

## ***Incineration– Annex to POPs Technology Specification and Data Sheet***

**Table 1: Technology Overview – Summary Technical Details**

Important note: The data given in this Annex cannot simply be compared with the data for technologies which are specifically designed to treat POPs!

This typical and state of the art Hazardous Waste Incineration (HWI) Plant with the combination of rotary kiln and secondary combustion chamber, followed by a boiler and sophisticated effective flue gas cleaning installations is able to dispose of continuously all kinds of hazardous waste: solid, liquid, gaseous, pasteous and materials in drums. The part of pesticides, packed in drums, is normally less than 1 %. Together with other POPs waste like PCB it can be sometimes up to 5 % and are often negligible compared to the total waste treated.

For the incineration process there is no difference by treating POPs or other kinds of hazardous wastes, which also can content higher concentrations of sulfur, chlorine, bromine, fluorine or heavy metals. Starting with checking the inventory, analyzing and the correct packaging regarding the weight of the single drums, filled with POPs in different concentrations, together with the daily incineration menu of the incinerator emission peaks are avoided. Thus you cannot see any difference in the continuous emission monitoring during POPs incineration. One reason is the big buffer capacity in the flue gas treatment installations.

| <b>Technology Provider</b>   | <b>Technology</b>  | <b>Scale +</b> | <b>Comp. treated</b>   | <b>Related comp treated</b> | <b>Validation project experience **</b>                         | <b>Applicability Ranking++</b> | <b>Additional Remarks</b>                      | <b>Others</b>          |
|--|--|----------------|--|-----------------------------|---|--------------------------------|--|------------------------|
| SAVA, Germany  | High temperature incineration in a rotary kiln with efficient flue gas cleaning system                 | F              | Pesticides and PCBs (including all kinds of related materials) |                             |   | DA                             | Runs since 1997; Spray dryer (no waste water); | Harbour at Brunsbüttel |
| Ekokem, Finland  | High temperature incineration in a rotary kiln   | F              | Pesticides and PCBs  |                             |   | DA                             | Since 1987<br>3 units                          |                        |
| Tredi, Saint Vulbas, France  | One rotary kiln and one static kiln (for liquid)   | F              | Pesticides and PCBs  |                             |   | DA                             |  |                        |
| AVG Abfall-Verwertungsgesellschaft mbH, Germany                    | High Temperature incineration plant  | F              | Pesticides and PCBs  |                             |   | DA                             | Since 1971 with 2 units                        |                        |
| Shanks, United Kingdom   | Various high temperature incineration plants   | F              | Pesticides and PCBs  |                             |   | DA                             |  |                        |
| HIM, Germany   | Rotary kiln and secondary combustion chamber, followed by a boiler and flue gas cleaning installations | F              | Pesticides and PCBs  |                             |   | DA                             |  |                        |
| +Key: F - Full-scale applications completed                        |  |                |  |                             | ++Key: Applicability ranking for pesticides                     |                                |  |                        |
| P - Pilot/Demonstration scale completed; no F-applications         |  |                |  |                             | DA – Direct applicable  |                                |  |                        |
| B - Bench/Laboratory scale completed; no P or F-applications       |  |                |  |                             | FS 1 – Full scale within reasonable period possible 0-2 years   |                                |  |                        |
| T - Theoretical applicable, no B, P, F applications                |  |                |  |                             | FS 2 – Full scale within considerable period possible 2-5 years |                                |  |                        |
| * Vendor claims performance of demonstration, but no data provided |  |                |  |                             | **Validation on the basis of info provided in Table 2 and 3     |                                |  |                        |

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**Table 2: Overview Project Experience per Technology Supplier**

Note: There are hardly any data available of direct monitoring of POPs destruction. Mostly 1 or 2 times per year are only the legally obligatory data available and these are independent of POPs treatment

| Technology Provider                                   | Contaminants  | Amount treated in tons  | Results incl. DRE, Pre-treat, Post treat Emissions, energy consumption, costs*  |   |   | Client References Name, address, contact person phone, Email, fax               |
|---|---|---|---|---|---|---|
| SAVA<br>Sonderabfallverbrennungsanlagen GmbH, Germany | PCBs contaminated metallic equipment<br>All kinds of PCB materials.<br>100% PCB oils, mineral oils, waste oils and aqueous washing liquids contaminated by PCB            | obsolete pesticides 4,700 t (collected amounts in projects with own field team from abroad); annual capacity 50,000 t | residues in general:<br>200 kg/t slag<br>75 kg/t filter dust<br>Disposed quantity is < 5% of total waste treated.<br>It is not possible to figure out these amounts for PCB treatment<br>DE's >99.99% in general (supplied by SAVA, UNEP 2004)) |   |   |   |
| Ekokem, Oy Ab, Finland                                | As above  |   | DE>99.9999% (supplied by Ekokem, UNEP 2004))<br>Continuous fluegas monitoring   |   |   | Since 1987 (UNEP, 2004)   |
| Tredi, Saint Vulbas, France                           | As above  |   | Residues in general:<br>Ash and dust: Few ppm kg /t waste treated<br>DE=99.999999% incineration (supplied by Tredi, UNEP 2004)  |   |   | Capacity 10,000 t/y PCB waste<br>100% PCB oils 6,000 t/y permitted (UNEP, 2004) |
| AVG Abfall-Verwertungsgesellschaft mbH                | As above  |   | Residues in general:<br>33% of incinerated waste is fly ash, slag and gypsum<br>DE=100% (supplied by AVG, UNEP 2004))   |   |   | Total capacity of plant 100,000 t /y  |
| HIM, Germany  | April/May 2005 pesticides in drums are delivered from the Ministry of Environment of Venezuela to the incineration plant and disposed of immediately without any problem. | Approx. 400 tons  | Parameter   | HWI 1<br>[mg/m <sup>3</sup> N.dry, 11 Vol% O <sub>2</sub> ] | HWI 2<br>[mg/m <sup>3</sup> N.dry, 11 Vol% O <sub>2</sub> ] | Total capacity of plant 110,000 t /y  |
|   |   |   |   | Yearly average  | Yearly average  |   |
|   |   |   | Dust  | 0.24  | 0.59  |   |
|   |   |   | CO  | 20.36   | 23.97   |   |
|   |   |   | SO <sub>2</sub>   | 1.19  | 1.45  |   |
|   |   |   | HCl   | 0.82  | 0.2   |   |
|   |   |   | Hg  | 0.0013  | 0.0003  |   |
|   |   |   | TOC   | 0.82  | 0.5   |   |
|   |   |   | NO <sub>x</sub>   | 128.26  | 130.34  |   |
| HIM, Germany  | PCB incineration campaign   |   | Destruction efficiency for PCB has been checked during PCB campaign. The result has been > 99.99992 %.  |   |   |   |

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**Table 3: Client References Overview project experience per technology suppliers**

Note: These data do not claim to be complete for all incineration plants. Only some examples received from 2 companies have been included in the list

| Technology provider                                   | Country, Employer References  | Contact   | Comp. treated  | Period treatment         | Treatment data | Description/notes   |
|---|---|---|--|--------------------------|----------------|---|
| SAVA<br>Sonderabfallverbrennungsanlagen GmbH, Germany | Togo, Shell/Croplife  | Dr. Lawrence Dollimore, Phone +44/1892861374  | Approx. 16 tons of obsolete pesticides               | 11/12/2005 (in progress) |                | In progress   |
| SAVA<br>Sonderabfallverbrennungsanlagen GmbH, Germany | EU PHARE, Contract and Finance Unit, Bucharest, Romania<br>Rambøll, Denmark<br>Site supervision and assessment incineration plant | Ms. Bettina Kamuk, Rambøll, Denmark<br>+45 45 98 86 26  | 1,720 t obsolete pesticides in 2005 (total contract) | 3/2005-11/2005           |                | Amount of stores: 99 stores all over Romania;<br>Duration of field work: 8 months.                                      |
| SAVA<br>Sonderabfallverbrennungsanlagen GmbH, Germany | Senegal, Mauritania and Cape Verde  | Dutch Embassy, Dakar, Senegal<br>Mr. Franke Toonstra, ph: +221-8490360<br>NIRAS, Denmark,<br>Mr. Preben Knudsen, ph: +45 96306421 | 783 tons of obsolete pesticides and related waste    | 2003-2004                |                | Amount of stores: Senegal: 10 stores; Mauritania 19 stores; Cape Verde: 16 stores;<br>Duration of field work: 8 months. |
| SAVA<br>Sonderabfallverbrennungsanlagen GmbH, Germany | Seretario de Ambiente y Desarrollo Sostenible, Buenos Aires, Argentina  |   | 200 tons of Lindane contaminated soil                | 2003                     |                |   |
| SAVA<br>Sonderabfallverbrennungsanlagen GmbH, Germany | Albania, EU PHARE, Project Management Unit  | Grigor Gjerci, ph: +355 4223818<br>COWI: ph: +45 29254494   | 360 tons of obsolete pesticides                      | 2002                     |                | Amount of stores: 32 all over Albania;<br>Duration of field work: 6 weeks.  |
| SAVA<br>Sonderabfallverbrennungsanlagen GmbH, Germany | Hydrogeotechnika, Poland  | Jaroslav Surma, former project manager, ph: +49 1702346853  | 1,300 tons of obsolete pesticides                    | 2001 – 2002              |                |   |
| SAVA<br>Sonderabfallverbrennungsanlagen GmbH, Germany | S.T.E. (Subsidiary of RWE), Italy   | Ph: +390108311591   | 200 tons of obsolete pesticides from Galliate        | 2000                     |                |   |
| SAVA<br>Sonderabfallverbrennungsanlagen GmbH, Germany | S.T.E. (Subsidiary of RWE), Italy   | Ph: +390108311591   | 130 tons of DDT sludge                               | 2000                     |                |   |
| HIM   | Venezuela   |   |  |                          |                |   |

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**Table 4: Utilities Required for Hazardous Waste Treatment**

(Data are general representative for the year 2003, but not specifically for high strength pesticides waste)

| Utility   | Units          | Quantity required per tonne of waste input | Quantity required per year (110,000 t Full-scale plant) |
|---|----------------|--|---|
| Electricity                                     | kWh            | 170  | 18,700,000  |
| Electricity produced and supplied to public net | MWh            |  | 1,700   |
| (50%) NaOH                                      | Kg             | 40   | 4,400,000   |
| CO2 production                                  | Kg             | 820  | 90,000,000  |
| Oil   | Kg             | 4  | 440,000   |
| Active Carbon /Calcium Hydroxide mix            | Kg             | 1.4  | 150,000   |
| Cooling and scrubbing Water (own supply well)   | m <sup>3</sup> | 1.7  | 187,000   |
| Slag production                                 | kg             | 215  | 23,600,000  |
| Filter dust and spray dryer residue             | kg             | 46   | 5,100,000   |
| Processing Rate                                 | kg/min         |  |   |
|   | Tonnes/month   |  | 9,170   |
|   | Tonnes/yr      |  | 110,000   |

- Oil consumption: Only used for start-up of the installation after standstill, otherwise the installation runs autarque only with the waste
- NaOH is only used to neutralise acid gas in the wet scrubber, strongly depending on Halogen and Sulfur content of the waste
- Aktive Carbon /Calcium mix is occurring in the last step of the fluegas cleaning, for traces of Dioxine and Mercury)