1. Background

Why did obsolete pesticides become such a priority in a country as Romania with so many other problems?

Frequently cases of food poisoning, accidents, and diseases related to obsolete pesticides have been reported to the Ministry in the last years. This made us realise that something must be done to avoid worse things to happen.

Obsolete pesticides occur in many of the small Romanian villages and endanger the drinking water and the food safety. Especially in the countryside, people are not able to protect themselves.

After a countrywide inventory and prioritisation in 2002, intensive and positive discussions were held with the EC Delegation in Romania, who took the reported problems very serious. Thanks to a joint commitment of the Ministry and the EC Delegation, it was possible to allocate the necessary PHARE funding in combination with Romanian financial contribution. And the project is now well underway.

What is the Romanian future perspective?

The following goals were set up:

1<sup>st</sup> priority: To ensure that “irrespective of the true amounts occurring at the end” all efforts should be given to eradicate all obsolete pesticides from the Romanian territory.

2<sup>nd</sup> priority: As part of the technical assistance programme from EU a small portion was allocated to develop a strategy for prevention of new obsolete pesticides stocks to build up.

The strategy shall include the following elements:

Education of Farmers:
A countrywide awareness campaign, which will give understanding to farmers on the dangers of obsolete pesticides, and which will help discovering the “last obsolete pesticide” in the remotest parts of Romania. If farmers are not changing their attitude, new pesticides problem occur.

Voluntary Agreement with the Industry to prevent Obsolete Pesticides:
Establish a voluntary agreement with all involved stakeholders. This could for example be with the Industrial Association for Plant Protection of Romania, the Associations of Distributors, the Agricultural cooperatives and other organisations.

**3rd priority:** No doubt giving the development towards Romanian entrance into the European Union, will give responsibility to producers and distributors to avoid re-occurrence of obsolete pesticides.

Not stand alone remediation project – followed by law enforcement and control.

**2. Work Programme in Romania**

**Working Procedure**

Before the activities start, all the personnel involved in the works are trained for the works in this project. The local engineers and local crews receive a specific training how to deal with the obsolete pesticides. The lessons include:

- The safe handling of the pesticides;
- The way of repackaging;
- The proper stowage and loading of the containers
- The cleaning of the sites, tools,
- The decontamination of personnel or materials if an incident has happened.

After the field crew has arrived on site, the Site Manager inspects the storage, check the types and amounts of materials and compares these data with those from the inventory.

If materials are found, which are not listed in the Inventory, they will be characterized and classified. The Site Manager must decide, how this can be carried out. If a material remain uncharacterized, the Site Manager decides, whether it has to be analyzed before taking it over.

Other materials, which cannot be characterized/classified like above, are not to be taken over.

The Site Manager is responsible for safe working and has to care for acceptable environmental conditions at the store.

All the activities to be executed in and around the site will be supervised by the experienced Site Manager.

**Preparing**
At the beginning of the works, the ground inside the store has to be cleaned (if possible) and the collected materials filled into drums or Big-Bags. Dust is avoided due to the use of a vacuum cleaner. During the repacking activities, the personal protection equipment has to be used all the time.

For each site the most suitable working area must be used to minimize the risk of repacking for the crew and a further contamination of the environment. A site plan will be prepared as part of the initial site inspection. This plan will show the lay-out of the facilities and the equipment for the operation.

The packaging of the materials has to be performed inside the storage facility if possible. That means that the drums must be packed close to this area, where the pesticides are located. This avoids further contamination. If there is no sufficient space available inside the storage, repacking will be practised on an area, which is covered by a plastic liner.

A spill-pan is generally used, if liquid pesticides are repacked or pumped. In the case of dusty pesticides, plastic liners will cover the working area as well (black zone). All obsolete pesticides, related waste, and contaminated soil are repacked in new UN approved packaging materials.

Labelling, storing and preparing for the transport will be made according to the instructions of the Environmental Plan.

Repackaging

Repackaging has to be carried out according to an Instructions for Packaging. The UN approved fibre boxes are with double liner and suitable for solid and pasty materials according to ADR/IMDG.

Handling

Liquid pesticides will be pumped into new steel drums by a special pump, which is constructed for pumping of flammable liquids and also for sludge residues.

After pumping off, a small liquid residue is still remaining at the bottom. Therefore, absorption material has to be added into the drum to remove the liquid.

Finally, the gas inside the drum has to be analysed by a special sensor (Ex-OX-instrument). If it is ensured, that the gas inside the drum is non-explosive, the drum will be pressed by a drumpressor and the resulting material to be put in Big-Bags.

Heavily corroded drums containing liquid pesticides have to be put in oversized drums.
The solid pesticides will be repacked in new open top drums, fibre boxes or Big-Bags. In the case of using drums or fibre boxes, a plastic or alluminium liner will be used. It will be closed after filling. The Big-Bags have a double liner inside and will be closed tight as well.

Pesticide wastes, which cannot be repacked (e.g. liquids with solidified/crystallized Sevin Oil) are placed in oversized drums with UN approval.

All information will be registered in the Logbook.

Labelling

The Labels are waterproof and readable and comply with international ADR regulations. The pre-printed labels are completed with the name of the store from the inventory. Information from the original label must be collected and provided for the disposal plant.

Cleaning the Site

After all the pesticides and contaminated materials have been removed, the storage site will be swept thoroughly. If necessary the vacuuming will be considered. The contaminated sand and soil on the floor will be swept up using brooms and shovels.

When the store has a solid bottom (concrete), its surface is treated with a 5% caustic soda solution for decontamination if necessary.

Transport

The packaged pesticides are transported to SAVA in Germany for treatment. During transport all required transfrontier documents are filled in and send to the relevant authorities.

3. Treatment in SAVA, Germany

Organisation

SAVA is situated in Brunsbüttel covering the region of Schleswig-Holstein as well as the plant offers services outside the region. Today SAVA treats waste from many countries among others Holland, Italy, Sweden, the Baltic States, Albania etc. At the moment 70% of the waste treated at SAVA is generated outside the Schleswig-Holstein region.

The overall aims of SAVA are in accordance with the Land of Schleswig-Holstein:
- to destroy organic substances that present environmental hazards and, hence, to avoid the necessity for the future remediation of contaminated sites
- to substitute fuels by converting the energy liberated into steam and electric power
- to utilize recyclable products such as slag and gypsum
- to reduce the volume of the waste

Layout
The property of SAVA amounts to 7 hectares.

The overall layout of the plant is as indicated at the aerial photograph below.

1. Access road, waste delivery and weighing station
2. Laboratory, operations scheduling, marketing
3. Drum storage facility
4. Tank farm
5. Solid materials bunker
6. Revolving cylindrical furnace
7. Boiler house
8. Flue-gas treatment
9. Stock
10. Energy and fire-brigade building, standby power-generating set
11. Turbine system
12. Rainfall retention basin
13. Administration and welfare building
Technical Data

SAVA is designed especially for treatment of hazardous waste by means of high temperature incineration in rotary kiln. The plant represents state-of-the-art technology in Europe for treatment of hazardous waste.

The overall flow diagram is presented below. The individual treatment steps are described in the chapters below.

Waste Types

The list of waste types received at SAVA includes petroleum industry residues and waste from commercial-available products such as paints, solvents, tars, pharmaceuticals, wood, rubber or plastic. The list covers organic residues from foodstuff industry, chemical industry and various other types of industries.

SAVA is capable treating waste in solid, liquid and pasty form. Far the most waste treated at SAVA is solid. In 2004 approximately 60% solid, 30% liquid and 10% pasty waste was received.

SAVA has developed a catalogue for waste accepted at the plant. The waste acceptance catalogue is classified according to the European waste catalogue using a 6-digit classification number.

SAVA has developed instruction sheet describing the terms of delivery. In total 11 instruction sheets describe the terms of delivery for instance there is one instruction sheet for solid waste that requires crushing, liquid waste, liquid waste for special batch, etc.

Reception

In accordance with the waste management regulations each consignment with accompanying manifests and applicable permits and licenses are verified, and the total weight of the vehicle is determined by means of a weighbridge.

The labelling of the incoming waste is controlled to ensure that all needed information is available.

Storage
After the waste has been identified and for some waste types compability tests are carried out the waste is directed to the appropriate storage area.

**Incineration**
The core of the process is the rotary kiln consisting of a revolving cylindrical furnace in which the thermal degradation of the waste is carried out. The waste is fed into the kiln by several means. Solid waste from the bunker is fed into the hopper by means of the overhead crane.

Waste in drums is fed by means of the drum lift and are fed via a sluice to the kiln.

Liquid waste is premixed in the storage tanks and is fed into the kiln or the secondary combustion chamber by burners or lances.

The calorific value of the waste is so high that no addition of fuel is required.

The vertical secondary combustion chamber ensures a complete burn out of the flue gases. In accordance with the EU-directive and the environmental permit the kiln has to operate at min. 1100oC min 2 sec. retention time when halogenated substances are incinerated.

**Energy Recovery**
The hot flue gas from the secondary combustion chamber passes to the steam boiler.

The steam is used in a steam turbine and generator where it is used for generation of electricity.

**Flue Gas Cleaning**
The flue gases are cleaned before emitted to the atmosphere. The flue gas cleaning system is a very advanced system ensuring that the plant at all time is capable fulfilling the environmental requirements.

Immediately after the boiler the flue gases are cooled in a spray dryer by means of water from the following quench and HCl-scrubber system.

The flue gases are dedusted in an electrostatic precipitator (ESP) where dust or fly ash is removed from the bottom of the ESP. Fly ash is one of the residues from the process.

In the subsequent quench cooling unit the flue gas is cooled to the saturation temperature before it enters the HCl-scrubber. The HCl-scrubber is acid-based and in addition to HCl it also removes other acidic components, resid-ual particulates and heavy metals.
After the acidic scrubber the flue gas passes the SO2-scrubber where lime stone is added to remove the SO2. Gypsum is generated and might principally be re-used. However, the product is not commercial competitive resulting in disposal of the gypsum in stead of sale.

To remove possible particulates and to remove dioxin the flue gas passes a bag house filter. Before entering the filter the flue gas is heated by means of a heat exchanger to a temperature above the dew point to prevent corrosion in the bag house filter. Lime and activated carbon is added to the filter.

Dust from the bag house filter is another residue from the flue gas cleaning process.

To remove NOx a catalyst is installed. A sufficient temperature is kept be means of an auxiliary steam generator

**Control of Operation**
The plant is manned 24 hours a day at the central control room. The plant is to a very high extent operated by the automatic CMS system.

In addition to the automatic CMS system chemical analysis are carried out during the daily operation to ensure that the process especially the scrubber system is in chemical balance. If not it is difficult to ensure a stable operation and following low emission data.

**Safety**
Occupational health and safety of the workers at the plant is a very important issue for SAVA.

First of all the control of all incoming waste and the correct mixing of the waste fed to the plant is of utmost importance for a safe and environmentally proof operation of the plant.

Also safety precautions taken during design of the plant has been carefully considered and the technical concept of the plant and the operation figures proof that even though hazardous materials are handled SAVA has succeeded to equip the plant with sufficient technical installation for a safe operation, as well as the manual operation is following strict procedures ensuring lowest possible risks for the workers and the environment.

**Environmental Data**
The plant is equipped with an advanced flue gas cleaning system and can without problems fulfill the requirements given in the EU-directive for waste incineration.
As seen from the below table, also presented at the home page of SAVAS the actual emission is considerably below these limits.

The following table lists the limits laid down in the 17th Directive pursuant to the Federal Law on Protection from Emission (17th BImSchV) and in the SAVA Planning Resolution (PR), given as average daily values against the actual annual and monthly averages.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Unit</th>
<th>Emission limit 17. BImSchV</th>
<th>Emission limit PR</th>
<th>Actual annual mean 2004</th>
<th>Actual monthly mean March 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon-monoxide</td>
<td>mg/m³</td>
<td>50</td>
<td>50</td>
<td>5.07</td>
<td>3.46</td>
</tr>
<tr>
<td>Particulates</td>
<td>mg/m³</td>
<td>10</td>
<td>5</td>
<td>0.34</td>
<td>0.27</td>
</tr>
<tr>
<td>Total carbon</td>
<td>mg/m³</td>
<td>10</td>
<td>5</td>
<td>0.46</td>
<td>0.48</td>
</tr>
<tr>
<td>Hydrochloric acid</td>
<td>mg/m³</td>
<td>10</td>
<td>5</td>
<td>0.01</td>
<td>0.11</td>
</tr>
<tr>
<td>Sulphur oxides</td>
<td>mg/m³</td>
<td>50</td>
<td>25</td>
<td>2.03</td>
<td>1.72</td>
</tr>
<tr>
<td>Nitrogen oxides</td>
<td>mg/m³</td>
<td>200</td>
<td>100</td>
<td>84.50</td>
<td>85.23</td>
</tr>
<tr>
<td>Mercury</td>
<td>mg/m³</td>
<td>0.03</td>
<td>0.03</td>
<td>0.0015</td>
<td>0.0013</td>
</tr>
</tbody>
</table>

The flue gases are checked for their content of heavy metals, hydrofluoric acid, dioxins and furans once each year in a monitoring campaign. The current results are listed below:

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Unit</th>
<th>Limits</th>
<th>Annual measurement 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrofluoric acid</td>
<td>mg/m³</td>
<td>1.0</td>
<td>&lt; 0.2</td>
</tr>
<tr>
<td>Total cadmium and thallium</td>
<td>mg/m³</td>
<td>0.05</td>
<td>0.0003</td>
</tr>
<tr>
<td>Total antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel, vanadium, tin</td>
<td>mg/m³</td>
<td>0.50</td>
<td>0.021</td>
</tr>
<tr>
<td>Total arsenic, benzo[a]pyrene, cadmium, cobalt and chromium</td>
<td>mg/m³</td>
<td>0.05</td>
<td>0.0008</td>
</tr>
<tr>
<td>Dioxins und furans as TE*</td>
<td>ng/m³</td>
<td>0.10</td>
<td>0.0067</td>
</tr>
</tbody>
</table>

*The toxicity equivalent TE is a total figure for the assessment of the total toxicity of all dioxins and furans.
Samples of slag, fly ash, filter dust, etc. are taken and analysis are carried out to ensure the right quality has been achieved.