and liaison with the various Working Groups
- Working co-operatively with research and development organisations to research sustainable waste management opportunities

Extension Officer

- Development of waste management plans for individual business and service units in Auroville
- Researching and implementing improved colour coded bin system for clear source segregation and collection.
- Assistance to communities in setting up waste management and recycling infrastructure
- Assistance to communities in setting up compost systems, or trouble-shooting problems within existing systems.
- Working with AVAG, NGOs such as Exnora, the village Health Workers and village leaders to develop appropriate waste management infrastructure, services, and educational programs within the village environment.

It is envisaged that Eco-Service will continue to grow as various opportunities develop over time.

WASTE MANAGEMENT TASK FORCE AND WORKING GROUPS

Purpose: *To assist Eco-Service in the implementation of the AV Solid Waste Management Strategy, ensuring the practical implementation is appropriate and effective.*

The model of a Waste Management Task Force will provide a means for the appropriate human resources and skills to be harnessed for the development components within the Strategy. Group members will be focussed on achieving specific goals rather than a being engaged in a forum for philosophical debate. As new issues arise, these will be dealt with professionally, and *within the context of the overall direction of the Strategy.*

A member of the Waste Management Task Force will necessarily be a member of a working group attending to a specific task. A working group may consist of one Task Force member who works with the waste management co-ordinator on a specific segment of the strategy. A working group may also consist of several members, one of which represents the group as a Task Force member.

In terms of accountability, members of a working group will be accountable to the agreed Task Force member for that area of interest. The Task Force member will be accountable to the waste management co-ordinator who is ultimately responsible for implementing the strategy. It should be stressed *that the Task Force does not and will not act as a management committee* which directs the waste management co-ordinator or Eco-Service employees in their daily operations. It is the Strategy which guides the actions and directions of Eco-Service, not the Task Force or particular individuals.

Roles and responsibilities for the Task Force and the Working Groups will be:

Waste Management Task Force Members

- Develop discreet components of the Waste Management Strategy under the guidance of the waste management co-ordinator and in the context of the waste management strategy.
- The task force member will act as the key contact for the specific working group.
- The provision of support for the waste management co-ordinator and extension officer in their respective roles.
- Contribute to the Strategy review and development process at various times in the future.

Working Groups

- Develop discreet components of the Waste Management Strategy in close collaboration with Eco-Service and its supporters.

- This will involve sharing ideas and research findings on information on various technologies and successful waste management models.

4. PROPOSED ACTIONS

There are a number of tasks envisaged for improving existing facilities and services, as well as developing new opportunities and resolving issues. The recommended actions are presented for facility improvements, service development, improving specific areas of waste management, and finally recommendations for developing new solutions.

4.1 INFRASTRUCTURE IMPROVEMENTS

Kuilapalayam Sorting / Storage Facility	
Construct 2 metre high brick fence with lockable steel gate around site to provide security when the depot is not staffed, and to provide relief from visual impacts.	Short Term
Access road repositioning and drainage works around depot	Short term
Yard to be levelled to provide an adequate working surface.	Short Term
Yard to be re-organised so that there is a loading/unloading area, a sorting area, a baling area and a material storage area.	Short Term
Landfilled waste in lateral canyon gully to be excavated, baled, and transported to the central waste storage facility. If this is not practical, then it can be used to fill the small land depression adjacent to the sorting facility.	Short Term
Install small water tank.	Medium Term
Plantings for shade provision and site beautification.	Medium Term
Investigate alternative sites for the relocation of the facility to a location that has a greater available land area, and is more suitable from a storm water management and buffer zone perspective.	Long Term
Kottakarai Sorting / Storage Facility	
Arumugam is to utilise the Storage Facility in the industrial area for sorting and baling recyclables and residual waste, reducing double handling and transportation. With improved facility layout, and supervision, the facility is to be operated in an efficient and clean manner.	Short Term

Waste Storage Facility in Industrial Zone	
In order to free up much needed floor space in the Storage Facility, the residual waste requires baling and stacking. This will be undertaken using the current hand baling equipment. This baling and compaction of waste will free up a considerable amount of floor space within the facility.	Short Term
Reorganise the interior of the Store Room to facilitate improved management of hazardous wastes. The waste categories for separate storage will be residual baled waste, batteries, incinerator ash, solvent containers, fluorescent tubes, PET, rubber, and leather.	Short Term
To reduce the risk of fire, provide greater security and mitigate visual impact, install fly screening and tin sheeting on the existing steel door frames.	Medium Term
A hand washing facility and water tank to be installed.	Medium Term
Security to be upgraded – front steel gate requires strengthening and provision of locking mechanism.	Short Term
Eco-Service to develop clear operating and quality control procedures for the facility, training staff, and supervising the standard to ensure proper management.	Medium Term – ongoing
Medical Waste Incinerator	
The incinerator should be tested for compliance with the Medical Waste (Storage and Handling) Guidelines to confirm that the incinerator meets national standards. Flue emissions and ash testing for residual pollutants are a component of this process. Based on the test results and advice from TNPCB, decision to be made regarding continued operation or phasing out of its use.	Short Term
Flue gas and bottom ash to be tested for dioxin and furan levels. In consultation with testing laboratory, TNPCB, and external expertise if necessary, determine whether emission levels are acceptable. If unacceptable, investigate pollution control devices or commence implementation of alternative system and phase out of incineration.	Medium Term
Modifications to be made to the incinerator to facilitate gravity feed loading to prevent contact with infectious waste through current hand loading system.	Short Term
Insertion of a steel grate to facilitate increased air flow into combustion chamber.	Short Term
Modify the primary combustion chamber so that ash falls into an ash box which can be emptied easily prior to each new burn.	Short Term
A clearly marked steel container should be purchased for the storage of cold ash. The ash is to be collected by Eco-Service on a fortnightly basis and transported to the Hazardous Waste Storage Facility where it is stored in a special bunker. Periodically, this ash should be mixed with cement and used as a fly ash binder.	Short Term

A secure storage area should be constructed adjacent to the incinerator. The storage area should be organised with signage and clear colour coded bins for waste segregation. The container for the storage of infectious waste should be clearly marked with the BioHazard symbol, and support an airtight lid.	Short Term

4.2 SERVICE IMPROVEMENTS

Eco-Service Waste and Recycling Collection	
Legal Standing: The Eco-Service co-ordinator to enter into a formal written agreement with the collectors, where the roles, responsibilities, mutual obligations and consequences of non-compliance are clearly outlined. A formal lease agreement should be entered into with Eco-Service collectors for the annual use of Eco-Service facilities.	Medium Term
Data Collection: The current system of data recording be modified so that more accurate waste data can be captured at the point of collection by Eco-Service. In addition to this, baled residual waste should be weighed periodically and weights recorded. Quantity of all bales should be recorded before final disposal.	Short Term
Transport Selection: As soon as solar vehicles become economically and practically viable, Collectors are to be provided with the means to convert to this technology or purchase these vehicles as a matter of priority. Eco-Service shall facilitate this technology upgrade.	Long Term
Occupational Health & Safety: Eco-Service collectors must operate and provide their employees with basic workplace Personal Protective Equipment such as gloves, vaccinations and yearly health check ups. This condition will form a part of the Eco-Service agreement with the service collectors. An effort will be made to educate Aurovilians to refrain from placing hypodermic needles, sanitary napkins, and household medical waste in their mixed or separated waste bins unless in a specific recognisable sealed medical waste bag.	Medium Term
The current system of emptying bins by hand should be replaced with a safer and more efficient materials handling procedure. A colour coded bin system where the customers bin is tipped into a container of similar colour on the collection vehicle would be ideal. Alternatively, bins could be lined with a suitable bag (hessian or jute) which is simply exchanged when full. The bags would be colour coded to identify the contents of the bag.	Medium Term
The collectors should utilise a hand cart or collection trolley where they are able to stack and transport multiple bags, scales, and other pieces of equipment. This will ensure grater efficiency and reduce the risk of back injury to staff members.	Medium Term
A logo to be developed for Eco-Service.	Medium Term
Eco-Service collectors to be provided with work clothes displaying the Eco-Service colours and logo.	Medium Term

Regular Opening Hours: Eco-Service collector at Eco-Service depot at Kuilapalayam to introduce regular opening hours each week. This will allow Aurovilians the opportunity to drop off recyclable and residual waste at a staffed facility in addition to collection by the regular collection service.	Medium Term
Source Separation: change current categories from 'separated' and 'unseparated' to categories that more closely reflect the materials rather than the activity. For example, the categories could be 'recyclable' and 'non-recyclable' or 'recoverable' and 'residual' or 'recyclable' and 'rubbish'. The charging system will impose a higher cost for waste that is unable to be recycled. Waste that has not been separated or is highly contaminated will also be charged at the higher rate. This new system should be introduced in conjunction with a major re-education program in respect to source separation.	Medium Term

4.3 WASTE MANAGEMENT SYSTEM IMPROVEMENTS

Waste Avoidance	
Eco-Service will assist all business and service units to develop and implement a waste management plan. A cleaner production approach will be employed to avoid waste as the first priority, as well as to improve source separation and safely handle hazardous wastes.	Medium Term
All proponents of new development applications to be assisted by Eco-Service to incorporate waste management planning as an integral part of the development application process.	Short Term & Ongoing
As the main shopping site in Auroville, Pour Tous has the opportunity as part of its relocation to become a zero waste outlet. Eco-Service will offer their resources in developing methods to sell products by refillable containers rather than individually packaged items. With a new store layout, products such as liquid detergent should be sold from a bulk container, with customers filling their own or recycled containers. Eco-Service will also work with suppliers to discuss changing packaging practices in innovative ways that do not threaten product hygiene or quality.	Medium Term
Reuse	
Mahasaraswati's Free Store to expand stock turnover through accepting or purchasing industrial discards from business units that can be reused.	Short Term
Eco-Service will develop an intranet waste exchange data-base. Users will list items available for trade, and materials wanted under a broad range of categories. The Free Store could supply a weekly listing as a means of advertising stock.	Medium Term

In designing a new expanded Mahasaraswati's Free Store, consideration to be given to elements such as loading and unloading, processing and value adding through repair, racking systems, and material display.	Long Term
Eco-Service to fully take over the role of jar and bottle collection and the deposit refund system, providing a more convenient service to customers, and freeing Naturellement from this service. Other units reusing packaging should also be encouraged to utilise the existing collection and sorting service rather than individual schemes that make participation more difficult.	Short Term
Recycling	
Investigate and document the "recycling chain". Determine where the collectors are selling their materials, and each transaction after this point.	Short Term
For each recyclable material, determine if greater returns can be achieved through stockpiling larger quantities and selling direct to end processors.	Short Term
For each recyclable material, investigate the economics of installing value adding infrastructure such as plastic shredders, in order to sell a more valuable product.	Medium Term
R&D: Investigate and develop technologies to produce end products from plastics, such as inert building materials.	Long Term
For materials such as rubber, PET, polystyrene foam etc, stockpile at Store Room in Industrial Zone until viable markets can be found. Eco-Service will actively seek out end uses for these materials.	Short – Medium Term
Organic Waste Management	
As a part of the Waste Exchange database, people who are involved in active composting and are seeking to increase output can list themselves as seeking organic resources. Also, people with less time or motivation for composting can list their organic resource, quantity and location of material available. Through this process, better utilisation of organic resources will be facilitated.	Medium Term
Eco-Service to offer advice on the design and management of compost systems; as well as offering a trouble shooting service.	Medium Term
Eco-Service to develop relationships with waste managers and composters in Pondicherry. Working co-operatively with these waste managers will provide opportunities for Auroville's sustainable agriculture endeavours.	Long Term
Sewage Sludge Management	
AV Water Service to improve current management practices utilised for this material. Management options are to be addressed by an external consultant to develop appropriate technologies and operating practices. (As per AV Water Service current plan).	Medium Term
As part of the consultancy brief, the use of EM technologies to treat the sludge and to minimise odour should be part of the research and development process.	Medium Term

Reuse of the sewage sludge resource through composting technologies is to be encouraged by Eco-Service and the Task Force.	Medium Term
As a pre-cautionary measure, end products to be utilised in forestry and garden development, as opposed to organically certified produce. End products to be periodically tested for contaminants.	Long Term
Sludge reduction methods to continue to be explored through increasing the use of reactor tanks, and avoiding the use of soak pits.	Ongoing
Construction and Demolition Waste Management	
Develop a construction site waste management model. Work with AV Roads to ensure end products are of maximum quality for reuse.	Medium Term
Promote this model amongst AV's building contractors.	Medium – Long Term
As each new development commences, promote this model with the developers and contractors, and seek their co-operation for waste segregation.	Medium – Long Term
Register stockpiles of rubble on the Waste Exchange Database as a resource available for reuse.	Medium Term
Establish appropriate sites for the interim storage of construction and demolition wastes to be used as resources for road building or clean fill. The first of these sites to be established as a pilot at AV Roads depot.	Short Term
Investigate the viability of using crushing and screening equipment to produce higher value construction materials.	Medium Term
Residual Waste Disposal	
As a matter of priority, establish a small landfill facility for the burial of residual waste, and special wastes such as asbestos sheeting and treated medical wastes.	Short Term
As a part of the planned hydro-geological and GIS survey to be undertaken in the future, determine the most environmentally appropriate areas within Auroville for waste stabilisation and landfilling. Consideration must also be given to issues such as water management, and compatibility of surrounding uses.	Medium Term
Conduct an Environmental Impact Assessment on the identified site, addressing all criteria as set out in MoEF Guidelines for Location and Operation of Land Fill Sites. Also develop a day to day site operations and management plan for the site to ensure it is operated according to sound pollution prevention principles.	Medium Term
Bale and stack all residual waste in the storage facility while final disposal options are further explored. Residual waste quantities will be measured on a weekly basis in order to accurately determine waste generation for Auroville.	Short Term
R&D: Instigate a research and development project for developing low technology residual waste disposal solutions appropriate to less economically developed countries. The areas of the most promise in disposal research are; 1) Investigating the use of EM for waste stabilisation, making waste inert prior to landfill, thereby reducing risks of leachate and groundwater contamination.	Medium Term

2) The development of compressed waste technology for use in the building and construction industry. 3) Energy from waste technology appropriate to developing countries, particularly those where landfilling is not feasible.	
In addition to establishing a secure landfill in Auroville, investigate the possibility of the long term utilisation of the proposed scientific landfill being planned for the Oulgaret municipality in the Union Territory of Pondicherry.	Long Term
Medical Waste Management	
One person on Health Centre staff to be made responsible / accountable for the efficient and safe operation of the incinerator, ensuring all safety and environmental standards are complied with.	Short Term
All PVC plastic medical waste should be sterilised in the Centre's autoclave. Once cleaned and sterilised, the plastic should be ground using a small shredder and recycled.	Medium Term
The Health Centre autoclave requires replacement in the medium term, as it is reaching the end of its useful life.	Medium Term
Staff require retraining in source separation to reduce the amount of material being burnt. The Mumbai Medi-waste Action Group have developed in house training modules for this purpose which Eco-Service will deliver as part of its education program.	Short Term
Training needs to be complemented with a review of waste segregation infrastructure. Colour coded bins and clear signage (using symbols and words) would greatly assist in reducing unnecessary burning of waste.	Short Term
Develop relationship with waste managers at JIPMER hospital in order to share information and explore opportunities for utilising JIPMER facilities.	Medium Term
Introduce special colour coded sealed bags for the storage of household medical wastes. These sealed bags will be placed in the unrecyclable or residual waste barrel/bin at each community. These sealed bags can then be safely separated for final disposal.	Short Term
Hazardous Waste Management	
An inventory of existing hazardous wastes to be completed by Eco-Service.	Short Term
All hazardous wastes produced by business units must be clearly labelled, and have accompanying technical data such as MSDS (material safety data sheets) produced by the manufacturer wherever possible. Eco-Service in consultation with the producer and TNPCB, will develop handling, storage and disposal plans for each of these wastes. As a key part of this process, material substitution options are to be fully explored.	Short Term
A secure storage area for the interim storage of hazardous waste to be constructed on site at the Matrimandir. This building/compound should be protected from the elements and locked. The building must be clearly labelled with appropriate signage, and all contents labelled and stored safely. The design and construction of the hazardous waste storage area will be carried out in conjunction with a specialist from TNPCB.	Medium Term

As a trial, a levy be placed on dry cell batteries sold by Auroville retailers with the funds being utilised by Eco-Service to assist with the safe storage and disposal of batteries.	Medium Term
Education	
Eco-Service to facilitate teacher trainer sessions for interested teachers from each school. The sessions would exchange ideas, disseminate information and inform of educational resources available and assistance to set up internal waste management programs.	Medium Term
Eco-Service to assist schools establish school waste management systems, including composting/vermi-composting programs, and waste separation.	Medium Term
Eco-Service to develop an educational display regarding what wastes are recyclable/reusable, what waste are not, and their current destination. The emphasis of the display is on what consumers can do to minimise their impact. An emphasis on the hazards of burning domestic waste should be included, as well as wastes that should be avoided such as asbestos and batteries, as well as unnecessary packaging.	Medium Term
Eco-Service to publish regular articles in Auroville News to raise awareness regarding various waste management issues amongst the broader community.	Short Term & Ongoing
When the Eco-Service collection categories are changed, produce an educational flier for the community explaining the changes, and describing which wastes are recyclable, and which are rubbish. Over a three month period, follow up by arranging waste information and planning sessions for each community to implement a standardised clear separation system.	Medium Term
Eco-Service to manage a 'zero waste' awareness and education campaign within Auroville. This includes setting of waste reduction targets for the community, and monitoring and reporting on progress.	Medium Term
Development of an Eco-Service web page which covers all aspects of the organisations activities. Include current projects, education initiatives, list of Eco-Service personnel, waste planning and strategy information, information on all aspects of solid waste management.	Medium term

4.4 FUNDING

Capital Funding

The capital funding required for the first stage of the process will be minimal. The main costs will be:

- Establishment of Eco-Service office
- Improvement of Kuilapalayam sorting and storage facility
- Baling of waste in storage facility, and facility reorganisation
- Improvements to medical waste incinerator and surrounding infrastructure

- Hazardous waste interim storage facility at Matrimandir

Once Off Project Funding

Additional expenditure would be required for:

- Training and development of Eco-Service staff
- Establishment and Implementation of two R&D projects
 - Waste disposal technologies
 - Plastic recycling technologies
- Development of waste education resources
- EIA process and establishment of landfill site

Capital funding may be secured through external funding, or through low interest loans. Over the longer term, the aim should be to develop Eco-Service to be financially independent through fee for service and the improved utilisation of resources within the waste stream.

Recurrent Funding

It is envisaged that funding for recurrent expenditure such as wages and administrative costs will come from three main sources:

User pay fees

This has already been established through the Eco-Service collection model, with people paying a fee for each bag of waste collected. Eco-Service currently produces an operating surplus, which is utilised for the ongoing establishment of infrastructure.

Through placing a greater emphasis on full cost recovery, particularly for industrial wastes and non-recyclable household waste, it is recommended that this revenue source could be increased over time without an undue financial burden on the users of the service.

Central Fund

Support from the Central Fund on a monthly basis is suggested as the second long term mechanism for funding. As an essential service for the community of Auroville, there is a sound case for the Central Fund providing maintenance on an ongoing basis. For guests and tourists, this is often the only mechanism for financially contributing to Auroville. However, the costs of collecting and processing the wastes they leave behind are currently not covered. It is reasonable to use some of their contribution to fund waste management and ongoing waste education.

As a Partner in Micro Enterprises

Eco-Service will have the ability to incubate and gain seed funding for the establishment of micro enterprises. These enterprises, which will concentrate on value adding recyclable material, will be in a position to share profits from their activities in support of Eco-Service.

4.5 TIME LINE

2001

- Finalisation of AV Waste Strategy
- Development of Waste Management Task Force, and employment of Eco-Service co-ordinator
- Establishment of Eco-Service office
- Infrastructure improvements to Storage Facility in Industrial Zone, Kulilapalayam sorting depot, and medical waste incinerator
- Establishment of framework and funding for two R&D projects in plastic recycling and residual waste disposal
- Potential landfill sites identified

2002

- Employment of Eco-Service Extension Officer
- Commencement of all short and medium term tasks identified in AV Solid Waste Strategy
- Landfill Environmental Impact Assessment completed
- Landfill to be constructed and ready for use
- Household and business/service unit participation in source separation to have increased from 66% to 75%

2003

- R&D projects completed with recommended solutions for implementation
- Strategic review of Waste Strategy by Task Force and Eco-Service
- All short term tasks completed
- All long term tasks commenced

2004

- All medium term tasks completed

2005

- All actions from the Strategy completed
- Comprehensive review and development of solid waste strategy for next 5 years.
- Household and business/service unit participation in source separation to have increased from 75% to 90%

APPENDIX A

DRAFT JOB DESCRIPTION – MAY 2001

POSITION: Eco-Service Co-ordinator

LOCATION: Auroville

OBJECTIVE:

The Eco-Service Co-ordinator will develop and operate a waste management service for Auroville, through the implementation of the AV Solid Waste Management Strategy. The co-ordinator will manage and facilitate a number of programs aimed at minimising the production of waste, maximising resource recovery and managing residual waste in an environmentally sustainable manner. The Co-ordinator will operate autonomously, but work collaboratively with a Task Force who will assist in the delivery of various components of the Strategy. The Co-ordinator will be AV's primary contact for all matters relating to solid waste management.

KEY RESULT AREAS:

1. Practical implementation of the Solid Waste Management Strategy, commencing and completing various programs within the specified time frames.
2. Supervision and development of all staff within Eco-Service
3. Co-ordination of the work undertaken by the Task Force, working directly with members to achieve specified outcomes.
4. Effective communication and information management.
5. Budgeting and financial management.
6. Administration of Eco-Service
7. Development and maintenance of relationships with community and all relevant solid waste management agencies.
8. Raising awareness of the work of Eco-Service and waste minimisation through innovative educative campaigns that reach all sectors of Auroville.

RESPONSIBILITIES, DUTIES AND ACTIVITIES

1. *Practical implementation of the Solid Waste Management Strategy*
 - In each area of the Strategy, develop a time line for each task, and delegate responsibilities for various components to relevant working groups.
 - Establish Research and Development projects in the fields of residual waste disposal options and developing micro-enterprises to recycle plastics. Research and development will be undertaken in close collaboration with the Centre for Scientific Research. CSR will act as a

project manager, assisting to identify partners, build a project team, structure the program and monitor progress and results.

- Monitor progress of the Strategy implementation, and undertake regular reviews to ensure all facets are being undertaken within the recommended time frames.

2. *Supervision and development of staff*

- Develop high operating standards and clear responsibilities for Eco-Service collectors, and ensure that these standards are maintained through providing appropriate levels of supervision.
- As Eco-Service grows, select new staff and provide appropriate training. The Co-ordinator will develop job descriptions, co-ordinate the interview selection process, and ensure quality training is undertaken.

3. *Co-ordination of the Working Groups and Task Force*

- Work closely with the working groups to undertake each of the identified tasks.
- Each quarter, facilitate a meeting of the Task Force to share reports on progress and determine ways to resolve any issues.

4. *Effective Communication*

- It is the Co-ordinator's role to ensure all participants are clear as to what the work expectations are, and what tasks they are required to undertake.
- The Co-ordinator will effectively build relationships and work co-operatively with external organisations such as the Pondicherry Municipality, the Tamil Nadu Pollution Control Board, and Exnora.

5. *Budgeting and Financial management*

- The eventual goal is for Eco-Service to be self funding. This will require careful budgeting and financial management, as well as creative approaches to developing further revenue streams, such as developing profitable micro-enterprises from resources within the waste stream.
- The Co-ordinator is to seek external funding resources where appropriate in order to undertake specific components of the Strategy, particularly in the implementation phase.

6. *Administrative management*

- The Co-ordinator will manage Eco-Service in a professional manner, and build institutional strength and human capacity. This will ensure all contributors can work effectively within a clear and logical framework.

7. *Relationships with the community and external agencies*

- The Co-ordinator is responsible for following up complaints, and working to resolve issues efficiently and fairly.
- The Co-ordinator will be the key contact person for waste management issues with external organisations. Developing a network of waste management professionals and agencies working in the area is important for collaborative projects, and for building resources to advise on specific issues. This network will also be important in identifying new opportunities for Eco-Service.

8. *Raising awareness of the work of Eco-Service and strategies for waste minimisation*
- Publicise and promote the work of Eco-Service within Auroville, seeking community support for sustainable waste management practices. Innovative community education programs and awareness raising campaigns will be an essential component of the Strategy, and a core part of raising the profile of Eco-Service.

ESSENTIAL SKILLS / EXPERIENCE

- Excellent communication skills – both written and verbal, and excellent listening skills
- Skills to manage Eco-Service profitably, and in a financially responsible manner.
- Organisational skills – the ability to set work programmes and achieve them within projected time frames
- The person will be innovative, and able to develop opportunities, particularly for micro-enterprises.
- A commitment to environmental sustainability
- Management and/or supervisory experience
- Enthusiasm and humility

PREFERRED SKILLS / EXPERIENCE

- Fluent in Tamil and English
- Waste management experience
- Business management experience

BIBLIOGRAPHY

Auroville Health Centre (2001): *The Gita of Waste*. Auroville Health Centre. Auroville India.

Auroville Master Plan (2001)

Baud, Isa; and Schenk, Hans (1994): *Solid Waste Management Modes, Assessments, Appraisals and Linkages in Bangalore*. Manohar Publications. New Delhi.

Coad, Adrian (2000): *Aid going to waste – and worse*. SKAT Waste Management Infopage. No 5. March 2000.

Committee constituted by the Hon. Supreme Court of India (1999): *Solid Waste Management in Class I Cities in India*

Dengel, Lucas (1998): *Project for Garbage Collection and Composting in Kulilapalayam*. Interim progress report to GTZ, Small Projects Fund, September 1998.

Dengel, Lucas (2000): *Solid Waste Management and Alternatives for Pesticide Use in the Pondicherry Region*. Published in “Pondicherry Environment at the Dawn of the New Millennium”. Pondicherry Pollution Control Committee.

Down to Earth: *Plastic Unlimited*. December 15, 2000. Pg 20 - 23

The Hindu (2001): *All corporations asked to curtail the use of plastic items*. March 8th, 2001.

Kampsax India Limited (2000): *Development of Scientific Solid Waste Management Yard at Mettupalalyam*. A report for Oulgaret Municipality, Local Administration Department, Pondicherry.

Mumbai Medwaste Action Group (1998): *Medical Waste Factsheet*. September 1998.

Tamil Nadu Pollution Control Board (1999): *Pollution Control Legislations*. Chennai.