SETCAR - Technologies and Facilities/equipment

Technology for treatment of water contaminated with:
- Petroleum products
- Polychlorinated biphenyl (PCB), HCH
- Mercury
- Heavy metals
- Toxic chemical substances

Facilities
- Mobile unit for treatment of water with toxic substances
- Installation for treatment of PCB water
- Installation for disposal of chemical wastes
- Installation for separation of waste waters and liquid waste treatment
- Installation for treatment of ammonia water
- Technology for treatment of sludge contaminated with:
- Petroleum products, drilling waste
- Heavy metals
- Various chemical substances

The following units are used:
- Treatment installation with two phase centrifuge
1. Technology for treatment of soil contaminated with:
   - Petroleum products
   - Polychlorinated biphenyl (PCB)
   - Mercury
   - Heavy metals:

   **Facilities**
   - Indirect thermal desorption unit
   - Direct thermal desorption unit
   - Soil Washing/sorting (Doppstadt)
   - Inertization
   - Stabilization - solidification
   - Bioremediation

1. Technology for treatment of PCB oil from electrical equipment (transformers, capacitors, etc)
   - Mobile unit for chemical de-chlorination, filtration, degassing and dehydration of PCB oil from electrical equipment
   - Mobile unit for oil reclamation – 2 units
1. Technology for disposal of electrical equipment with PCB (transformers, capacitors and other electrical equipment):
   - Stationery facility for disposal of electrical equipment with PCB

**SPECIFIC TECHNOLOGIES OF SETCAR S.A.**

**TECHNOLOGIES FOR DECONTAMINATION**

1. Technology for decontamination and dismantling of carbon sulfide storages
2. Technology for degassing of carbon sulfide railway tanks
3. Technology for decontamination of carbon sulfide installation
4. Technology for decontamination of methanol installation
5. Technology for decontamination of ethyl xanthate installation
6. Technology for decontamination of galvanic sections
7. Technology for decontamination of railway tanks contaminated with cyanides
8. Technology for decontamination of petroleum products storage tanks
9. Technology for decontamination of fuming sulphuric acid tanks
10. Technology for decontamination of silicon tetrachloride tanks
11. Technology for decontamination of asbestos containing locations
12. Technology for decontamination of cold stations
13. Technology for decontamination of mercury packages
14. Technology for decontamination of PCB equipment
15. Technology for decontamination of PCB contaminated electrical stations
16. Technology for passivation and decontamination of used nuclear fuel storage
17. Technology for recovery of sodium sulphate from tanks
TECHNOLOGIES FOR DISPOSAL
1. Technology for cyanides disposal
2. Technology for disposal of bromides and hydro-bromic acid
3. Technology for disposal of white phosphorus
4. Technology for disposal of sodium and potassium permanganate
5. Technology for acids neutralization (sulphuric, hydrochloric, nitric)
6. Technology for peroxides disposal
7. Technology for ammonia waters disposal
8. Technology for rocket fuel disposal
9. Technology for disposal of arsenic white and arsenic pentoxide containing solutions
10. Technology for breakdown of emulsions
11. Technology for disposal of heavy metals from waste water
12. Technology for disposal of water-based paint
13. Technology for disposal of liquid phase in petroleum lagoons
14. Technology for disposal of liquefied compounds from pressure tanks (chlorine, ammonia, sulphur dioxide, acethylene etc.)
15. Technology for deactivation of pyrophoric nickel catalysts
16. Technology for disposal of PCB from contaminated oil
17. Technology for disposal of PCB from water
TECHNOLOGIES FOR SOIL AND WATER TREATMENT

1. Technology for washing the lindane contaminated soils
2. Technology for treatment of soils contaminated with petroleum products, by direct thermal desorption
3. Technology for treatment of soils contaminated with petroleum products, by encapsulation
4. Technology for treatment of mercury contaminated soils, by indirect thermal desorption
5. Technology for treatment of phenols contaminated soils, by indirect thermal desorption
6. Technology for treatment of lindane contaminated soils, by indirect thermal desorption
7. Technology for bioremediation of soils contaminated with petroleum products
8. Technology for bioremediation of PCB contaminated soil
The work involved the processing within 12 months, of petroleum waste from 31 lagoons. Total estimated quantity- liquid, solid wastes and other wastes –is about 230,000 m³. Estimated quantities on types are; 64% solid waste, 35% liquid waste and 1% other waste.
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Mobile laboratory for chemical analysis
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INDIRECT THERMAL DESORPTION

The indirect thermal desorption units consist of 6 portable units, made of metal structures container type which assures a good mobility and reduced time for mounting and demounting, on the location close to contaminated site.

Transport „in situ“ of indirect thermal desorption unit has the advantage of avoiding the pollution given by the transport of contaminated soil to long distances and, implicitly, reduction of the decontamination costs.

Indirect thermal desorption aims the separation of toxic volatile substances by heating the contaminated soil at temperatures higher than the boiling point of substances in question. By heating the contaminated soil, water vapours, toxic volatile substances vapours are discharged followed by separation from solid particles, condensation of water and toxic substances vapours, intaking and cleaning by the help of some special solutions and and cleaning on active coal of gaseous phase resulted. Vapours discharge from contaminated soil granules depends on the soil composition, grading, moisture and retention time in the desorber, contamination degree, temperature in desorber as well as the vacuum level in the installation.
Contaminated products resulted from processing, are collected separately and finally disposed at authorized companies, according to current legislation. The most important advantage of indirect thermal desorption is given by the fact that contaminated soil does not come into direct contact with hot gases, thus avoiding their contamination.

The fact that entire gases circuit is under vacuum, any possibility of air contamination by eventual leakages, is eliminated. Water vapours elimination before desorption increases the capacity of this unit. Thermal balance of this instalation is very efficient, all the energy of combustion is used before for desorption and after for solid material drying. Under vacuum desorption reduces the boiling point of volatiles compounds and in thus energy consumption.
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Further to indirect thermal desorption we get decontaminated soil and the gaseous phase containing volatile toxic products (PCB, HCH, Hg, H$_2$S, CS$_2$, petroleum hydrocarbons, organic solvents, POPs, VOC).

Vapours discharge from contaminated soil granules depends on the soil composition, grading, moisture and retention time in the desorber, contamination degree, temperature in desorber as well as the vacuum level in the installation.

The gaseous phase removed from the process, containing water, volatile toxic substances vapors, non-condensable gases, is purified by being treated with specific solutions, followed by absorption on activated carbon and removed from the system, being exhausted in the air.

Further to the treatment of gaseous phase, the laboratory testing indicates the imposed parameters according to the limits provided by legal norms.

The technological unit for indirect thermal desorption is equipped with measure and control devices (level gauges, pressure gauges, compound gauges, thermometers) for continuous monitoring and adjustment of operation parameters.
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Thermally treated soil is cooled and, after specific testing, is stored in special arranged spaces, as decontaminated soil.
Project HCH – TURDA site- ROMANIA

In this project, as first stage, over 140,000 mc of HCH contaminated soil had to be excavated, sorted, temporary stored in another location for further treatment!

Stages of the project:

Site organization
- Sampling and analysis
- Analysis of other pollutants (CN, Hg)

Analysis done in a mobile laboratory of SETCAR specially equipped.

Testing is followed by a site condition evaluation
SETCAR equipped a mobile laboratory with a fluorescence analyzer with X rays supplied by Oxford company, an instrument XMET 5000 type, computer and proper software. The laboratory has also proper glass, analytical scale, test kits for determination of inorganic chlorine.

For identification and determination of metal content in soil and rocks, the same fluorescence X rays analyzer is used with a proper software. Mobile laboratory has its own system to generate electricity, water installation and water tanks, system for collection of waste waters and a ventilation system.

For the processing of laboratory data there is a computer with a printer. Information can be sent by internet to other laboratories or collaborators.

Laboratory furniture allows to collect and store the samples.
Management for dislocation works:
- Works supervision;
- Weighing;
- Decontamination of vehicles when going out from contaminated area;
- Area buoyage and signalling for excavation;
- Rapid intervention in case of accidents on the route.
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HCH
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HCH

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GRAVEL AND STONE WASHING

DOPPSTADT
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Contaminated soil treatment in mobile unit for direct thermal desorption
The unit is mounted on a trailer, together with own electricity generator. Direct thermal desorption has additional water cooling and recirculation system used for dust and condensing volatile substances intake, removed from contaminated soil. Mobile unit for direct thermal desorption is equipped with all measure and control devices needed for monitoring and real time adjustment of flow parameters.
Rehabilitation of historically Polluted Site – Location of Former Chemical Factory (Crangurile village)-Romania Project financed from EU funds

Soil treatment by chemical stabilization and solidification
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SITE INITIAL VIEW
The main objective of rehabilitation is to reduce the mobility of contaminants in groundwater on site.

- Between 1958-1990 chemical factory in village groves, Dambovita, produced a series of chemicals: laundry soap, corrosion inhibitors, dyes, chromic anhydride, insecticides, brake fluid, antifreeze, rodent poisons.
- Uncontrolled chemical residues were stored in pits on site and directly into the soil, creating risks to human health and the environment through contamination of groundwater and creek flood.
- Following to preliminary investigations in 2009 it was issued the rehabilitation feasibility study site area of approximately 20,000 m² by washing soil solidification and stabilization first meter central area of the site approximately 40,000 m³.
Various colors determined by different degrees of contamination identified on site
Tests for in situ determination of treatment technology
Treatment test in SETCAR laboratory
Technological Platform
Installing stabilization/solidification equipment
Surface excavation site at a depth of 1 m
Excavators ready for work
Activity commencement
Clearing the area with waste selective collection as well as authorized transport for disposal
Mobile laboratory of “Balint Analitika”
Sampling and field tests (screening)
Soil washing with DOPPSTADT SM620 Unit
Excavation and material preparation for treatment
Excavation of sludge and Green Pasta (with high chromium content) awaiting extraction and processing in reactors
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Chrome conversion and stabilizing the reactors
Homogenization after supplying hydraulic additives
The material changes color after adding additives
Solidification with hydraulic binders
Excavation refill with treated soil and compaction on layers
Spreading layer of topsoil and grass all over the site

Before treatment

After treatment
Further to the Cooperation Agreement between OHIS-O rganic Chemical Industry “Naumovski-Borce-Skopje, K + S Entsorgung GmbH-Germany, SETCAR S.A. and Ministry of Environment and Physical Planning of the Republic of Macedonia, SETCAR transported a desorption-module to the contaminated parcel owned by OHIS, set up and operated of the desorption module on the OHIS site and treated 2 x 5 t HCH-contaminated soil in the desorption module
TECHNICAL CONCEPT
Elaborated by K+S Germany and SETCAR Romania
for the project
“OHIS Site Remediation” – Skopje – MACEDONIA

• PRESENTATION OF SETCAR EXPERIENCE IN THE FIELD OF CONTAMINATED SITES REMEDIATION
  SETCAR S.A. is a private company, working since 1994 and, starting with the year 2000 the company specialized itself in the field of hazardous waste decontamination.
  In the field of contaminated sites, within 2009-2011 SETCAR participated with specialists, operators, equipment and mobile laboratory, in some special projects
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PILOT TEST PLANT

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TECHNICAL CONCEPT
Elaborated by K+S Germany and SETCAR Romania
for the project
“OHIS Site Remediation” – Skopje – MACEDONIA

- Decontamination by indirect thermal desorption of more lots of soil contaminated with HCH, Hg, phenols, hydrocarbons from BECHTEL motorway - TURDA The outputs obtained were more than 95% for Hg even 99.99%.
- Decontamination by indirect thermal desorption of more lots of soil contaminated with HCH, Hg, phenols, hydrocarbons
- In contrast with direct thermal desorption where the pollutants are put into contact with burned gases, the indirect one assures a evaporation, desorption, pollutants separation, more efficiently
Proposals K+S and SETCAR

We propose the following technology:

• Selective excavation, extremely carefully done, surgically, with continuous laboratory monitoring leading to a material sorting on categories:
  • 1. non-contaminated
  • 2. low contamination 2-300 ppm HCH;
  • 3. slight contamination 0.03% - 30% HCH
  • 4. medium contamination 30 - 40% HCH
  • 5. strong contamination > 40% HCH
  – Material from category 1 is stored separately and protected to avoid further contamination.
  – Material from category 2 is decontaminated by indirect thermal desorption. Decontaminated product is added to the one from category 1;
  – Material from category 3, the one from category 4 and the one from category 5 are homogenized, packed in big bags, transported and stored in underground storage at K+S.

• Remarks: Extremely high concentrated quantities, under the form of solid blocks, will be packed, transported and disposed by incineration. We consider that such quantities will be very small.

• Technology proposed leads to a safe and cheaper final disposal compared with solutions for chemical de-chlorination or incineration suggested until now.
Test proposal K+S and SETCAR

**Participation K+S**
- K+S and SETCAR will demonstrate the off site underground storage of HCH/Hg contaminated soil. The following steps are planned:
  - Taking 5 samples of contaminated soil, sending samples to K+S laboratory
  - Analysis in the K+S laboratory, determination of packaging
  - Preparing the notification documents
  - Transport to the underground storage
  - Storage in Herfa

**Participation SETCAR**
- Sampling of HCH/mercury contaminated soil in Skopje and sending the samples (max. 5) to K+S laboratory
- Preparing the notification papers for max. 2 trucks of mercury contaminated soil in big bags to Herfa together with the Macedonian authority, the waste generator OHIS Skopje and K+S
- Supervision of filling the big bags by the Macedonians.
- Supervision of loading the 2 trucks by the Macedonians
- Organisation and supervision of transport to Herfa and **Participation OHIS Macedonia**
Pictures from project development - OHIS Premises
OHIS premises
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Project development
TEMPERATURE = 400 °C
MOISTURE ~ 16%
TIME = 15 min
PRODUCTIVITY = 0.3t/h

CONCLUSIONS

• The pilot test, according to the contract, was developed on November 6th and 7th, for a total time of 10 hours.
• The input HCH concentration was about 4000 ppm, compared with 300 ppm initially proposed.
• The temperature for desorption was 400 °C.
• Processing time was about 15 minutes. The processed flow was about 0.3t/h, imposed by very high HCH concentration. In order to get a processing rate of 99.88%, it was necessary to process the material twice.
• For initial HCH concentrations of 300-400 ppm, final values can be guaranteed of less 2 ppm of HCH with a processing rate of 99.5 %, with a single passing through desorber.
• SETCAR S.A. has installations for thermal desorption with capacities of 5-10-20 tons/hour.
THANK YOU FOR YOUR ATTENTION