Miia Liikanen, Jouni Havukainen, Kaisa Grönman & Mika Horttanainen

Report on waste streams in the South Karelia region
Sub-action A.6.1
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1 Introduction

The purpose of this report is to identify and quantify potential waste materials for re-materialization in the South Karelia region. The Kompotek re-materialization pilot plant utilizes various waste materials, which mainly originates from construction and demolition (C&D) activities and industry, to produce new composite fibre products. Therefore, this report focuses particularly on C&D waste streams. The main raw materials of the plant are recycled wood and plastic. Gypsum (plasterboard) and insulation wool (mineral wool) are also potential raw materials for the plant. The capacity of the pilot plant is 2 000-3 000 tonnes per year (Uusioutiset, 2017).

VAHTI database, a monitoring system of the Finnish environmental administration, is the primary information source for the report. The information from the VAHTI database is supplemented with waste data information from the environmental authorities of Lappeenranta and Imatra. Additionally, the information about received C&D waste streams in the regional waste management company, Etelä-Karjalan Jätehuolto Oy (EKJH), are separately dealt with since EKJH will be the main raw material provider for the pilot plant. The reference year of the report is 2016, i.e. all waste data included in the report is from the year 2016.
2 Waste streams in the South Karelia region

2.1 VAHTI database

VAHTI database is a monitoring system for the Finnish environmental administration. Operators possessing an environmental permit report their annual waste data to the database. VAHTI database is the main information source for the national waste statistics. The following waste data is recorded to the database:

- Received waste streams (i.e. incoming waste streams to a facility)
  - The received wastes are either treated (recovery or disposal) in a facility, stored or directed to further treatment. In the latter case, the waste flows are reported as generated waste flows to the VAHTI database.

- Generated waste streams (i.e. outgoing waste streams from a facility)

- Stored wastes (i.e. the storage situation of a facility at the end of the year)
Received and generated waste streams are dealt with in this report, i.e. stored waste flows are not taken into account. (Merilehto et al., 2007.)

European waste catalogue (EWC) codes of wastes are recorded to the VAHTI database. EWC codes consist of three parts (00-00-00). The first two numbers (i.e. the first part of the code) indicate the origin of the waste (see Table 1). The second and third part of the code define the type and quality of waste. (Statistics Finland, 2018.) Based on the EWC codes the origin and composition of waste streams can be assessed.

**Table 1.** The first two numbers of EWC codes indicating the origin of waste (Statistics Finland, 2018).

<table>
<thead>
<tr>
<th>EWC code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Wastes resulting from exploration, mining, quarrying, and physical and chemical treatment of minerals</td>
</tr>
<tr>
<td>02</td>
<td>Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing</td>
</tr>
<tr>
<td>03</td>
<td>Wastes from wood processing and the production of panels and furniture, pulp, paper and cardboard</td>
</tr>
<tr>
<td>04</td>
<td>Wastes from the leather, fur and textile industries</td>
</tr>
<tr>
<td>05</td>
<td>Wastes from petroleum refining, natural gas purification and pyrolytic treatment of coal</td>
</tr>
<tr>
<td>06</td>
<td>Wastes from inorganic chemical processes</td>
</tr>
<tr>
<td>07</td>
<td>Wastes from organic chemical processes</td>
</tr>
<tr>
<td>08</td>
<td>Wastes from the manufacture, formulation, supply and use (mfsu) of coatings (paints, varnishes and vitreous enamels), adhesives, sealants and printing inks</td>
</tr>
<tr>
<td>09</td>
<td>Wastes from the photographic industry</td>
</tr>
<tr>
<td>10</td>
<td>Wastes from thermal processes</td>
</tr>
<tr>
<td>11</td>
<td>Wastes from chemical surface treatment and coating of metals and other materials; non-ferrous hydro-metallurgy</td>
</tr>
</tbody>
</table>
Wastes from shaping and physical and mechanical surface treatment of metals and plastics

Oil wastes and wastes of liquid fuels (except edible oils, and those in chapters 05, 12 and 19)

Waste organic solvents, refrigerants and propellants (except 07 and 08)

Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified

Wastes not otherwise specified in the list

Construction and demolition wastes (including excavated soil from contaminated sites)

Wastes from human or animal health care and/or related research (except kitchen and restaurant wastes not arising from immediate health care)

Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use

Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions

The treatment method of waste is recorded by Recovery (R) and Disposal (D) codes to the database. Definitions for the RD codes are presented below in Table 2. Based on the RD codes, the disposal, recovery and recycling rates of waste streams can be estimated.

Table 2. Definitions of the RD codes (Government Decree on Waste 19.4.2012/179).

<table>
<thead>
<tr>
<th>RD code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>D 1</td>
<td>Deposit into or on to land (e.g. landfill, etc.)</td>
</tr>
<tr>
<td>D 2</td>
<td>Land treatment (e.g. biodegradation of liquid or sludgy discards in soils, etc.)</td>
</tr>
<tr>
<td>D 3</td>
<td>Deep injection (e.g. injection of pumpable discards into wells, salt domes or naturally occurring repositories, etc.)</td>
</tr>
<tr>
<td>D 4</td>
<td>Surface impoundment (e.g. placement of liquid or sludgy discards into pits, ponds or lagoons, etc.)</td>
</tr>
<tr>
<td>D 5</td>
<td>Specially engineered landfill (e.g. placement into lined discrete cells which are capped and isolated from one another and the environment, etc.)</td>
</tr>
<tr>
<td>D 6</td>
<td>Release into a water body except seas/oceans</td>
</tr>
<tr>
<td>D 7</td>
<td>Release to seas/oceans including sea-bed insertion</td>
</tr>
<tr>
<td>D 8</td>
<td>Biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12</td>
</tr>
</tbody>
</table>
2.1.1 Received waste streams

All waste streams

The locations of all received wastes recorded in the VAHTI database are presented in Fig. 1. In total, approximately 1.2 million tonnes of received wastes was reported to the VAHTI database in the South Karelia region. 99.6% of the received waste originated from the region.
Fig. 1. Received wastes based on their location in 2016.

The received wastes are classified based on their origin in Table 3. As can be seen, approximately 57% of the wastes was from wood processing industry, more precisely from pulp and paper industry. Approximately 165 000 tonnes of C&D wastes were received in the region.

Table 3. Received wastes classified based on their origin.

<table>
<thead>
<tr>
<th>EWC code indicating the origin of waste</th>
<th>Mass (t/a)</th>
<th>Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 exploration, mining, quarrying, and physical and chemical treatment of minerals</td>
<td>138 244</td>
<td>11.7</td>
</tr>
<tr>
<td>02 agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing</td>
<td>5 500</td>
<td>0.5</td>
</tr>
<tr>
<td>03 wood processing and the production of panels and furniture, pulp, paper and cardboard</td>
<td>670 377</td>
<td>56.7</td>
</tr>
<tr>
<td>04 the leather, fur and textile industries</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>05 petroleum refining, natural gas purification and pyrolytic treatment of coal</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>06 inorganic chemical processes</td>
<td>1 067</td>
<td>0.1</td>
</tr>
</tbody>
</table>
### Received wastes' disposal, recovery and recycling rates (excluding stored wastes, i.e. RD codes D15 and R13) were the following:

- **disposal rate:** 20%
- **recovery rate:** 80%
- **recycling rate:** 10% (NB: recycling is part of recovery (i.e. the sum of the percentages ≠ 100%).)
Construction and demolition waste

The EWC codes and mass flows of received C&D wastes are presented in Table 4. Based on the EWC codes the composition of C&D waste can be estimated. Concrete, bricks, tiles and ceramic compose approximately 34% of the C&D wastes. Also the share of metals is high: approximately 32%. Considering potential raw materials for the pilot plant, approximately 6300 tonnes of wood, 23 tonnes of plastic and 106 tonnes of mineral wool were recorded to the database.

Table 4. Amounts of received C&D wastes classified based on EWC codes.

<table>
<thead>
<tr>
<th>EWC code</th>
<th>Definition</th>
<th>Mass (t/a)</th>
<th>Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 01</td>
<td>concrete, bricks, tiles and ceramics</td>
<td>56 284</td>
<td>34.1</td>
</tr>
<tr>
<td>17 02</td>
<td>wood, glass and plastic</td>
<td>6 424</td>
<td>3.9</td>
</tr>
<tr>
<td>17 03</td>
<td>bituminous mixtures, coal tar and tarred products</td>
<td>760</td>
<td>0.5</td>
</tr>
<tr>
<td>17 04</td>
<td>metals (including their alloys)</td>
<td>52 190</td>
<td>31.7</td>
</tr>
<tr>
<td>17 05</td>
<td>soil (including excavated soil from contaminated sites), stones and dredging spoil</td>
<td>37 399</td>
<td>22.7</td>
</tr>
<tr>
<td>17 06</td>
<td>insulation materials and asbestos-containing construction materials</td>
<td>1 290</td>
<td>0.8</td>
</tr>
<tr>
<td>17 08</td>
<td>gypsum-based construction material</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>17 09</td>
<td>other construction and demolition wastes</td>
<td>10 481</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td>∑</td>
<td>164 828</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Received C&D wastes’ disposal, recovery and recycling rates (excluding stored wastes, i.e. RD codes D15 and R13) were the following:

- disposal rate: 7%
- recovery rate: 93%
• recycling rate: 16% (NB: recycling is part of recovery (i.e. the sum of the percentages ≠ 100%).

2.1.2 Generated waste streams

All waste streams

The locations of all generated wastes recorded in the VAHTI database are presented in Fig. 2. In total, approximately 510,000 tonnes of waste was generated in the South Karelia region in 2016 and left from the facilities for further treatment. 77.4% of the generated waste was treated in the region.

Fig. 2. Generated waste streams based on their location.

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Mass (t/a)</th>
<th>Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lappeenranta</td>
<td>235,417</td>
<td>46.2</td>
</tr>
<tr>
<td>Imatra</td>
<td>229,468</td>
<td>45.0</td>
</tr>
<tr>
<td>Ruokolahti</td>
<td>20,529</td>
<td>4.0</td>
</tr>
<tr>
<td>Parikkala</td>
<td>269</td>
<td>0.1</td>
</tr>
<tr>
<td>Taipalsaari</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Luumäki</td>
<td>1,001</td>
<td>0.2</td>
</tr>
<tr>
<td>Savitaipale</td>
<td>15,724</td>
<td>3.1</td>
</tr>
<tr>
<td>Rautjärvi</td>
<td>7,547</td>
<td>1.5</td>
</tr>
<tr>
<td>Lemi</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Σ</td>
<td>509,956</td>
<td>100.0</td>
</tr>
</tbody>
</table>
The generated wastes are classified based on their origin in Table 5. As can be seen, approximately 48% of the generated wastes derive from wood processing industry, more precisely from pulp and paper industry. Approximately 71 000 tonnes of C&D wastes were generated in the region.

**Table 5.** Generated wastes classified based on their origin.

<table>
<thead>
<tr>
<th>EWC code indicating the origin of waste</th>
<th>Mass (t/a)</th>
<th>Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 exploration, mining, quarrying, and physical and chemical treatment of minerals</td>
<td>8</td>
<td>0.0</td>
</tr>
<tr>
<td>02 agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>03 wood processing and the production of panels and furniture, pulp, paper and cardboard</td>
<td>246 561</td>
<td>48.3</td>
</tr>
<tr>
<td>04 the leather, fur and textile industries</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>05 petroleum refining, natural gas purification and pyrolytic treatment of coal</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>06 inorganic chemical processes</td>
<td>2 120</td>
<td>0.4</td>
</tr>
<tr>
<td>07 organic chemical processes</td>
<td>352</td>
<td>0.1</td>
</tr>
<tr>
<td>08 the manufacture, formulation, supply and use (mfsu) of coatings (paints, varnishes and vitreous enamels), adhesives, sealants and printing inks</td>
<td>8</td>
<td>0.0</td>
</tr>
<tr>
<td>09 the photographic industry</td>
<td>1</td>
<td>0.0</td>
</tr>
<tr>
<td>10 thermal processes</td>
<td>52 814</td>
<td>10.4</td>
</tr>
<tr>
<td>11 chemical surface treatment and coating of metals and other materials; non-ferrous hydro-metallurgy</td>
<td>1</td>
<td>0.0</td>
</tr>
<tr>
<td>12 shaping and physical and mechanical surface treatment of metals and plastics</td>
<td>392</td>
<td>0.1</td>
</tr>
<tr>
<td>13 oil wastes and wastes of liquid fuels (except edible oils, and those in chapters 05, 12 and 19)</td>
<td>743</td>
<td>0.1</td>
</tr>
<tr>
<td>14 waste organic solvents, refrigerants and propellants (except 07 and 08)</td>
<td>23</td>
<td>0.0</td>
</tr>
<tr>
<td>15 waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified</td>
<td>3 250</td>
<td>0.6</td>
</tr>
<tr>
<td>16 wastes not otherwise specified in the list</td>
<td>6 502</td>
<td>1.3</td>
</tr>
<tr>
<td>17 construction and demolition wastes (including excavated soil from contaminated sites)</td>
<td>71 265</td>
<td>14.0</td>
</tr>
<tr>
<td>18 human or animal health care and/or related research (except kitchen and restaurant wastes not arising from immediate health care)</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Generated wastes’ disposal, recovery and recycling rates (excluding stored wastes, i.e. RD codes D15 and R13) were the following:

- disposal rate: 5%
- recovery rate: 95%
- recycling rate: 57% (NB: recycling is part of recovery (i.e. the sum of the percentages ≠ 100%).

**Construction and demolition waste**

The EWC codes and mass flows of generated C&D wastes are presented in Table 6. Concrete, bricks, tiles and ceramic compose approximately 54% of the C&D wastes. Also the share of soil, stones and dredging spoil is rather high: approximately 20%. Considering potential raw materials for the pilot plant, approximately 590 tonnes of wood was sent from facilities for further treatment. No plastic, gypsum and mineral wool was recorded with the 1702 EWC code.
Table 6. Amounts of generated C&D wastes classified based on EWC codes.

<table>
<thead>
<tr>
<th>EWC code</th>
<th>Definition</th>
<th>Mass (t/a)</th>
<th>Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 01</td>
<td>concrete, bricks, tiles and ceramics</td>
<td>38 773</td>
<td>54.4</td>
</tr>
<tr>
<td>17 02</td>
<td>wood, glass and plastic</td>
<td>862</td>
<td>1.2</td>
</tr>
<tr>
<td>17 03</td>
<td>bituminous mixtures, coal tar and tarred products</td>
<td>5 692</td>
<td>8.0</td>
</tr>
<tr>
<td>17 04</td>
<td>metals (including their alloys)</td>
<td>5 212</td>
<td>7.3</td>
</tr>
<tr>
<td>17 05</td>
<td>soil (including excavated soil from contaminated sites, stones and dredging spoil)</td>
<td>14 053</td>
<td>19.7</td>
</tr>
<tr>
<td>17 06</td>
<td>insulation materials and asbestos-containing construction materials</td>
<td>40</td>
<td>0.1</td>
</tr>
<tr>
<td>17 08</td>
<td>gypsum-based construction material</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>17 09</td>
<td>other construction and demolition wastes</td>
<td>6 632</td>
<td>9.3</td>
</tr>
<tr>
<td></td>
<td>∑</td>
<td>71 265</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Generated C&D wastes’ disposal, recovery and recycling rates (excluding stored wastes, i.e. RD codes D15 and R13) were the following:

- disposal rate: 3%
- recovery rate: 97%
- recycling rate: 85% (NB: recycling is part of recovery (i.e. the sum of the percentages ≠ 100%).

2.2 Etelä-Karjalan Jätehuolto (EKJH) Oy

EKJH is the waste management company of the South Karelia region owned by nine municipalities. The waste management centre of the company is located in Kukkuroinmäki, Lappeenranta. The Kompotek pilot plant is also located in Kukkuroinmäki. In 2016, approximately 70 900 tonnes of waste, including soils, were received by EKJH (see Fig. 3) (EKJH, 2016).
The waste streams disposed of in landfill composed merely 4% of all received waste streams in 2016. The composition of these waste streams is presented in Fig. 4.

**Fig. 3.** Received waste streams in 2016 by EKJH based on their treatment method (EKJH, 2016).
In 2016, 1,950 tonnes of C&D waste (including mixed C&D waste, insulation wool, plaster and roofing felt) was received in EKJH. Approximately 33% of the received C&D waste was disposed of in landfill, and the rest was directed to material and energy recovery. (EKJH, 2017.)

The largest waste streams directed to energy and material recovery in EKJH in 2016 are presented in Fig. 5. In addition to the waste streams presented in the figure, also hazardous waste, impregnated wood, waste electrical and electronic equipment (WEEE) and tires were sent to energy and material recovery.
2.3 Waste streams reported to the city authorities of Lappeenranta and Imatra

The environmental authorities of municipalities monitor waste streams of certain operators possessing an environmental permit. These operators are typically smaller compared to operators reporting their waste flows to the VAHTI database. The waste data (received/incoming waste flows) reported to the environmental authority of Lappeenranta city in 2016 was the following. In total, approximately 81 000 tonnes of
was recorded, of which 85% (69 000 tonnes) were soils. The remaining was mainly gravel, metal, paper and cardboard, and mixed recyclable wastes.

The waste flows reported to the environmental authority of Imatra city were in total 9 900 tonnes. The majority of them was concrete, tiles and asphalt (79%). The rest was mainly metal, paper, organic waste, wood and stumps.

3 Summary

The regional waste streams are summarized in Fig. 6. As can be seen, VAHTI database was the primary information source for the report. Considering the potential raw materials for the pilot plant, over 6 000 tonnes of wood originating from C&D industry was recorded to the database. Since the treatment capacity of the plant is 2 000-3 000 tonnes per year, it can be assumed that wood needed for the composite production can be supplied from the region. Based on the waste flow data of the other main raw materials for the pilot plant, i.e. plastic, mineral wool and gypsum, 23 tonnes of plastic and 106 tonnes of mineral wool were recorded to the database. It can be assumed that the majority of these fractions were included in the Other C&D waste category (EWC code 17 09), i.e. they were not source separated, and separately collected and treated. In order to assess whether all raw materials for the pilot plant can be supplied from the region, more information about the mixed C&D wastes would be required.
Fig. 6. Summary of reported waste streams in the South Karelia region in 2016.
References


EKJH, 2017. Personal communication.


