Site Remediation – Emissions and Boundary Monitoring

Introduction

The remediation of contaminated land sites can prove to be a challenging undertaking. There is considerable risk of chemical exposure to both the onsite workforce and to surrounding communities. To offsite receptors, the remediation process itself can become a significant route of exposure, with the excavation and uncovering of otherwise trapped contaminants resulting in potential volatilisation and aerosolisation of organic and inorganic toxic compounds.

Environmental Effects from Chemicals in Soil

As such, it is often necessary to undertake monitoring regimes for the early detection of in field short-term emissions of site related chemicals. The early detection of these emissions can be used to trigger associated contingency measures. These measures can then help mitigate and/or reduce emission exposure to surrounding communities to accepted regulatory and recommended guideline limits. When monitoring for emissions these normally fall into the two groups of Volatile Organic Compounds (VOCs) and Dusts/Particulates (particulate matter). As a minimum it is expected that trigger levels for noise, dust and VOCs are provided and acted upon.

In achieving this it is necessary to provide a site specific plan for proposed activities. Where a risk assessment shows that emissions require control, monitoring must take place to demonstrate effective abatement, this should include details of:

- Pollutants to be monitored
- Emission limits and Trigger levels for each pollutant
- Number and location of source emission points
- Monitoring protocol, which includes frequency of monitoring, type of equipment, calibration, accreditation, sample collection and procedure

- The experience and qualifications of personnel carrying out the monitoring and those responsible for interpreting and acting upon the results
- Emissions action plan
- A baseline monitoring programme might be required where other emission sources similar to the proposed activity already exist.

From these prior steps boundary air quality monitoring, trigger points can be set for each parameter **(for example, between 80% and 90% of air quality criterion)** which provide adequate protection of each environmental medium or human health.

Monitoring of VOCs and Dust: Technical View

Before the commencement of a project it is necessary to establish baseline conditions at the site. This step involves conducting short-term air monitoring before any emissions-generating activities begin. It is important during this step that consistency in sampling methodology is maintained throughout the remainder of the works, otherwise baseline or subsequent results may be called into question. This step allows any unanticipated difficulties to be addressed prior to commencement of full-scale remedial activities.

For VOCs initial sampling will normally entail the use of sorbent tubes. These will be placed at a number of locations along the perimeter of the site. VOCs present in the air are trapped onto absorbent material within sample tubes over a 28 day period. The sample tubes will then be analysed for the amount of VOC that has been absorbed. This is then converted to concentrations of VOCs in the air. Alongside this, fence line monitoring utilising Photo Ionisation Detectors (PIDs) can be undertaken to identify trends in VOC concentration to ppb levels. Such instruments include the Ion Science Tiger PID and Rae Systems ppbRAE.

In a similar fashion, PM10 particulate monitoring must also be undertaken at this stage to establish its baseline. This can also be achieved through two techniques typically; the Frisbee Dust Deposit Gauge (outlined in BS1747 Pt1) and/or through the use of direct reading PM10 monitors, such as the TSI Environmental DustTrak.

DustTrak Environmental Aerosol Monitor, real-time dust monitoring for any outdoor environment.

On commencement of remedial works it is then necessary to continue with the sampling of both VOCs and Dust/Particulate.

Dust and particulates should be monitored by determining prevailing wind direction across the site, the setting out of a line across the site according to the direction of the prevailing wind and operation of a minimum of two automatic particulate monitors to measure PM10 levels at either end of the line - either inside or outside the site boundary. These instruments should provide data that can be downloaded in real-time. This ideally will report a 15-minute running average of concentrations generated during field activities which will subsequently trigger alerts or alarms if a trigger value is exceeded. Work may normally continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150µg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

VOCs should be monitored and recorded at the downwind perimeter of the immediate work area, with further periodic measurements taken on the upwind site boundary to further establish background conditions.

Typically VOC monitoring response and action levels are measured over a 15 minute average and if exceeded, work activities must be temporarily halted and monitoring continued. If levels subsequently drop below the trigger value commencement of work activities can normally resume with continued monitoring. However, if the organic vapour level remains sustained above the trigger value at the perimeter of the work area, activities must be shut down and work re-evaluated.

Recent advances in technology have allowed for the live specific measurement of BTEX compounds, which commonly are of greatest concern and the primary factor for the imposition of VOC emission limits. As such, it is now possible through the use of the Ion Science TITAN and the Defiant Technologies FROG-4000 and TOCAM to quantify these live, potentially opening the fence line monitoring of these compounds to more rigorous techniques that will ultimately enable the timely remediation of contaminated land sites with less disruption of works.

Titan Benzene Specific Monitor and TOCAM Toxic Organic Chemical Air Monitor.

Finally, it is always important to remember that there is a distinction between concerns about odour and any toxicological effect from exposure to chemicals. The human nose is very sensitive and many substances that are perceived as odorous are usually present at levels below which there is a direct toxicological effect.

This does not detract from the fact that odours can cause nuisance leading to stress and anxiety, with some people experiencing symptoms such as nausea, headaches or dizziness, as a reaction to odours even when the substances are not at harmful levels to health.