



## INDUSTRIAL WASTE MINIMISATION PROCEDURES FOR WASTE ASSESSMENT

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### INTRODUCTION

#### Background

Production of consumer and industrial products can result in large quantities of waste. These materials, if improperly dealt with, can threaten both public health and the environment. Awareness of environmental problems is increasing. No one wants a waste treatment plant or landfill site in their vicinity. Hence the disposal of waste is becoming increasingly more difficult and costly. For example, landfilling, which has been a traditional option for industrial waste disposal, is now becoming a less desirable means of dealing with waste because of environmental concerns. Alternative disposal techniques, such as incineration, are very costly.

By reducing the quantity of material lost from the production process or recovering energy and materials, the costs associated with waste disposal can be significantly reduced.

#### The Waste Minimisation Policy

In 1986, the Victorian Government adopted an Industrial Waste Strategy which provided a framework for the proper management of hazardous industrial wastes and recommended statutory and non-statutory measures to control industrial waste.

New technologies will enable industries to recover valuable materials from their waste streams and to reduce or eliminate waste generation. However, depending on the factory operations, there will be many different types of waste streams originating from various industries.

Although an industry will have a general perception about the types and quantities of waste in its waste streams, an overall waste assessment of the company's operations will enable it to identify options for minimising wastes and reduce the potential liabilities associated with handling and disposing of wastes.

The Victorian Industrial Waste Management Policy (Waste Minimisation) was adopted in November 1990. The policy identifies the 'waste audit' or waste

assessment, as being the first step towards waste minimisation. Waste assessments are the starting point in the search for ways to minimise waste. The value of waste assessments is being recognised by Victorian industry. Already there are more than fifty Victorian manufacturers conducting waste assessments.

#### Waste Minimisation Projects

A proper and thorough waste assessment, followed by a carefully considered waste management plan, will on most occasions produce savings and improve operating efficiencies whilst protecting the environment. This process is known as waste minimisation or cleaner production, and provides industry with a 'win-win' situation, a win for the environment, and a win for industry through improved efficiencies. Details of successful local waste minimisation projects have been prepared as case studies. Details are available from EPA to assist companies to minimise their wastes.

#### Purpose of the Industrial Waste Assessment Document

This document has been prepared to assist people to carry out systematic waste assessments. Although assessments can be conducted in a number of ways, it is important for management to be aware of the options before selecting one particular approach.

In this document we adopt a simplified approach to waste assessment, using modest resources, based on methods developed in the USA.

### WASTE ASSESSMENTS

#### Benefits of a Waste Assessment

A waste assessment is an essential starting point for identifying waste reduction opportunities. An assessment can identify housekeeping problems and operating inefficiencies that cost little to correct. It can also provide information necessary to assess the potential value of implementing technologies that require significant capital investment. Opportunities will be identified that will result in cost savings and improved efficiencies.

Using the waste assessment results, the waste generator can:

- save money by reducing waste treatment, raw materials, and other operating costs
- reduce potential environmental liabilities and meet statutory obligations to protect the environment
- protect public health and worker health and safety

### **Objectives**

The objective of conducting a waste assessment is to identify each and every gas, liquid and solid waste stream leaving the industrial premises, to quantify how much is being discharged, to calculate the costs incurred through pre-treatment, storage, handling and disposal, and to determine the liabilities associated with the generation of those wastes.

Results of the waste assessment will enable the preparation of the waste management plan and help to identify the best options for effective waste management.

## **COMMENCING THE WASTE ASSESSMENT**

### **Procedures**

For a waste assessment to be successful, it must be comprehensive. The critical elements of a successful waste assessment program are:

- management commitment
- personnel involvement
- access to background data
- resources to obtain additional data.

The full commitment of management is necessary to perform a comprehensive waste assessment. Without that commitment the project simply becomes a paper exercise that achieves little actual waste reduction.

A comprehensive study of a company's wastes requires not only characterisation of the various waste streams, but also examination of raw material use, production processes and schedules and waste handling methods.

A waste assessment project can be divided into the following steps:

- selection of assessment team
- project scope
- preparation for assessment
- data collection
- report
- communicating results
- evaluation of waste reduction opportunities
- preparation of waste management plan.

### **Selecting the assessment team**

The assessment team will comprise a dedicated leader and several active and knowledgeable members. Its exact size will be determined by the

expected time span of the project, staff availability and the size and complexity of the plant.

The leader should have solid technical credentials as well as proven problem-solving abilities. The Works Manager or Production Manager would be suitable candidates for the team leader. The team leader will be responsible for organising the team and assigning duties. The leader will conduct reviews, control the schedule and develop the scope of the project.

The team leader is responsible for keeping the project team on schedule. This can be accomplished by a series of reviews. For example, the project team might meet weekly. It is also useful to maintain a record of meetings and discussions. If possible, the waste assessment should be undertaken by a team consisting mainly of plant personnel and should involve every employee at some stage during the project.

The project team will ideally be composed of:

- site or works manager as the leader
- production manager or technical manager
- environmental engineer or officer
- supervisor with hands on knowledge of how the process is actually conducted on a day-to-day basis
- outside consultant assessor.

The project leader makes sure that the project team is given enough authority to gain access to all required technical documentation and to a wide range of people inside and outside the organisation. The team should include at least one 'outsider' who will be able to help spot and avoid inbred plant biases.

If the facility being assessed is small, it may be that just one person, such as the plant manager or the process chemist could carry out the assessment work alone. The results should then be overviewed by an outsider or other independent person.

It must be remembered that most good ideas for cutting wastes will come from the shop floor. Workers should be encouraged to make suggestions, and management should reinforce the message that all suggestions will be welcomed.

If the company lacks the technical capabilities, knowledge of environmental control and regulation to carry out a waste assessment, an experienced private consultant should be hired. Professional staff of the EPA's Cleaner Production and Waste Management Branch are also available to provide assistance with waste assessment procedures and the preparation of waste management plans. Telephone (03) 9628 5111 or (03) 9628 5070.

### **Project Scope**

The assessment team should decide on the facilities to be assessed by discussing the company's waste generation problems, and then

identifying those production processes that contribute to waste generation. The success of a waste assessment depends on the cooperation of all personnel within the facility, so it should be stressed that the assessment is not a fault-finding exercise. The team should ensure that the staff are informed about the assessment project and understand the project objectives.

### **Preparation for the Assessment**

All the existing background information on the plant's operation is collected. Much of the information necessary to perform a waste assessment may already exist, although such information is not always readily available.

When all the sources of information are located, they should be updated to indicate the actual status of the selected plant. The team leader should ensure that the whole team is familiar with the operations of the selected facility. A simplified flowsheet could be used for this purpose.

### **Sources of Information**

- design information
- process flow diagrams
- materials and heat balances of the processes
- operating manuals and process descriptions
- equipment lists
- equipment specifications
- plan elevation and layout of plant
- raw material/production information
- product composition and batch sheets
- product and raw material inventory records
- operator data logs
- operating procedures
- production schedules
- material safety data sheets
- environmental information
- waste transport certificates
- emission inventories
- waste analysis reports
- license and works approval
- compliance records
- economic information
- waste treatment and disposal costs
- product and raw material costs
- water consumption and costs
- energy consumption and costs
- operating and maintenance costs.

### **Suggested Worksheet Titles**

Separate worksheets should be used during the data collection process. Some suggested titles are:

- plant information
- site description
- input material summary
- products summary
- characteristics of individual waste streams
- summary of waste streams
- flow diagrams
- material balances
- checklist of frequently occurring incidents.

### **Data collection**

#### **(a) Stage 1**

When all the required information is assembled the project team can start the actual assessment. During this stage, the data collected will be on the input materials, products, and the waste streams from the available sources identified above.

Consider the following points in identifying and characterising the input materials, products and waste streams:

- reviews of process flow diagrams, piping and instrumentation diagrams and material balances are particularly useful in collecting information on all waste streams leaving the plant
- equipment for cleaning wastes must also be considered. Indeed in batch processes large quantities of wastes may be associated with operations such as cleaning a reactor or mixing vessel, yet these incidental wastes rarely appear on process flow diagrams or are quantified in process descriptions. Hence, discussions with key operations personnel are essential to identify and define such wastes.

The following steps are recommended in collecting the necessary data for each of the waste streams:

- identify and name each and every waste stream, such as gas, liquid and solid, and also the input material stream and output product stream using flow diagrams
- collect data on the product streams using a worksheet consisting of the following:
  - ♦ hazardous components
  - ♦ production rate
  - ♦ products
- systematically collect data on a particular waste stream using a discussion group or workshop, and encompassing the following:
  - ♦ nature of the waste (gas, liquid, solid)
  - ♦ generation rate
  - ♦ composition of the waste
  - ♦ quantity (present and future)
  - ♦ degree of hazard (toxicity, flammability, etc)

### **(b) Stage 2**

Stage 2 is a comprehensive plant assessment, and is performed to fill in the gaps identified during the review of the background information in stage 1.

Although the collected information is critical to gaining an understanding of the process involved, inspecting the site is important in order to witness the actual operation and get a complete picture of the processes.

For example, modifications may have been made which are not indicated in the flow diagrams. Waste streams that were indicated as leaving the facility separately may be discharged into a common drain.

The main objective of an inspection is to achieve a greater understanding of primary and secondary causes of waste generation and to cover any items missed during the earlier data collection stage.

The following guidelines are suggested for site inspection.

- select which team members will participate in the site inspection
- prepare an agenda covering all wastes (and their generation points) requiring clarification from the earlier stage
- schedule the inspection to coincide with the particular operation that is of interest, such as make up chemicals addition, bath replacements, waste discharge in batch operations and so on
- interview the operators, shift supervisors and other responsible people directly. Try to assess the operators and their supervisors awareness of waste generation aspects of the operation
- observe the 'housekeeping' aspect of the operations. Make use of this opportunity to watch for these frequently encountered waste producers
- monitor the operations at different times during the shift, and if necessary, during all three shifts, especially when waste generation is highly dependent on human involvement, such as in the areas of painting or parts cleaning.

### **THE REPORT**

It is recommended that the report be produced in a well documented format containing all of the collected information. The following suggested headings are provided for guidance:

- introduction
- short summary of the approach taken to the waste assessment project
- description of the assessment team, such as positions and the names of the team members

- facility location and size
- description of processes, including flow diagrams necessary to detail the pertinent aspects of waste generation
- raw materials and products summary
- description of waste streams, sources and current methods of management (This information should be supplemented with summaries of waste generation rates, composition and disposal costs)
- summary of waste stream characteristics and ranking
- detailed collected data, as appendices.

### **WASTE MANAGEMENT PLANS**

The waste assessment results should now be reviewed and areas of opportunity for waste reduction examined for technical and economical feasibility. A payback period of three years or less is usually acceptable. Steps should then be taken to prepare the Waste Management Plan and later implement each of the recommendations contained in that plan. A waste management plan is not a final document. It is only the starting point to minimise wastes and it should be periodically reviewed and updated.

To assist with industrial waste assessments and waste management plans, EPA has publications available from the Information Centre.

### **FURTHER INFORMATION**

EPA Information Centre  
40 City Road, Southbank 3006  
Tel: (03) 9695 2722 Fax: (03) 9695 2780

#### **EPA Regional Offices**

##### ***Gippsland***

7 Church Street, Traralgon 3844  
Tel: (03) 5176 1744 Fax: (03) 5174 7851

##### ***North-East***

24 Ely Street, Wangaratta 3677  
Tel: (03) 5721 7277 Fax: (03) 5721 2121

##### ***North-West***

261 Hargreaves Street, Bendigo 3550  
Tel: (03) 5442 4393 Fax: (03) 5443 6555

##### ***South Metro***

45 Princes Highway, Dandenong 3175  
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##### ***South-West***

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Tel: (03) 5226 4825 Fax: (03) 5226 4632