

## **OEK Germany, Rotary Oven Plant for Soil and Sludge Hydrocarbon Remediation**

The rotary oven system is designed for a provision of heat treatment of soil and sludge polluted by oil products. The system is designed as a complete mobile and independent unit, capable of working at any terrain condition. The whole plant may be transported in the marked containers and to be erected and dismantled repeatedly. A minimum economical period of the system work on one location is 18 months.

The main components of the system are rotary oven and thermoreactor (both are shown below) where the unwanted substances are burned off. The treated soil is stored in prisms to cool down and – if desired – to be treated biologically before is sent back to the original location for backfilling and cultivating.

**Picture 1. Rotary oven and thermoreactor.**

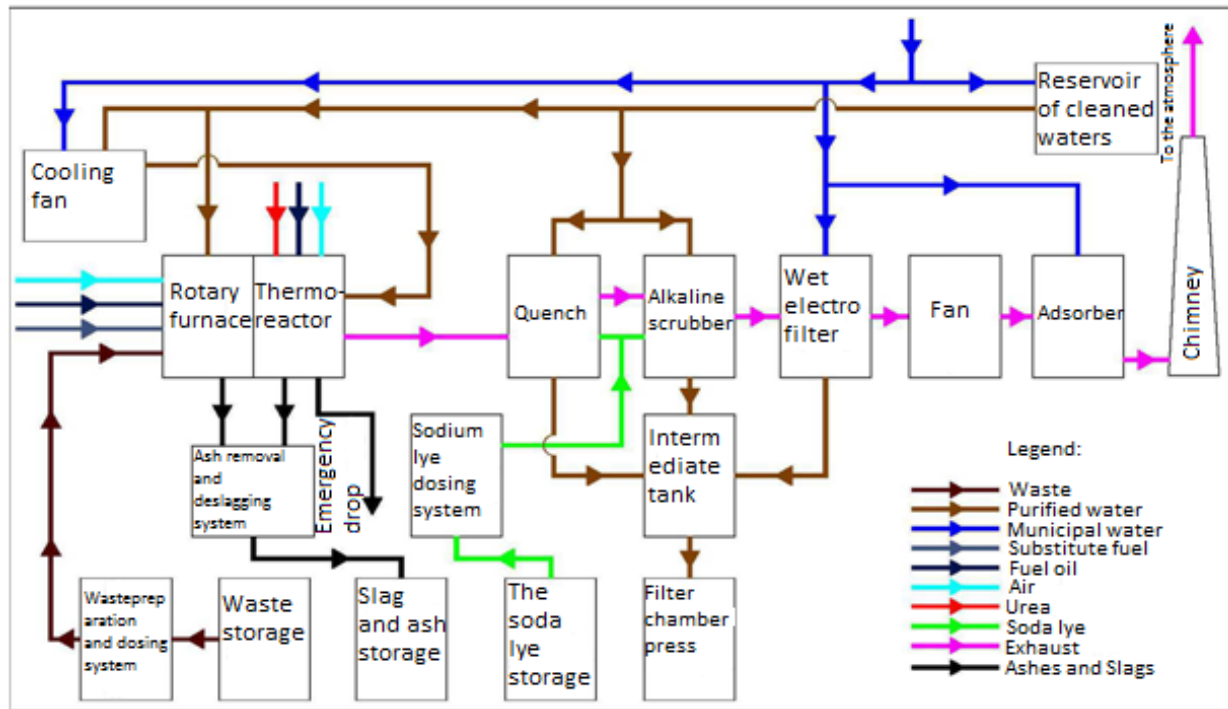


**Table 1: Technical Characteristics**

<b>ITEM</b>	<b>Individual Units</b>	<b>Combined Units</b>	
Capacity, solids	2,500 t / h	20,000 t / annum	
Capacity, liquids	1,500 t / h	16,000 t / annum	
Mode of work	24 h / day	290 days / annum	
Rotary Oven Temperature	500 – 800 C	-	
Exhaust Gases Temperature	65 C	-	
Monitoring	Central electronic system		
Electrical Energy	Independent (2 gen-sets)		
Personnel	1 operator, 2 assistants	4 brigades / day	
Installation time	3 – 7 weeks		

Apart of the heat treatment elements mentioned above, the system is equipped with such the auxiliary components as water pumps, storage tanks (water, diesel, chemicals), electric power generators, air compressors, wheel loaders, exhaust filtering system, mechanical and chemical absorbers etc. System requires also separate services connected with material excavation and delivery to the plant premises, transport for backfilling.

The ideogram of the technological process of the heat treatment system is presented below:



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**The system operating sequence is as follows:**

1. Delivery and storage of the polluted soil / sludge
2. Thermal treatment of the material
3. Cleaning of exhaust fumes
4. Cleaning of the technological water
5. Monitoring

**Ad 1. Delivery to the Plant, Storage of the Material, and Delivery to the Rotary Oven**

1. Delivery to the plant by tippers (soil) or tankers (liquid sludge)
2. At the entry point a quality control is conducted for the storage location identification
3. Deliveries are weighted and recorded at the plant entrance, material delivered to the appropriate storage location
4. Materials are delivered to the rotary oven

**Ad 2. Thermal Treatment of the Material**

1. Material is loaded to the rotary oven. The oven is initially heated by a diesel burner and later hydrocarbons in the material self-ignite and burn due to high temperature inside the oven. During burning air and water are pumped into the chamber. Air – in order to support burning process, and water – in order to keep

2. Solids remaining after burning of hydrocarbons are offloaded automatically at the end of the rotary oven. They are cooled inside water and after that they are sent to a steel container. The containers are emptied at the storage yard. From there the materials will be sent either to the further treatment (biological upgrading) or directed straight for backfilling.

#### **Ad. 3 & 4. Cleaning of Exhaust Fumes and the Technological Water**

1. The fumes are directed from the rotary oven to the thermoreactor for final burning under automatic control system. Compressed air is pumped inside the thermoreactor to ensure optimal oxygen level required for final burning. Ammonium is injected into the thermoreactor to ensure reducing the level of nitrogen oxide. The fumes are directed to further treatment and cooling by salted water injection. Also NaOH is injected to the flow of cooled gas to neutralize acidity. Then the gas passes through a wet electro-filtering process and then, through active carbon, is directed to the emitter (50 m high and 0.8 m diameter) equipped with monitoring system.
2. The process of wet treatment of exhaust fumes results into producing of sludge. It is pumped into press where the water is forcefully removed. The remaining material is sent to the dangerous materials storage for a safe disposal by the authorized agents. The water is utilized in the ongoing process and, whenever necessary, its level is replenished by adding a fresh outside water.

**Picture 2. Another view of the plant.**

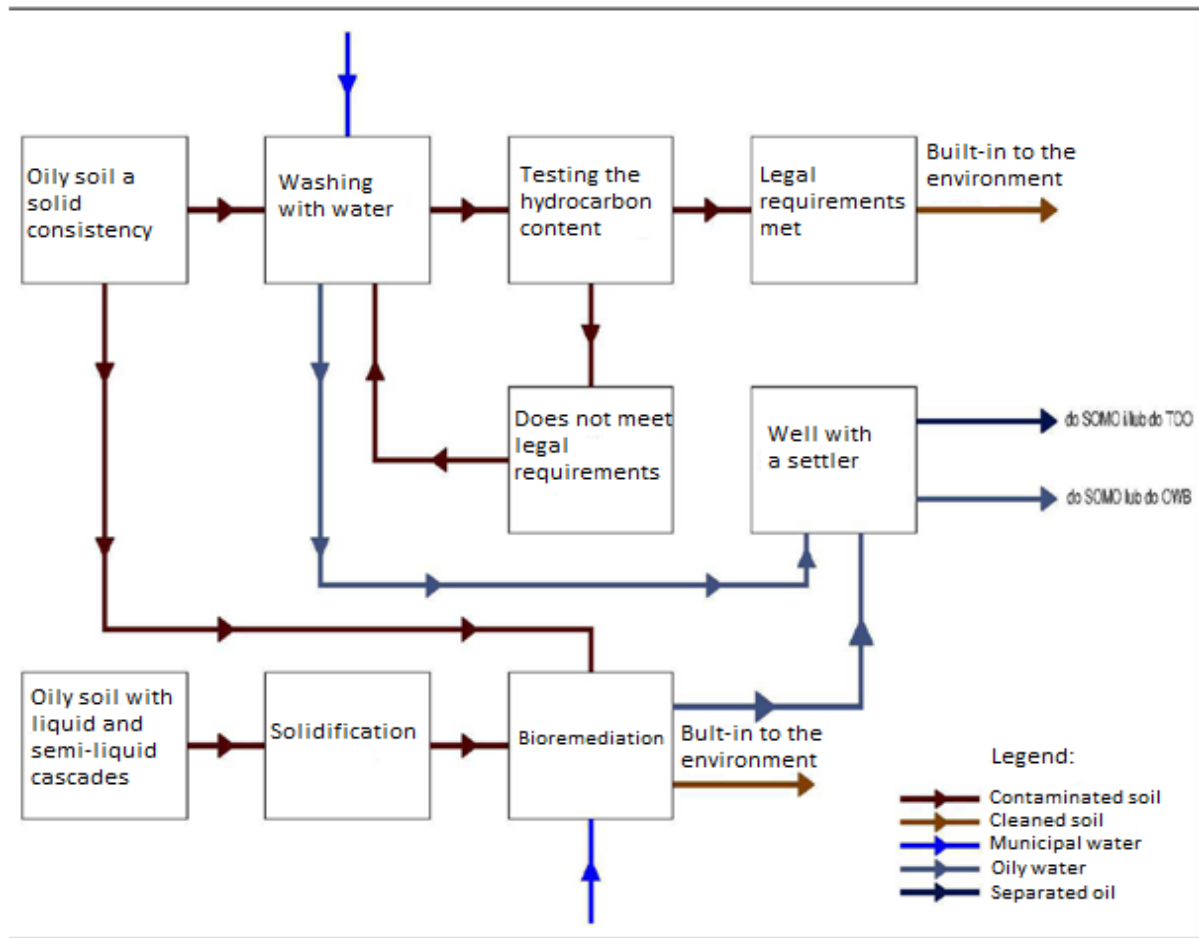


#### **Ad. 5. Monitoring**

1. Basic controlled quantities are temperature in the rotary oven, temperature in the thermoreactor, exhaust fumes chemical composition. All the above are controlled during the whole time of the utilization process.

## **BIOLOGICAL REMEDIATION**

There are several methods to be utilized to get the final product (heat treated soil) biologically remediated. Below indicated ideogram shows one of the method:



**Ideogram 2: Biological Remediation**

At the plot of land next to the plant the concrete slabs are cast with geotextile isolation beneath. Drainages are installed round the slabs with a mobile water treatment plant connected. Prisms of the treated material are formed on top of the slabs and clean water is applied on top of the prisms. Then the approved locally available filling is added such as top soil, laterite, saw-mill wood etc. When the prisms are well mixed with the imported material, bioremedial fertilizers and bacterial diffusions are added. After a prescribed period the mixture is ready for loading for transportation and backfilling.