5. SEDIMENT CONTAMINATION

5.1 Biogas Parameters

5.1.1 Three reclamation options including no dredged reclamation, minimum dredged reclamation and dredge for ex-situ treatment reclamation have been assessed in the EIA. Except the dredge for ex-situ treatment reclamation, most of the contaminated sediments in the development areas would be left in place for the other two options. Based on the biogas assessment, methane generation potential was found to be high in the contaminated sediments. Suitable treatment is likely to be adopted to reduce the potential methane hazard to the future development prior to reclamation. To determine the actual methane emission rate after reclamation, biogas monitoring should be carried out.

5.1.2 Biogas mainly composes of methane and carbon dioxide. The presence of these gases may reduce the oxygen volume in confined space. Biogas monitoring should therefore include:

- Methane
- Carbon dioxide; and
- Oxygen.

5.1.3 The atmospheric pressure and surrounding environmental conditions such as wind speed/direction and temperature should be recorded during monitoring. A sample format for biogas monitoring shown in **Appendix B** for reference. The final format of this table for biogas monitoring should be agreed with EPD.

5.2 Monitoring Equipment

5.2.1 *Monitoring for Biogas after Reclamation*

5.2.1.1 Monitoring boreholes should be installed to measure the actual methane emission rate. The depth of monitoring boreholes is usually down to the groundwater level. Biogas monitoring should be undertaken using suitable portable instruments and be carried out by competent and trained operators.

5.2.1.2 The biogas monitoring equipment should be well maintained and fully calibrated before used. The gas measuring equipment should be able to monitor continuously the levels of methane, carbon dioxide, oxygen, temperature, atmospheric pressure and gas pressure. The equipment should be operated in diffusion mode during monitoring and be equipped with built-in functions to indicate the low battery, measurement error and over range conditions. In addition, the equipment should be able to store the *in-situ* monitoring data and allow the data to be transferred to a PC for data analysis.

5.2.1.3 The recommended ranges of measurement for various parameters are presented as follows:

Methane	0 – 100% Lower Explosive Limit (LEL) and 0 – 100% volume
Carbon Dioxide	0 – 100% volume
Oxygen	0 – 25% volume
Atmospheric pressure	mm/H_2O or mBar; the measuring equipment should be sensitive to a variation in 0.5mm of water gauge.
Gas pressure	Pascal
Temperature	0 – 100 ^oC

5.2.2 *Monitoring for Biogas during Construction*

5.2.2.1 Biogas may accumulate in excavated areas, confined areas and areas below ground. When methane concentration reaches a dangerous level, it would pose a risk of explosion and asphyxiation. Suitable portable gas detectors should be used to detect the biogas in these areas. The equipment used for borehole monitoring can also be applied in this case. Other gases such as carbon monoxide and hydrogen sulphide may also be generated and accumulated in confined areas. The gas detectors should have the functions to detect these dangerous gases during monitoring.

5.2.2.2 The portable gas detectors should be equipped with suitable alarm device to alert the operator who is carrying out the monitoring when the following conditions are detected:

1) The flammable range of methane is 5 – 15% v/v. When the concentration of methane rise to 20% LEL or 1.0% v/v, no works and no entry to the construction site should be allowed and the personnel on-site should be evacuated.

2) Carbon monoxide is toxic and any personnel should not stay in an area with high concentrations of carbon monoxide. The concentration of carbon monoxide should not exceed 300ppm for short-term exposure (1 hour) and should not exceed 50ppm for long-term exposure (8 hours).

3) When oxygen level drops to 18% v/v or below, there would be a risk to the personnel on-site. Ventilation should be increased to restore the oxygen level to above 18% v/v.

4) Hydrogen sulphide is toxic even at low concentrations. A threshold limit of hydrogen sulphide concentration is 10 ppm for 8-hour Time Weighted Average and 15ppm for 10-minute period.

5.3 Monitoring Locations

5.3.1 Monitoring borehole locations are related to the likely risks posed by the potential emission of methane gas. The proposed monitoring borehole locations are shown in **Drawing No. 22936/EN/145**. The total number of monitoring boreholes at Kai Tak Approach Channel (KTAC), Kwun Tong Typhoon Shelter (KTTS) and Hoi Sham are listed below:

Location	No. of Borehole
KTAC	10
KTTS	10
Hoi Sham	20