

Guidelines – Conducting Waste Audit

Issued by: Inspection Department – Operations Section

1.0 Background

A waste audit is a procedure for surveying processes and/or equipment and identifying waste minimization options as a necessary first step to waste minimization. The results of a Waste Audit can provide management with timely and useful information for developing a viable Waste Management plan that can accomplish the following goals:

- Save money by reducing water treatment and disposal costs, raw material purchases, and other operating costs.
- Reduce potential environment liabilities.
- Protect public health and worker health and safety.
- Protect the environment.
- Improve corporate image.

The purpose of a general waste audit is to identify all possible outputs from an industrial process to each segment of the environment and to assess the likely impact of those wastes as well as compliance to local standards and regulations.

Waste Audit will be required for certain operating industries to ensure compliance with the provisions of PCFC Environmental Rules and Requirements.

2.0 Types of Waste Audit

Audits can be done on any type of waste e.g. paper and office waste, municipal waste, commercial and industrial waste, construction and demolition waste etc. There are a number of different ways to conduct a waste audit, such as visual waste audits, waste characterization, desktop audits and others. The type of audit you use depends on the type of waste, where it is and what you want to get out of the audit.

3.0 Guidelines for Waste Audit Reports

3.1 Objectives of Waste Audit

The objectives for conducting a waste audit are to:



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- Identify each and every gas, liquid and solid waste stream generated by the industry, using flow diagrams.
- Quantify and characterize every waste stream, a material mass balance is often a useful tool.
- Establish how and why the waste stream is generated.
- Calculate the costs incurred with pretreatment, storage, handling and disposal.
- Determine the liabilities associated due to the generation of those wastes, including compliance with Trakhees Regulations.
- Identify options for effective waste management so that a waste management plan can be developed including waste minimization potential.

3.2 Stages of Waste Audit

a. Selection of an Audit team

An audit team usually comprises a leader and several members. However its exact size will be determined by the time span of the audit, manpower availability and plant size.

The audit team may consist of:

- Consultants (with prior approval from Trakhees)
- Site or Works/Production Manager
- Environmental Engineer/Officer
- Supervisor with hands-on knowledge of the process
- Process Engineer
- Waste treatment supervisor, etc.

b. Determination of Audit Scope

This will usually be determined by Trakhees Inspection Department – Operations Section at the time of requiring the Audit. The approved consultant would propose Audit Scope for PCFC approval. An audit may involve a single industrial process or an entire industrial facility.



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An audit may be limited to the outputs from the plant of facility or may involve detailed assessment of waste impacts on the environment.

c. Collection of Preliminary Data

The objective of this activity is to collect all necessary background information on the plant's operation. The types of information that can be useful in conducting the audit are as follows:

- 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
 - ⇒ Other
- Raw Material and Product Information
 - ⇒ Product composition and batch sheets
 - ⇒ Raw materials (including water, fuel) analysis
 - ⇒ Operating procedures
 - ⇒ Operating schedules
 - ⇒ Material Safety Data Sheets (MSDS)
 - ⇒ Other
- Environmental Information
 - ⇒ Waste disposal receipts (e.g. Dubai Municipality-DM) and data
 - ⇒ Emission inventories
 - ⇒ Waste analysis reports (e.g. air emissions, wastewater, etc)



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- ⇒ Correspondence with Trakhees Inspection Department – Operations Section
- ⇒ Authority permits
- ⇒ Risk Assessment (RA) and Environmental Impact Assessment (EIA)
- ⇒ Other (e.g. Cleaner Production Alternatives, Odor Complaints from neighbors, etc)

- Economic Information
 - ⇒ Waste treatment and disposal costs
 - ⇒ Product and raw materials costs
 - ⇒ Water consumption costs
 - ⇒ Energy consumption costs
 - ⇒ Operating (e.g. Fuel, Raw Materials) and maintenance costs
 - ⇒ Other

- d. Identification and characterization of input materials, products and waste streams
 - Identify and name each and every waste stream (gas, liquid and solid), input material stream and output product stream using the flow diagrams of the facility

 - Collect data on input material and product streams
 - ⇒ Hazardous components
 - ⇒ Material handling and storage
 - ⇒ Production rate
 - ⇒ Products

 - Collect data on the identified waste streams
 - ⇒ Nature of waste (gas, liquid, solid)
 - ⇒ Generation rate



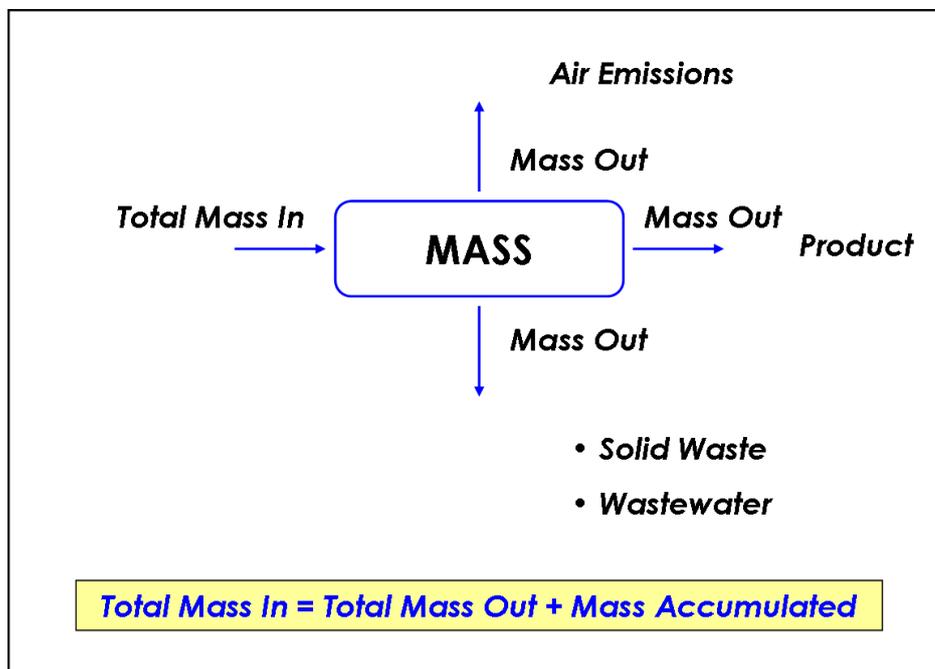
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- ⇒ Composition of the waste
- ⇒ Quantity (present and future)
- ⇒ Degree of hazard (toxicity, flammability, etc.)
- ⇒ Current disposal practices for each stream

e. Material Balance

A material balance is an important tool to identify losses and to verify quantitative data of material input and output of the production process.

The principle of mass conservation is as shown in the diagram below:



A material balance should be made individually for all components that enter and leave the process. When chemical reactions take place in a system there is an advantage of doing “elemental balances” for chemical elements in a system. Material balance can assist in determining concentrations of waste constituents where analytical test data is limited.

f. Comprehensive plant and environmental analysis



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A comprehensive plant assessment is performed to fill gaps identified during the review of the background information. This is mainly achieved through a sit inspection. The main objective of an inspection is to achieve a fuller understanding of the principal and secondary causes of waste generation and to cover the items missed in the preliminary data collection stage.

g. Evaluation of data and regulatory compliance

- Waste Impacts

- ⇒ Evaluate the volumes and components contained in each waste stream against the regulatory standards.
- ⇒ Report on company environmental practices, policies and monitoring systems.
- ⇒ Assess the impact of waste streams on the surrounding environment.

- Minimization

- ⇒ Generate waste minimization options for each waste stream such as:
 - ✓ Changing plant operation and/or procedures by improved house keeping and educating employee about waste reduction.
 - ✓ Substituting non-toxic material in the production process.
 - ✓ Reclaiming materials to avoid creating wastes.
 - ✓ Adopting Reuse, Recovery and Recycling (RRR) alternatives.
 - ✓ Modifying equipment to improve efficiency.
 - ✓ Altering final product to eliminate processes that generate waste.
 - ✓ Using clean fuel.
- ⇒ Conduct preliminary technical and economic assessment of waste minimization options by considering the following factors:
 - ✓ Technical Factors
 - Product quality.
 - Safety/occupational health.



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- Production constraints/flexibility.
 - Space requirements.
 - Installation time, production downtime.
 - Reliability.
 - Commercial availability.
 - Proven performance in a similar application.
 - Regulatory constraints.
 - Expertise/skill level required for operation and maintenance.
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- ✓ Economic Factors
 - Capital cost.
 - Operating cost.
 - Potential savings.
 - Profitability requirement using methods like payback period, net present value (discounted cash flow) and return on investment.
 - Intangible or qualitative benefits such as improvement in corporate image and, reduction of risk and liability associated with the avoidance of penalties for non-compliance and cost of workers compensation.

h. Preparation of Waste Audit Report

When all the information and findings are collected, they should be dated, documented and filed for future reference. The final product of a waste audit is a report that presents the results of the audit and recommendations of waste minimization options. A suggested format for the Waste Audit Report outline is given below:

- Introduction

- ⇒ Give a brief description of company's operations, dates when audit was conducted, and team members involved.



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- ⇒ Mention environmental and/or other related issues (i.e. air emissions, wastewater, hazardous, H & S issues, etc) that provide the basis for the audit.
- Scope Audit
 - ⇒ Give a brief description of target processes and equipment that are selected including the rationale for the selection.
 - ⇒ Provide a site plan showing the drainage system, wastes discharge point and interim storage onsite, air, wastes) facility layout and surrounding land uses/neighbors, etc.
- Results of Audit
 - ⇒ Provide both qualitative and quantitative description of waste streams (e.g. air, wastes) identified.
 - ⇒ Describe problems in process operation and maintenance, waste management methods and practices, storage and handling of raw materials (including water, fuel) and spill control.
- Evaluation of Audit
 - ⇒ Provide technical and economic assessment of identified waste minimization options.
 - ⇒ Assess compliance with Trakhees regulations.
 - ⇒ Evaluate impact of the plant on the local environment with respect to air emissions, solid/liquid wastes.
 - ⇒ Recommend changes to management policies or practices including cleaner production and RRR options as alternatives.

There are many informative websites related to the audits.

Please visit www.epa.gov/Environmental, www.policyworks.gov, www.ea.gov.au websites.