Improving Waste Management by Providing Audit Capability to the Waste Declaration System

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Presenter

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Education
• B.S., Environmental Engineering, Middle East Technical University, 2008
• M.Sc. Environmental Engineering, Middle East Technical University, 2013
• Ph.D.(c), Environmental Engineering, Middle East Technical University

Experience
• Environmental Consultant, Private Sector, (2009 – 2014)
• Teaching Assistant, Middle East Technical University, (2014 – 2018)
• Lecturer, Water Management Institute, Ankara University, (2018 - ... )
Introduction

• Waste Management in Turkey
  • Current Legislation
  • Categorization and Management of Wastes

• Waste Declaration System
  • Data Overview
  • Limitations of Waste Declaration System

• Methodology
  • Screening of Economic Activities
  • Additional Economic Activity Groups
  • Determination of Waste Generation Factors

• Improvements Made in Waste Declaration System
Waste Management in Turkey

**Aim** is to determine the general procedures and principles regarding:

a) Ensuring the **management of wastes** from generation to disposal without harming the environment and human health

b) Reducing the use of natural resources and ensuring waste management through ways such as **reducing** waste generation, **reuse, recycling** and **recovery** of wastes

**Waste Management Regulation – 2015**

Most recent legislation on general waste management practices
As part of EU harmonization process, Turkey has adopted the European Waste Catalogue and waste management practices.
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Categorization and Management of Wastes in Turkey

As part of EU harmonization process, Turkey has adopted the European Waste Catalogue and waste management practices.

RECOVERY OPERATIONS

R 1 Use principally as a fuel or other means to generate energy (*)
R 2 Solvent reclamation/regeneration
R 3 Recycling/reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes) (**)
R 4 Recycling/reclamation of metals and metal compounds (***)
R 5 Recycling/reclamation of other inorganic materials (****)

(TR) Waste Management Regulation Annex-II

Waste Declaration System

Administered by Ministry of Environment, Urbanization and Climate Change

Online Waste Declaration System

Built In

- EU Waste Catalogue
- Recovery and Disposal Methods
- Statistical classification of economic activity codes (NACE Rev.2)
- Licensed Waste Treatment Facilities

Waste Producers Annually Declare

- Production Capacity
- Waste Code(s) + Waste Amount(s)
- Recovery / Disposal Method
- Activity code(s) of Waste Producer
- Name of the Waste Receiving Facility
Waste Declaration System Data Overview

- **C - Manufacturing**
- **D - Electricity, gas, steam and air conditioning supply**
- **E - Water supply; sewerage, waste management and remediation activities**
Limitations of Waste Declaration System

- Some waste generators fail to declare their waste codes according to their industry-specific waste catalog

<table>
<thead>
<tr>
<th>Production Capacity</th>
<th>Waste Producers Annually Declare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recovery / Disposal Method</td>
<td></td>
</tr>
<tr>
<td>Activity code(s) of Waste Producer</td>
<td></td>
</tr>
<tr>
<td>Name of the Waste Receiving Facility</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Waste Code(s) + Waste Amount(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>07 02</td>
</tr>
<tr>
<td>07 02 01*</td>
</tr>
<tr>
<td>07 02 03*</td>
</tr>
<tr>
<td>07 02 04*</td>
</tr>
<tr>
<td>07 03</td>
</tr>
<tr>
<td>07 03 01*</td>
</tr>
<tr>
<td>07 03 03*</td>
</tr>
<tr>
<td>07 03 04*</td>
</tr>
<tr>
<td>07 05</td>
</tr>
<tr>
<td>07 05 01*</td>
</tr>
<tr>
<td>07 05 03*</td>
</tr>
<tr>
<td>07 05 04*</td>
</tr>
</tbody>
</table>
Limitations of Waste Declaration System

- The current online system depends highly on the declarations of the waste generators, with limited auditing capabilities:
  - of waste type (waste code)
  - of waste amount
- Also, production capacities does not correlate well with the amount of waste generated
Screening of Economic Activities

• Due to time and work force requirements, the study was limited to selected industrial activities
  
  • Field studies were conducted to at least one facility for each selected activity
  
  • Waste generating processes, type of waste and waste generation factors were evaluated for each selected activity
Screening of Economic Activities

• 4 sectors are responsible from generation of 62% of all wastes by weight (NACE 25 – 24 – 35 – 20)
Screening of Economic Activities

NACE 24 – Manufacture of basic metals
3 sub-classes are responsible from generation of 65% of the wastes
Screening of Economic Activities

• By targeting 65% of all waste production in each NACE Rev.2 division, **78% of all waste** production (by weight) in Turkey was covered.

• In other words, total waste of **66 sub-class activities** were evaluated to cover 78% of all waste production from **774 sub-class activities**.

<table>
<thead>
<tr>
<th>Division</th>
<th>Percentile</th>
<th># of sub-class activities (TR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>65 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>39</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>78%</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>66</strong></td>
</tr>
</tbody>
</table>
### Additional NACE Classifications

- In some cases, even the six-digit NACE classification does not allow identification of correct waste codes and generation factors.
- Additional categories were created during process analysis.

<table>
<thead>
<tr>
<th>Division</th>
<th>Group</th>
<th>Class</th>
<th>Sub-class (TR)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>20.1</td>
<td></td>
<td></td>
<td>Manufacture of basic chemicals, fertilizers and nitrogen compounds, plastics and synthetic rubber in primary forms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20.13</td>
<td></td>
<td>Manufacture of other inorganic basic chemicals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20.13.90</td>
<td></td>
<td>Manufacturing of Chemical Elements, Inorganic Acids and Compounds Not Elsewhere Classified (Metalloids such as Chlorine, Iodine, Fluorine, Boron, Silicon, Phosphorus, Arsenic, Scandium, Mercury, Oxides, Hydroxides, Hydrogen Chloride etc.)</td>
</tr>
<tr>
<td>24</td>
<td>24.4</td>
<td></td>
<td></td>
<td>Manufacture of basic precious and other non-ferrous metals</td>
</tr>
<tr>
<td></td>
<td>24.42</td>
<td></td>
<td></td>
<td>Aluminum production</td>
</tr>
<tr>
<td></td>
<td>24.42.17</td>
<td></td>
<td></td>
<td>Aluminum production (Unprocessed)</td>
</tr>
</tbody>
</table>

**24.42.17.01 - Primary Aluminum Production – From Ore**

**24.42.17.02 - Secondary Aluminum Production – From Recycled Aluminum**

*Same Activity, Different Production Practices*
Waste Generation Factor

- There must be a relation between:
  - Activity carried out $\square$ Waste code
  - Production amount $\square$ Waste amount

\[
\text{Waste Generation Factor (WGF)} = \frac{\text{Annual Waste Amount (kg)}}{\text{Annual Production Amount (kg, piece, m}^3, m^2, \text{ etc.)}}
\]
Waste Generation Factor

- Process specific waste codes were determined based on NACE codes of the facility
Example Process Analysis: Sunflower Oil Production

Sunflower Seeds and Impurities → Pre-processing

Sunflower Seeds → Mechanical Press → Solvent Extraction

02 03 04 → Mechanical Press

Raw Oil → Mucilage Removal

Mucilage Removal → Acid Removal

Acid Removal → Bleaching

Bleaching → Odor Removal

Odor Removal → Winterization

02 03 04 → Winterization

02 03 03 → Solvent Extraction

02 03 01 → Mucilage Removal

07 06 08 → Acid Removal
Waste Groups

For Each Economic Activity (NACE Rev.2)

- Process Wastes & WGFs
- Other Wastes & WGFs

Common in all activities: Cleaning equipment, maintenance waste, food waste, office waste etc.

Mandatory Wastes

Generated every year

Expected Wastes

Not generated every year or depends on specific practices
# Example Waste Groups & WGFs
## Sunflower Oil Production

### Mandatory Wastes

<table>
<thead>
<tr>
<th>Waste Code</th>
<th>Description</th>
<th>Minimum WGF (g/kg)</th>
<th>Maximum WGF (g/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>02 03 01</td>
<td>Sludges from washing, cleaning, peeling, centrifuging and separation</td>
<td>0.04</td>
<td>14</td>
</tr>
<tr>
<td>02 03 03</td>
<td>Waste from solvent extraction</td>
<td>0.01</td>
<td>2</td>
</tr>
<tr>
<td>02 03 04</td>
<td>Materials unsuitable for consumption or processing</td>
<td>0.0035</td>
<td>30</td>
</tr>
</tbody>
</table>

### Expected Wastes

<table>
<thead>
<tr>
<th>Waste Code</th>
<th>Description</th>
<th>Minimum WGF (g/kg)</th>
<th>Maximum WGF (g/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>02 03 02</td>
<td>Waste from preserving agents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 01 10 *</td>
<td>Other filter cakes, spent absorbents</td>
<td>0.03</td>
<td>0.044</td>
</tr>
<tr>
<td>07 06 08 *</td>
<td>Other still bottoms and reaction residues</td>
<td>0.006</td>
<td>0.023</td>
</tr>
</tbody>
</table>
Changes in Waste Declaration System

• The list of mandatory wastes, expected wastes and their respective Waste Generation Factors (WGF) were implemented in the Waste Declaration System.

• The WGFs will be re-calculated by the system automatically every 3 years, and the system will replace old values with the approval of regulatory and supervisory authority.
Changes in Waste Declaration System

• This implementation of WGF will be used for following purposes:

1) If mandatory wastes are not declared, the system will not allow completion of declaration

2) If the amount of a mandatory waste declared is below minimum or above maximum, the system will send a warning message to the regulatory and supervisory authorities

3) The system will compare WGF of a waste generator with declarations of other waste generators in the same activity group. If the declared amounts are outside the limits, the system will send a warning message to the regulatory and supervisory authorities
Changes in Waste Declaration System

- The Waste Declaration System will ask for three additional information:

  1) The **actual production** amount

  2) If there are any waste minimization and/or waste re-use/recovery practices in the facility, the system will ask for the **amount of waste before & after recovery/minimization**. The WGF will be calculated based on the amount before recovery/minimizaton.

  3) If there are more than one activity in the facility, the system will ask for an estimate **distribution** of wastes between activities

<table>
<thead>
<tr>
<th>Waste Code</th>
<th>Waste Amount (ton)</th>
<th>Activity #1</th>
<th>Activity #2</th>
<th>Activity #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>02 03 01</td>
<td>1000</td>
<td>600</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>02 03 03</td>
<td>500</td>
<td>100</td>
<td>400</td>
<td>-</td>
</tr>
</tbody>
</table>
Improvements in Waste Declaration System

To improve waste declaration procedure for waste producers

To relate waste codes to production practices

To audit waste types and quantities from each industrial facility

To add auditing capability to waste declaration system

To measure performance of waste minimization practices

Simplified user interface

Process Analysis:
- Field studies
- Literature
- Workshops

Waste Generation Factor (WGF)
- Field studies
- Literature
- Declaration system information

Statistical evaluation capability
- Min-Max ranges of WGFs

On-site waste minimization/recovery information

Improved Waste Management
Acknowledgement

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Thank You