ABSTRACT

The Centre for Best Available Techniques (BAT) is founded by the Flemish Government, and is hosted by Vito. The BAT centre collects, evaluates and distributes information on environmental friendly techniques. Moreover, it advises the Flemish authorities on how to translate this information into its environmental policy. Central in this translation is the concept “BAT” (Best Available Techniques). BAT corresponds to the techniques with the best environmental performance that can be introduced at a reasonable cost.

This report focuses on in-situ and ex-situ soil remediation. Flanders counts 20 permitted soil remediation centra. These centra are specialised in the treatment of ground coming from soil remediation projects. The soil remediation centra are mostly situated outside the built-up area or in an industrial zone. Relevant aspects for the location of these centra are the availability of supply- and transport-routes and the nuisance that can be caused by these activities. Important environmental issues for soil remediation activities are noise, odour, dust, fire- and explosion-hazard and local air pollution. But most of the soil remediations are done on-site by specialised contractors.

Sub-techniques that lead to an environmental-friendly execution of the soil remediation techniques are evaluated in this BAT report, and thus *not* the soil remediation techniques at such. The environmental techniques considered in this report are mostly related to two main environmental topics: air pollution and ground water remediation. Organic compounds (VOC) and odour are the most important emissions. Common ground water pollutants are VOCl, BTEX, mineral oil, PAC, heavy metals and MTBE.

BAT selection was brought about on the basis of, among other things, a literature survey, a technical and socio-economic study, cost calculations, foreign BAT reports, plant visits and discussions with industry experts, representatives of the federation, suppliers and specialists from (semi) public institutes. The formal consultation was organised by means of an advisory committee of which the composition is given in Annex 1.

Several preventive measures are BAT, e.g. reduction measures for dust and VOC emissions and the prevention of noise nuisance. All of these preventive measures are already imposed by *Achilles* (Flemish safety, health and environmental protection system for on-site soil remediations).

The available VOC emission reduction techniques contribute also to the prevention of dust and heavy metal emissions. The following techniques are BAT:
– placing a covering layer on the polluted soil
– use of sprinklers
– use of windshields
– regulary cleaning of the yard and the use of wheelwash installations
– unloading of VOC contaminated soils in covered halls with extraction hoods

BAT to remove VOC and odour are:
– activated carbon:
  • for most pollutants
  • only dry air
  • *Achilles* proscribes the use of two adsorption units

- Biofilter:
  - moist air
  - pollutant must be biodegradeble (C 10-C 16)
  - low concentrations
  - not in winter
  - needs more maintenance
  - not often used (1 out of 80 yards)
- Thermal incineration units:
  - only when the incineration can be autothermal; high concentrations

A BAT evaluation is done for 6 important and common groups of ground water pollutants; VOCl, BTEX, mineral oil, PAC, heavy metals and MTBE.

This BAT evaluation led to the following conclusions:
- Air stripping is BAT for the removal of VOCl and BTEX. Air stripping must be completed with an air remediation technique. Depending on the situation a post-treatment with activated carbon may be necessary.
- BAT for the removal of mineral oil is one of the following: activated carbon, air stripping, biological treatment or oil/water seperator.
- Activated carbon is BAT for the removal of PAH. If only naphthalene has to be removed also air stripping and biological treatment are BAT.
- For the removal of heavy metals precipitation, completed with ion-exchange for Cd, is BAT.
- For MTBE removal a combination of an activated carbon filter with strippers is BAT.

On the basis of these BAT conclusions VITO proposed environmental permit conditions for thermal treatment plants and for the reduction of air pollution from soil remediation activities.

For the reduction of air pollution in general, it is suggested that the soil remediation experts should indicate whether or not the general conditions stated in Vlarem II appendix 4.4.2 are exceeded.
- If these values are exceeded, the operator needs to fulfill the general conditions of appendix 4.4.2
- If these values are not exceeded, the 90% rule should be taken into account. This means that only 10% of the pollutant may be emitted into the atmosphere. This should be well-monitored during the soil remediation project.

Measurements should be carried out following to the EU standards for the monitoring of legal emission limit values.

The BAT analyses did not lead to a proposal for new water discharge values for this activity. When issueing a permit for a specific soil remediation site one has to consider not only BAT but also the environmental quality standards, risk reduction, environmental benefits and costs. The BAT associated reduction percentages however can be used as a basis for acceptable discharge values. Current discharge limit values (Tabel 5.3) can be seen as guiding level.

When setting up the soil remediation project the soil remediation expert needs to consider the following guidelines.

Guiding principles for the options of discharge are:
1. re-use of waste water or re-infiltration into the soil
2. if no full re-use or re-infiltration is possible, discharge of water into surface water is possible.
3. last option is the discharge of the ground water in sewage system

Further research concerning risk and cost evalution is appropriate to come to a list of achievable discharge limit values for ground water remediation.

Concerning thermal treatment plants, we propose to apply VDI guidelines also in Flanders. Standards for Hg, NO_x and dioxines can be geared to the waste incineration standards, namely 0,1 mg Hg/Nm³ as halve hour average, 0,05 mg Hg/Nm³ as daily average and 400 mg NO_x/Nm³ as daily average. The VDI guideline does not mention a dioxine standard. It could be considered to implement the dioxine standard from waste incineration within the regulations for thermal treatment plants.

In the case of mobile thermal treatment plants, it can be considered to allow deviations from these standards. These mobile plants have some environmental benefits compared to off-site thermal plants; there is no need for transportation of the polluted soils to the soil remediation plants. This is reflected in less emissions of NO_x (6,1 g/km), SO_2 (0,13 g/km), dust (0,28 g/km), hydrocarbons (1,2 g/km) and CO (2,7 g/km) and prevention of possible noise nuisance caused by this transportation.

Standards for on-site thermal treatment installations could be calculated on the basis of the standards for off-site thermal plants. The standards for on-site thermal plants could be these for on-site intallations increased with the emissions saved by transportation taken into consideration the throughput (tonnes per hour) and the off-gas volume.

Overview of the German emission limit values for on-site and off-site thermal treatment plants (VDI guideline 3898)

Polluent	VDI guideline	
	Daily average in mg/Nm³ at 11 %O_2	Half hour average in mg/Nm³ at 11 %O_2
CO	50	100
Total dust	10	30
Total C	10	20
HCl	10	60
HF	1	4
SO_2	50	200
NO en NO_2	200	400
Hg	0,03	0,05
Dioxines and furanes	-	-