

ISTD/ I-17-03

VEDBAEK - DENMARK

Context

The site is located at LINDEVANGSVEJ 8, DK 2950 Vedbaek, Denmark. It is a private house located in a residential area, north of Copenhagen. Contamination is partially located by the house under the terrace and mainly in the garden.



Project Description

The target zone is contaminated with mineral oil (C10-C40). The estimation of the diesel amount present in soil are 12000 to 15000 liters and its total mass is estimated to 10800 kg. The soil analysis results showed that the average concentration is close to 1000 mg/kg DM (dry matters) with a maximum concentration of 22000 mg/kg DM.

On this project, the pollutant vapours and gases were directly reinjected into the burners (reburn) so no condensed products were collected during treatment.

For technical reasons, it was decided to treat all the contaminated zone through two batches. As most the groundwater is located below the contaminated zone, the groundwater has not been lowered. the image below summarizes the sampling drills locations on site (aerial view with sampling points).



figure 1 : sampling drill locations on site

Key words

Contaminants
TH : C10 – C40

Max. concentration
22.000 mg/kg DM

Volume
batch 1 : 2400 m3
batch 2 : 3857 m3
Total =

Tonnage
Total = 10137 Tons

Nb of heating tubes
57 + 69 (L: 2m)

Temperature Target
220°C

Heating duration
batch 1 : 69 days
batch 2 : 65 days

Treatment targets
<100 mg/kg DM

Location
Vedbaek- Denmark

Future Use
Residential

Client
NIRAS

Partner
ARKIL

Consultant
ARKIL

Date
2017



Key words

Contaminants
TH : C10 – C40
BTEX

Max. concentration
6750 mg/kg DM

Volume
1022 m3

Tonnage
1260

Nb of heating tubes
37 (L: 13m)

Temperature Target
220°C

Heating duration
57 days

Treatment targets
<100 mg/kg DM

Location
Omøvej - Denmark

Future Use
Residential

Client
NIRAS

Partner
ARKIL

Consultant
ARKIL

Date
2017

Monitoring

Monitoring gases from vapor tubes has been realized on the batch 1 and the batch 2 on the 21/03 and 29/03 for the first batch and the 19/06 and 22/06 for the second batch. The vapor tubes sampling was performed by an activated carbons filter and analyzed by gas chromatography-mass spectrometry laboratory method.

Analytical Results

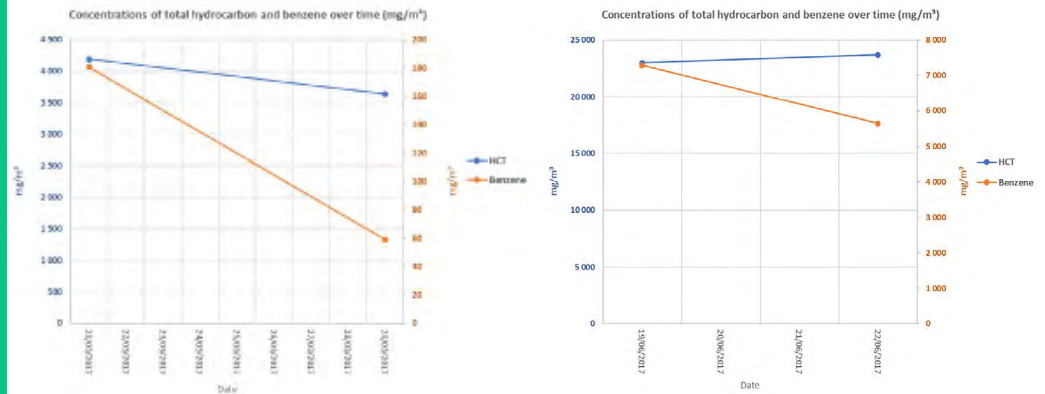


figure 2 : HCT & Benzene concentrations over time (batch 1 & 2)

The graph below depicts the concentrations of HCT and benzene on batch 1 and batch 2 over time. An increase of concentration of benzene was observed over time in exchange of a decrease of concentration of total hydrocarbons.

The end of treatment on the batch 1 was on 31/03/2017 and 28/06/2017 for the batch 2. The sampling drills locations are shown in Figure 1. The target treatment level on batch 1 is 8 m up to 10 m and for the batch 2 is 10 m. To obtain these levels, drills have an average depth of 14.5 m on the first batch and an average of 13.2 m on the second one.

Drill	KB1	KB2	KB3	KB4	KB5	KB10	KB11	KB12
Sampling upper depth (m)	1	1	9	3	1	3	2	1
Sampling down depth (m)	12.3	14	16	15.5	15.5	14.5	12.5	12.5
BTEX sum (mg/kg DM)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Average C6H6-C35 (mg/kg DM)	<20	<20	<20	364	<20	<20	40	150
Highest C6H6-C35 (mg/kg DM)	<20	<20	<20	1300	<20	<20	160	750
Lowest C6H6-C35 (mg/kg DM)	<20	<20	<20	<20	<20	<20	<20	<20

table 1 : BTEX and hydrocarbons concentrations average

In soil samples from KB1, KB2, KB3, KB5, KB10 and KB11 concentrations are well below the quality criterion of 100 mg/kg of dry matters. For the vast majority of the samples, total hydrocarbons are below the detection limit. The Benzen, Tuolen, Ethylenzenen and Xylene concentration are below the detection limit.

Once the first batch treatment was stopped. The soil being sufficiently heated, the humidity coefficient is substantially decreased engendering thereafter the permeability parameter increasing, producing a capillarity rise phenomenon at a later stage. This process is known as sponge phenomenon. Comparing to the initial total volume in soil estimated to 12000 liters (close to 1000 mg/kg DM with a maximum concentration of 22000 mg/kg DM), The total mass of pollutant into soil was estimated at 10800 kg. The remaining residual concentration estimated to 9,75 kg highlight a 99 % of allowance level.